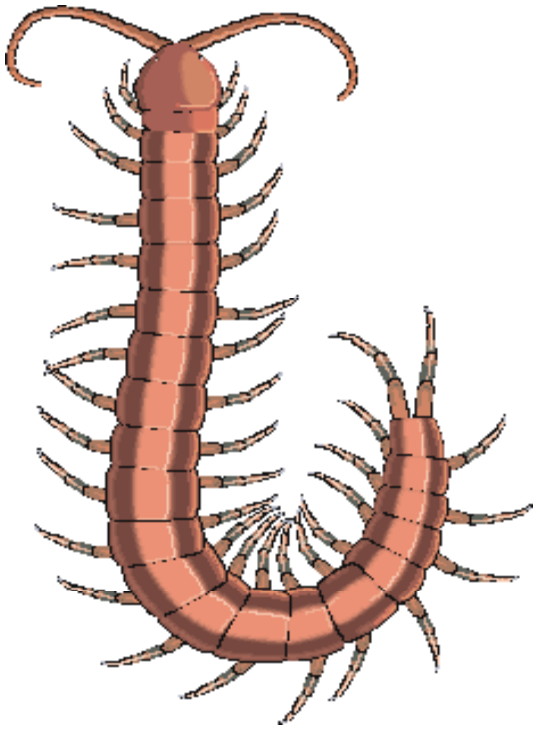
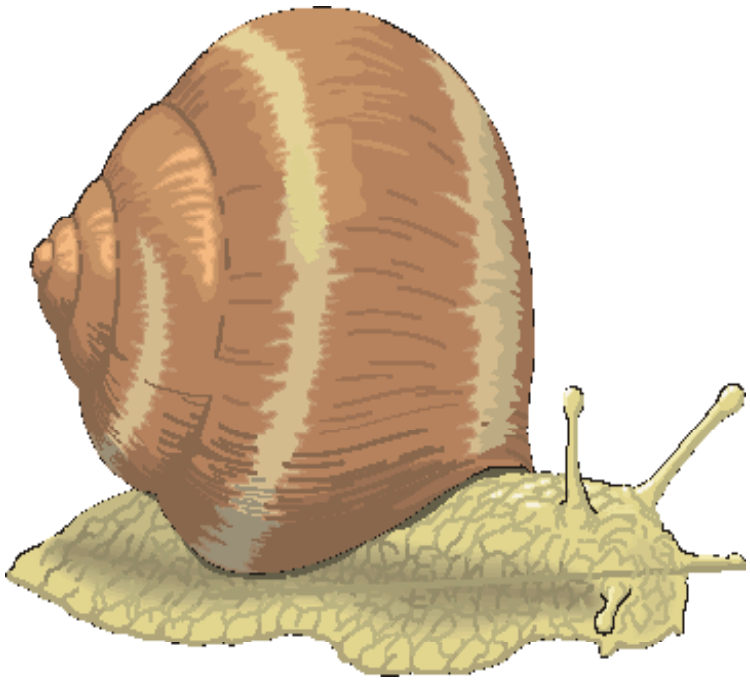
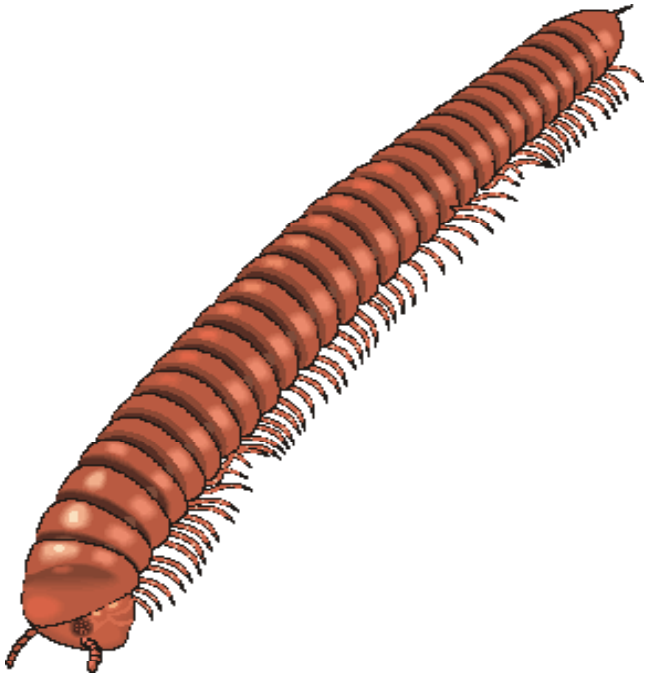
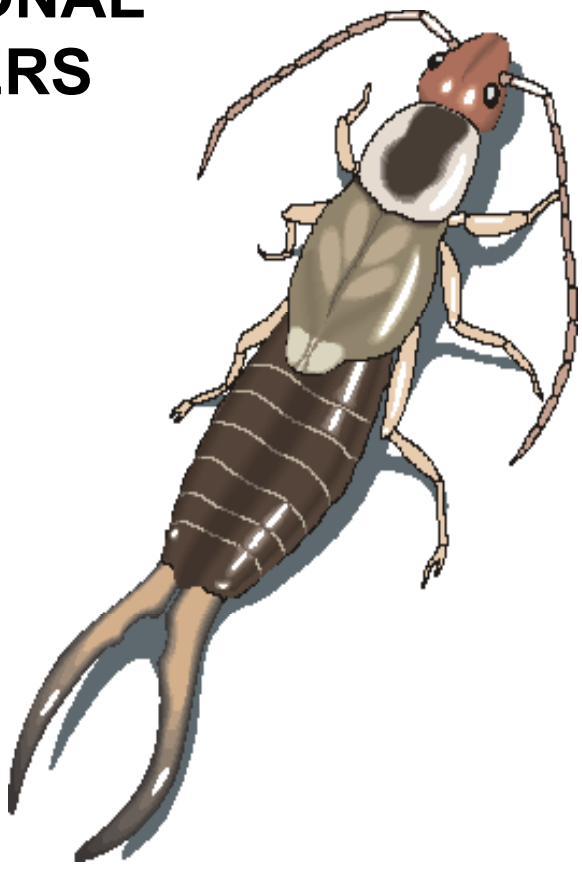




CHAPTER 32
THE BEST CONTROL FOR OCCASIONAL INVADERS





OCCASIONAL INVADERS OVERVIEW

Occasional invaders are insect or arthropod pests that usually invade your building because outside conditions become too hot or too cold, too wet or too dry, etc. Others are attracted to your lights at night and a few occasionally enter in search of food. Most occasional invaders will not live inside for more than a few days, especially if you have reduced your humidity and practiced proper ventilation and sanitation including routinely cleaning with diluted Safe Solutions Enzyme Cleaner with Peppermint or steam cleaning. They are doomed and any control other than vacuuming is unneeded. **The only need for control then is to stop the visual annoyance of the occupants.**

Successful control of occasional invaders requires several mechanical approaches:

- Practice proper sanitation. Routinely cleaning with 1 - 2 oz. Safe Solutions Enzyme Cleaner and/or ½ c. borax per 1 gal. hot water or steam clean.
- Proper ventilation and the proper installation and maintenance of dehumidifiers, air conditioners and/or fans.
- Caulking cracks and crevices around the exterior of buildings, including all window and door casings.
- Placing exterior lighting as far from structures as possible and/or using non-attractive lighting.
- Keeping garbage cans tightly covered, cleaned and up off the ground and garbage sealed in plastic bags.
- Weather-stripping all windows and doors, installing sweeps on the doors.
- Maintaining a vegetation-free zone around building perimeters. Elevate lumber and wood piles.
- Thinning or removing dense and especially dead/decaying vegetation anywhere on the property.
- Stacking firewood up off the ground and away from buildings.
- Sealing all entry points into the structure, including those around plumbing, electrical wiring, etc.
- Making sure all soffits, attic and wall vents are properly screened.
- Eliminating or screening all access points to crawl spaces.
- Removing all refuse, trash and/or debris around the building, e.g., bark, grass clippings, boxes, leaves and mulch. Correcting all moisture problems. Trimming branches that touch or overhang the building. Keep grass cut short.
- Making sure all ground level overhead doors seal properly.
- Lightly sprinkle or dust with food-grade DE, baking soda, talcum powder, Comet® or medicated body powder in the sill boxes and entryways.
- Vacuum and/or trap and/or spray all visible pests with diluted Safe Solutions Enzyme Cleaner with Peppermint or their Not Nice to Bugs®.

INTELLIGENT PEST MANAGEMENT®

CONTROL OVERVIEW - Control begins outside with the reduction or elimination of conditions conducive to infestation and harborage(s) near the structure, e.g., removing food sources, debris, weeding plant beds, etc. Caulk/seal all cracks and crevices and other openings, e.g., around vents, pipes, doors, windows and other holes in the masonry, add door sweeps, properly screen windows and doors, etc. Since some pests are attracted to light, change bulbs to less-attractive yellow bulbs or sodium vapor lamps. Mechanical removal with a vacuum works well, especially when great numbers are involved like the June bug, millipede, cricket, box elder bug and elm leaf beetle seasonal invasions. **Remember, you must seal all visible cracks and crevices and other openings inside and out.** Routinely inspect all incoming goods and/or materials. Spray infested areas with diluted Safe Solutions Enzyme Cleaner with Peppermint (1 oz. per 1 qt. water) or Not Nice to Bugs®.

Bagworm Control - Bagworms are found on woody outdoor plants in warmer (than Michigan) parts of the country. Bagworms create an ever-growing bag out of their host plant as they also eat its leaves and twigs. Control by handpicking. Put the bagworms in a plastic bag, freeze for 2 weeks and then discard (if you throw them directly into the trash, they will move all over). Bagworms overwinter as eggs in the old “bags” that hang on trees and bushes and then hatch in June. New bagworm larva move throughout the plant and feed, after their first instars - the larvae may spin webs and catch the wind and “balloon” from plant to plant. Sprays of BT’s are effective at this point. Then set out pheromone traps around the first of August to reduce the male breeding population. Bagworms pupate in the fall, males leave their bags and mate with females who stay in their bags. The female lays eggs in her old bag and dies. Bags are difficult to penetrate with sprays, even with diluted enzymes. So pick off the bags, which look bad anyway and kill them safely and effectively.

BOX ELDER BUG, A/K/A Pop Bug, Populist Bug, Grass Bug, Democrat Bug and Cottonstainer
Originally *Leptocoris trivittatus* (eastern) (Say) and *l. rubrolineatus* (western) (Barber)
The eastern scientific name has been changed to *Boisea trivittata* (Say) and the western scientific name to *Boisea rubrolineata*

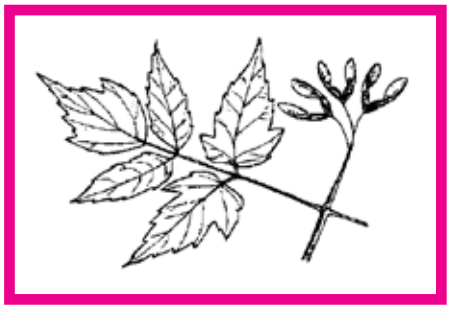
Class - Insecta
Order - Heteroptera
Family - Rhopalidae

The conspicuous black-and-red box elder bugs are divided into two species. Box elder bugs undergo gradual/simple metamorphosis. The eastern species grows to be about 1/2" long; it is distributed as far west as Nevada, while the slightly smaller western species ranges in California and Oregon. These elongate-oval bugs lay eggs in the spring basically on female or pod-bearing box elder trees.

The young nymphs are bright red. Dark markings become more apparent on older nymphs. Eastern nymphs feed primarily on the female Box elder tree (*Acer negundo*, Linnaeus) foliage, tender twigs, and winged seed pods. The Western box elder bug primarily feeds on *Acer macrophyllum* (another box elder) other maples, almonds, apples and other fruit. In late summer, mature nymphs and adults crawl down the tree trunk by the hundreds and disperse. Adults also fly directly from the tree into houses. Like attic (cluster) flies, the bugs find spaces under siding, around window and door facings where they enter wall voids and rooms in houses.

Box elder bugs seek overwintering shelter outdoors in tree hollows, as well as in sheds, barns and houses. **Those that find harborage indoors move around and fly on warm winter days.**

Habitat Alteration



The best management method is to find at least any/all female box elder trees and remove them. These "trashy" trees are seldom planted as ornamental shade trees; they seed themselves and grow as weed trees, and are not eliminated mainly because they are difficult to identify. Their branches break easily in storms, they have messy seeds and are short-lived.

Their leaves, somewhat like maples, are variably shaped on the same tree. Seed pods are helpful in the identification of the female trees. It usually takes a large invasion before tree removal is practiced.

- Caulk around entry points on the building foundation and door and window facings. At times it may be necessary to caulk other points of entry indoors. Lightly dust with food-grade DE.

Intelligent Pest Management® Control

- Seal all cracks and crevices, and/or dust with talcum powder or medicated body powder or food-grade DE.
- Remove infested trees.
- Vacuum or steam clean bugs inside.
- Detergents have also been shown to kill these bugs. Use Safe Solutions, Inc. food-grade diatomaceous earth or spray them with Not Nice to Bugs® or Safe Solutions Enzyme Cleaners with Peppermint. They are especially vulnerable when they congregate on buildings. Vacuum them up or steam clean them.

TYPE METAMORPHOSIS - Gradual/Simple

Egg - Initially straw-yellow in color turning dark reddish-brown in color, normally deposited on female box elder leaves, stones, grass, bark, shrubs and trees in the spring. Turn red as the embryos develop and hatch in about two weeks.

Nymph - Resembles adult in appearance but smaller, first instars are wingless and bright red in color and

sparsely covered with bristles; 5 instars; last stage dark red in color with slate black wing pads.

Adult - Fertile males and females overwinter.

Type of Mouthparts - Piercing, sucking.

DESCRIPTION

Adult - Flat, narrowly oval in shape, 1/2" long, large black bug with three red strips on the thorax and red veins on the wings. Hibernates and overwinters inside; enters in the fall.

Nymph - Initially bright red, sparsely covered with short hairs, resembles adults but smaller and without wings. Goes through 5 molts in about 60 days.

Egg - In the spring they are laid on stones, grass, shrubs and female box elder trees on the leaves and bark. Light straw-yellow color when first deposited become a dark reddish-brown.

LENGTH OF LIFE CYCLE - Approximately 3 - 4 months with up to 2 - 3 generations per year.

HABITAT - Found mainly on female box elder trees but will also feed on strawberries, apples, many plants, e.g., silver maple and apple trees, dead bees and are cannibalistic. Migrate on and into buildings in the fall; can fly 2 miles or more.

NATURE OF INJURY - They can stain curtains, drapes, rugs and spreads with their defecation. They generally only attack the female (seed-bearing) box elder trees, male (staminate) trees are not usually attacked and should be the only box elder tree purposely planted in your area. Normally harmless to humans (box elder bugs do not sting and seldom bite with their piercing-sucking mouthparts), but their presence is undesirable. When crushed, they produce a foul odor. They cause distorted leaf damage to infested trees.

HARBORAGE POINTS - Groups cluster under edges of bark, around the base of trees, on steps and siding. Adults can fly 2 miles or more in search of suitable places to hibernate and then will enter into buildings to overwinter in attics, crawls and walls (in the fall) through cracks and crevices; they frequently are found in large numbers around foundations and windows, under piles of bricks, wood, leaves, etc. On warm days or in the spring they become active and crawl into occupied areas where they are noticed. They normally overwinter near their host trees. Seal and caulk all cracks and crevices and other openings; screen and weather-strip all windows and doors; vacuum up all invaders; apply hot, soapy water to the adults and spray the nymphs with cold water from a hose for adequate control outside, or simply vacuum them up. **Remove and replace at least the female box elder trees with a more desirable species.**

Intelligent Pest Management®

CONTROL - Remove all female box elder trees or spray (clean) routinely with diluted Safe Solutions Enzyme Cleaner with Peppermint or Not Nice to Bugs®. Vacuum up all adults. Seal, caulk, and/or screen all possible entry points. Install chimney caps. Lightly dust with food-grade DE.

ELM LEAF BEETLE
***Pyrrhalta luteola* (Muller)**
Formerly known as *Galerucella xanthomelaena* (Schrank)

CLASS - Insecta
ORDER - Coleoptera
FAMILY - Chrysomelidae
TYPE METAMORPHOSIS - Complete

Egg - Deposited in bunches on elm leaves.

Larva - Do most of damage, but adults eat leaves too.

Pupa - Transformation period between larva and adult takes about 10 days. The larvae travel down the trunk of elm trees to pupate.

Adult - Fertile males and females.

TYPE MOUTHPARTS - Chewing

DESCRIPTION

Adult - Yellow to olive green in overall color, with a black stripe along the edges of each forewing cover (elytron). About 1/4" long with black spots on the head and thorax. Legs and antenna are yellowish and the yes are black. Simply use a vacuum, broom and dustpan, or remove by hand any adults that enter the building. First found in Baltimore, Maryland in 1834.

Pupa - Orange-yellow to golden-yellow and approximately the same size as the adult. This stage lasts about 10 days.

Larvae - Mature larvae are caterpillar-like, yellowish, striped and spotted with black, up to 1/2" long with 6 black legs located behind the black head. Young larvae are all black and slug-like. Feed on the underside of the leaves for 2 - 3 weeks leaving their leaves skelontonized.

Egg - Bright yellow to orange-yellow and spindle-shaped; laid in groups of about 5 to 25 on the underside of elm leaves. Hatches in about one week.

LENGTH OF LIFE CYCLE - 2 - 3 months with up to 2 - 3 generations per year.

HABITAT - Usually found outdoors on elm trees.

NATURE OF INJURY - Harmless to humans but its presence in buildings is undesirable. Heavy infestations can completely defoliate elm trees. Elm leaf beetle larvae scrape the tissue from the surface of leaves; adult beetles chew holes through the entire leaf.

HARBORAGE POINTS - All stages are found in elm trees but the adults commonly migrate into buildings in the fall to hibernate. On warm, fall days or even in the spring the elm leaf beetle adults become active and crawl into occupied areas, congregating around doors and windows trying to get outside. This is usually when they are noticed and become a nuisance.

Intelligent Pest Management®

CONTROL - Inside the building, vacuum up all invaders, make no other control to kill them inside. Lightly dust with talcum or medicated body powder or Safe Solutions, Inc. food-grade DE. Outside the building caulk or seal all openings with duct tape or steel wool all cracks, crevices, and other openings. Install weather-stripping and screening on all doors and windows, especially wherever you observe them gaining entrance. Remove and replace all elm trees with a more desirable species. If you must use a pesticide poison (as a last resort) inside, use a dust, e.g., boric acid or silica aerogel per label directions (treat like cockroaches). The pathogen bacterial *Bacillus thuringiensis,* var. San Diego will also destroy adult elm leaf beetles, as will the mini-wasp, parisitoid *Tetrastichus galerucae*, which lays its egg inside the egg stage of elm leaf beetles where it hatches and eats the embryo. Milky spore disease used on turf areas and neem sprayed on trees will also control this beetle. Better still, simply spray them with 1% Safe Solutions Enzyme Cleaner with Peppermint per 1 qt. water. or Not Nice to Bugs®.

GROUND BEETLES
(Over 25,000 species)

CLASS - Insecta
ORDER - Coleoptera
FAMILY - Carabidae
TYPE METAMORPHOSIS - Complete

Representative species - Black ground beetles, *Harpaulus spp;* Caterpillar hunter, *Calasoma scrutator* (Fabricius); Pincher beetles, *Scarites spp*.; and the Stink beetles, *Nomius pygmaeus* (Dej.).

Egg - Usually laid in ground.

Larva - Grub-like in appearance or worm-like. Lives in ground, decaying wood or within food materials. Dirty white/yellow to black in color.

Pupa - Quiet stage during transformation between larva and adult - occurs in a cocoon.

Adult - Fertile males and females.

TYPE MOUTHPARTS - Chewing

DESCRIPTION

Adult - 1/16" - 1-3/8" long, body elongated and somewhat flattened, usually shiny black or dark brown in color, but occasionally patterned and/or brightly colored. They have hard shell-like wing covers. Abdomen usually widest part of body, thorax smaller and head usually the narrowest part. Several species can fly. Typically live on/in the ground under rocks, leaves, mulch, stones, wood, logs or other debris. Only a few species fly and are attracted by lights (especially blue neon lights). Most enter buildings by crawling inside through window and door gaps, cracks and crevices, so seal, screen and caulk. After the fall rains some of these beetles may enter homes and/or buildings in large numbers. Some come inside in the hot, dry summer seeking moisture. They are basically beneficial natural pest control agents in agro-ecosystems.

Larva - Grub or worm-like in appearance. Size varies depending on species and climatic conditions. Usually found in or on the ground or where food is available.

Pupa - Various sizes and shapes for their cocoons.

Egg - Eggs laid in various numbers and locales, depending on species.

LENGTH OF LIFE CYCLE - About one year for most species.

HABITAT - Usually found on the ground under stones, logs, leaves, bark, debris or running about on the ground. Mostly nocturnal (active at night) insects that prefer dark places. Some are attracted to light at night. Once inside they usually wander around aimlessly until they die. **Find and remove any reservoir.**

NATURE OF INJURY - Basically visual annoyance only. They give off a very unpleasant odor when handled or crushed. Nearly all are nocturnal and predaceous on other insects which crawl around on the ground at night. No-tillage practices result in greater Ground beetle abundance than conventional tillage.

HARBORAGE POINTS - Will occasionally invade and are then found in basements, dark closets and under rugs, on walls, ceilings and furniture.

INTELLIGENT PEST MANAGEMENT®

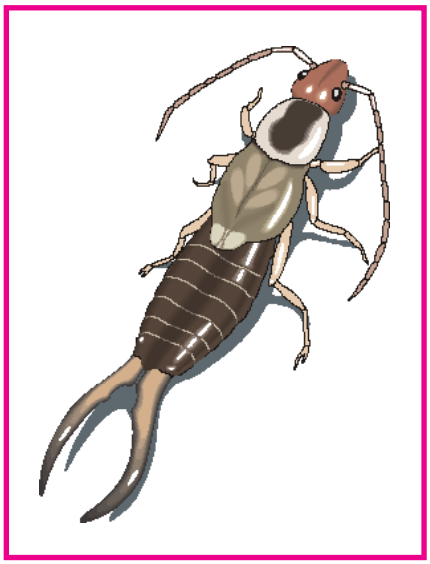
CONTROL - **Outdoors**: Since most of the ground beetles enter from the outside, the physical structure plays an important part of the control program. Lightly dust with talcum or medicated powder or Comet® or food-grade DE or spray them with or Not Nice to Bugs® or diluted Safe Solutions, Inc. Enzyme Cleaners. Caulk and seal

off all points of entry for this is the most important control procedure. The next steps is to eliminate attractants, turn off bright lights at night, clean up all items/debris/boards or other objects next to the structure, or in the yard under which they can hide during the day. Store firewood as far away as possible. Change lighting to yellow bulbs and/or sodium vapor lamps. **It is best not to control beneficial predators.**

Indoors treatment should be limited to vacuuming up the adults and properly disposing of the disposable vacuum bag. Carefully inspect all possible hiding areas such as behind furniture, in closets, beneath edges of carpeting and other cracks or crevices. Then carefully caulk or seal all cracks and crevices and other openings. Note: I have found that simply lowering the temperature with air conditioning removes most of these pests. Remove the rest by using a vacuum, broom and dust pan or a piece of tissue. Install duct tape, sticky-side up. **Routinely clean and spray with Safe Solutions, Inc. Enzyme Cleaners or Not Nice to Bugs® to remove them and their prey.**

EARWIGS
Class - Insecta, Order - Dermaptera, Suborder - Forficulina
Family - Several species

GENERAL DESCRIPTION



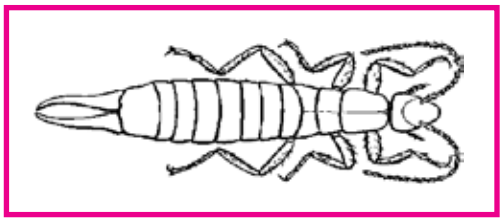
Earwigs are conspicuous and easily recognized relatives of cockroaches. They are 1/4-1" long, elongated, flattened insects with forceps or pinchers at the tail end; they may be winged or wingless. At first glance, winged earwigs appear to be wingless; in fact, their wings fold up many times under the small front wing covers; some fly to lights. Earwigs have chewing mouthparts and are opportunistic omnivores that feed on other insects and often scavenge in garbage and moist plant material. They also feed on some plant tissue, and at least one is a pest in greenhouses. They are dependent on high moisture. Earwigs are active at night; they shelter together and are quiet during the day, hiding in moist, shady locations. Tarsi are 3 segmented.

Earwig females tend their young. Like roaches, they are crack and crevice oriented. They place their eggs in moist depressions or holes, guard them, groom them until they hatch, and take care of the early stage nymphs. Earwigs grow with gradual/simple metamorphosis: older nymphs and adults harbor together - their gregarious behavior is (like the cockroach) the result of an aggregation pheromone.

Approximately 1,100 species of earwigs have been described worldwide. About 22 species occur in the U. S., but only a few are household pests. The common name of "earwig" comes from an old European superstition that these insects enter the ears of sleeping people and bore into the brain. The old Anglo-Saxon word *earwicga* literally means "ear-creature". This belief is basically without foundation; only occasionally one will try to bite inside a human ear. *Dermaptera* refers to the "skin-like" forewings present in winged species, and the term *forficulina* translates into "little scissors." Antennae are thread-like and about half the body length. The forceps-like abdominal cerci are apparently used as both offensive and defensive warnings or weapons, and are sometimes used to capture prey and to fold their wings after flight. **As frightening as they look these pincers are not considered harmful to people.** They are considered to be beneficial insects by many people because they are predators on some small insects, e.g., aphids, and they are primarily scavengers of dead animal or plant materials, although they do feed on and/or damage live plant materials. Populations generally build up around building foundations. If you must kill them simply spray the foundation with dish soap water and/or Safe Solutions, Inc. Enzyme Cleaners or or Not Nice to Bugs®. **Install and use a dehumidifier and/or lightly dust with food-grade DE.**

CLASS - Insecta
ORDER - Dermaptera
FAMILY - Forficulidae, Labiduridae, Carcinophoridae
TYPE OF METAMORPHOSIS - Gradual/simple

Egg - About 30 laid singly or in batches on the ground or in cells beneath the soil surface and tended by the female who guards the nest from all intruders including her mate. The female picks up each egg in her mouth and cleans or "licks" fungus off the surface of each egg.



Nymph - Resembles the adult in appearance, but smaller in size and wingless. The female feeds the first instar in the nest or earthen chamber.

Adult - Fertile males and females. The antennae of adults have 10 segments, nymphs have less. They rarely fly. Earwigs are nocturnal or active at night and they hide during the day.

NOTE: Earwigs forage at night, covering up to 100 yards, eating the eggs, young and adults of small insects, spiders, mites and nematodes, as well as algae, fungi, mosses, pollen and tender plant tips and flower petals. During the day they hide in any tiny crevice they find near or in the ground, on plants, in piles of debris, in the cracks and crevices of the bark of trees, or in houses, under cloth, sheds and other structures. They invade homes in times of drought or when there is a scarcity of suitable crevice-like hiding places out of doors. Earwigs are considered beneficial insects that are predators of aphids, fruit worms and spider mites. European gardeners actually trap and/or cultivate them into plum, apple, and other trees so the earwigs can munch on these pests and snails, caterpillars, small beetles and thrips. Earwigs have an uncanny ability to sense stress in plants and will attack that plant over a healthy plant.

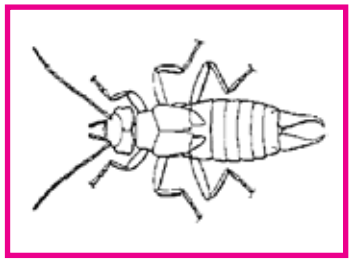
TYPE MOUTHPARTS - Chewing

DISEASE ASPECTS - Possible carrier of disease organisms and cause skin abrasions.

SPECIFIC EXAMPLES

EUROPEAN EARWIG
Forticula auricularia (Linnaeus)
Family - Forticulidae

DESCRIPTION



The European earwig is our most common earwig and it was introduced into the United States. This dark reddish-brown insect with a reddish head and pale, yellowish-brown legs, grows to be 5/8-1" long and is common in the Northeast, Northwest, parts of southern Canada, and now is found in the middle Atlantic states. Like most earwigs, the European earwig requires high moisture and builds up in shady yards where stones and boards offer protection. These earwigs enter on ground floors and can make their way into other parts of houses. They also hide in wrappings used to trap gypsy moth larvae. **Install and maintain a dehumidifier and/or fans.**

Adult - About 3/4" - 5/8" long, dark reddish-brown body with a darker reddish head and paler wing covers and pale yellowish-brown legs; has a pair of forceps at the end of the abdomen. The first pair of wings are scale-like and serve to cover the folded hind pair of membranous wings, but the insect seldom flies. The male's pincers are large and curved; the female's are smaller and nearly straight. Omnivorous feeders fond of plants and other insects. They can bite. Can float on water for over 24 hours, but will drown quickly in soapy water. Generally nocturnal. They have a foul odor and they hibernate in cold months. This species is omnivorous, eating plants, other insects and decaying vegetation. Antennae are 12-segmented.

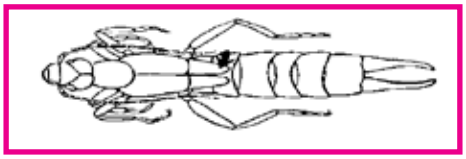
Nymphs - Same as adult in general appearance, but smaller and wingless. There are usually four nymphal

instars or molts that take them from nesting to free-foraging creatures.

Egg - Laid in the upper few inches of the soil and guarded by the adult female. A single female will lay approximately 30 - 60 eggs for the first brood, but considerably less for the second batch, per year. About 70 days to maturity.

Note - Other species range in size from 3/8" to 1" long and are yellow-brown to brown-black in color. Some have wings; other are wingless. Spray infested areas with dish soap and water or 1 oz. Safe Solutions, Inc. Enzyme Cleaner with Peppermint per quart of water or lightly dust with food-grade DE.

RIPARIAN OR SHORE OR STRIPED EARWIG
Labidura riparia (Pallas)
Family - Labiduridae



DESCRIPTION

The striped earwig, common in the tropics and subtropics, has now extended its range across the southern and southwestern United States. These earwigs burrow in soil, mulch, rubbish, and grass thatch. The striped earwig is about one inch long, and brown or tan with pale stripes on the thorax. The abdomen is darker and slightly banded. This earwig survives well in disturbed areas such as new subdivisions. They are doubly obnoxious when they come inside because they emit a foul odor when crushed. **They have a very low tolerance for heat, so steam clean.**

Note: I have found that simply lowering the temperature with air conditioning removes most of these pests. Remove the rest by using a vacuum, broom and dust pan or a piece of tissue. Routinely clean with diluted Safe Solutions, Inc. Enzyme Cleaners to remove them and their prey..

Adult - Large, about 3/4" to 1-1/4" long. Their color ranges from pale brown with indistinct darker markings to chestnut or red-brown with indistinct markings to black. The head is usually chestnut with the pronotum and front wings with pale stripes along the edges and in the middle. The abdomen is usually banded. The antennae and legs are yellow-brown with bands. Usually lives in burrows beneath debris and other organic matter. They feed on insects and are also scavengers of pests, e.g., aphids, armyworms, mites and/or scale insects. They are attracted to lights at night and give off a foul odor when disturbed or crushed.

Nymph - Same as the adults in general appearance, but smaller and wingless.

Egg - Laid in the soil by the female. A single female will lay 60 -70 eggs in a batch. When they hatch she begins to eat them. They can cause skin abrasions in humans.

RED-LEGGED or RING-LEGGED EARWIGS
Euborellia annulipes (Lucas)
A/K/A the Starch Bug
Family - Carcinophoridae

DESCRIPTION

Adult - This is a native American species found in our South and Southwest. About 1/2" to 1" long and wingless, The body is dark brown to black with a brown head and yellowish brown belly underneath. The antennae are about 16 segmented and black or brown with two to three off-white segments near the tip. The legs are yellow-brown with one to two dark brown cross-bands or strips. They feed on plants, insects and grain. Nocturnal, they avoid lights, excavate shallow nests under boards, rocks and litter.

Nymph - Same as the adults in general appearance, but smaller and wingless.

Egg - The female will produce 20 - 60 eggs per batch with three to four batches annually.

LENGTH OF LIFE CYCLE - About one year.

GENERAL COMMENTS

HABITAT - They are gregarious, usually occurring in groups which prefer dark, damp areas indoors, outdoors and under porches and other structures. Indoors, earwigs hide in basements, crawl spaces, greenhouses, closets, chests, drawers and other storage areas. Earwigs are nocturnal or active at night and hide during the day in moist, shady places such as under stones or logs or in mulch. Neither the eggs nor nymphs can withstand long periods of dryness. **Install and peroperly maintain a dehumidifier, air condtioner, vents and/or fans.**

EARWIG OVERALL COMMENTARY

Earwigs are attracted to lights or to insects attracted to lights. Replace them wth sodium vapor or yellow lights. Usually it is the European and red-legged earwigs which occasionally enter buildings, sometimes by the thousands. Earwigs are also attracted to fish oils so add some aspartame to the oil and use as a nontoxic bait.

Inspection - Remember to set out a few traps, e.g., rolled up newspaper, a piece of corrugated cardboard or a paper towel tube filled with straws and sealed at one end. When the earwigs crawl inside they usually can not back up and escape. Put down duct tape (sticky-side up) held in place with masking tape at the edges.

- Look under cloth, bark, boards and stones near house foundations.
- Inspect cracks around foundation and door stoops.
- Check behind bird houses, tree trunk wrappings, and under plant mulch.
- Because they are active at night, check your garden, etc. at night with a red or yellow flash light to locate infestations and/or damage.

Habitat Alteration/ Harborage Removal

- Practice proper sanitation and reduce moisture and seal out routes of entry.
- Repair broken irrigation systems or broken downspouts.
- Grade property so water drains away from the structure.
- Caulk ground floor entries, windows, and cracks between door stoops and patios and the building foundation. Lightly dust with baking soda, Comet®, talcum, medicated body powder or food-grade DE.
- Remove as much harborage as possible, e.g., piles of lumber, leaf litter, bricks, ivy or other heavy ground covers, limbs, mulch, plant debris, stones, firewood, and boards.
- Trim hedges and plants away from foundations that increase moisture retention.
- Remove debris and organic matter within a zone of at least 3' from the foundation.
- Establish an 18” - 24" vegetation-free zone around the perimeter with stones or gravel underlined with landscape cloth.
- Trim back tree limbs that heavily shade the home or foundation contributing to moisture retention.
- Properly vent and/or cover crawl spaces.
- Install dehumidifiers, air conditioners and/or fans.
- Close-mow the lawn.
- Water only when necessary and then only early in the morning.
- Use only sodium vapor or yellow bug lights outside.
- Properly ventilate and dehumidify moist basements, crawls, porches, and so forth. Increasing the heat and/or lowering the humidity or moisture discourages earwig buildup.

IINTELLIGENT PEST MANAGEMENT®

CONTROL

- Practice proper sanitation and reduce moisture levels and caulk.
- Spray the foundation up 3 feet and out 4 feet using a hose-end sprayer filled with any dishwashing soap.
- Vacuum basement areas or elsewhere inside or outside to remove earwigs.
- See the “inspection” traps. Add a little honey or peanut butter (and a little earwig frass), bury or place a shallow dish, bottle, jar or an empty tuna/sardine can in the earth - so the “hole” is now at ground level - add or leave a little fish oil in your “trap” - in the early a.m. shake the contents of each “trap”

into a bucket of soapy water. You can also make shallow traps with soapy or diluted Safe Solutions Enzyme Cleaner.

- Set out rolls of cardboard or newspaper in and under bushes, plants, tree crotches, etc. and then burn or destroy these traps daily. Lightly dust them with food-grade DE.
- Take a cardboard box; punch holes in the side of the box near the bottom. Sprinkle bran or oatmeal inside the box and then set them out in the infested area. Burn or destroy the boxes daily.
- **Install a dehumidifier & fans to establish a low moisture zone around the building.**
- Prepare a band of vegetation-free (and bark/mulch-free) area around the building. Lightly dust with DE.
- Caulk/seal all cracks and crevices in the foundation. Lightly dust with Comet® or talcum or medicated body powder or Safe Solutions, Inc. Food-Grade DE. Spray Not Nice to Bugs®.
- Sprays of detergents and/or dishsoaps are known to quickly kill earwigs. Use pesticidal soaps when labeled for this use, or better still spray with diluted Safe Solutions Enzyme Cleaner with Peppermint.
- Bait with 5% or less boric acid or 1% protease enzyme baits or corn meal with 3% or less sodium borate or 4% food-grade DE per label directions - don't forget to add a little earwig frass.
- Earwigs will not cross a stripe of petroleum jelly or duct tape (sticky-side up).
- A tachnid fly parasite imported from Europe will greatly reduce earwig populations. Plant dill, parsley, sweet clover, fennel, buckwheat and herbs to make these flies feel at home.
- Leave a couple of cans (half full of beer) out overnight - tomorrow they may be full of earwigs.
- Steam clean the infested area.

NATURE OF INJURY - Earwigs are omnivorous and scavengers, eating practically anything they can chew. They are also a visual nuisance in structures. When crushed or disturbed they give off a foul, disagreeable odor. Some can even spray the foul odor when provoked. Red-legged earwigs can cause skin abrasions in some people and are pests of potatoes in storage. Earwigs fed on live or dead plants and/or insects. At times they damage cultivated plants. Vegetables, flowers, fruits, ornamental shrubs and trees, and feed on honey in bee hives, Irish and sweet potatoes in storage. They can damage the roots of greenhouse vegetables, and are pests in flour mills, breweries, meat-packing plants, slaughter houses, gardens and nurseries. They generally are considered beneficial predators.

HARBORAGE POINTS - Earwigs prefer cool, dark, moist places, basements, crawl areas, flower beds, gardens, along foundation walls, under rocks, boards, stones, timbers, etc., during the day. At night they forage out as far as 100 yards, and may invade the surface and interior of your structure in large numbers, getting into dark closets, under rugs and furniture. **Remove the reservoir and control the pest problem.**

INTELLIGENT PEST MANAGEMENT®

CONTROL - **Outdoors:** Remove all nonessential plant debris, dead vegetation, mulch, boards and objects such as stones, from around the structure as they will harbor earwig populations. Prune all branches or foliage that touch the building. Establish a 3 - 6 foot zone of bare concrete, stones or soil that will dry out around the structure. The purpose of this is to establish a low-moisture zone which is disagreeable to earwigs. Spraying with diluted Safe Solutions, Inc. Enzyme Cleaners, peppermint or dish soap, will kill them and will even provide a temporary barrier outside and the sill plates inside. Install a dehumidifier and/or fan and a vapor barrier in the crawl if needed. Caulk, seal and repair all possible entrance points that would permit access to your building by these pests. Screen and weather-strip windows and doors to eliminate access to your building. Lightly dust with food-grade DE.

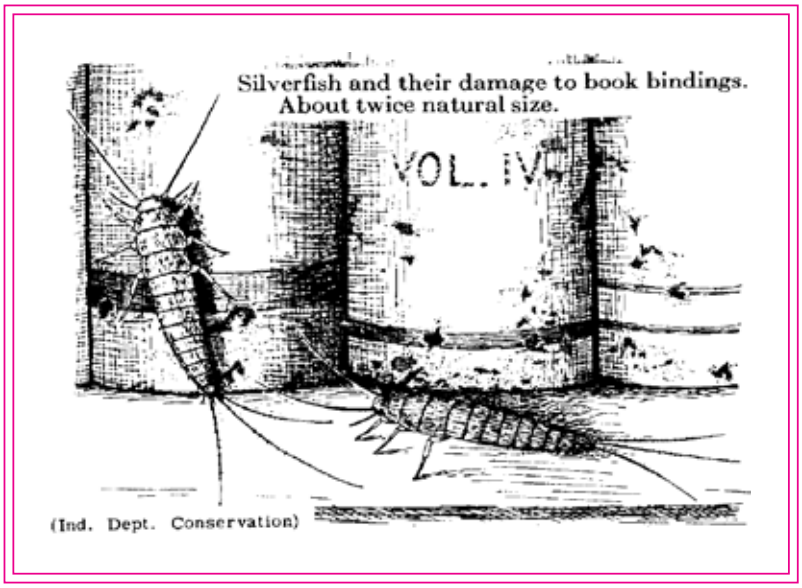
Earwigs are easy to trap. Try 5% or less boric acid or 3% or less sodium borate or enzyme or, better yet, DE baits. Duct tape or containers such as tuna fish cans with 1/2" of vegetable oil, fresh beer, raisins, bacon grease or moistened bread crumbs (or even damp sawdust) can serve as traps without any poison. Because of the earwig's predilection for crawling into small spaces, boards, cardboard tubes, rolled -up newspapers or dark plastic are good traps. The trap, baited or not, should be place on the soil near plants just before dawn and checked with a flashlight several hours later or in the morning. Dropping or shaking the trapped insects into a pail of soapy water will drown them, or you can spray or flood the traps with diluted Safe Solutions Enzyme Cleaner with Peppermint. The parasitic fly, *Digonochaeta septipennis (*imported from Europe), will dramatically reduce earwig populations. The tachnid fly, *Bigonicheta spinipennis*, is also an excellent earwig predator.

Indoors: Treatment may be made supplemental to outside control; lower the humidity, vacuum all hiding areas

such as behind furniture, in closets, beneath edges of carpeting and other cracks and crevices, or simply use a broom and dustpan or a piece of tissue to pick up these pests. Be sure to put the vacuum bag outside in sealed garbage container or in a black garbage bag in the direct sunlight for several hours immediately after picking up these pests. Combinations of diluted Safe Solutions Enzyme Cleaner with Peppermint or dish soap and water used as sprays or traps or baits will kill these pests inside or outside. Mop with diluted borax (1 cup per gallon of hot water) or steam clean the infested area. Lightly dust with food-grade DE, talcum or medicated body powder or Comet®. Not Nice to Bugs® can also control these pests inside as a last resort.

SILVERFISH
***Lepisma saccharina* (Linnaeus), *Ctenolepisma-lineata pilifera* (Lucas) and *C. longicaudata* (Esch), *C. quadriseriata* (Packard)**

FIREBRAT, A/K/A Bristletails, tasseltails, fringetails, fishmoths, slicker, sugar louse or fish, silverwitch, paper moth and wood fish.
***Thermobia spp.,* e.g., *Thermobia domestica* (Packard)**



CLASS - Insecta
SUB-CLASS - Apterygota (bristletails)
ORDER - Thysanura
FAMILY - Lepismatidae and others

TYPE METAMORPHOSIS - Without metamorphosis; they mature through a gradual developmental process called ametabolous.

Egg - Laid singly in secluded places.

Nymph - Resembles adult, but smaller in size.

Adult - Carrot-shaped insect, tapering from head to tail, with three bristles at the tail end.

TYPE MOUTHPARTS - Chewing

DISEASE ASPECTS - Not known to be vectors of diseases.

OVERVIEW

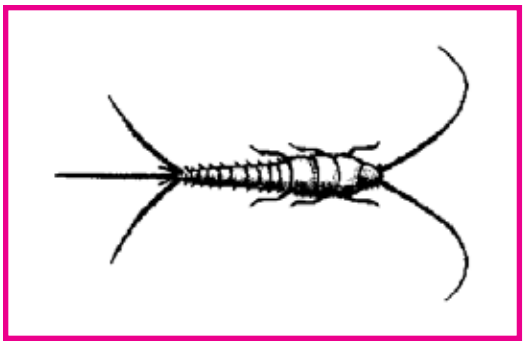
Silverfish and firebrats are among the most ancient of insects; they were on earth before insects developed wings. These pests were among the most common insects in homes and businesses when wallpaper was the usual wall covering and when coal furnaces had glued, taped, insulated pipes. They prefer to live in dark, warm (70° - 80° F.), moist (with a relative humidity of 75% - 95%) areas where there is a good supply of starchy foods, mildews and/or molds. They can run extremely fast. **Install a bright light and a fan and lightly dust with food-grade DE.**

Pest bristletails are about 3/8" - 1/2" when adult and, unlike other insects, they continue to molt and may shed their exoskeletons as many as 50 or 60 times when full grown. They have long antennae in front and three antenna-like processes behind the "bristles" of their bristletails. They are slender, broadest in front and gradually taper toward the rear. In general, they shun light and prefer dark, undisturbed sites. Two species, the silverfish and the firebrat, are the most common representatives of the bristletails.

Note: There are more than 400 species worldwide in the order Tysanura, but only a few in the family Lepsimatidae inhabit buildings. There are 8 - 10 different species of silverfish in North America, but only one species of firebrat. These insects are similar in shape, but differ in color - silverfish are uniformally grayish to silver or green in color, occasionally with dark lines down the back, whereas firebrats have a mottled black and white color and have longer antennae. Silverfish are usually found in moist environments and feed on starchy substances such as bookbindings or paper. Silverfish adults are about 3/8" to 1/2" long when grown and their bodies have a flattened, carrot shape with two long antennae and three appendages attached to the tapered posterior end. Each appendage is about as long as the body. The silvery or metallic sheen and the rapid darting movements and fish-like undulating turns have given this household inhabitant its name. **Both silverfish and firebrats are hardy and can live without food for several months.** The common name firebrat comes from the frequent occurrence of certain species in fireplaces, ovens, chimneys, furnace rooms, insulation and around hot water and heat pipes, and other warm areas. Their preference for temperatures around 100° F. makes them a particular problem in places like bakeries. They can live for 3 years or longer and can lay up to 100 eggs in a lifetime.

GENERAL DESCRIPTION

Adults excrete dry feces and are primitive, wingless insects with usually 3 appendages at the end of their abdomen. They have been found as fossils dating back more than 400 million years.



Silverfish - Nocturnal, about 1/4" to 3/4" long, silvery-sheen, covered with scales. Have two long, segmented antennae, three caudal appendages (two cerci and one median process): Primitive, wingless insect, the body tapers from head to tail like a tear drop/fish/carrot. They move sideways and prefer cooler and moisture areas than the firebrats. It prefers temperatures between 70° F - 80° F. and can live without food for several months. They feed on fungus, protein, sugar or starch substances like flour, starch, glue, paste and the starch sizing on textiles and papers, but they can also digest some synthetic fabrics and cellulose fibers, e.g., wallpaper, books, photographs and other paper or cardboard objects.

Silverfish build up around the materials they are feeding on such as dead insects, wallpaper paste, damp wallpaper, spilled flour in cupboards, corrugated cardboard boxes in damp basements, insulation glue and stored books in unventilated attics. Their feeding leaves irregular yellow-stained holes in sized textiles, e.g., linen, silk, rayon, cotton and paper, surfaces removed from corrugated cardboard, and irregular areas grazed off cloth-bound books. Damaged products will often have a dark fungus growing on them as a result of the humidity and insect fecal deposits. Large populations of silverfish spread out into other humid areas. Silverfish are often trapped in wash basins and bath tubs in bathrooms to which they migrate from the basement or out of wall voids penetrated by pipes. They have sinuous movements and quickly dart to cover when disturbed. They live from 2.5 - 8 years depending on the species and conditions. **Silverfish avoid light, so turn them on.**

Firebrat - Same form as the silverfish, but rather larger and wider and has not the same metallic appearance, being grayish white with darker speckled markings with longer antennae that often extends past the tip of the abdomen. Fast runners who prefer the dark; they are cannibalistic. Firebrats are not silvery but are mottled dark-gray and dull-yellow. Their cosmopolitan distribution, size, shape and appendages are like silverfish, but firebrats prefer decidedly higher temperatures and surroundings warmed to 90° F. or more, **especially from 98° - 102° F.** Examples of firebrat habitat are bakeries where heat and starches are prevalent, furnace rooms, steam pipe tunnels, hot apartment bathrooms and partition walls or water heater rooms. Firebrat eggs will not hatch at temperatures below 75° F. Their feet are so fireproof they can walk on extremely hot surfaces.

Note: Several other species of the order Thysanura closely resemble the firebrat. They are frequently abundant and their general behavior is much like that of the firebrat.

Nymph - Similar to the adult, but smaller in size. Whitish for the first 3 months; then after the third molt the silvery, spade-shaped scales appear. The external sexual organs appear at the eighth molt. There may be 60 - 80 molts. (No other known insect goes through so many molts.) Note: The adults keep on molting throughout their lives and can continually regenerate organs, e.g., legs that are accidentally lost.

Egg - Small, whitish, turning yellow to brown oval-shaped object deposited loosely in secluded places or placed in cracks in batches. Female silverfish lay eggs in secluded places. They lay only a few at a time in several batches over a period of weeks. Fewer than 100 eggs are laid by a single female. They are oval and about 1/32 " long, white and smooth at first, but they soon become brownish and wrinkled and hatch in about 28 weeks, depending upon the temperature. Firebrats lay about 50 eggs at a time in several batches, but some individuals have been observed to lay up to 195 eggs.

LENGTH OF LIFE CYCLE - 3 months - 2½ years depending upon the temperature and humidity.

HABITAT

Silverfish - Prefer dark, warm, damp places, such as basements in northern states, and structures and homes in the South. It may also become abundant in ceiling voids and/or attics, especially with roof leaks. Prefers temperatures ranging from 72° F. - 80° F.

Firebrat - Less restricted to moisture than the silverfish. Prefers temperatures above 90° F. Often found around heating plants, ovens and other places of extreme warmth. Injured appendages are regenerated.

SPECIFIC EXAMPLES:

The Common Silverfish, *Lepisma saccharina* (Linnaeus): This silverfish is found in basements around water pipes; sometimes common in newly built homes before the masonry has dried; uncommon outdoors.

The Four Lined Silverfish, *Ctenolepisma lineata* (Fabricius): In attics with wood-shingled roofs; can live outside and has been found in mulch outside. The fourlined silverfish has four dark lines down its abdomen and is very slightly longer than the common silverfish. It builds up in the mulch of flower beds and under roof shingles, then enters attics and upstairs rooms. They can be common both outdoors and indoors on the east and west coasts. High humidity from overhanging trees in summer promotes build-up of this species. Install and use a dehumidifier and/or fans.

The Gray or Longtailed Silverfish, *Ctenolepisma longicaudata* (Escherich) formerly known as *Ctenolepisma urbana* (Slabaugh): This gray silverfish is found throughout the building, around water pipes in bathrooms; can live in drier areas such as crawl spaces under the house, or in the attic; often found in new homes; not normally found outdoors. The gray silverfish is uniformly gray, sometimes very dark. It is most common in southern California and Hawaii. This species is more a pest of paper and textiles. Never drinks.

***Thermobia domestica* (Packard):** The common firebrat - this firebrat is found in and around ovens, bakeries, book and paper storage areas. ***Thermobia campbelli* (Barnhart):** Can be found in book covers.

NATURE OF INJURY - Rolled oats, dried beef, bond paper, linen, cotton, silk, rayon, bookbinding's, flour, cereals,

starched cloth, documents, can labels, wallpaper, cellophane, paper, glue and paste and any type of human food or fiber that can be gnawed, eaten or disfigured/contaminated with their feces.

Inspection

- Place silverfish and firebrats in alcohol to preserve them. They are soft and very fragile. When they are captured for identification, scales are usually rubbed off and appendages broken off.
- Check all starched-based materials in the infestation area including glued boxes, wallpaper, books and book bindings, art prints, file boxes, kitchen and bathroom cupboards, glued insulation baits, flour paste, and stored textiles especially those that are starched or sized.
- Inspect rooms connected to infested areas through wall or floor penetrations, or through closet ceilings.
- Note all areas with high humidity and high temperatures and lower both accordingly.

HARBORAGE POINTS - Any room, in any building where warmth (71° F. to 90° F. or more) and moisture prevail and sufficient food is available. They are commonly found in dark closets, behind baseboards and in wall cracks, and normally stay close to floor level. Firebrats can be found in boiler rooms and wherever high temperatures are maintained. Usually adults and/or eggs are simply carried into your building in packages, books and paper.

Habitat Alterations

- Practice proper sanitation; dry out the area and deny them food.
- Locate and correct all moisture sources. Mend pipe leaks. Lower the temperature.
- Caulk all cracks and crevices. Lightly dust with food-grade DE.
- Ventilate closed rooms, attics and crawl spaces.
- Dehumidify humid spaces. Apply dessicant dusts, e.g., talcum powder, DE or mop with borax.
- Eliminate standing water. Reduce moisture and humidity.
- Temperatures below 60° F. will stop both species from breeding.
- Make changes in grade and guttering where water runoff causes damp basements and walls.
- Prevent access to food, especially starch materials, e.g, paper.
- Eliminate stored materials that harbor bristletails.
- Dispose of infested storage boxes and relocate stored materials in dry spaces after inspection of materials. Remove leaf and grass litter from the perimeter of the building.
- Trim trees where shade is causing moist conditions on roofs and roof eaves.

INTELLIGENT PEST MANAGEMENT®

CONTROL - Non-chemical control of these pests is usually the only permanent solution.

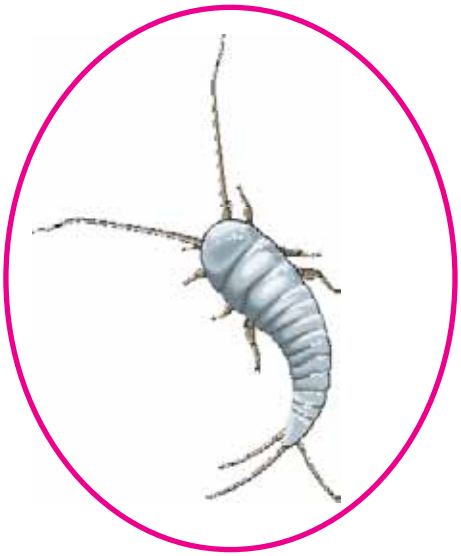
1. **First of all, reduce the temperature below 60° F. and turn on bright lights and/or carefully and thoroughly vacuum and/or steam clean and use baited sticky traps or install duct tape (sticky-side up)** to catch or remove as many of the insects as possible (try baiting with a combination of dried beef, dead cockroaches, rolled oats, wheat paste, or cornmeal with or without boric acid or sodium borate). Silverfish can also be trapped very easily in small glass jars, such as baby food containers. Wash the jars thoroughly in hot water and detergent to remove all traces of food and oils; make sure the glass is clean and smooth on the inside. Wrap the outside with masking tape or dark fabric stockings so the insects have something to grip as they climb up. There is no need to bait inside. They will climb in all by themselves to just to look. Clean routinely with diluted Safe Solutions Enzyme Cleaner with Peppermint and/or borax. Spray with Not Nice to Bugs®. **Caulk all cracks and crevices, including under the baseboard.**
2. **Then correct all moisture problems by using a dehumidifier and repairing all leaking or sweating plumbing.** You can occasionally dry out small areas with a fan or light bulb or a container of anhydrous calcium chloride. Carefully inspect all pipe chases, ceiling voids, attics, bathrooms, under tubs, kitchens and basements, including all boxes, laundry and dish washers. Lightly dust with food-grade DE, talcum or medicated body powder, Comet®, or baking soda. **Lower the temperature.**
3. **Eliminate as many harborage sites as possible** by patching, sealing and/or caulking all visible cracks and crevices. Caulking guns or a spatula with a dish of plaster will permanently correct most harborage problems and stop these pests from hiding and breeding. Replace cedar shakes.

4. **Regularly remove (clean up)** all cellulose lint, food crumbs and/or starchy food scraps and other organic debris, and remove all other potential food stuffs and infested items. Infestations (on articles) can be destroyed by incineration or (if you wish to save the article) by freezing them or treating them in high temperatures of 120° F. for an hour, or microwave them for 30 - 60 seconds. Secure all non-infested articles in tightly sealed containers, plastic wrap or cabinets. Routinely clean with Safe Solutions Enzyme Cleaner with Peppermint. Seal all hiding and feeding areas with caulk or patching plasters.
5. Put all infested items in a plastic bag and freeze for 4 - 7 days. Microwave infested books for 30-60 seconds - lay curled books flat on a table to flatten out again. Some parchments and old manuscripts or illustrations with metallic salts may be damaged in a microwave.
6. As a last resort, try dusting with talcum powder, calcium chloride dusts, baking soda, food-grade diatomaceous earth, boric acid, or silica aerogel in areas inaccessible to people and pests.
7. **Continue to inspect and eliminate and/or cut off all potential food sources.**

Due to their nocturnal habits and size, silverfish and firebrats are difficult to see. If possible, make observations or surveys of silverfish or firebrats during the night, using a flashlight with a red or yellow filter. They may also be monitored with sticky traps or duct tape. These insects usually go unnoticed until populations get very large or damage becomes very severe. Control may be difficult because it is hard to locate the sources of infestation. Keep silverfish and firebrats from entering your buildings from outside by caulking or sealing all visible exterior openings. Inspect all incoming goods very carefully. Caulk all cracks and fill other openings inside the building to eliminate their hiding and nesting places. Moisture attracts these insects, so routinely to repair leaking pipes and drains and insulate water pipes to prevent water condensation. Wherever possible, eliminate their sources of food; store books, paper, linens, flour, cereals and similar items in tightly sealed containers or cabinets. Find the reason for the moist conditions and correct them. Use dehumidifiers, increase air flow or focus heat on any damp area to dry them out. Lightly dust with talcum or medicated body powder or Comet®. As a last resort, use desiccants such as anhydrous calcium carbonate, or absorbing dusts such as borax, food-grade diatomaceous earth or silica aerogel to dry up damp areas and/or destroy these pests. Mop with CB Mop Up®, web site: http://www.cbproproducts.com/indProduct.php4?itemNum=42-8010RV&title=Dusts&color=C44C04 , disodium octoborate tetrahydrate or borax carefully. **Routinely clean with diluted Safe Solutions Enzyme Cleaner with Peppermint.**

Follow-up - Educate occupants regarding bristletails' need for starch-based foods, humid conditions and the firebrats attraction for high temperatures. Practice proper exclusion, sanitation and habitat reduction. Steam clean or clean with diluted Safe Solutions, Inc. Enzyme Cleaners and/or borax. On rare occasions you may have to use a starch/boric acid bait, aspartame (Equal) or sticky traps baited with boric acid baits, e.g., if an area is to be closed up for an extended period of time. **Note: Some species of silverfish can be very resistant to high temperatures and low relative humidities.**

SUMMARY



Ancestors of the silverfish and firebrats are among the most ancient insects. Silverfish prefer a moist or humid environment with a moderate temperature. Several species of silverfish live outside and inside. Firebrats, on the other hand, seek very hot places like bakeries, furnace rooms and hot apartment bathrooms.

Both silverfish and firebrats feed on starch materials such as flour, paste, glue, textiles and paper sized with starch. Boxes of books, corrugated cardboard, flour or cake mix spills, glued insulation batts, taped heat pipes, etc. They also eat paper. They can survive for weeks without food and water.

Removing the infested material is the first step in control of these pests. Ventilating moist or hot spaces, using dehumidifiers, fans and vacuums will quickly and safely suppress most of these pests.

Most infestations are very localized with heat/temperature being the limiting factor. Act accordingly and use a vacuum at night with a red filtered light to find and remove these pests, repair or eliminate leaking pipes and other

moisture problems, heat or freeze infested articles to dry them out and kill insects, clean and caulk cracks and crevices where lint accumulates and allow these insects to feed and breed, remove any other food sources and seal up cracks and crevices. Lightly dust with food-grade DE. **Routinely clean with diluted Safe Solutions, Inc. Enzyme Cleaner with Peppermint. Spray as needed without Not Nice to Bugs®**.

SPRINGTAILS

CLASS - Insecta
ORDER - Collembola (from a Greek word meaning "gluey peg".)
FAMILY - Some 6000 species; 812 species in 83 genera in North America alone.
TYPE METAMORPHOSIS - Considered to be without metamorphosis or with simple/gradual metamorphosis.

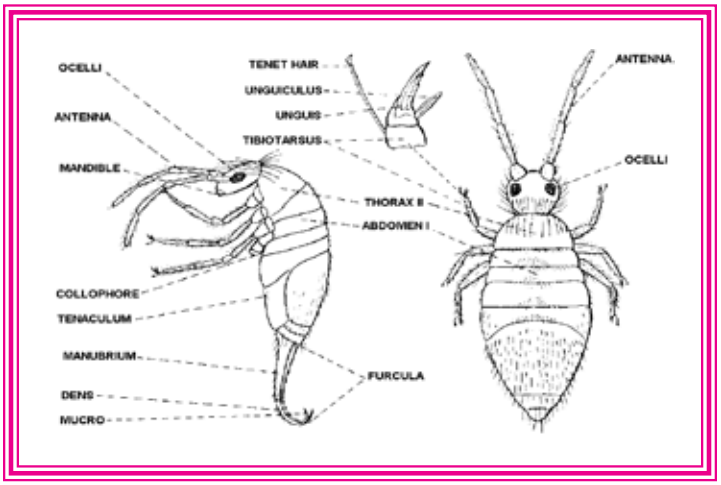
Egg - Microscopic in size.

Nymph - Resembles the adult in appearance, but smaller in size.

Adult - Fertile males and females. Their "tail" resembles a lever and is called the furcula. A clasp called the tenaculum holds the furcula to the abdomen. When disturbed the clasp releases the "tail" which strikes the ground, springing the insect into the air. When found on the snow, they have been called "snow fleas".

TYPE MOUTHPARTS - Piercing and sucking

DESCRIPTION



Adults - Minute primitive pests, 0.04 to 0.08" long, body elongate, of various shapes and sizes, soft, wingless, but all have a furcula or forked muscular "tail" at the tip of the abdomen which is used to spring them into the air. A 3/16" specimen can leap 3-4". They move in short runs followed by periods of rest. Usually white or gray but sometimes green, orange, yellow, blue or purple in color; they move about sporadically and appear in large numbers. The short antennae have only 4 segments and there are only 6 segments on the abdomen, which is the smallest number found on any insect. Their eyes are small with no more than 8 facets each. Small, slender, unmodified legs. Most species lack a breathing tube or trachael system, so respiration or breathing is through the cuticle. This also means water (with or without enzymes passes through the cuticle. Another unusual body part is a ventral tube or collophore on the underside of the abdomen. A tiny capillary tube runs from the bottom of the collophore to the mouth. When the insect wants a drink it sticks the tube into a drop of water and sucks the water off the top of the tube, like using a straw. There are over 675 species occurring in the U. S. and Canada, but only 20 or so will infest buildings. Over 4,000 species have been discovered worldwide. If someone tells you they have hundreds or thousands of very small, jumping insects (all over) - they probably have springtails. If you find them in the snow, they are called "snow fleas." In one soil study in Iowa, scientists found 100 million springtails in 11 square feet (one square meter) of farmland. They can jump 50 to 100 times their own body length.

Immatures or Nymphs - Same as adult in appearance except smaller in size. Usually 5-10 molts, but some species may molt up to 50 times.

Eggs - Microscopic, laid singly or in clusters in moist areas, usually several times.

LENGTH OF LIFE CYCLE - Virtually unknown. The oldest known fossil insect is a springtail that lived 400 million years ago. They are basically the first insect to infest a dead person and have been found in living people who

are sick.

HABITAT - There are found everywhere except for the open ocean and submerged in freshwater. They are one of the most common soil insects; they live as scavengers in soil amid dead leaves and mulch or in other moist areas rich in organic matter such as the soil in flower pots or in newly-seeded lawn areas well covered with composted manure, they are usually but a temporary nuisance attracted to cool areas of high moisture and are never found in hot, dry environments, so increase the heat and install a dehumidifier. They occur in enormous numbers on the surface, in the soil of woodlands, and also in decaying plant bulbs or other vegetable matter and other damp, dark places, e.g., kitchens, bathrooms, outhouses, cellars or basements, crawl spaces, verandas and/or on the snow. They will only invade buildings that have constant high humidity, organic debris and mold so install and use a dehumidifier, air conditioning and/or fans and clean with diluted Safe Solutions Enzyme Cleaners with Peppermint and/or borax. As the building dries, the springtails die or leave. **Use a dehumidifier and fans.**

NATURE OF INJURY - Usually only a visual, temporary annoyance to people. Homeowners may discover large numbers of these minute pests in their swimming pools, hot tubs, potted plants, and/or in moist soil and/or mulch or when they invade the building in search of better areas of moisture or dryness or they may be lured into an area by lights. Occasionally springtails will attack and damage the roots and stems of young seedlings. Some cause dermatitis in man, some are pests of dry milk. Various species feed on various materials, including living plants, algae, damp vegetation, fungi, spores, pollen, decaying plants and animal debris. Some are attracted by light. When they are disturbed they leap several inches into the air and then become invisible. The National Pediculosis Association has reports of collembola living in the sinus cavities and under the skin of several people. Try using a dry sauna at the highest temperature you can stand and/or bathe in diluted Lice R Gone®, Safe Solutions, Inc. Enzyme Cleaners and/or borax. Pyrethroids will not control springtails and are dangerous.

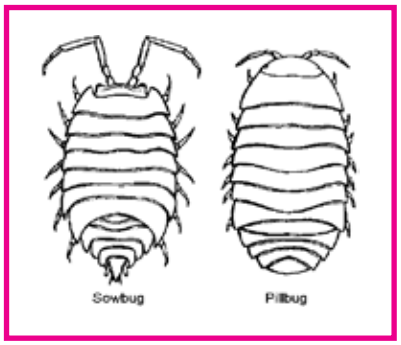
HARBORAGE POINTS - Found in decaying plants, bulbs and other decaying organic matter, basements, crawl spaces, potted plants, around kitchen sinks, and any other place that is damp and dark. In the Arctic, Pennsylvania, Michigan, etc., they can cover the snow. **Where possible spray or clean with Safe Solutions Enzyme Cleaner with Peppermint and/or borax or Not Nice to Bugs® carefully.**

INTELLIGENT PEST MANAGEMENT®

CONTROL - Make an unsuitable environment for springtails, simply increase air circulation and dry out the infested site. Repair any plumbing or moisture problems (e.g. sweating pipes) inside, increase the heat and install a dehumidifier, air conditioning and/or fans. Remove moldy wood and other damp or moldy items and/or treat with sodium borate. Eliminate low moist areas around outside of the home. Sealing cracks and crevices helps reduce the humidity and prevents invasions. Remove mulch and rotting vegetation. Allow plants to dry out before waterning them. Minimize use of outdoor lights. Keep screens and doors in good repair. Allow potting soil of houseplants to dry out between waterings, do not overwater potted plants. Caulk and seal the exterior of your home. Turn off the lights by the pool, etc. if you find you are attracting springtail invasions. Usually all you have to do is simply air the room and vacuum all of the visible pests. Eliminate places of concealment. Remove plants, bark, mulch, moist leaves and other such materials from under windows and near doors. Caulk and seal all visible cracks and crevices inside and outside. Control the humidity and moisture and you control the springtails. Spray heavily infested areas (that can not be dried out) with diluted Safe Solutions, Inc. Enzyme Cleaner with Peppermint and/or borax. Chlorinated water in your pool will eventually kill/drown the springtails in your pool water. Predacious mites will control them naturally. Try sprinkling (lightly) talcum powder or food-grade diatomaceous earth or Comet® in infested areas. Lights can be used to lure them onto glueboard traps or duct tape (sticky-side up) or food-grade DE.

SOW BUGS AND PILL BUGS
Phylum - Arthropoda

GENERAL DESCRIPTION



These small, oval land crustaceans, protected by objects on the ground, feed on decaying vegetable matter and fungi. They have been known to clip outside potted plant roots, but very little damage is expected of them. Heavy infestations outside encourages movement that causes individuals to find their way inside. Their names, *Porcellio* and *Armadillidium,* seem to distinguish these small oval arthropods. Sow bugs are more flattened than pill bugs. Salted and fried, they are an African snack eaten like potato chips.

Habitat Alterations

- Practice proper sanitation and humidity reduction.
- Remove hiding places where sow bugs and pill bugs can develop near the building, such as under boards on the ground, flower pots and flat stones.
- Remove mulch and replace with gravel, if necessary.
- Install a dehumidifier, vents, air conditioning or at least fans; direct ground water rain gutters and sprinklers away from the foundation.

Pill bugs are sometimes called roly-polies and get this common name because they roll up into a tight ball when disturbed. Both of these land-dwelling crustaceans are arthropods and not insects. They are called the wood louse in England. They both feed on decaying vegetable matter, rotting plants, mold, other woodlice, shed exoskeletons or their own excrement, and require moisture to survive. A/K/A Bibblebugs, cudworms, coffin cutters, gammer-sows, chookies, etc.

CLASS - Crustacea
ORDER - Isopoda
FAMILIES - *Porcellionidae and Armadillidiiae,* e.g., *Porcellio laevis* (Koch) the dooryard sow bug; and *P. scaber* (Latreille) or common sow bug, both cannot roll up into a tight ball. Both have two permanent tail-like appendages at the tip of their abdomens. *Armadillium vulgare* (Latrielle), the common pill bug, can roll up into a ball and lacks appendages and will feed on decaying protein.

TYPE OF METAMORPHOSIS - Gradual/simple

Egg - Retained in the marsupisum pouch underneath the female for about two months; then the very white young are born alive.

Nymph - Resembles adult in appearance but smaller in size. After the fourth instar, molting occurs every two weeks until the creature is 20 weeks old; then the period between molts varies. Most die due to dehydration.

Pillbug Adult - Fertile females and males. Gray/brown in color. 1/4-5/8” in length; averages about 1/2” long and typical of crustaceaus, with 7 pairs of similar legs. The head and abdomen are small, but the thorax is relatively large with 7 hard individual, overlapping plates. Convex above but flat or hollow underneath. Females are considered to be gravis when carrying eggs, embryos or young in their marsupia.

DESCRIPTION - The only crustaceans that live their entire life on the land. Their eyes are not on a stalk. The antennae are relatively large and consist of an elbowed peduncle and a whip-like flagellum. Preceding the antennae is a pair of much smaller antennules. **They must keep their breathing organs moist or they will die.**

Sowbug Adult - Light gray to slate colored, oval, arched body, about 1/4” to 5/8” long, seven-segmented thorax with seven pairs of similar, walking legs after the first molt. The abdomen consists of 6 segments, each with a pair of appendages known as pleopods; the last pair are called uropods. While they are truly terrestrial crustaceans, the greatest threat to their persistence is desiccation, so use a dehumidifier. Has two long and two short antenna. Sow bugs (not pill bugs) have two prominent tail-like appendages.

Nymph - Resembles the adult in appearance but smaller.

Egg - Microscopic in size and carried by female and hatch within the brood pouch or marsupium under the body. Normally the number of young per brood is 28 (range 5-79) and there are 1-3 broods per year. It takes about 45 days for the eggs to hatch, develop and emerge from the pouch.

LENGTH OF LIFE CYCLE - Approximately two generations per year. Takes one year to reach maturity; may live for 2 years. Both easily succumb to dry conditions, so dry everything out.

HABITAT - Lives in warm, dark, humid places such as greenhouses, flower beds, basements, first floor areas, but more commonly found under bark, dead laves, stones, crawl space buildings and under objects and organic debris and damp ground. Normally nocturnal. At times they can bury themselves several inches in the soil in order to avoid water loss. Usually inactive during the winter months. They both feed on decaying vegetable matter. **Remove any and all reservoirs and you control the pest problem.**

NATURE OF INJURY - Visual annoyance inside but they do hurt living plants outside and will feed upon decaying wood and other soft debris and/or vegetation, roots and tender growth of nearly all greenhouse plants. They invade damp basements and crawl spaces and/or first floors of structures via door thresholds, especially buildings with sliding glass doors on the ground level. They also may infest potted and overwatered plants. Indoor invasion typically means that there is a large population immediately outside the building. Usually they do not survive indoors for more than a couple of days unless there are very moist conditions and a food supply present. Routinely spray and/or clean with diluted Safe Solutions, Inc. Enzyme Cleaner with Peppermint and/or borax.

HARBORAGE PLACES - Because water loss is such a problem, sow bugs are inactive during the day and remain hidden under objects to reduce moisture loss. During the day they can be found around buildings in such places as under trash, boards, rocks, flower pots, piles of grass clippings, flower bed mulches, and other decaying vegetation. These pests are nocturnal and/or confined to areas of high moisture because they lack both a closing device for their respiratory system and an other waxy layer on their exoskeleton to prevent excessive water loss. **So install and properly maintain dehumidifiers, air conditioners and fans and/or desiccating dusts.**

INTELLIGENT PEST MANAGEMENT®

CONTROL - They lack a closing device for their respiratory system and an outer waxy layer on their exoskeleton and are therefore very susceptible to water loss. Properly install and maintain dehumidifiers, air conditioning, fans and/or vents. Carefully inspect and vacuum up or sweep up all visible pests. Caulk/seal all cracks and crevices. **Routinely clean and/or spray with diluted Safe Solutions Enzyme Cleaner with Peppermint and/or borax, or lightly dust with food-grade DE.**

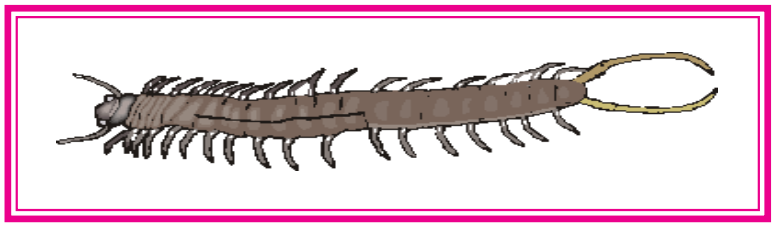
Indoors - Use a dehumidifier, air conditioners and/or fans. Cover earthen floors with a vapor barrier; repair plumbing and any secondary leaks, e.g., roofs; properly ventilate basements and crawl spaces to eliminate excess moisture from these locations; repair and seal cracks in foundation walls; caulk and weather-strip around doors and windows and drain any/all standing water and moist areas around the building.

Outdoors - Eliminate or reduce any and all moist areas. Carefully inspect crawl areas, around perimeter of structure, flower and shrub beds and weep holes in brick veneer structures. Remove grass clippings, bark, leaves, mulch, peat moss, debris, boards, stones and other such materials away from the perimeter of the infested building. Caulk and seal and/or screen all cracks, crevices and openings as necessary. Improve grade and drainage of rain water away from the foundation. Simply raking mulch and/or leaf litter away from the building in enough to control many of these pests.

Sanitation is important. Pill bugs and sow bugs quickly build up on fallen fruit, dog droppings and other similar organic material. Heavy mulch in flower beds also encourages these pests and makes control difficult. Clean up and remove all decaying organic matter, boards, grass clippings, mulch, bark, rocks, timbers, decorative items, RR ties, etc., especially close to your building. Trap them out of doors using boards, folded newspapers or dark plastic and then destroy. **Spray infested areas with diluted Safe Solutions Enzyme Cleaner with Peppermint or lightly dust with food-grade DE.**

Remember, the key to permanently controlling these pests is to reduce or eliminate the moist areas which make their survival possible. Remove mulch, boards, excess ground covers, piles of grass clippings, leaves, store boxes, lumber, firewood and flower pots off the ground, and provide adequate ventilation in crawl spaces. Use a dehumidifier and/or air conditioning, install a moisture or vapor barrier and proper venting in any crawl spaces, correct all moisture and plumbing problems and do not let branches touch or overhang the building. Be sure your doors are tight fitting. Use fans when necessary and borax or desiccating dusts, e.g., talcum powder or Comet® or food-grade DE if and/or where needed.

CENTIPEDES
AKA - "Hundred-Leggers"

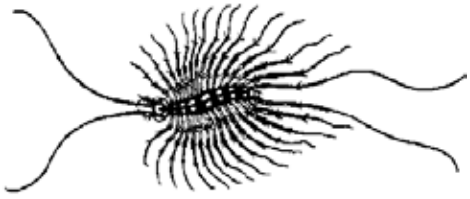


PHYLUM - Arthropoda
CLASS - Chilopoda

TYPE MOUTHPARTS - Chewing with poison jaws connected to poison glands.

Centipedes are sometimes combined with millipedes in the large group Myriopoda. There are at least 2,800 species of centipedes and over 6,500 species of millipedes. Centipedes will eat millipedes. Centipedes are flattened, elongated and many-segmented arthropods with one pair of legs attached to each segment (5 - 177 [or more] pairs) and one pair of somewhat long (many-jointed) antennae. Except for one group, centipedes live outside under stones and logs. The centipede that lives inside is known as the house centipede, *Scutigera coleoptrata* (Linnaeus).

Adults are 1/8" to 6" long elongate, flat and wormlike in appearance, yellow to dark brown in color often with stripes or markings, and run in a graceful manner on many, very long legs. House centipedes are found in small numbers in basements and other rooms that are not continuously occupied. They feed on worms, tiny insects and spiders. Although beneficial, they frighten many people who then insist they be controlled. House centipedes usually live in places that can be vacuumed; if the area is damp, use a rinse-and-vac or steam clean and use a dehumidifier and fans and vents and food-grade DE.



House Centipede

There are about 500 species in the U. S., centipedes are sometimes called "hundred-leggers" because of their numerous and highly visible legs. They have one pair of legs attached to most of their body segments. Even though centipedes are beneficial insect predators, they are also a high visual nuisance pest. Some species can inflict a painful *bite* and/or sting (with poison "jaws" connected to poison glands) that are not lethal, but usually results in a wasp-like sting and slight swelling. Centipedes actually have a pair of *chelicerae* that are tipped with sharp fangs and can "bite", but bites are not caused by the insect's actual jaws but by their front legs which contain poison glands and function like jaws; apply ice and antiseptic to the *bitten* area. Centipedes are typically found in areas of high moisture such as loose bark, in rotting logs, under stones, boards, railroad ties, trash, piles of leaves and grass clippings, mulch around flower beds, plantings, etc. where their typical prey is found. Most centipedes are nocturnal or active at night and hide by day in the earth, wandering forth by night to hunt. The first instars usually only have four pairs of legs - additional segments and pairs of legs are added with additional molts. Pairs of legs in adults can range from 5 - 177 pairs! Whatever the number, it will always be odd.

They occasionally invade structures, especially where they survive on flies, spiders, etc. Although they may be found anywhere in a building, including beds, the usual places are damp basements, bathrooms, damp closets

and potted plants and other damp situations where they are likely to find their prey, e.g., worms, pill bugs, insects, etc. They need areas of high moisture, so properly install and maintain dehumidifiers, fans and/or vents. Spray infested areas with diluted Safe Solutions Enzyme Cleaner with Peppermint and/or borax.

The integument of centipedes lacks the waxy coating of the typical insect cuticle and makes this creature extremely susceptible to death by desiccation. Centipedes are primarily carnivorous and obtain most of their moisture needs from their prey. Some species will sometimes feed on plant tissues, causing injury.

LAWN CENTIPEDE
Scolopendra spp.

Adult - Flat, elongated animal with one pair of legs per body segment. One pair of antenna usually long and many jointed. The wormlike body may be as long as 6". Their legs and antennae are proportionally shorter than the house centipede. "Giant" centipedes are in this family, e.g., *Scolopendra heros* can be 8" long. This giant desert centipede has a dark blue head and posterior "pseudohead", when a predator grabs the pseudohead, the real head can still bite.

Giant Desert Centipede *(Scolopendra heros)* is one of the world's largest species of centipede, not to mention, one of the prettiest. Although the venom from this centipede is not normally considered deadly, the Giant Desert Centipede can give a very painful bite and the venom injected could leave a person in pain from anywhere between a couple hours to a couple days! In 1931, a centipede taxonomist by the name of G. Attems listed three subspecies of Giant Desert Centipedes. These are the: Red-Headed Centipede *(Scolopendra h. castaneiceps)*; a beautiful jet black centipede with a red head and yellow legs, the Black-Tailed, also known as the Blue-Tailed Centipede *(Scolopendra h. heros)*; a yellowish centipede with light yellow legs and a blue to navy blue tail, and lastly the Giant Arizona Desert, or Black-Headed Centipede *(Scolopendra h. arizonensis)*; a red or orange centipede with yellow legs and a black head and tail, some with black stripes running across the tergites, parallel to the legs. The Giant Desert Centipede is a great display animal, and is a prized invertebrate in any collection. Centipede babies will eat pinhead crickets, or other small insects. Adults will consume almost any creature that is not larger that itself, including large crickets, cockroaches and even fuzzy mice.

COMMON HOUSE CENTIPEDE
***Scutigera coleoptrata* (Linnaeus)**

Adult - Worm-like body, grayish yellow in color, about 1" - 2" long with extremely long legs with quick movements. Can live its entire life inside a building. Usually has 15 pairs of legs. Body is grayish-yellow with three longitudinal dark stripes extending the full length of the back. Very long slender antennae. Uses last pair of hind legs to grab and hold its prey, e.g., spiders. There are 5 larval instars and 4 post larval instars before maturity. Originally from Mexico, it is now found throughout the United States.

NATURE OF INJURY - Centipedes can inflict a painful bite, especially if annoyed or crushed, but they are considered beneficial as they feed on small insects, their own larva and spiders. All centipedes have poison "jaws" with which they inject venom to kill their prey. If handled roughly, some of the larger species can break the human skin, resulting in a bite which causes some pain and swelling, something like a bee sting, e.g., the large Scolopendra can inflict a very painful bite and should be handled with great care.

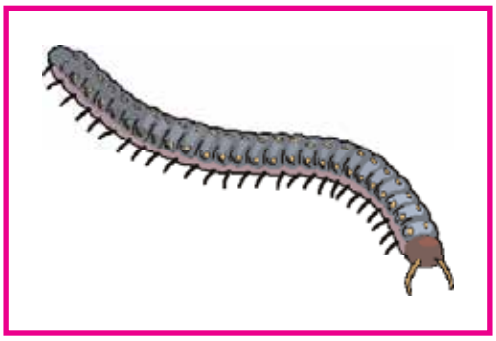
INTELLIGENT PEST MANAGEMENT®

CONTROL - The key to centipede control is to dry out the area and to remove their habitats, e.g., all excess vegetation, compost piles, trash, rocks, boards, decaying grass and leaves and other reservoir hiding places outside, especially from around the perimeter or foundation to reduce or eliminate moist areas and moisture problems, hiding places and harborages. **Inside:** Usually only one or two individuals will invade inside - vacuum up the pests; practice proper sanitation; use a dehumidifier, fans and/or air conditioning; install vents and a moisture barrier and/or fans in the crawl space; correct all moisture and plumbing problems. Caulk all access points to buildings. Dust with baby powder with talc or, better yet, food-grade DE. Spray with diluted Safe Solutions, Inc. Enzyme Cleaners or Not Nice to Bugs®. **Outside:** Trim all branches that shade, touch or overhang the building, routinely remove accumulations of leaves and grass clippings, trash, wood, logs, stones and rocks; store firewood, etc. up off the ground, and provide adequate ventilation throughout the building.

Inside centipedes are easily removed with a vacuum cleaner. A vegetation and foliage-free area or 3-foot band of exposed sand, stone or soil next to and around the foundation walls makes an ideal barrier. Place duct tape sticky-side up where you see these pests.

MILLIPEDES, AKA "Thousand-leggers"
PHYLUM - Arthopoda
CLASS - Diplopoda**, Order - Various**

GENERAL DESCRIPTION



Millipedes are cylindrical, many segmented arthropods with two pairs of legs attached to each segment. They have short antennae. Millipedes live outside in leaf litter; unlike centipedes, they may build up in very large numbers. Millipedes migrate in dry weather and enter basements, ground floors and window wells. They are a particular problem in houses located near woodlands. One species, the brown millipede, has been known to crawl up forest cabin walls when populations are numerous.

About 1,000 species in the U. S. Millipedes are sometimes called "thousand-leggers", but they usually only have 30 - 90+ pairs of legs, and never more 200 pairs; with bodies cylindrical and wormlike, about 1/16" - 4-1/2" long overall. They also are called diplopods or "double-foot."

FAMILIES - *Parajulus, Uroblaniulus, Oxidus, Fontaria* and *Orthmorpha, Orthoporous, etc.*
PHYLUM - Arthropoda
CLASS - Diplopoda

TYPE METAMORPHOSIS

Egg - Deposited in clusters in moist soil, the eggs are fertilized internally.

Larva - Resembles adult in appearance, but smaller in size with fewer legs. Usually takes 2 - 5 years and from 7-10 molts to reach sexual maturity. First instars usually have no more than seven body segments and usually have only three pairs of legs. Additional segments and pairs of legs are added with each additional molt.

Adult - Slow crawling, rounded, oval bodied animal, brown to brownish-black or gray in color with 2 pairs of legs on most of their body segments. May live several years. Slow moving vegetarians or herbivores.

DESCRIPTION

Adult - Slow crawling with 2 pairs of legs on most of their body segments about 1½" - 4½" long cylindrical and worm-like, nocturnal; hide during the day beneath various objects located on damp soil or in leaf litter or leaves. Adults and young can overwinter or hibernate and are usually found in the soil. Color usually blackish or brownish, occasionally red, orange or with mottled patterns. They are normally unable to survive indoors, but can live outside for several years.

Larva - Same coloring as adult but smaller in size. Does not have as many segments or many legs as adult. Usually there are 7 - 10 molts with additional segments and legs added with each molt.

Egg - Clusters laid during the summer in nest-like cavities in the moist soil. Eggs are usually white and hatch within a few weeks. As few as 20 and up to 300 eggs are laid during a lifetime.

LENGTH OF LIFE CYCLE - About four to five years depending on food, moisture and climatic conditions. Normally over-winter in the soil. Under extremely dry conditions they will migrate and search out a more suitable moist environment. They thrive in damp, organic matter.

HABITAT - Normally lives and hides outdoors in damp organic debris such as leaves, bark and in mulch around

outdoor plantings. Pay particular attention to cool, damp areas. They require high moisture areas with decaying vegetation e.g. trash piles, compost heaps, mulches, leaf litter, etc. - so eliminate them.

NATURE OF INJURY - Feed on damp and decaying wood and other vegetation as well as tender new roots and green leaves. Can migrate and become a nuisance in a house, especially in lower levels, e.g., crawl spaces during the fall. They protect themselves by secreting an unpleasant odor. Several species (when handled) give off an ill-smelling, repugnant fluid that contains hydrogen cyanide (hydrocyanic acid), iodine, and quinone which is toxic to some animals and arthropods and can raise small blisters in humans. Appply a corticosteroid cream or lotion.

HARBORAGE POINTS - Prefer damp, dark places under leaves, boards, in cellars, crawl spaces, etc., and forage out at night to feed and mate. Remove these reservoir problems, install a dehumidifier and control these pests. **Remember, they are unable to reproduce or even survive in an indoor environment.**

INTELLIGENT PEST MANAGEMENT®

CONTROL - Clean and/or spray with diluted Safe Solutions, Inc. enzyme cleaners or their peppermint soap and/or borax. **(Remember that borax kills plants.)** Spray them with Not Nice to Bugs®. Caulk as many cracks, crevices and/or openings you can find. Carefully inspect for insects and problem moisture areas. **Millipedes feed on and reproduce in decaying organic matter, so remove all these materials.** If they come inside they will eventually die within the structure as normal building conditions are too dry for them. Millipedes are not poisonous so remove by hand, broom or vacuum them all up live or dead. Be sure to check drip pans under window air conditioning units, under refrigerators, in crawls, basements and garages, under radiators and in other damp areas. **At times millipedes migrate by the thousands from surrounding fields**. They travel at speeds of a few inches to several feet per minute. They will climb trees and walls at night up to heights of 9 feet and come down at daylight after mating. It is virtually impossible to stop these masses with volatile “registered” pesticide poisons, so vacuum/steam clean or carefully spray infested areas with diluted Safe Solutions Enzyme Cleaner with Peppermint and/or borax. Lightly dust with food-grade DE.

EXTERIOR CONTROL - The key to controlling millipedes is to reduce or eliminate the moist areas which make their survival possible, e.g., piles of trash, rocks, boards, leaves, grass and compost outdoors and all moisture problems inside that attract them. Closely mow and edge the lawn and routinely dethatch the lawn because dense thatch just above the soil surface holds moisture. Mow the lawn closely and edge it because this promotes quicker drying. Routinely remove accumulations of leaves and wood debris, rocks, bark, mulch, stored firewood, etc. up off the ground, and provide adequate ventilation in crawl spaces to reduce sheltered, damp hiding places they use for harborages. Water lawns only as absolutely necessary and then only in the early morning to allow the grass to dry during the day. Caulk and seal all cracks and crevices. Steam clean or vacuum and/or spray foundations and/or visible insects with soap and water and/or diluted Safe Solutions Enzyme Cleaners or Not Nice to Bugs®.

During mass migrations, the major population can be found (during a night-time inspection), and can be easily removed with a shop vac. Indoors, they are most easily removed with a vacuum. You can try lightly sprinkling baby powder with talcum or Comet® cleanser, food-grade DE and/or mop the floor with CB Mop Up® or borax.

Final notes: To safely and permanently control both centipedes and millipedes you must eliminate any/all moist habitats such as crawl spaces, poorly drained areas, and piles of trash, grass clippings, leaves, mulch or compost. Remove indoors by vacuuming. Caulk all seams around basement windows, doors, and cracks or holes in the foundation. **Remember to dethatch lawns regularly, mow and edge lawns, remove debris and water only during the morning hours so grass will dry during the day.** Centipedes and millipedes most often are found in damp secluded areas outdoors—usually under mulch, bark and lumber. Firewood stacked alongside a structure also may harbor centipedes and millipedes. Stack the wood in a more remote location. Lumber, old boards, grass clippings, boxes and similar items should also be moved away from the structure.

Habitat Alteration

- Closely mow the lawn and edge it and dethatch it .
- Remove leaf litter, lawn clippings, mulch, debris and compost near house foundations.
- Caulk around door and window facings, weather-strip doors and ground level windows.
- Direct rain gutter down spouts and sprinklers away from the foundation.
- Water lawns only in the early a.m. so the grass can dry out during the day.

Intelligent Pest Management® Control Summary

- Practice proper sanitation.
- Install a dehumidifier, air conditioner and/or fans. Steam clean or carefully spray infested areas with diluted Safe Solutions Enzyme Cleaners with Peppermint and/or borax or Not Nice to Bugs®.
- Carefully seal/caulk all cracks and crevices around building foundations.
- If the infestation is particularly persistent, or if the migrating pests have built up in very high numbers, create a vegetation-free area around the building as a barrier.
- Vacuum outside during mass migrations and/or the occasional invader inside.
- Lightly dust with talcum powder, baking soda, food-grade DE and/or mop with sodium borate or borax.

SPIDER MITES

Spider mites are tiny oval arthropods barely visible to the naked eye. They are found mostly on the undersurfaces of leaves, and if numerous they may be spotted by the formation of a silky webbing between veins on the leaf undersurface. Spider mites thrive on dry warm conditions and literally boom after volatile, synthetic insecticide poison applications. Even very weak solutions of diluted Safe Solutions, Inc. Enzyme Cleaners will kill them and yet not harm the beneficial organisms.

Spider mites are among the most common pests which attack ornamental plants. They are not insects, but more closely related to spiders and ticks. Adult mites, spiders and ticks have eight legs. Mature mites are usually less than 1/50” in length and generally found on the undersides of the leaves. Mite infestations are often not detected until the plants are severely damaged, stunted and/or dying.

Mites have needle-like, piercing mouthparts with which they puncture the leaf and suck the plant juices. Damage from light infestations appears as yellow or gray stippled patterns on the leaves. The undersides of infested leaves usually have fine silken webbing spun across them. Heavy infestations cause the leaves to turn yellow, gray or brownish and eventually drop off. Webbing may be spun over entire branches or in the case of small plants, over the entire plant. When the undersides of the leaves are examined closely with a 10 or 15 power magnifying glass, the small mites can be seen. They may be reddish, green, yellow, purple, black, or virtually colorless. The body contents sometimes show through their transparent body wall giving them a spotted appearance. Cast skins may also be seen among the live mites imparting a grayish residue to the undersides of the leaves.

There are many species of mites and their development differs somewhat, but a typical life cycle is described next. The adult female mite is capable of laying several hundred eggs during her life. The eggs are attached to the fine silk webbing and hatch in approximately three days. The immature mites molt three times before reaching the adult stage. The length of time from egg to adult stages varies greatly depending on temperature. Under optimum conditions, (approximately 80^{o} F), mites complete their development from egg to adult in 7-10 days. There are many overlapping generations per year.

Some of the plants on which mites are frequently found include African violet, azalea, camellia, chrysanthemum, citrus, ligustrum, pyracantha, orchid, rose, and viburnum as well as others. Mite damage is much more severe during dry weather. Large numbers of mites are commonly seen during the spring months, especially April and May, and also again in September and October.

Spider mites live within the silk webbing they make, remove this webbing and you gain control. A fine misting with water will highlight the webs, allowing them to be picked off by hand or vacuumed with a rinse-and-vac. Over larger areas a forceful spray of water (with or without diluted enzyme cleaner) will disrupt the webbing and dislodge the mites. Insect predators include lady bug beetles, praying mantis, assassin bugs, other mites and tiny wasp-like parasitic insects. The Author has controlled spider mites with diluted Safe Solutions, Inc. Enzyme Cleaners at a 1 to 500 (or greater) ratio and did not harm the beneficials.

HELIX WORMS

Whenever you find these all over the building, trees, etc., simply spray them with dormant oil/Safer's soap or diluted Safe Solutions Enzyme Cleaner with Peppermint or Not Nice to Bugs®.

CHIGGERS
Trombicula spp.
FAMILY - Trombiculidae

Chiggers, sometimes called harvest mites or redbugs, are mites, close relatives of spiders and ticks. Morethan 3000 species of chigger mites have been classified, but only about 20 species are considered to be pests. (In Asia, chiggers serve as vectors of scrub typhus, but do not cause skin reactions, e.g., lumps or itching.) The common chigger is *Trombicula alfreddugesi* (Udemans), it occurs all over the U.S. *Tromicula splendens* (Ewing) occurs primarily along the Atlantic and Gulf Coasts. *Tromicula batatas* (Linnaeus) primarily is found in the south. The brilliant red-colored, eight-legged adults can be seen crawling on the ground and are about 1 mm long and usually bright red. The mite life cycle is divided into six stages: egg, 2 larval and 3 nymphal and adult stages. The parasitic nymphs feed on an animal or human host. Adult chiggers are free-living predators of small invertebrates, e.g., springtails, isopods and other arthropods, their eggs and some dead organic matter and are not parasitic and do not attack man and other animals. In the larval stage microscopic (invisible to the eye) chiggers are parasites of vertebrates, including man. The most common species of chiggers inhabit cut-over areas, especially wild blackberry patches, forest edges and river valleys. Only the larval stages wait in tall grass and shrubs and readily transfer to the first appropriate host that happens by. On man, they seem to prefer areas of the body where the clothing is tight, such as the waist, crotch, armpits and ankles and/or where the flesh is tender. Itching starts in about 3 - 6 hours, followed by the development of red, dome-shaped lumps. The itching then increases in severity for a day or more and may not subside for days. They do not suck blood, but instead pierce skin cells, insert saliva (digestive juices) which digests the tissue and then they slurp up the (semi-digested) material. Eliminate or closely mow all breeding sites, especially tall grass, brush, briars, weeds and other thick vegetation that provide an abundance an abundance of moisture and shade. Remove populations of wild hosts, e.g., rodents. Wear protective (zippered) clothing such as a long-sleeved shirt and trousers, shoes and socks. Tuck pant legs into boots or socks. Avoid sitting on the lawn or in brushy areas. Remove and wash your clothing as soon as possible. Take a warm, soapy shower or bath if you are exposed and scrub with a stiff-bristled brush. If you do become infested, scrub the chiggers away. Chiggers drown in castor oil. Use a hand magnifying lens to examine the affected area and make sure that you have removed them all. Spray the yard with diluted Safe Solutions Enzyme Cleaner with Peppermint. A moist aspirin tablet will ease the pain/itch of their bites, or apply an oatmeal and crushed banana compress or diluted enzyme cleaner after chigger heads and bodies are flicked from the victim's body.

Pest and Intelligent Pest Management® Review

The larval chigger is an active creature that moves to the tip of grasses and fallen leaves to wait for and grab onto a passing meal. They need moisture to survive, so increase air circulation and sunlight. Rodents are a common host but chiggers can attack a variety of other animals and humans. Chiggers move to a feeding spot (ears of rodents, around the eyes of birds, or where clothing is tight on humans) and attach themselves tightly to the rim of a hair follicle. After secreting digestive enzymes, they suck up liquefied host tissues. They neither suck blood nor burrow into the skin. The rash and hardened, raised area around the bite and the intense itching associated with chiggers is an allergic reaction to the mite's salivary secretions.

Chiggers most frequently occur in overgrown brush or grassy areas, especially where small rodents, birds, rabbits, livestock, pets, poultry, snakes, toads, man and other animals are abundant. Females lay eggs singly on the ground in groups of up to 400, picking damp but well drained sites. They may be particularly abundant near stream banks, under trees, orchards, or berry thickets. There is one generation each year with chiggers most abundant during July, August and early September.

Personal Protection

- Avoid walking through uncut fields, brush, and other overgrown areas, especially during July through early September. Instead, walk in the center of dirt and/or mowed trails to avoid brushing up against vegetation where chiggers congregate. Most chiggers will attack around the ankles or under the knees; some will, however, attack the crotch and/or armpits, but they normally wander about a person's legs for several hours before they begin to feed - so vacuum and/or brush your clothes regularly or carefully mist or spray with diluted Safe Solutions, Inc. Enzyme Cleaners. Use Safe Solutions Insect Repellent.
- When hiking or camping in chigger-infested areas, wear long pants tucked into boots or socks. This will help keep chiggers on the outside of your clothing. Lightly dust with food-grade DE.
- Consider applying an insect or tick repellent (e.g., menthol or talcum powder) to shoes, cuffs, socks, and pant legs. If you use a poison, be sure to read and follow directions for use on the container.
- Showering or bathing immediately after coming indoors effectively removes chiggers which have not yet attached. Soaking in diluted Safe Solutions, Inc. Enzyme Cleaners or vinegar water should remove those that have attached.

Controlling Chiggers Outdoors Using Intelligent Pest Management® Techniques

Chiggers are sometimes in yards, parks, camps, picnic sites, and other recreational areas. They can be reduced in these areas by vegetation management. This includes regular mowing and brush removal to create a less favorable habitat for chiggers and their wild hosts. Wood, brush piles, and other accumulated debris should also be removed. Short grass will allow penetration of sunlight and wind and will promote drying. These conditions are less suitable for chiggers and provide a more long term solution.

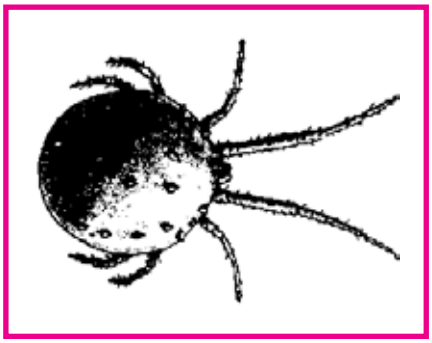
Diluted Safe Solutions enzyme sprays or Not Nice to Bugs® may provide some temporary reduction of chiggers. They are most effective when directed into areas where chiggers and their animal hosts are likely to frequent. Pay particular attention to borders and fences between wooded or brush areas and the lawn, around ornamental plantings, beside foot paths, and the dog house. **Lightly dust with food-grade DE.**

A single application of diluted Safe Solutions Enzyme Cleaner with Peppermint during late-April or May is often all that is required, although treatment may need to be repeated in June.

The ground and vegetation up to a height of about three feet should be thoroughly wetted with enzymes. Children and pets can be kept off treated areas until the vegetation is completely dry. Treating the entire lawn is of little benefit since chiggers avoid direct sunlight and normally will not infest areas which are well maintained. Put out a few dozen black plastic plates wirth a light coating of oil.

You can also apply (with protective gloves and a respirator/dust mask) 5 pounds (for every 100 sq. ft. of lawn) powdered soil sulphur early in the morning when everything is wet with dew. Sulphur applications should be made once in late spring and again in late summer. Make sure to water the powder into the lawn for at least 20 minutes. CAUTION: You may make the soil more acidic. This treatment will not only help control chiggers, but also fleas and will lower soil pH.

CLOVER (OR BROWN) MITES
The Clover mite, *Bryobia praetiosa* (Koch) and the Brown mite, *B. arborea* (Morgan and Anderson)
Class - Arachnida, Order - Acari, Family - Tetranychidae



This fast-moving, harmless mite has an oval, soft body less than 1/64" - 1/16" long in its adult stage. It is bright to dark red, and when smashed leaves a red streak. Front legs, as long as the body, move like antennae. [This characteristic distinguishes this mite from other red species]. Their are no male clover mites in the United States. The Brown mite lives in orchard trees, the Clover mite lives in grasses, weeds, shrubs and occasionally invades houses. A related species *Petrobia latens* (M.) has invaded homes in California. Females deposit their red eggs (about 70) in bark crevices and building cracks during early summer and in the fall. Nymphs develop from summer eggs to invade dwellings in the fall.

Immature stages are bright red in color. Eggs laid in the fall hatch the following spring.

Their habitat is grass and low weeds near building foundations, warmed by the sun and sheltered from the chill. Occasionally clover mites can be found feeding on moss on the roof and entering the structure by the thousands! Mite invasions are influenced by the temperature in their habitat combined with heat reflected from adjacent buildings. Mites build up on the south side of buildings where their habitat optimum temperature reaches above 69° F. on sunny, late fall and early, spring days; general air temperatures are lower. As general air temperature increases, the temperature in the mites' habitat grows too high. Both egg and mite development and activity suspend when temperatures exceed 75° F. or fall below 45° F. in their ground level habitat on grass or house foundations and siding. When active, mites move from the grass area onto foundations, up under sheathing, or into wall cracks and spaces around windows that lead indoors. Mites that reach interior wall voids in the fall may contribute to the following early spring invasion. Mites seem particularly attracted to fresh mortar. They feed on some 200 different plant species, e.g., trees, crops, shrubs, flowers and grass.

Clover mite populations seem to be highest and most invasive following the installation of new lawns. Clover mite populations reach their height where subdivisions or housing developments are landscaped by seeding and raking bare earth, or more often now, by hydro-seeding. Well-fertilized grass (and other ground cover in the West) contributes to the mites' well-being; lack of shade allows uniform temperatures across the sunny lawns and buildings. Scraped, bare soil is devoid of predatory mites and insects; it encourages the free build up of clover mites on new, fertilized grass. As the lawn matures and the plant, shrub, and tree community diversifies, a diversified insect population is supported and clover mite invasions essentially cease. Spray heavily infested areas with diluted Safe Solutions Enzyme Cleaner with Peppermint or Not Nice to Bugs®. Vacuum clover mites inside to avoid red smears and stains. Lightly dust with food-grade DE.

Habitat Alterations

Whenever infested buildings and yards meet criteria that support clover mites, habitat alteration should be strongly recommended.

Outside:

- Place bare earth covered with ground up tires, stones, gravel or gravel over plastic or a weed barrier fabric as a barrier strip about 2' wide on the sunny side of buildings to stop clover mite migrations.
- Plant shrubs in front of this strip; shrub mulching will add to the barrier's effectiveness by diversifying the habitat and breaking up the even temperature gradient near the foundation. Do not mulch (with organic materials) next to the foundation. Lightly dust with food-grade DE.
- Close-mow the lawn in a 20 foot band to decrease grass protection and temperature insulation.
- Caulk building cracks and the spaces where window and door framing join building siding.

Inside:

- Caulk window and door framing and weather-strip windows on the sunny side of the house.
- Caulk electrical plates and other openings. Properly install fans and a dehumidifier.

Note: Most pyrethroids will not kill mites of any kind.

INTELLIGENT PEST MANAGEMENT®

Control

Outside:

- Create a vegetation-free area around the building and/or use (insecticidal) soaps per label directions or, better still, spray infested areas with diluted Safe Solutions, Inc. enzyme cleaners or soaps. Just a18" (to 36" wide) grass-free strip around a building will reduce the number of invaders by 90%. Lightly dust with baby powder containing talcum powder or Safe Solutions Food-Grade DE.

Inside:

- Simply vacuum or place a thin film of cooking oil or Vaseline or sticky tape or duct tape (sticky-side

up) on window sills to trap mites for removal later. This will avoid most red smears and stains.
- Vacuuming up the invading mites immediately reduce the population. Use caution: sweeping or brushing can smear them. Mop with diluted Safe Solutions, Inc. Enzyme Cleaners and/or borax.
- Caulk/seal all cracks and crevices and/or openings in structural joints and spaces from which mites emerge. Lightly dust with talcum and/or medicated body powder or food-grade DE.
- Practice proper exclusion, sanitation and habitat reduction techniques.
- Steam clean as needed or spray with Not Nice to Bugs® as needed.

Follow-up

- Monitor lawns in new areas or subdivisions with actual or potentially high clover mite populations. Spray with diluted Safe Solutions Enzyme Cleaner with Peppermint.

CLASS - Arachnida
ORDER - Acarina
FAMILY - Tetranychidae. There are 15 - 20 different morphological forms of the clover mite in the U. S.

Metamorphosis - Simple/Gradual

Egg - Laid in and around dry protected places such as mortar joints, under shingles, bark, between the walls in cracks and crevices, in concrete and other similar areas.

Larva - Has six legs, but otherwise similar in shape and habit to adult.

Nymph - Has eight legs, but otherwise similar in shape and habit to adult. Bright red in color.

Adult - Has eight legs and is oval in shape. No males have been found.

TYPE OF MOUTH PARTS - Piercing and sucking.

DESCRIPTION

Adults/Nymphs - Approximately 1/32" long, flat and wrinkled. Have a dark red or brown to greenish bodies with scattered, feather-like plates on their backs. The legs are often reddish-orange; the front pair is the longest.

Larva - Has six legs and is similar to the adult. When newly hatched the larva are reddish; may become greenish-brown after feeding.

Eggs - Very minute, spherical and bright red. Usually laid in winter. Will not hatch at temperatures over 86° F. or below approximately 40° F.

LENGTH OF LIFE CYCLE - One to seven months, with up to two to five generations per year.

HABITAT - Dwells and feeds on a wide range of plants, including fruit trees, cucumbers, ornamental plants, dandelions, legumes, lawn grasses, weeds, clover, flowers and vines. Clover mites have the unusual habit of migrating from outdoor sites into homes and buildings in tremendous numbers, usually in spring. They are often found indoors on the sunny side of your building. Establish a bare soil/stone/concrete barrier about 2 ft. wide around the foundation to discourage migration into your building.

NATURE OF INJURY - Plant feeding on a great variety of flowers, plants and trees (deciduous and conifer) may cause foliate to turn yellow or brown and wilt. Flowers and cucumber plants are also injured by feeding. Clover mites are objectionable indoors because they crawl over walls and other objects in great numbers and can stain surfaces with red spots if crushed. They do not attack man.

HARBORAGE POINTS - Carefully inspect outdoors in grass, shrubs, trees and crevices and faults in your exterior walls. Indoors, carefully inspect in crevices around your window and door frames, hardware, plaster, baseboard and quarter round, furniture and on exposed surfaces, especially on the sunny side of your building.

INTELLIGENT PEST MANAGEMENT®

CONTROL - **Stop fertilizing your lawn**, put a 24" grass-free sand, gravel, concrete, or stone perimeter barrier around the foundation of your building. Make sure all windows and doors are properly caulked, sealed, and screened to prevent entry by these mites. Careful inspection will reveal greater populations of these pests on heavily fertilized older lawns than any other ground covering. Use a knockdown spray or spray with diluted enzyme cleaner or simply vacuum inside your building. Dry out the outside area, remove vegetation (for a distance of 20 feet out from the walls) and/or install a plant free peagravel/coarse sand/stone/concrete barrier around the perimeter of the structure, especially the sunny side of the structure. Cut grass closely and remove clippings. Spray infested areas with diluted Safe Solutions Enzyme Cleaner with Peppermint. Caulk and seal all cracks and crevices and other opening. Install a dehumidifier and/or use desiccating dusts (e.g., talcum powder or Comet® cleanser) only if necessary.

Remember, a vacuum cleaner may be used to pick up all visible exposed mites and eggs instead of using any volatile, synthetic residual poison or aerosol chemical poison applications. Be careful, however, to avoid crushing the pests as red stains might result. For mites on wall papered walls or curtains, carefully vacuum or if stains develop, stand back about 6 feet and drift a mist toward the area with diluted Safe Solutions, Inc. enzyme cleaners. Even if you only properly seal and caulk your building, you will eliminate any further entry into your building.

FOREST TENT CATERPILLAR

The forest tent caterpillar, *Malacosoma disstria*, is an important defoliator of North American hardwoods including sugar maple, oak, black gum, and aspen. Despite its name, the forest tent caterpillar does not build tents but spins silken mats on tree trunks and large branches.

New caterpillars (larvae) hatch in the early spring when leaves begin to grow. The caterpillars eat foliage, and when they are numerous, tree crowns may appear thinner or in the worst situations, they may eat all the leaves on a tree.

When enormous numbers of caterpillars are present, the situation is referred to as an outbreak. These outbreaks typically occur every 6-16 years. An outbreak may last up to 6 years depending on weather conditions, food (leaves) supply, and natural enemies such as parasites, predators, and diseases. The effect of forest tent caterpillar feeding on trees is usually some dead branches and growth loss. However, when feeding is combined with other factors like drought or disease, a tree may die. Spray with or Not Nice to Bugs®, diluted Lemon Joy® dish detergent or diluted Safe Solutions Enzyme Cleaner with Peppermint. Lightly dust with food-grade DE.

Fully grown caterpillars are about two inches long and have a row of 10 - 12 footprint-shaped markings down the middle of their backs. After feeding on foliage for several weeks, the caterpillar spins a cocoon on leaves or bark. Light brown moths emerge from the cocoon and mate. Females lay up to 200 eggs in "egg bands" that encircle small twigs. The insect overwinters in the egg stage.

EASTERN TENT CATERPILLAR

Eastern tent caterpillars *Malacosoma americanum* (F.) become a pest when they feed on deciduous trees and cause defoliation. They construct a tent of silk on one or more branches of a tree. The tent provides protection against weather conditions and predators. The caterpillars feed during the day, and at night, they return to the tent for protection. Considered to be one of the most widespread defoliators of deciduous shade trees.

The caterpillar is approximately 2" long, hairy and black with a cream colored stripe down its back. Blue spots, as well as, brown and yellow lines can also be seen along the sides of the caterpillar's body. Put a Vaseline® or Tanglefoot® pest barrier around infested trees, shrubs and vines.

LIFE CYCLE

The life cycle of the eastern tent caterpillar consists of egg, larva, pupa and adult stages. In June or July, the female adult, a reddish-brown moth, lays numerous eggs (up to 300) on a branch. The eggs are held together

by a sticky substance, and the following spring when the leaves begin to unfold, the eggs hatch into the larval stage. It is the larval stage (caterpillar) of the life cycle which causes damage. In approximately five to seven weeks, the caterpillars reach maturity. In early July, the caterpillar leaves its food source and wanders about looking for a suitable place to pupate and may even move indoors; then it spins a cocoon and pupates for two weeks. After emerging as an adult, it mates and lays eggs within a period of 24 hours. Only one generation of Eastern tent caterpillars is produced each year.

MONITORING

Monitor for eastern tent caterpillar presence at different times of the year. Check for cocoons during summer, silky tents during the spring and egg masses in fall and spring. If present, begin a control program using one or more of the following methods.

PHYSICAL

Begin control at night when groups of caterpillars will be gathered together inside a tent. Cut the tent open and hand pick the caterpillars. The removed caterpillars can be placed in a bucket of soapy (Lemon Joy® dish detergent) water, diluted Safe Solutions enzyme cleaner, or crushed. This is most effective because large numbers can be removed at once.

You can also physically remove egg masses by scraping the clusters with a knife. Prune trees in late fall or early spring to keep populations low.

BIOLOGICAL CONTROL

Some natural enemies of tent caterpillars are birds and rodents. Open the nests or tents to expose the caterpillars to them. Spray with the bacterium *Bacillus thuringiensis* (Bt).

CHEMICAL CONTROL

If physical and biological measures are not effective, use diluted enzyme cleaner spray which will have a minimal impact on both you and the environment. Apply a dormant oil in late winter to kill the eggs before they hatch. An insecticidal soap is another option for control of the eastern caterpillar. Open the tent or nest and spray them with diluted Lemon Joy® or Safe Solutions Enzyme Cleaner with Peppermint or Not Nice to Bugs® directly on the caterpillars late in the day when they are gathered inside. Or cut off the nest, put it in a bag and freeze it or throw the nest into a pond for the fish to eat. Lightly dust with food-grade DE.

THE GYPSY MOTH
ORDER - Lepidotera
FAMILY - Liparidae

Description - The Gypsy Moth, now called *Portheria dispar* (Linnaeus), a species introduced from Europe, is the most common in the East; its larva does tremendous damage to the forest trees and about 500 different plant species. In the late 1860s a French astronomer named Leopold Trouvelot brought an obscure European moth then called *Lymantria dispar* (Linnaeus) to his home in Bedford, Massachusetts to develop a disease-resistant form of silk worm. Some of his captive moths escaped. Since that time there have been organized eradication efforts in the U.S. Despite these efforts, the gypsy moth has spread and become the most notorious forest/tree pest in North America. Note: The Gypsy moth was first identified in Michigan in 1954, and aerial spraying with DDT for the next nine years resulted in the “successful” eradication. In 1966 a “new” infestation was found and carbaryl was used to “eradicate” the Gypsy moth. In 1973, carbaryl and diflubenzuron were used by the Michigan DOA to “eradicate” the Gypsy moth. By 1980 the Michigan DOA “eradication” efforts continued and over 16,000 ha were sprayed with poison between 1980 and 1984. By 1984, the Gypsy moth had spread to 73 of the 83 counties in Michigan. Today, spraying of Bt and other toxins continue to “control” this pest. Male Gypsy moths are brownish, with plumose antennae, and are good fliers; the females are white with black markings; do not fly. They are in the Tussock Moth family. Lepidoptera all have scale-covered wings.

Gypsy Moth Control - Scrape and remove all egg masses - 50% of all residential egg masses (containing

500-1000 eggs) occur within reach of the ground. Try to spray the infested trees with or Not Nice to Bugs® or soapy water and/or diluted Safe Solutions Enzyme Cleaner with Peppermint using a stainless steel 3½-gallon fire extinguisher, but if the trees are too tall - Gypsy moths like to migrate down the trunk during the heat of the day to find cool shade - so tie layers of burlap around the trunk of the infested tree and then late in the afternoon, lift the layers of burlap and spray them with diluted enzyme cleaner or vacuum them up or brush them into a 5-gallon bucket half filled with soapy water - repeat as necessary. Install bands of Tanglefoot® or Vaseline® around the infested trees. You might also try parasitic wasps - some suppliers are: A-1 Unique Insect Control, 5504 Sperry Dr., Citrus Heights, CA 95621, 1-916-961-7945, web site: http://www.a-1unique.com; ARBICO International, P. O. Box 4247 CRB, Tucson, AZ 85738, 1-800-827-2847 (BUGS), web site: http://www.arbico.com; Beneficial Insectary, 9664 Tanqueray Ct., Redding, CA 96003, 1-800-477-3715, web site: http://www.insectary.com; Caltec Agri Marketing Services, P. O. Box 576155, Modesto, CA 95351, 1-800-491-2847 (BUGS), web site: http://www.caltecag.com/; Nature's Control, P. O. Box 35, Medford, OR 97501, 1-541-245-6033, web site: http://www.naturescontrol.com and/or Natural Pest Controls, 8864 Little Creek Dr., Orangevale, CA 95662, 1-916-726-0855, web site: http://www.natpestco.com - this shows promise but really has not been properly field tested. Aqueous neem seed extracts containing 0.5% extractable product sprayed on oak tree leaves gave 100% control of gypsy moth. Remove debris, bark flaps and dead branches every fall. Gypcheck® is the registered name of a baculoviris or nuclear polyhedrosis virus, which is a naturally-occuring pathogen that can collapse high gypsy moth populations. The USDA - Forest Service has registered this microbial control agent for use against the moth. Azadirachtin, a tetranortriterpene present in Neem extracts, can also be used to control these pests as can diluted Safe Solutions Enzyme Cleaner with Peppermint or their food-grade DE.

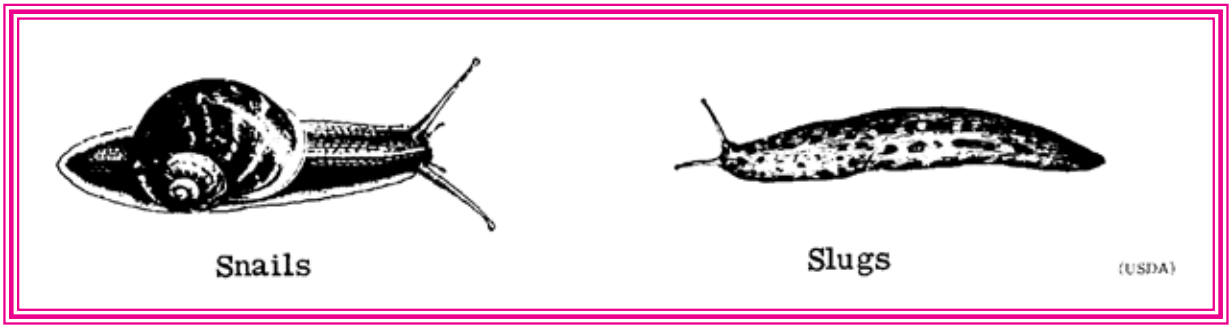
IMPORTED PARASITES THAT ATTACK GYPSY MOTHS IN NORTH AMERICA

Natural Controls & Parasites	Type	Host Stage	Generations per Year
Anastatus disparis	Wasp	Egg	1
Ooencytrus kuwanai	Wasp	Egg	2-4
Apanteles melanoscelus	Wasp	Young larva	2
Phobocampae disparis	Wasp	Young larva	1
Exorista larvarum	Fly	Larva	Numerous
Compsilura concinnata	Fly	Larva	Numerous
Parasetigena silvestris	Fly	Larva	1
Blepharipa pretensis	Fly	Larva	1
Brachymeria intermedia	Wasp	Pupa	1-2
Entomophago maimaiga	Fungus	Disease	NA
NPV (nucleopolyhedrosis)	Virus	Disease	NA

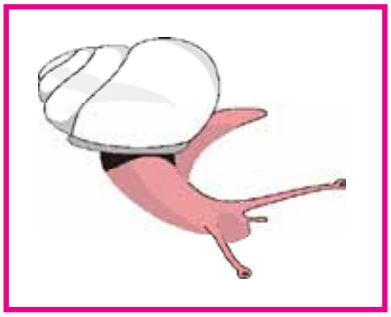
When the temperatures drop below -28° F on a single day or below -15° F at least 15 days, the eggs begin to perish in the egg masses. Try Bt or diluted Safe Solutions, Inc. enzyme cleaner sprays or their peppermint soap or diluted red dye if you must spray. Put Tanglefoot® or Vaseline® pest barrier around infested trees, shrubs and vines.

In 1999 Delaware's Department of Agriculture announced that for the first time since 1981 it would not be spraying 49,000 acres in spring and summer; the 1998 virus and fatal mold applications had resulted in no egg masses in the Fall 1998 survey.

SNAILS AND SLUGS



We make fun of these creatures that epitomize the slow. We have “snail mail;” when we feel less than full of energy, we say we are “sluggish” and we call those of us that are lazy “sluggards;” when some is slow, we say they are doing so at a “snail’s pace.” Snails and slugs are mollusks related to clams, oysters, scallops, abalone, octopi and squid. Other pests that belong to this group are the shipworms (shipworms bore into wood that is in contact with salt or brackish water) and the pholads, clam-like marine organisms that attack and destroy submerged wood. Snails have prominent shells that distinguish them from slugs. They are pulmonates (having lungs). They both require a continual source of moisture to stay healthy and to make the slime trails formed by mucus that are essential to their locomotion. There are several hundred species of snails and about 40 species of slugs in the U.S. Slugs and snails are hermaphrodites, they have both male and female sex organs. Both snails and slugs have 4 tentacles on their heads. They have eyes at the tips of their larger posterior (or optic) tentacles. They have three pairs of chemosensory pads capable of sensing odors and/or tastes. The long posterior tentacles have a pair of sensory pads that pick up odors from a distance. The short, stubby anterior tentacle pads can detect closer odors. The third pair of sensory pads is on the labial pads adjacent to the mouth and may be used to taste. Eggs are laid in masses of up to 100 eggs in soil, under debris, rocks and plants. The eggs are large, 1/8 to 1/4 inch in diameter, white or colorless. A single slug can lay up to 400 eggs in a year, starting at the age of three months. Eggs do not hatch until they come in contact with moisture. Slugs may live up to two years and the common brown garden snail may grace your garden for up to 12 years. They seem to have strong homing abilities.



PHYLUM - Mollusca
CLASS - Gastropoda;. Subclass - Pulmonata
ORDER - Stylommatophora, Geophila (=stylommatophora)
FAMILY - Various including *Limax, Deroceras, Helix.* and *Oxychilus.*

TYPE OF MOUTHPARTS - Rasping

METAMORPHOSIS - Simple/Gradual

DESCRIPTION

Snails - Color varies but is often gray. Body soft, sluglike, lacks segmentation, with jointed appendages, exoskeleton and a back bone. Head with two pairs of tentacles or feelers. The larger pair bear eyes at the tip. Mouth is in the center of the head below the tentacles. Snails are encased in an ever growing, calcareous, twisted, hard, rounded shell (1/8” to 2” in diameter), with a “foot” or bottom surface with mucus glands at the base of the shell. The eggs are generally round, white and covered with a limy shell and laid in one mass of about 10 - 200 eggs in a cavity about 1” in the ground. Some snails are carnivores, eating snails, slugs and/or worms.

Slugs - A “snail” without a shell. Body soft, without segmentation, with jointed appendages, exoskeleton and a backbone, with a pair of conspicuous upper tentacles usually bearing eyes and another pair of short tentacles beneath the head. Vary in color from whitish yellow to gray to black and some are mottled. They are similar to snails in structure; slimy creatures 1” - 8” long. Their foot or bottom surface has mucus glands and they move by gliding on a mucous film. Often they leave a mucus-like trail on surfaces. Lay 25 or more oval translucent eggs under a damp protected location. They reach maturity in 3 - 12 months.

LENGTH OF LIFE CYCLE

Snails - 1 - 3 (up to 12) years. May seal off their shell and become dormant for up to 4 years.

Slugs - Approximately 1 - 2 years.

HABITAT - Snails and slugs are omnivores that are most active at night (nocturnal) or dark days when they come out of damp areas, soil litter, foliage of plants and other protected hiding areas to feed. During the day, they prefer damp, dark hiding places such as under flat stones, old decaying timbers, damp refuse, boards or logs, in damp basements, among ivy, dense shrubbery, in rock piles and under trash piles and damp plant debris, or in drain piles, green houses and storage pits. They will often return to the same sheltered resting area each day unless the area becomes too dry or has been disturbed. They normally overwinter in the soil below the leaf litter. Snails and slugs are hermaphrodites, each possess both ovaries and testes, so both individuals can be fertilized and lay eggs. They both require continual moisture to stay healthy. **Remove the moisture and you remove both snails and slugs.**

NATURE OF INJURY - Snails and slugs can be nuisance garden pests and may cause damage by feeding on landscape plants, fruits, vegetables, berries and/or other foliage outside or indoors. They can be a nuisance when they occur in greenhouses, on doorways, walls, walkways or steps. When crushed they make a smelly mess. Some aquatic snails vector disease organisms which can be transmitted to people. Warm temperatures and high humidity, damp weather and rain and heavy, coarse or loamy soils - most encourage the activity of snails and slugs. They will even eat rodent poison bait blocks.

Beneficial Aspects - Some species of snails are predaceous and may be established in programs of biological control of pest snails. Try ARBICO International, P. O. Box 4247 CRB, Tucson, AZ 85738, 1-800-827-2847 (BUGS), web site: http://www.arbico.com or Sespe Creek Insectary, P. O. Box 176, Lindsey, CA 93247, 1-559-562-6464, email: sespecreek@ocsnet.net.

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CONTROL - Practice proper sanitation. Install a dehumidifier inside. Install a pair of free-range Guinea fowl, http://www.guineafowl.com/fritsfarm/guineas/ and remove harborage outside, e.g. boards, cut grass, clutter, debris, mulch and stones. Call a gourmet to eat your snails, or if you cannot find a gourmet, predacious snails, sciomysid flies, frogs, toads, firefly larvae, skunks, opossums, moles, rats, chickens, ducks, turkeys and other birds, snakes, ants, spiders, centipedes, turtles, beetle grubs, earwigs and other beetles also will feed upon both snails and slugs, or you can simply pick them up and remove them at night or early morning before the dew has left the plants. Collect them in jars of alcohol or salt water to kill them - pick them up with tongs or tweezers or chopsticks or cut them in half with pruners. Sanitation, thorough rototilling and habitat reduction are your best means of control. Look for them under loose boards, firewood, flat stones and rocks from your yard or garden on a routine basis, or leave a few wide boards or a black plastic bag or damp burlap bag on the ground as a trap. Asphalt shingles with the rough sides facing up are great traps for slugs in grassy areas. The dark, moist area underneath draws them - so check them daily. When you find the slugs, crush them. Their dead bodies attract more slugs to eat them. Vent and dry out all crawls and damp basements, e.g., install a dehumidifier. Use silicone caulk to seal all cracks, crevices, and other openings and screen all vents. There are several poison baits that are commercially available, e.g., Mexacarbamate, Mesarol or metaldehyde. Remember, these pests are most active on rainy, foggy or moist nights. Put out a 2-liter “wasp” trap cut in half with the top inverted as a “funnel” or a shallow pan buried in the earth to the lip, then fill either with beer; slugs will crawl in and drown. Look carefully at potted plants for slime trails before bringing new plants into your home. If you put up a copper barrier, with or without an electric charge, they will usually not cross it. A raw potato (sliced), banana peel, inverted grapefruit halves, lettuce leaves, dead snails or slugs, beer or fermented bread dough can be used as a non-toxic baits - leave out overnight, at dawn (or just before) pick up any snails or slugs with a tweezers and drown them in hot soapy water. Bait a can in the earth with beer, bran or raw potato and catch these pests, then freeze or drown them or release them in another area. A salt or borax barrier will either kill or repel snails and slugs but it may also hurt your plants, so use food-grade DE or crushed egg shells or garlic oil. Garlic oil will cause slugs and snails to run away; if they can not, garlic seems to make them create so much mucus they effectively dry out. To protect plants in pots, wrap a thin (25-gauge) copper wire around the pot and twist the ends together with a needle nose pliers - if the plant leaves do not touch the ground (as a bridge), your plants will be slug and snail

free. If you use poisons, be sure children and pets can not reach them. Remember, snails are beneficial. If birds can not eat snails, they need another source of calcium or they will produce defective shells. Snails and slugs are very vulnerable to dehydration. Raised boards, over-turned clay dishes and pots, plastic containers and brown beer bottles partially filled with beer can be used as inexpensive but effective traps. Spray them directly with 5% ammonia in water or 50-50 vinegar and water, or grind up some antacid tablets that contain aluminum hydroxide and mix in water and spray on infested plants or areas. Use copper barriers - their slime apparently produces an electric shock. Sprinkle powdered ginger around your plants. Spray with a combo of vinegar and hot pepper. Caffeine kills and repels slugs, so try using your coffee grounds as a slug/snail barrier. Clear away weeds, stones, debris boards and other slug/snail habitats. Drop them in soapy water for their first and last bath. The nematode *Phasmorhabditis hermaphrodita* is an excellent biological control agent, but if you can not find them or feel they are too expensive, try the mite *Fuscurclear opoda marginata*. Try using Safe Solutions Enzyme Cleaner with Peppermint and add some aluminum salts.

SNAIL AND SLUG SUMMARY

Remember, slugs are not really insects and thrive in moist shade, especially where shredded bark is used as a ground cover. Slugs go deeper into the ground during cold or dry weather. You can set out pans of beer that they really go for and drown in. The best lager beers to use as a (fresh) bait are either a German light beer called Heiniken® or Kingsbury Malt Beverage® ; the least favorite are non-lager beers. Try encircling plants and target areas with ashes from the grill, wood ashes, coarsely ground egg shells, crushed walnut shells, ginger, cinnamon, talc, sand, hydrated lime, coffee or coffee grounds, food-grade diatomaceous earth, or copper barriers; or by simply cultivating the soil on a routine basis and avoid using any mulches other than ornamental pine bark mulches. Interplant repellent plants, e.g., prostrate rosemary *(Rosemary officinalis)* or wormwood *(Artemisia absinthium)* to repel snails and slugs or make a wormwood tea and spray heavily around infested plants but, remember, wormwood is toxic when ingested, so be very careful when you handle it and do not spray plants you are going to eat. Spray them and/or plants with diluted enzymes and/or a 50/50 water and vinegar solution. You can also spray them with fresh lime juice or you can sprinkle tiny pieces of coarse human or horse hair or fresh cedar sawdust or chips, or cinders, or dry wood ashes in problem areas. The tiny hairs irritate the soft skins so much they dehydrate themselves to death trying to dislodge the irritating hairs. Plant horseradish or mustard plants to attract them to an area, then bury brown beer bottles 2/3 empty in the ground with the neck just slightly exposed - slugs will fall in and drown. As a last resort, buy commercial traps and/or baits and/or try spraying with pureed and strained slug/snail juice in water. Interesting Facts: Slugs chew their food with 27,000 tiny teeth, consuming several times their body weight each day. They can travel up to 3 city blocks in one day. One slug species can drag up to 50 times its own weight. An active slug can lose 40% of its body weight in 2 hours of slime trail production. Snails and slugs quickly die with water and mucous losses of 50% of body weight. *Phasmarhabditis hermaphrodita* is a parasitic worm that kills slugs as well as any poison. Free-range chickens, ducks and geese will eat slugs and snails.

SWIMMING POOL INSECTS, e.g., backswimmers, giant waterbugs, water boatmen, etc. Note: Backswimmers have also been called water bees because of their painful sting. **Chemical: Never apply insecticide poisons near or in the pool water.** Non-chemical: Avoid using outside lights near the pool. Maintain proper chlorine balance in the pool. Cover pool when not in use. We suggest you use chlorine with great caution. You can safely treat swimming pool pests with any enzyme cleaner approved for use in swimming pools. R. D. Wilix in New Cures for Almost Every Disease (1994) noted chlorinated drinking water is directly responsible for more than 4,200 cases of bladder cancer and 6,500 cases of rectal cancer every year! This need not be; potable and/or pool/spa water can be better treated with ozone, diluted enzyme cleaners, aeration, sodium borate and/or hydrogen peroxide.

Thrips - Thrips are very small (1/64 - 1/16") insects that are concealed in flowers or vegetation. Indoors, they are primarily a visual nuisance, but will on occasion bite people/pets. There are over 690 known species in the U.S. and Canada. They are plant feeders with piercing or sucking (asymmetrical) mouthparts. Thrips are either wingless or have four wings. Color ranges from usually black to sometimes gray, yellow or brown - they are sometimes marked with red, black or white. Thrips are particularly abundant in the flower heads of dandelions, daisies and horse chestnuts. They can be serious pests of cultivated plants and can act as vectors of disease. They usually invade structures through external openings and screens, and/or are blown in via the breeze when

doors or windows are opened and/or are carried inside with cut flowers or potted plants or when the line dried laundry is carried inside.

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Thrip Control - Caulk, seal, screen, install door sweeps and a dehumidifier (they love moisture and are found in great numbers in grassy areas around pools and ponds). Dry your clothes in a clothes dryer. Spray visible infestations on plants, etc. with 3 - 4 teaspoons of liquid dish soap per gal. water or 1 oz. Safe Solutions, Inc. Enzyme Cleaner per qal. water. Repeat this spray treatment in a week. An alternative and simpler control would be to simply vacuum with a little talcum powder in the bag, or use a steam cleaner. If you want a "barrier", try lightly dusting with food-grade DE, talcum powder, baking soda, or Comet® or finely ground Tums®.

Lady Bugs - Some ladybird beetles can and do bite. Turn on a light and vacuum them up at night, or wherever you see them during the day.

OCCASIONAL INVADER SPRAYS. First try spraying any insect pest with Not Nice to Bugs®, soapy water and/or diluted Safe Solutions, Inc. Enzyme Cleaner with Peppermint (try using 1 oz. per 1 qt. water or less) or borax before using anything stronger. Usually the insect pest dies quickly with these non-toxic sprays that are ecologically safe, non-flammable, hypo-allergenic and biodegradable. You could also try dusting with talcum or medicated body powders or mopping with CB Mop Up®, borax or disodium octoborate tetrahydrate or food-grade DE to keep an area pest free. Try rhubarb sprays, sprays made of diluted enzyme cleaner, peppermint soap, eucalyptus soap, garlic oils, or some of the homemade "Pestisafes®" we have detailed previously, including: stinging nettle sprays, alcohol sprays, hydrogen peroxide sprays, etc., or simply hand pick or remove the "critters". **Always use the safest alternative possible.**

Zebra Mussels - You can kill invasive zebra mussels with low energy radio waves. A common soil bacterium, *Pseudomonas fluorescens,* produces a toxin deadly to zebra mussels. Zebra mussels can be killed by properly injecting potassium chloride solution into the infected body of water. The solution is thought to be harmless to the environment and people.

Asian Long Horned Beetles - Woodpeckers will eat them, if you do not kill the woodpeckers and/or destroy their habitat. Verbenone, it was told to the Author, has been used to safely control pine beetles.

Occasional Invaders - Typical First Strikes by Housekeeping & Maintenance

1. **Doorsweeps - If you can slide a piece of paper under the door and especially if you can see light under the door, pests can enter.** Practice proper sanitation and properly install doorsweeps. Keep the area as dry as possible. Trim all branches that touch or overhang the building and caulk all visible cracks, crevices and other openings. Maintain routine and thorough sanitation and proper food and garbage storage. **Routinely clean and spray with diluted Safe Solutions Enzyme Cleaner with Peppermint and/or borax or Not Nice to Bugs®.**
2. Find the source of the infestation and discard it or treat it with food-grade DE and/or temperature. Then vacuum up all visible pests inside and spray with diluted (1 oz. per 1 qt. water) Safe Solutions Enzyme Cleaner with Peppermint inside or outside.
3. Steam clean and/or mop the floors with 1 - 1½ c. borax per 1 gal. hot water.
4. Lightly sprinkle food-grade DE, talcum or medicated body powder, baking soda, a little lime, table salt or ground calcium chloride (Comet® or finely ground Tums®) inside and outside or draw a barrier line of defense with Safe Solutions, Inc. Chalk De-Fence.
5. Be sure to eliminate all moisture and plumbing problems, and reservoirs (hiding/breeding areas).
6. Change the exterior lighting to yellow bug lights or sodium vapor lighting.
7. Install and properly maintain vents, air conditioners, dehumidifiers and/or fans.
8. Closely mow grass and eliminate leaf litter, ground cover, general litter, and trim all overhanging or touching branches.
9. Virtually any caterpillar (pest) problem can be resolved with diluted (Lemon Joy®) dish detergent or diluted Safe Solutions Enzyme Cleaner with Peppermint. **Be sure you are not burning the infested plants with your diluted or ready-to-use sprays.**

10. Slugs and snails are attracted to dry cat food, so stick some next to and under a board to attract them. Then pick up the board occasionally and destroy the pests. Make a small "wasp" trap out of a small plastic bottle. Cut the top part off where the bottle begins to curve, invert it into the bottle like a funnel, duct tape the edges, add a little beer and bury it so the edge of the adapted bottle is at ground level.
11. Camphor and menthol vapors will often repel insects, e.g., lady beetles and mites.
12. Safe Solutions, Inc. food-grade DE will repel and/or control most insects, mites and/or arachnids.
13. Properly install double-side carpet tape or duct tape (sticky-side up) wherever you see pests crawling.
14. **If you still have pests read the rest of the chapter and/or call Get Set, Inc. @ 1-616-677-1261.**

Mystery Bites - Be sure to also check for scabies, new carpet, proper humidity, ventilation problems, plant thrips, aphids and ladybugs, as well as looking for chiggers, spiders, kissing bugs, mites, lice, ticks, fleas and/or ants as possible culprits. Sometimes the person may be having an allergic reaction to medications, pesticides and/or detergents, a fibrous dermatitis (or skin irritation) from tiny fibers or even a medical condition that leads to skin sensations.

The rust mite, *Aceria anthocoptes, i*s magnified about 700 times. Photo courtesy of USDA-ARS.

Miscellaneous Mites - More than 6,000 mite species infest nearly every agronomic and horticultural plant important to agriculture. USDA-ARS press release. The Author has found every species that he sprayed were easily controlled with diluted Safe Solutions, Inc. Enzyme Cleaners. Soybean oil and/or olive oil simply smothers them and kills their eggs.

Mold - It is reapidly becoming a major source of litigation and concern. Usually the mold most commonly named as a major problem is *Stachybotrys chartarum,* but as of this writing has not been scientifically proven to have poisonous effects. Molds need moisture to grow. Borax (sodium borate) and dehumidifiers quickly control most (toxic) mold problems. The Author's patented process on the use of enzymes and surfactants, including Safe Solutions, Inc. Enzyme Cleaner with peppermint and sodium borate, will also safely control mildew and mold problems, as he has proven for many years.

Chlorine Bleach is Not Effective in Controlling Mold.

- Because it is too diluted and thus too weak to permanently control mold.
- What killing power chlorine bleach does have is diminished significantly, e.g., 50% loss in killing power in just the first 90 days inside a never opened jug or container. Chlorine constantly escapes through the plastic walls of its containers.
- Bleach's ion structure prevents the chlorine from penetrating into porous materials such as drywall and wood—the chlorine just stays on the outside surface, whereas mold has enzyme roots growing into the porous construction materials.
- Chlorine bleach is NOT registered with the EPA as a disinfectant to kill mold or anything else. You will not find an EPA pesticide registration number on the label of any brand of chlorine bleach.
- Using bleach can cause problems, e.g, the fumes are very caustic and great care must be taken not to breathe it in too much. It also can damage clothing and carpeting, etc.

Bugs Bothering You? People Magazine 12/1/03: He Can Jam His Way Out of a Jam. While scouting for his charity The Hole in the Wall Gang, which runs summer camps for kids with illnesses, (Paul) Newman was besieged by insects. He got them out of his way by donning a chef's hat and smearing a slab of strawberry jam on the peak, then continued with his work.

The Mountain Pine Beetle (MPB) is the most aggressive, persistent and destructive bark beetle in the United States and western Canada. Mountain Pine Beetles are truly a major pest problem as evidenced by the story: Bark Beetles Kill Millions of Acres of Trees in West at:
http://www.nytimes.com/2008/11/18/science/18trees.html?_r=1&pagewanted=all

The Best Long Term Economical Control is that of natural control or using Natural Enemies: Natural enemies of this species include woodpeckers, predaceous and parasitic insects and nematodes (Reid 1963, Rasmussen 1976). Invertebrate natural enemies of Dendroctonus ponderosae:

Invertebrate Predators -
Enoclerus sphegeus (F.)1
Laphria gilva (L.)2
Lonchaea sp.1
Medetera aldrichii (Wheeler)1
Temnochila chlorodia (Mannerheim)3
Thanasimus undatulus (Say)1
Xylophagus sp.1

Invertebrate Parasitoids
Coeloides dendroctoni (Cushman)1
Dinotiscus burkei (Crawford)1
Roptrocerus eccoptogastri (Ratzeburg)1

1 Rasmussen 1976
2 Schmid 1969
3 Furniss and Carolin 1977

Current Pest Management Techniques include harvesting at the leading edges of what is known as "green attack", as well as other techniques that can be used to manage infestations on a smaller scale, including: Pheromone baiting - is luring beetles into trees ‘baited’ with a synthetic hormone that mimics the scent of a female beetle. Beetles can then be contained in a single area, where they can more easily be destroyed. Sanitation harvesting - is removing single infested trees to control the spread of beetle populations to other areas. Snip and skid - is removing groups of infested trees scattered over a large area. Controlled, or mosaic, burning - is burning an area where infested trees are concentrated, to reduce high beetle infestations in the area or to help reduce the fire hazard in an area. Fall and burn - is cutting (felling) and burning beetle-infested trees to prevent the spread of beetle populations to other areas. This is usually done in winter, to reduce the risk of starting forest fires.

Aggressively searching out, removing, and destroying the breeding brood in infested trees is the best "industry" way to slow the spread of mountain pine beetles; however, it may not protect specific trees. Spraying trees with registered pesticide POISONS to prevent attack is currently considered the most "effective way to protect a small number of high-value trees" from mountain pine beetles. Carbaryl (Sevin SL and XLR, and others), permethrin (Astro, Dragnet, and others), and bifenthrin (Onyx) are registered in the United States for use in the prevention of pine beetle infestations. Carbaryl is considered by the EPA to likely be carcinogenic to humans. It is moderately toxic to wild birds and partially to highly toxic to aquatic organisms. Permethrin is easily metabolized in mammalian livers, so is less dangerous to humans. Birds are also practically not affected by permethrin. Negative effects can be seen in aquatic ecosystems, as well as it being very toxic to beneficial insects. Bifenthrin is moderately dangerous to mammals, including humans; it is slightly more toxic to birds and aquatic ecosystems than permethrin, as well as extremely toxic to beneficial insects. Spraying can be effective at protecting the pines, but is not recommended for large-scale use due to ecological and financial reasons. Pines should be sprayed before the beetle flight in July, so May or June will yield the best results. Spraying one's own trees requires both spraying and safety equipment; a licensed applicator is highly recommended by the "industry".

The Author's Recommendations - The Author would suggest rather than the use/misuse of volatile pesticide POISONS that you consider the use of a new safe pest control spray that the Author developed for Ron Guthrie at MOJO Distributing in Burnet, Texas - it will be sold by them as an EPA exempt pesticide to safely control

insect, arachnids, mold, etc. - The Author would spray this product by itself at the rate of 1 oz per gallon during the beetle flights. If you use this spray and mix in 1% Disodium octaborate (or Borax) to only spray the tree trunks the Author believes it will easily penetrate the pine bark and kill beetle grubs and rot as well - .Disodium octaborate is currently registered by the EPA to protect wood from rot and termites and is labeled for bark beetles and is basically safe to use. Spray the tree trunks to the point of run-off - let dry and respray. (Borax is not so registered.) Do not get disodium octaborate or borax in your mouth or on any leaves or you and the plants may get sick and die!) You could alternatively dust your trees with food-grade DE in May and June.

Caution: ALL species, ages, and sizes of healthy pine tree trunks should be sprayed or dusted, from the ground to the top of the tree, before June 1st each year. Spray/dust all of the spruce tree trunks also. All trees infested with MPB and other bark beetles should be removed and properly disposed of before June 1st each year. The Author believes that tree trunks properly treated with disodium octaborate or borax will not require yearly spraying.

"The world is full of willing people...some willing to work, the rest willing to let them." — Robert Frost

Hear about the race between two silkworms? It ended in a tie.