

Cornell University



## Integrated Management of Flies in and around Dairy and Livestock Barns

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### Introduction

In the past, management of flies in dairy and livestock barns often relied solely on insecticide use. But this single-tactic approach can aggravate fly populations' resistance to insecticides and inadvertently destroy natural enemies of flies. Today successful farmers are combining careful use of pesticides with other integrated pest management (IPM) practices.

Figures 1 and 3 are from *Flies and Disease*, vol. 1, 1971, by Bernard Greenberg, published by Princeton University Press. Franticek Gregor, artist. Reprinted by permission.



Figure 1.



Figure 2.



Figure 3.



Figure 4.



Figure 5.



Figure 6.



Figure 7.



Figure 8.



Figure 9.

IPM seeks to maximize the effectiveness of pest control while conserving beneficial insects and minimizing pesticide use. The cornerstone of effective IPM is correct identification along with accurate and timely monitoring of pests. Other components are various combinations of cultural, biological, and chemical control practices designed to keep fly populations below economically injurious levels. This fact sheet provides information on fly biology, economic importance, identification, monitoring, and management.

## Biology and Importance

The two principal fly pests of confined livestock are house flies and stable flies. House flies, *Musca domestica* (fig. 1), are non biting insects that breed in animal droppings, manure piles, decaying silage, spilled feed, bedding, and other organic matter. They can complete their life cycle from egg to adult (egg, larva, and pupa) in 10 days under ideal conditions in summer months. Each female lives 10 to 21 days and can produce 150 to 200 eggs, which she lays in batches at 3- to 4-day intervals. Although house flies may be of only minor direct annoyance to animals, they have considerable potential for transmitting diseases and parasites.

Severe housefly infestations may increase bacterial counts in milk, and state inspectors routinely note the presence of flies in milk rooms. An abundance of flies can also become a serious nuisance both around the farm (fig. 2) and in nearby communities. Demographic changes in the Northeast in recent years have brought neighbors close to many once isolated dairy and livestock farms. These new neighbors often put great pressure on farmers to keep house fly populations to a minimum.

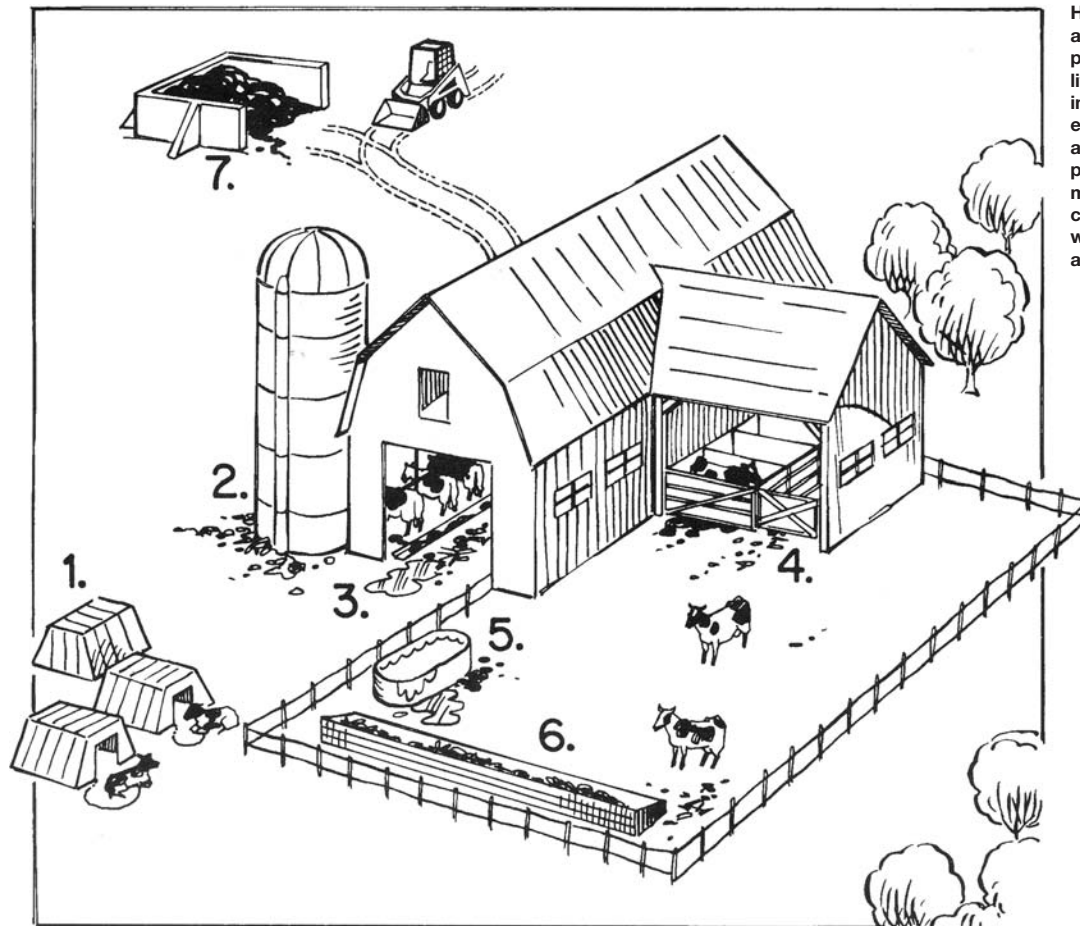
The stable fly, *Stomoxys calcitrans*, (fig. 3) is about the size of a house fly, but the adult has piercing mouthparts that protrude spearlike from under its head. Stable flies breed in wet straw and manure, spilled feeds, silage, grass clippings, and various other types of decaying vegetation. Stable flies take about 3 weeks (21 days) to develop through the egg, maggot, and pupal stages to become adults. The adult female fly lives about 20 to 30 days and lays 200 to 400 eggs.

Cattle are most irritated by these pests during the warm summer months. Both male and female stable flies feed on blood several times each day, taking one or two drops at each meal. Cows' stomping of feet is a good indication that stable flies are present because they normally attack legs and bellies (fig. 4). Production performance declines in infested herds because of the painful bites the cows sustain and the animals' fatigue from efforts to dislodge the flies.

## Monitoring

House flies can be monitored using baited traps or spot cards. Baited traps are gallon plastic milk jugs in which four 2-inch holes have been cut in the upper part of the sides (fig. 5) to allow flies attracted to bait placed on the inside bottom of the jug to enter. The traps are suspended from rafters or other building supports with 18- to 24-inch-long wires. Spot cards are 3- by- 5-inch white tile cards that are attached to obvious fly resting surfaces (areas with large numbers of fly fecal and regurgitation spots) (fig. 6)

The number of baited traps or spot cards required will vary according to the size of the barn, but there should be a minimum of five at equidistant locations throughout each animal



House and stable flies breed in areas where moist organic matter is present. Common fly breeding sites on livestock operations include locations in and around (1) calf hutches, especially inside corners; (2) silo leak and spill areas; (3) animal stalls and pens, feed preparation, storage and manger areas, near water sources; (4) calf, hospital, and maternity areas; (5) water tanks; (6) feed troughs; (7) inside and outside manure handling areas.



housing unit. These monitoring devices are left for 7 days. Then the number of flies collected in the traps or the number at fecal and vomit spots on the spot cards are counted.

Baited trap catches in excess at 250 flies per week or spot card counts of over 100 spots per card per week are considered high levels of fly activity. House flies in the Northeast are active from May through October; populations peak from mid-July through mid-September.

Stable flies are monitored by counting flies on all four legs of about 15 animals in the herd. An average of 10 flies per animal is considered a high level of fly activity.

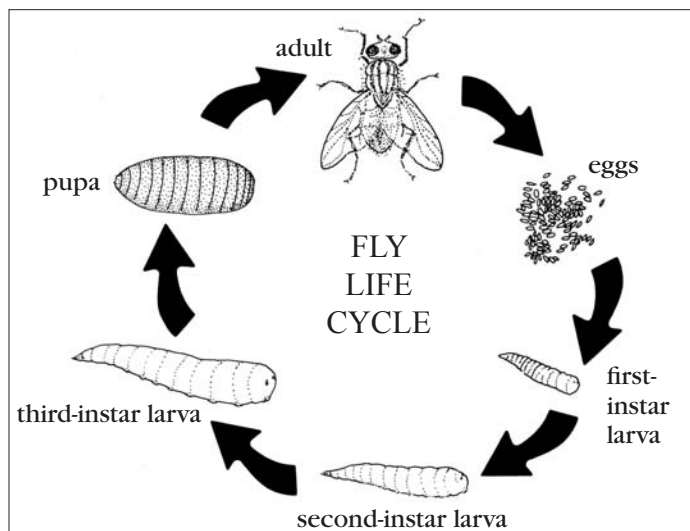
## Management Cultural Control

A variety of cultural control practices can be used effectively to manage houseflies and stable flies.

- *Practice Sanitation.* The fly life cycle requires that immature flies (eggs, larvae, pupae) live in manure, moist hay, spilled silage, wet grain, or a similar environment for 10 to 21 days depending on temperature and fly species. Weekly removal and spreading of materials in which flies breed helps to break the fly's life cycle. Waste management is therefore the first line of defense in developing an effective fly management program. It is much easier and less costly to prevent a heavy fly buildup than to attempt to control large fly populations once they have become established.

The prime sources of flies in confinement areas are animal pens, especially those housing calves. The pack of manure and bedding under livestock should be cleaned out at least once a week. In free-stall barns the next most important fly breeding area is the stalls, which should be properly drained and designed to encourage complete manure removal. In stanchion barns, drops should be cleaned out daily. Wet feed remaining in the ends of the mangers, as well as green chop and other forage and feed accumulations around silos, are excellent locations for flies to breed and should be cleaned out at least weekly.

- *Use sticky tapes, paper, and ribbons.* Sticky ribbons, especially the giant ones, are very effective for managing small to moderate fly populations.
- *Maintain a fly-free zone in the milk room.* Installing and maintaining tightly closed screen doors and windows to the milk room can greatly reduce fly numbers in this sensitive area. Occasional flies that get in can be controlled with sticky tapes, light traps, or careful use of insecticides.



- *Prevent flies from emigrating from the facility.* Certain management practices can help minimize the amount of favorable outdoor fly breeding sites. Spreading manure and bedding as thinly as possible will help ensure that it dries out quickly. It should also be disked under to help kill fly larvae and pupae that may be present, especially under cool or overcast weather conditions, which slow the manure drying process. Drainage problems that allow manure to mix with mud and accumulate along fence lines in exercise yards should be eliminated. Gaps under feed bunks where moist feed can accumulate should be sealed.

## Biological Control

Flies have natural enemies that are commonly present in dairy and livestock barns. Beetles (fig. 7) and mites (fig. 8) devour fly eggs and larvae. Fly pupae are attacked by small parasitoids (fig 9). Unnoticed and unaided by us, these natural biocontrol agents can take a heavy toll on the fly population.

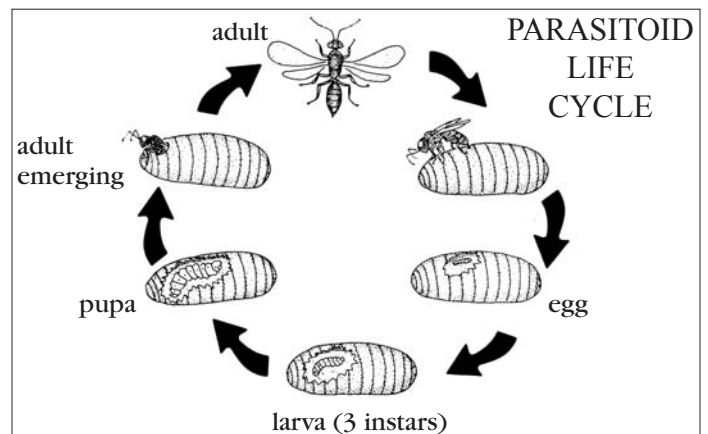
Parasitoids are among the most important of these natural biocontrol agents. Some species perform better in different climates, and some prefer different kinds of manure and other fly breeding materials. The species that is best adapted to farms in the Northeast is *Muscidifurax raptor*, which attacks fly pupae (fig. 9) inside barns as well as outside and is the main naturally occurring parasitoid on our farms.

Parasitoids are like "smart bombs"-they live only to find and kill fly pupae. Although the female parasitoid has a stinger, the only purpose she can use it for is to kill flies. When she finds a fly pupa, she stings and feeds on it. This kills the fly. She then uses her stinger to lay an egg inside the pupa. The egg hatches, and the parasitoid larva feeds on the dead fly. The young adult parasitoid then chews its way out of the fly's pupal case and searches for new pupae to kill. Development from egg to adult parasitoid is completed in about 3 weeks.

Evolution has led to a natural balance in which the parasitoid and the fly coexist. If we think of them as competitors in a race that happens each summer, the fly has certain advantages that help it to win unless we intercede. For example, the fly develops twice as fast from egg to adult, lives longer, and lays more eggs than *Muscidifurax raptor* parasitoids. As fly populations begin to grow in late May and early June, the parasitoid populations lag behind.

The parasitoid also lags behind the fly in developing resistance to insecticides. Many insecticide treatments for flies therefore have the undesirable side effect of killing large numbers of parasitoids. Each subsequent insecticide treatment

Life cycle drawings are from R. C. Axtell, *Fly Control in Confined Livestock and Poultry Production*, Technical Monograph, Ciba-Geigy Corporation, Greensboro, North Carolina, 1986. Reprinted by permission.



kills more beneficial insects and creates conditions that require repetitive treatments to keep flies in check.

Parasitoid populations can be conserved by using insecticides that are compatible with these important biocontrol agents. Baits and pyrethrin space sprays are good examples of compatible insecticides. Residual premise sprays are highly toxic to parasitoids and should be used only as a last resort.

### Parasitoid Releases

Along with conserving natural enemies, it is possible to go one step further and release parasitoids to “jump-start” their population growth in the early summer. Such releases can be effective in managing fly populations if certain conditions are met:

- Waste management is a must; parasitoid releases complement manure management but cannot replace it.
- When insecticidal treatment is necessary for supplemental fly control, only insecticides that are compatible with parasitoids (space sprays and baits) should be used.
- Parasitoids are sold as immature insects in killed fly pupae. Local suppliers ship the parasitoids in cheesecloth bags. If most fly breeding on the farm occurs inside the barn, these bags should be stapled to posts and rafters near areas where fly breeding is a problem. If calves are housed in hutches, at least a portion of the bags should be opened and about three heaping teaspoons of pupae (approximately 1,000) placed in each hutch weekly.
- Many companies that sell parasitoids advertise their products in farm magazines, but not all of them sell the right species or provide parasitoids that are adapted for the northeastern climate. *Muscidifurax raptor* is the species recommended for use in the Northeast. *Nasonia* parasitoids are inexpensive but are inappropriate for use in dairies.
- Parasitoid releases should be started early, preferably in middle to late May, and continue weekly until the middle of August.
- How many parasitoids should be released? Weekly releases of either 200 parasitoids per milking cow or 1,000 parasitoids per calf have proven effective in research trials. But every farm is different, and release rates and schedules may require adjustment to achieve a level that is both effective and affordable for an individual farm.

- How cost effective are released parasitoids? Prices vary, but the average is about \$13 per batch of 10,000 parasitoids plus shipping charges. At a release rate of 200 per cow (= 26 cents) per week, total costs for the summer are between \$2,600 and \$4,700 per cow, depending on how long the releases are sustained.

In research trials, the cost of releasing parasitoids has been more than offset by reductions in insecticide treatments. On average, dairy farmers who use biocontrol in fly IPM programs make 80 percent fewer insecticide treatments than farmers who rely solely on insecticides for fly control. In addition, fly populations on IPM farms are about 50 percent lower than on conventionally managed farms. It is important to understand, however, that no single fly management strategy such as parasitoid releases alone will provide long-term control.

### Chemical Control

Insecticides can play an important role in integrated fly management programs. Chemical control options include space sprays, baits, larvicides, residual premise sprays, and whole-animal sprays.

Space sprays provide a quick knockdown of adult flies in an enclosed air space. Because space sprays have very little residual activity, fly populations in the Northeast are still relatively susceptible to them. Baits are also very useful for managing moderate fly populations. Space sprays and baits are compatible with fly parasitoids.

Several insecticides are labeled for use as larvicides, either for direct treatment of manure or in controlled-release formulations. Direct application of insecticides to manure and bedding should be avoided in general because of harmful effects on the natural enemies of flies. The only exception is occasional spot treatment of breeding sites that are heavily infested with fly larvae. Controlled-release larviciding options include boluses and feed additives that result in the insecticide's being excreted with animal feces.

Treatment of building surfaces with residual sprays has been one of the most popular fly control strategies over the years. Unfortunately, however, flies have developed a high resistance to these materials. They should be used only as a last resort to control fly outbreaks that cannot be managed with other techniques.

Whole-animal sprays can be made directly on the animals. Although this approach can provide the animals with needed relief from stable fly bites, the control is short-lived.

**Warning.** Always read product labels carefully before applying any insecticide. Mix and apply as directed. Do not overdose. Do not treat too often, and follow all precautions exactly. Remember that improper practices can produce illegal residues even when correct materials are used. It is illegal to use an insecticide in any manner inconsistent with the label.