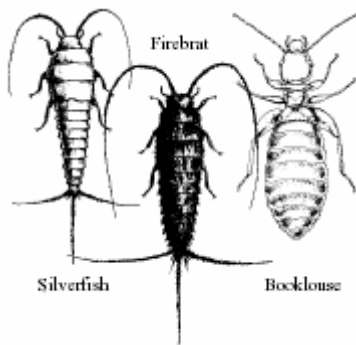


## IPM for Silverfish, Firebrats, and Booklice in Schools

### Introduction

The presence of silverfish, firebrats, or booklice is an indicator of excessive humidity. These insects can damage paper and book bindings, starched fabrics, cotton, linen, silk, rayon, cereals, and wallpaper. They also feed on the molds growing on various surfaces.

Silverfish, firebrats, and booklice are frequently introduced into a building with boxes of materials that have been stored in damp basements or attics, but they can also wander in from outdoors. They are fast-moving and can travel throughout buildings in ventilators or heating ducts originating in damp basements. Once these insects find a good source of food; however, they stay close to it. In general, they do very little damage, but they may be seriously upsetting to people who are afraid of insects. They may also attract spiders that prey on these insects.



### Identification and Biology

#### Silverfish and Firebrats

Silverfish are about 1/2 inch long when fully grown and are covered with silvery scales. They are grayish to greenish in color, have two long antennae, and

their bodies have a flattened-carrot shape. There are three long appendages attached to the tapered posterior end, each about as long as the body. They do not have wings. Firebrats have a mottled appearance with patches of white and black and are shaped similarly to silverfish.

#### Characteristics of Silverfish

- lay eggs in any season, usually in secluded places
- life cycle is 3 to 4 months
- prefer moist areas (75 to 97 percent humidity) and moderate temperatures (70 to 80°F)
- active at night or in dark places and rarely seen unless disturbed during cleaning
- indoors, may be found throughout the building—sometimes in boxes and books, or in glass utensils and sinks into which they have fallen
- leave yellowish stains on fabric
- outdoors, live in nests of insects, birds (especially pigeons), and mammals, and under the bark of trees

#### Characteristics of Firebrats

- lay eggs in cracks and crevices
- life cycle is a few weeks
- prefer moist areas with temperatures above 90°F
- active at night or in dark places
- found where heat and starches are present (for example, in bakeries); also found in furnace rooms, steam pipe tunnels, and partition walls of water heater rooms.

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## Booklice (Psocids)

The common booklouse is a small, grayish, soft-bodied insect whose shape superficially resembles that of a head louse. Booklice are wingless and have chewing mouthparts. The size of an adult is approximately 1/25 to 1/12 inch. Relatives of the booklouse live outside under the bark of trees where they feed on molds.

### Characteristics of Booklice

- life cycle is around 110 days
- prefer warm, moist conditions that are conducive to the growth of the mold and mildew they feed on; require humidity of at least 60 percent.
- found in books and paper products
- sometimes found on houseplants where they may be feeding on honeydew (a protein-rich substance excreted by plant-eating insects such as aphids), or more likely, on the sooty mold that grows on the honeydew

## Damage

The mouthparts of silverfish and firebrats are used for biting off small particles or for scraping away at surfaces. Silverfish and firebrats eat material high in protein, sugar, or starch, including cereals, moist wheat flour, starch in book bindings, sizing in paper, and paper on which there is glue or paste. These insects often attack wallpaper, eating irregular holes through the paper to get to the paste. Silverfish may bite very small holes in various fabrics, including cotton, linen, and silk, even though they cannot digest either linen or cotton. Firebrats will feed extensively on rayon, whereas silverfish usually damage it only slightly.

Booklice cause little direct damage to plants and wood because they feed chiefly on mold. Damage to books may be more direct since they eat the starch sizing in the bindings and along the edges of pages.

## Detection and Monitoring

Silverfish are found in bookcases, on closet shelves, behind baseboards, wallpaper, window or door frames, and in wall voids, attics, and subfloor areas. They prefer bathrooms and kitchens because of the moisture. Firebrats will be found in similar but warmer areas. If you suspect that damage to books, carpets, curtains, art prints, or other materials is due to silverfish or firebrats, confirm your suspicions using the following test.

- Mix flour and water to the consistency of house paint.
- Coat one or more 3x5 index cards with the paste.
- Let the cards dry and place them where you have spotted damage.
- If silverfish or firebrats are in the vicinity, they will be attracted to the card within a week and will feed on the paste. Characteristic feeding marks are minute scrapings in irregular patterns, and the edge of the card may be notched.

If you see groups of small whitish insects in damp areas, suspect booklice, particularly if mold is present or the area smells moldy. Remember that booklice are considerably smaller than silverfish and lack the telltale three long bristles at the tail end.

Silverfish, firebrats, and booklice can also be detected by placing sticky cockroach traps in the area where damage is occurring. These traps, along with other homemade ones, can also be used for control purposes (see the discussion below under Physical Controls). When the insects are caught, they should be preserved in alcohol for professional identification.

## Management Options

Management of booklice, silverfish, and firebrats is essentially the same. All three are living indicators of excessive moisture. An occasional individual is not a pest and is usually tolerated by most people. Nonetheless, its presence should be taken as a sign to investigate moisture problems.

### Physical Controls

#### Dehumidifying

If moisture is not eliminated, it may bring more serious problems, such as termites, carpenter ants, and wood rot (see Chapter 16, IPM for Wood-Damaging Pests). School libraries and paper supply storage rooms could have independent dehumidification systems in areas where high humidity is a concern.

You can do the following to decrease humidity.

- Mend leaking pipes.
- Ventilate closed rooms and attics.
- Eliminate standing water.
- Replace any single-glazed window that repeatedly accumulates condensation with a double-glazed window.

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- Use a dehumidifier in rooms such as bathrooms that are regularly moist.
  - Use anhydrous calcium carbonate, a dehydrating agent that is available from chemical supply companies, or silica gel, available from camera stores, to absorb free moisture, particularly in enclosed areas. Silica gel is often packaged in small cloth bags that can be dried out in an oven and then reused. Do not use these agents in areas to which children have access.

### **Vacuumping**

Regularly vacuum accumulations of lint in cracks and crevices. Wherever possible, such potential hiding and feeding areas should then be sealed with patching plaster and/or caulk.

### **Exposure to Heat and Cold**

Firebrats die when exposed to a temperature of 120°F for one hour. Below freezing and above 112°F, nymphs are killed quickly. Thus, in areas of the building where temperatures can be elevated, use hot air as a lethal treatment. After a general effort has been made to reduce the source of the humidity, a small heater can be used to warm and dry the problem area. The heat should be turned off before the wood surface gets too hot to touch. Books and similar materials that are suspected sources of infestations should be placed inside a plastic bag with a dehydrating agent (anhydrous calcium carbonate) and placed in the freezer for a week to kill all life stages of the insect.

### **Microwave Radiation**

Books infested by silverfish and booklice can be placed in a kitchen microwave oven for 30 to 60 seconds. Most books can undergo this treatment without any damage. The glue on paperback book bindings may soften initially, causing the book to curl a little, but if the book is set on a flat table, it will soon straighten out. This treatment is not recommended for very old books made of parchment or other fragile paper, or for books with gilding or color illustrations that may contain metallic salts in their paints—metals and microwaves don't mix.

### **Trapping**

Silverfish can be trapped very easily in small, clean glass jars. The outside of the jar should be wrapped with masking tape so the insects have something to grip as they climb up. Tests have shown that adding bait does not enhance the trapping power of the glass jars—they work just as well completely empty. Set the jars upright in areas where silverfish have been seen. Silverfish can also be trapped in sticky

cockroach traps. Remember that there is no point in trapping if the original moisture conditions are not corrected; pests will continue to migrate to the damp area.

### **Drying Stored Articles**

Periodic airing and drying of articles stored in damp areas may help reduce the mold on which booklice feed. Disposing of moldy articles is often the simplest way of ridding an area of booklice infestations.

### **Consider Structural Changes**

Condensation from wooden windows can cause mold to grow on and around windows. Sometimes the condensation can be eliminated by switching to aluminum windows with double panes. Other structural changes should be considered in order to reduce moisture accumulations that lead to pest presence.

### **Chemical Controls**

It should not be necessary to use pesticides to control silverfish, firebrats, and booklice. Instead, focus on reducing humidity and on heating or freezing infested articles. When the pests are detected, they can be vacuumed up.

If non-chemical methods alone prove insufficient to solve the problem, then integrating a pesticide into your management program may be warranted. For information on the hazards of various pesticides and on how to select an appropriate pesticide for your situation, consult Appendix G for a list of resources.

Pesticides must be used in accordance with their EPA approved label directions. Applicators that are hired by the school must be certified to apply pesticides and should always wear protective gear during applications. All labels and Material Safety Data Sheets (MSDS) for the pesticide products authorized for use in the IPM program should be maintained on file. Do not apply these materials when buildings are occupied and never apply them where they might wash into the sanitary sewer or into outside storm drains.

Diatomaceous earth, borate-based insecticidal dust products, and silica aerogel can be used to kill these insects. Diatomaceous earth and borate-based products must be kept dry to be most effective, but silica aerogel will work under damp conditions.

Dusts should be applied only in cracks and crevices, attics, crawl spaces, and other areas that are relatively

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inaccessible to humans and pets. Wear a dust mask or a professional-quality respirator to provide proper lung protection when applying any dust.

## **Resources**

For management practices and pesticide recommendations on silverfish, firebrats and booklice control, see the publications available from UNL Cooperative Extension, located in most counties, or from Communications and Information Technology, Box 830918, University of Nebraska, Lincoln, NE 68583-0918, or see them on-line at <http://www.ianr.unl.edu/pubs/>.

Educational resource guides on silverfish and firebrats are available at <http://lancaster.unl.edu/enviro/pest/insect.htm>.