

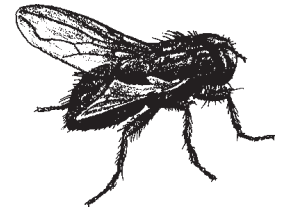
# CHAPTER 9

## IPM FOR FLIES IN SCHOOLS

### INTRODUCTION

Many species of flies can be problems in schools. Each kind of fly has a distinct breeding site inside or outside the school building. In order to control pest flies, it is necessary to know which fly is causing the

problem and where it is breeding. Table 9-1 summarizes identifying characteristics of the most common pest flies encountered in schools.



House Fly

### Garbage- and Manure-Breeding Flies

#### IDENTIFICATION AND BIOLOGY

Flies such as house flies, dump flies, blow flies, and blue and green bottle flies which breed in food wastes (garbage) and/or animal feces are generally referred to as “filth flies.”

Sometimes flies are confused with wasps; however, flies have two wings, while wasps and all other winged insects have four wings arranged in two pairs, although sometimes the second set of wings may be covered or hidden by the first. Wasps, unlike flies, fold their wings alongside their bodies when at rest. Most pest wasps are colorfully marked with yellow, red, black, and white. These wasps are less likely to come indoors, they are aggressive in their flight around foods, particularly sweets, and they are larger than filth flies. Filth flies do not act aggressively and do not bite. The cluster fly, which is also larger than the filth flies, can be identified by its stout body with crinkled yellow hairs.

grass clippings allowed to rot in a pile, and even in moist soil that is mixed with garbage. The larva hatches from the egg and grows until it is ready to form a puparium (a kind of cocoon) from which an adult fly will emerge. Once the adult fly emerges, it doesn’t grow any larger; small flies do not grow into larger flies.

#### DAMAGE

Flies that invade cafeterias and kitchens carry bacteria and other microbes which contaminate food, utensils, and surfaces. It is good hygienic practice to prevent this exposure.

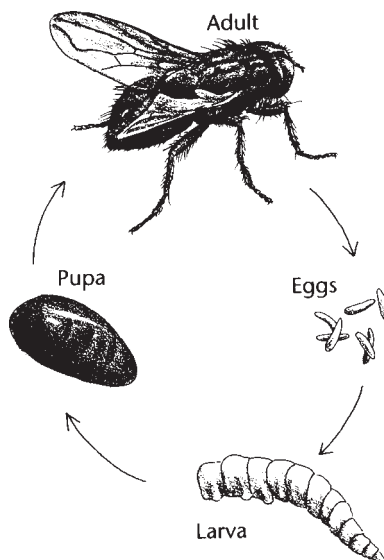
#### DETECTION AND MONITORING

It is important to correctly identify the problem flies and pinpoint their breeding sites. Table 9-1 can help you with identification, or you can take several specimens to a specialist. The specialist should be able to tell you what kind of breeding site to look for after an identification has been made.

To collect specimens inside, use sticky flypaper or gather dead specimens from windowsills and light fixtures. Outside, trapping is one of the easiest methods of catching flies for identification (see the discussion below for trap construction, placement, and baits). If adult flies consistently avoid baited traps, it may indicate that the pest fly is not a filth fly. In this case, you can try using a butterfly net to catch one of the flies.

#### MANAGEMENT OPTIONS

To manage flies, you must find and reduce breeding sites, install and maintain screens to keep flies out of buildings, kill those flies that do get inside with a fly swatter or flypaper, and reduce or eliminate the odors that attract flies.



Filth flies pass through four distinct stages in their life cycle: egg, larva (maggot), pupa, and adult (see Figure 9-1). Adult female filth flies look for a moist place with the right smell to lay their eggs. This can be in food waste in a garbage can or dumpster, in dog or cat feces, in dead animals, in kitchen drains, in

Figure 9-1. Life Cycle of a Fly

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In a school with a frequent waste removal program, it is very possible that few flies are breeding on the school property. It is more likely that odors from dumpsters, garbage cans, kitchens, and cafeterias are attracting flies to the school from the surrounding neighborhood. House flies and blow flies, the species that most commonly invade buildings, usually develop outside and follow odors into the building. They can also be pests when students or staff are eating outside. In schools where waste removal is infrequent, fly populations can be breeding at the waste collection site.

### **Habitat Modification**

This is one of the most important aspects of fly control. Without controlling wastes and odors, it is impossible to control filth flies.

### **Food Waste**

- All food waste from the kitchen, cafeteria, and other areas should be separated from other garbage, drained so it will be as dry as possible, and then stored in sealed plastic bags before discarding.
- Place containers with small amounts of food waste, such as milk or yogurt cartons, into sealed plastic bags before disposal. This method will reduce access to flies (and yellowjackets).
- Promptly fix drains or electric garbage disposal units that leak, or drains that allow food waste to accumulate under sinks or floors. Leaky drains can attract many species of flies. Remove any food waste that has accumulated under sinks or floors or in crawl spaces or basements at the site of the broken drain, and then clean the area thoroughly.

**Table 9-1. Common Flies Found in and around Schools**

**Please find this table at end of chapter.**

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## Other Garbage

- In food preparation areas, rinse all cans, bottles, and plastic containers before recycling or discarding.

## Exterior Garbage Cans and Dumpsters

- To avoid attracting flies into the building, place dumpsters and recycling containers upwind from the outside doors of the school, particularly doors to the kitchen or cafeteria. When dumpsters are downwind, flies are attracted to the waste odors and then find the odor trails that the breeze blows down from the doorways. Following these odor trails, they find their way into the building.
- Wastes should be collected and moved off site at least once a week. In hot months, garbage collection twice a week will significantly reduce fly problems.
- Make sure garbage can and dumpster lids seal tightly when closed and remain closed when not in use. Do not leave lids open at night; garbage can attract other pests, such as rodents. Repair or replace garbage cans with holes or with lids that do not close tightly. For more information on rodent-proof garbage containers, see Chapter 12, IPM for Rats and Mice.
- Regularly clean garbage cans and dumpsters to prevent the build-up of food waste, an ideal place for flies to lay eggs. Use a high pressure stream of water or a brush and soapy water, if necessary. A solution of borax and water will eliminate odors. Do not allow soured milk to collect in trash receptacles; it is a powerful attractant to flies. If possible, dumpsters should be fitted with drains so they can be hosed or scrubbed out as needed. Another option is to require the refuse company to clean the dumpster or replace it with a clean one more frequently.
- Flies can develop in soil soaked with water used to clean garbage cans and dumpsters. Check these areas regularly. If you see maggots, scrape them up along with the soil and dispose of everything in a plastic bag sealed tightly with a knot or a twist-tie.
- Do not store extra garbage outside of dumpsters or garbage cans in cardboard, plastic, or paper; this provides easy access for rats, dogs, raccoons, or other animals.
- Inspect dumpsters and other outdoor trash receptacles at the end of the day and remove any wastes lying on the ground.
- Garbage cans on the school grounds should have removable domed tops with self-closing, spring-

loaded swinging doors. Cans should be lined with plastic bags that can be tightly sealed and removed daily.

- Inform students, teachers, and staff of the importance of placing garbage inside the proper containers. Garbage should not be left lying on the ground.

## Animal Feces

Remove droppings promptly and put them into plastic bags that are sealed before disposal. Dog feces that dry quickly may attract adult flies with their odor but are unlikely to host many maggots. Droppings that remain damp because of humidity or rain can breed a number of maggots.

## Odors

Flies can detect odors over long distances. Smells of souring milk from hundreds of containers thrown in dumpsters can attract thousands of flies from the surrounding neighborhood. Storing garbage in sealed plastic bags and having cans and dumpsters cleaned and emptied frequently to eliminate odors is very important. Removing pet feces also helps reduce attractive odors.

Flies attracted to open kitchen or cafeteria doors, or to dumpsters or garbage, will rest on nearby walls, eaves, and rafters. While resting, they leave fly specks, which have a strong fly-attracting odor. These brown- to cream-colored specks should be washed off with an odor-eliminating cleaner (a mild solution of borax and water can be particularly effective) otherwise they will continue to attract flies.

## Physical Controls

### Screens

Install screens over windows, doors, and vent holes to prevent flies from entering buildings. Weather-stripping or silicone caulk can be used to insure a tight fit. Torn screens can be repaired with clear silicone caulk. Screen doors should be fitted with springs or automatic closing devices that close the screen door firmly after it is opened. External doors that cannot be screened should be fitted with automatic closing devices, and/or vertical strips of overlapping plastic that allow human access but prevent fly entry. “Air walls” that force air across openings are another alternative to screen doors.

### Fly Swatters

In many instances, the old-fashioned fly swatter is the safest and quickest way to kill flies that have found their way into a room. Aim the fly swatter about 1 1/2 inches behind the fly, rather than directly at it, because research

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has shown that when a house fly takes off from a horizontal surface, it jumps upward and backward. Stiff plastic swatters seem to work better than wire-mesh ones. The fly's unblurred range of vision is about 1 1/2 feet, and the swatter can be moved to this distance before striking (Tierney 1988).

### **Flypaper**

Sticky flypaper is effective at catching flies because it takes advantage of their natural habit of moving up to the ceiling to rest. It will take several days for a new strip of flypaper to start catching flies. Use a number of strips at a time and replace them when they are covered with flies or when they begin to dry out. Flypaper can be very useful in areas where there are too many flies to kill with a fly swatter, and where aesthetic appeal is not of primary importance. Flypaper is also a useful monitoring tool.

### **Fly Traps**

Fly traps can be used to reduce adult fly populations, capture specimens for identification, and monitor the effectiveness of control programs. Fly traps are not toxic and are more selective than using insecticide. Traps need to be serviced regularly, appropriately placed, and repaired or replaced when damaged.

### **Trapping Flies Indoors**

Electrocuting light traps are preferred for indoor use and can be used in food preparation and storage areas. Light traps will not work well in a room with many and/or large windows because the bright light coming in the windows is a much more powerful attractant than the comparatively weak light coming from the trap.

Contrary to the advice provided in some promotional literature for ultraviolet light or electrocutor traps, these traps should not be used outdoors. They are relatively non-selective in the insects they attract and will kill many more beneficial and innocuous insects than pests.

The following are key points to remember when using light traps for indoor flies:

- Use the number of traps recommended by the manufacturer, or, as a general rule, one trap for every 30 feet of wall.
- Mount traps 3 feet from the floor on the perimeter walls of the room, because hungry flies circle the

perimeter of a room close to the floor when looking for food.

- Mount traps 5 feet away from any open food and 25 feet from any doors or windows. Traps work best in rooms without windows.
- Empty and clean the traps weekly to prevent dermestid beetles from developing in dead flies.
- Replace lamps at least once a year.
- The more expensive black light "blue" bulbs do not attract more flies than regular black light bulbs.
- The lamp should be directed toward the interior of the building. Do not place traps where flies that are outside can see the light bulb. This may attract more flies.
- Place traps near odor sources (such as cooking areas, garbage cans, outdoor restrooms), since odors will be more attractive (especially from a distance) than the light.

### **Trapping Flies Outdoors**

To capture flies outside, use traps with a screen cone suspended above the bait. These cone-type traps take advantage of the fly's habit of flying or walking toward light. Cone traps can be easily made from wood together with aluminum or plastic screening; use the dimensions in Figure 9-2. Flies are attracted to the bait in the pan under the trap. Once the flies are under the trap, the brightest spot they see is the hole in the cone above them. They walk up through the hole and are trapped in the outer screen cage. Since flies are attracted to the light and it is always lighter above them, they do not find their way back out through the hole in the cone.

The following are key points to remember when trapping flies outdoors:

#### **Trap placement is important.**

- If an area has a small or moderate fly problem, traps placed close to buildings can attract flies from all over the neighborhood and make the problem worse. It is better to set the traps close to fly breeding sites with any prevailing breeze blowing from the trap toward the breeding area.
- Since most bait odors are heavier than air, place traps so odors flow over the area where flies are developing.
- Do not set traps near doorways or entrances to buildings.

- Place traps away from outdoor areas that are used for eating or recreation.
- Generally, traps are most effective when placed on the ground, but they can be hung over the openings of dumpsters and from buildings or fences as well. Traps hung in these areas must not interfere with the opening and closing of the dumpster, and should be placed in areas where people will not tamper with them and will not be offended by the bait odors.
- Place traps in sunlight. Flies are more active in sunlight, both outside and inside the trap. Flies buzz more in the sunlight, and the noise coming from the trap will attract additional flies from a distance. Yellowjackets are also attracted to the buzzing and will enter the cone trap in search of food.

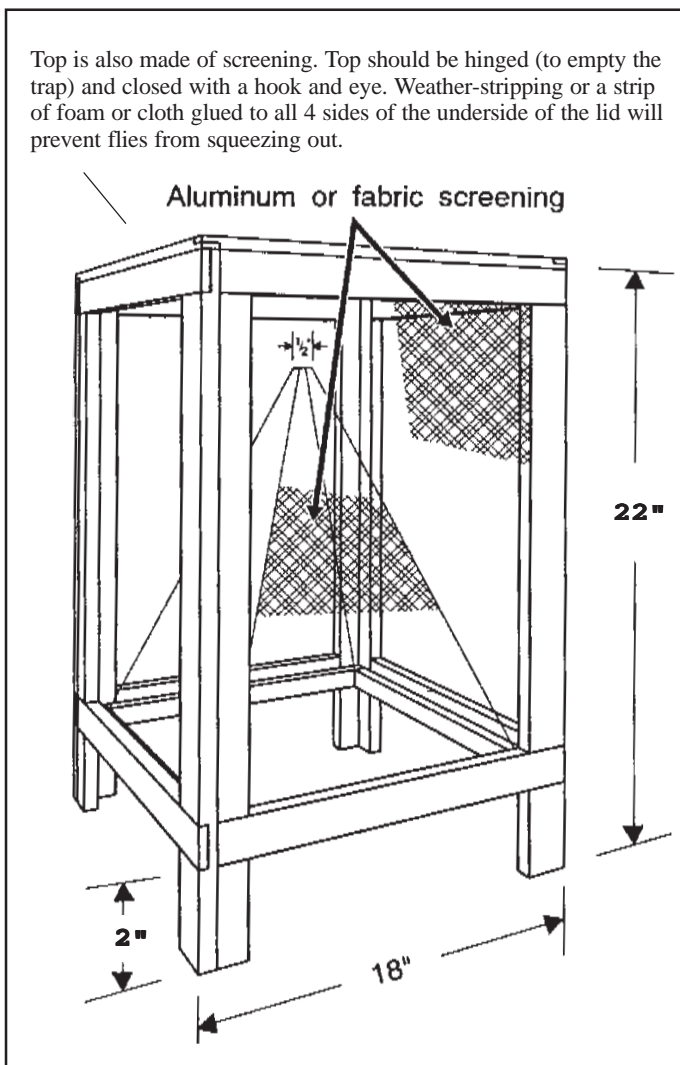


Figure 9-2. Cone Trap. Bait pan is placed beneath bottom of the cone. Make sure the top edge of the bait pan is above the bottom edge of the trap.

#### Empty the trap to maintain performance.

Empty the trap when dead flies cover about one quarter of the cone. Do not release live flies that are in the trap. Kill them by enclosing the trap in a plastic bag and placing it in the sun. After the flies are dead, the contents of the trap should be poured into the plastic bag, sealed, and discarded in a dumpster or garbage can.

#### Do not clean the trap between uses.

The smell of the millions of fly specks deposited on the screen is very attractive to flies.

#### Bait is important to the performance of the trap.

- Liquid bait, either the Yeast Bait or the Beltsville Bait (see Box 9-A for recipes), is a superior attractant that will not breed flies unless it is allowed to dry to a sludge. If either of these baits contaminate clothing and hands, use baking soda and water to remove the odors.
- Yeast Bait has a foul odor that is particularly attractive to female flies because it smells like a good place to lay eggs. This bait will lure flies even from the most attractive breeding sites.
- Beltsville Bait will attract male flies as well as females because it contains sugar. This sweet bait can be used in cool weather when the main aim of trapping is to reduce the total number of flies rather than to suppress breeding.
- Baits such as decaying meat or fish scraps will attract mainly blow flies and flesh flies. These baits should always be put inside a rolled down plastic bag and then placed in the bait pan. Watch the bait so that it does not become a breeding site for flies. The larvae feeding on the bait can crawl out of the plastic bag and away from the trap to pupate. If larvae are found in the bait, the plastic bag should be sealed, thrown away, and replaced with a new bag and bait.
- Sex pheromone baits for flies do not last long and do not attract flies from a distance. They are likely to be more expensive and less effective than other food-type baits which can be mixed from common materials and attract both sexes.
- Do not add poison to the bait. Flies are more attracted to the live flies in the trap than they are to dead ones.
- The top edge of the bait pan must be at least 1/2 inch above the bottom edge of the trap. If flies can sit on the top edge of the bait pan and look out under the trap, trap catches will be poor.

## Box 9-A. Fly Bait Recipes

### Liquid Yeast Bait

(from Satrom and Stephens 1979)

This recipe makes 7-9 portions of liquid bait for use with a cone trap. It can be stored 20-30 days once it is ready for use.

#### Ingredients:

2 quarts tepid (not hot) water (95-105° F)  
1 cup + 3 oz. active dry yeast (baking yeast)  
2 tablespoons ammonium carbonate (optional\*)

#### Mixing the bait:

Use a plastic (not glass) narrow-necked gallon jug with a screw cap for mixing, ripening, and storing bait. Bleach or milk jugs work well. Wide-mouth containers will not produce effective bait.

Mix all the above ingredients in the jug. Important: With cap lightly sealed, allow mixture to begin to ripen (see ripening instructions below). It will foam up at first. After it subsides (1-2 days), tighten the lid and continue ripening till very smelly (2-9 additional days). Gases must escape while bait is foaming up (loose cap), but bait must finish ripening without air (tight cap) to attract flies.

#### Ripening the bait:

Allow bait to ripen 4-10 days in a place where temperatures remain above 60° F during the night and day. Bait is ripe when it is very smelly, with a musky, penetrating odor. Warm daytime temperatures will make up for slightly cooler (less than 60°F) nights, but in general, the warmer the average temperature, the faster the bait will ripen. Because of its heavy odor, the bait should be ripened in a well-ventilated area where it will not offend people. Do not ripen or store the bait in direct sunlight. Extreme temperatures can build within the jug, kill the yeast, and cause gases to expand enough to pop off the lid or break the jug.

#### Storing the bait:

To maintain potency, store bait with the cap kept tight. Open the jug only when necessary to refill the bait pan. Do not store in direct sunlight.

\*Ammonium carbonate is available from chemical supply houses and will improve the odor of the bait.

Note: Ripened bait should be treated as a decaying food material. It can cause gastro-intestinal disturbances if ingested.

#### Using the bait:

Stir or shake the bait supply each time before adding to the bait pan. Pour about 1 cup (8 ounces) of bait in a wide pan on a level surface under the trap. Be sure the edge of the pan is higher than the bottom edge of the trap frame.

The bait is effective in the pan for at least 3 to 5 days. It attracts more flies on the first day, and then gradually declines thereafter. Don't let the bait dry out.

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### Beltsville Bait

(from Pickens, et al. 1994)

This makes a dry bait that can be easily stored for a considerable time. It must be mixed with water before using.

#### Ingredients:

1 pound granulated sugar  
1 pound baking powder (double-acting type)  
2 ounces dry active yeast (baking yeast)  
6 ounces air-dried blood or freeze-dried fish meal  
1/4 cup honey  
2 tablespoons\* water

#### Procedure:

Mix ingredients thoroughly. Press mixture into a plastic ice-cube tray to form cubes. Invert the tray to dump the cubes, and let them dry to form hard blocks. To use the bait, add 2 cubes of bait to 2 quarts of water. Place bait in a wide-mouth pan beneath a cone-type trap. Flies are attracted to this bait from only a short distance, so traps should be placed within 6 feet of areas where flies are active. Bait pans should be cleaned and baited every 1 to 2 weeks and should be kept filled with water.

\*Quantity of water needed may vary with humidity of air when mixing. Use only sufficient water to bind dry ingredients together when they are compressed.

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**Prevent excessive amounts of water from getting into the trap.**

If dead flies in the trap get wet and begin to rot, they will attract blow flies that will lay their eggs on the outside of the screen. When the tiny blow fly larvae hatch, they crawl through the screen to feast on the rotting mass of flies. This turns the trap into a messy breeding site for flies.

- Do not place traps where sprinklers will get them wet.
- In areas where there are frequent rainstorms during the trapping season, it may be necessary to fit the trap with a clear Plexiglas™ top.

## **Chemical Controls**

Except for odor-eliminating chemicals such as borax, pesticides are not recommended for fly control.

### **Borates**

Low concentrations of borax in water can be used to eliminate fly odors. This solution is particularly effective for removing fly specks from walls and eaves, and for rinsing out garbage cans and dumpsters. These solutions should not be used near ponds, streams, lakes, or other bodies of water, and should not be poured onto plants.

## **Fruit Flies, Cluster Flies, and Phorid Flies**

### **IDENTIFICATION AND BIOLOGY**

#### **Fruit Flies**

These small flies are commonly seen flying around ripe fruit, especially bananas. They are about 1/8 inch long and usually have red eyes. They lay their eggs near the surface of fermenting fruits and vegetables and other moist organic materials (including damp mops and cleaning rags as well as residues in bottles, cans, garbage disposals, and drains). Their life cycle, from egg through maggot and pupa to adult, takes little more than a week, and the number of flies that can be produced by a single piece of fruit is enormous. These flies are most often a problem in late summer and early fall, so careful storage of fruit and vegetables is necessary at these times of the year.

#### **Cluster Flies**

Cluster flies are larger and darker than house flies and have a distinctive yellowish color caused by the crinkled yellow hairs on their bodies. In the summer, cluster flies lay their eggs in soil where the maggots parasitize earthworms. Soil containing many earthworms—for example, large lawn areas on the school grounds or in nearby parks—is a common source of these flies. In the fall, the adults can be seen clustering on the south and west sides of buildings. As the weather gets cooler, these flies begin looking for sheltered places to spend the winter and often enter buildings.

#### **Phorid Flies**

The most common phorid fly, *Megaselia scalaris*, is small (1/16 to 1/8 inch) with a yellowish-brown body and light

brown wings. The adults seem reluctant to fly, and they run around on walls, windows, and tables with a characteristic quick, jerky motion. The females are strongly attracted to odors and lay their eggs on or next to decaying material, both plant and animal. Food sources for the larvae are highly varied, from decomposing fruit, vegetables, and meat to open wounds in animals and people, and human and animal feces. The life cycle from egg to adult takes from 14 to 37 days.

### **MANAGEMENT OPTIONS**

#### **Fruit Flies**

Fruit flies are most active from late summer through early fall. Problems with these flies can be avoided by ripening fruit in paper bags. Seal the bags by folding the top over several times and closing it with a paper clip or clothes pin. Once fruit is ripe, it should be stored in the refrigerator. Careful storage of fruit during the rest of the school year may not be necessary.

If an infestation is discovered, look for and remove the material that is breeding the flies. Begin by searching for the obvious sources, such as ripe fruit and vegetables, and then look at water from refrigerators, humidifiers, or sink drains that may be fermenting; spoiled animal food; or even damp, sour mops or rags. Areas outside the building near windows and doors should be checked for rotting vegetable matter. All breeding sources should be removed and disposed of in a sealed plastic bag. Make sure that screens and windows near food preparation areas are in good repair.

#### **Fruit Fly Trap**

To make a simple trap for fruit flies, combine 1 cup of vinegar, 2 cups of water, and 1 tablespoon of honey in a

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2-liter soda bottle. Replace the cap, shake the mixture well, and punch holes in the side of the bottle above the liquid so the flies can get in. Using string, hang the bottle about 5 feet from the ground. Periodically, dump out the dead flies.

### **Cluster Flies**

Cluster flies are not as strong fliers as house flies and can easily be killed with a fly swatter or removed with a vacuum. Cluster flies can also be allowed to exit by opening the window. They can find their way into buildings through unscreened doors and windows, openings under siding and around roofs, unscreened ventilating spaces, cracks around windows, and holes where wires penetrate the walls of the building. During warm winter periods, cluster flies hidden in buildings become active and are attracted to windows.

### **Phorid Flies**

Phorid flies breed in diverse sources of organic matter, so it may take considerable sleuthing to find their breeding sites. Once the site is found it must be thoroughly scraped, cleaned, and dried. Large infestations of these flies are often the result of broken drains or garbage disposals that allow organic matter to accumulate in out of the way places such as wall voids, under floors, in basements, or in the soil of crawl spaces.

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**Table 9-1. Common Flies Found in and around Schools**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Description</b>	<b>Sources</b>
House Fly	<i>Musca domestica</i>	medium-sized, gray; 4 stripes on thorax	garbage, human and animal manure
Dump Flies	<i>Opbyra</i> spp.	medium-sized; black	mixed garbage, bird feces; in the Pacific Northwest, sometimes replaces the house fly as the main indoor pest
Black Blow Fly	<i>Pbormia regina</i>	large; dark blue	garbage, animal carcasses; most abundant in early spring
Green Bottle Fly	<i>Pbaenicia sericata</i>	medium-sized; shiny green to bronze	garbage containing mixtures of animal and vegetable matter, dead animals, fresh meat; enters buildings less frequently than house flies
Blue Bottle Flies	<i>Cynomyopsis cadtverina</i> <i>Callipbora</i> spp.	medium-sized; thorax dull, abdomen metallic blue	exposed meat feces, overripe fruit and other decaying vegetable matter; enters buildings in cool seasons
Little House Fly	<i>Fannia canicularlis</i>	small, dull gray, yellow on upper abdomen; males circle in the air	decaying vegetable and animals matter, especially the manure of humans, horses, cows, poultry, and dogs; also piled, moist, grass clippings
Cluster Fly	<i>Pollenia rudis</i>	larger than house fly; dark gray with distinctive yellow hairs; adults sluggish	larvae parasitic on earthworms; adults enter houses in fall
Fruit Fly	<i>Drosophila</i> spp.	very small; yellow-brown	fermenting fruit and vegetables, other moist organic matter
Phorid Fly (Drain Fly)	<i>Megaselia scalaris</i>	similar to fruit fly, but more humpbacked in appearance	decomposing organic matter including vegetables, fruit, flesh, feces