Fly control: reducing disease and productivity losses

The two principal fly pests of confined livestock are House flies (Musca domestica) and Stable flies (Stomoxys calcitrans).

by Richard J. Hack, RJH Consulting LLC, USA.

House flies are a well-known cosmopolitan pest of both farm and home. This species is always found in association with humans or the activities of humans. It is the most common species found on pig and poultry farms, horse stables and cattle ranches.

Not only are house flies a nuisance, but they can also transport disease-causing organisms. Excessive fly populations are not only an irritant to farm workers but, when there are nearby human habitations, a public health problem could occur.

Stable flies are about the size of a house fly, but the adult has piercing mouthparts that protrude spear-like from under its head for blood feeding. Cattle are irritated by these pests, causing a reduction in productivity. The long, bayonet-type mouthparts, called a proboscis, are used to tear through the skin, causing blood to pool at the skin surface. These bites can be quite painful.

The stable fly is one of the most serious pests of confined livestock throughout the United States. In many areas it is becoming a more serious problem for pastured cattle as well, associated with hay waste residues from the large, round hay bales used to feed them. Scientists have calculated that a pair of flies beginning reproduction in April have the potential, under optimal conditions, to be the progenitors of 191,010,000,000,000,000,000 flies by August.

Fly biological and behaviour patterns

House flies lay eggs in organic material including manure and decomposing material which may be located under water leaks and in areas that are difficult to clean.

Fig. 1. House fly and Stable fly life cycle and characteristics.

<table>
<thead>
<tr>
<th>House fly</th>
<th>Stable fly</th>
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<tbody>
<tr>
<td>Adult flies are 6-7mm in length with reddish eye and spongy mouthparts.</td>
<td>Adult flies are 6-7mm in length, with piercing mouthparts.</td>
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<tr>
<td>Live for 15-25 days</td>
<td>Live for 20-30 days</td>
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<tr>
<td>Females lay several batches of 75-150 eggs at 3-4 day intervals</td>
<td>Females lay 200-400 eggs</td>
</tr>
<tr>
<td>Life cycle egg to adult 7-10 days (optimum summer temperature)</td>
<td>Life cycle egg to adult 21 days</td>
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When house flies land on a surface they vomit, defecate, or both. Vomiting allows the fly to dissolve and consume what may be on the surface. A light brown speck is a vomit spot and a dark speck is a defecate spot.

When house flies are not laying eggs, they are typically found around windows, doors and the ceiling areas of buildings. These resting places are generally near favourite daytime feeding and breeding areas and sheltered from the wind. At night, flies are normally inactive.

Fly eggs hatch, become larvae in the breeding areas before they pupate and finally hatch into adults to repeat the lifecycle throughout the fly season. The house fly development cycle, population density and daily activities, including flight in a particular locality, depend on resource, temperature and other biotic and abiotic factors.

If food is not limiting, flies will complete their life cycle in about 10 days at 29.5°C, 21 days at 21°C and 45 days at 15.5°C. The optimum temperature for fly development is around 26°C with the lower and upper thermal limits of 12 and 45°C, respectively.

Eggs can hatch within nine hours after oviposition and take about 7-10 days to complete egg to adult stage under ideal conditions. However, cooler weather, dry media and scarce food may increase development time to two weeks or more. Flies produce multiple generations per year and the generations overlap; all stages are present at the same time.

Even if the development depends on temperature, multiple generations per year are possible in tropical and temperate regions due to their peridomestic habits.

Different studies have reported different distances that flies can travel, ranging from 3.22km up to 32.19km. The flights are mostly aimed at searching for food and oviposition sites. Flies travel relatively longer in rural areas than urban areas due to widely scattered human settlements. At night, flies are normally inactive.

Stable flies at and above 2.5-5.0 flies per leg reduce both weight gain and feed conversion efficiency in feeder cattle.
Antibiotic-resistant bacteria on dairy farms can lead to treatment failures and increased resistance in both dairy and non-dairy animals. Flies can also be a vector for transmitting antibiotic-resistant bacteria to healthy cows.

### Disease transmission and productivity impacts

| House flies | Spread bovine mastitis and other diseases | Transmit antibiotic-resistant bacteria | Increase bacterial counts in milk |
| Stable flies | Reduced weight gain and milk yield due to fly avoidance behaviours that reduce time spent feeding and resting | Milk production reduced 1.49kg/day (3.3 lb/day) | $2.2 billion cost to US livestock industry |

**Table 1. Impact of flies on disease transmission and dairy productivity.**

Continued from page 13 because they normally attack legs and bellies. Production performance declines in infested herds because of the painful bites and the animals’ fatigue from efforts to dislodge the flies. Stable flies are strong fliers and have been reported to travel long distances from their breeding site around farms or between farms. Stable flies overwinter as larvae or pupae by burrowing in the soil under organic matter.

### Disease transmission and impact on productivity

**House flies** pose a serious health hazard to people and animals by spreading numerous diseases in and around animal rearing facilities and nearby residential areas. In dairy barns, flies feed on milk leaking from the udders of diseased animals and spread diseases such as bovine mastitis to healthy cows. Severe housefly infestations may increase bacterial counts in milk. State inspectors routinely note the presence of flies in milk rooms.

Fly control can reduce the spread of disease in farms and, as a result, reduce the need to use antibiotics to treat disease. Flies harbour and spread the presence of flies in milk rooms. State inspectors routinely note the presence of flies in milk rooms.

### Fly larvae find ideal conditions to develop and grow on dairy sites.

Their numbers vary on number adult fly populations.

### Integrated Pest Management

Integrated pest management (IPM) is recommended for implementing a successful fly management program in and around dairies.

- **Monitoring:**
  - Monitoring of the fly population is an indispensable part of IPM. Several monitoring tools have been developed for adult and larval populations to enable farm managers to monitor for impending emergence of adult flies and provide a basis for timing and frequency of spray applications.
  - **Sanitation:**
    - Sanitation removes fly breeding areas resulting in a reduction in larvae and viable areas for adults to lay eggs. Depending on the type of dairy facility, dry manure management is highly effective in reducing fly populations. Where applicable, frequent removal of manure prevents fly buildup by breaking the breeding life cycle. It is important to scatter the manure lightly outdoors to kill eggs and larvae by drying. Spilled feed should not be allowed to accumulate. Regulate water flow to drying watering sources and prevent/repair any leaks. Adequate cross ventilation should be provided in the facility.

### Management systems and breeding sites

Each dairy is unique. What is common to all dairies are the fly breeding areas. Common fly breeding sites include locations in and around:

- **Calf hutches, especially in the corners.**
- **Silo leak and spill areas.**
- **Animal stalls and pens, feed preparation, storage and manger areas, near water sources.**
- **Calf, hospital, and maternity areas.**
- **Water tanks.**
- **Feed troughs.**
- **Inside and outside manure handling areas.**

### Table 2. Methods of monitoring fly populations

<table>
<thead>
<tr>
<th>HOUSE FLIES</th>
<th>SPOT CARDS</th>
<th>STICKY RIBBONS</th>
<th>SCUDDER GRID</th>
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<td><strong>Spot cards</strong> — small 7.5 x 12.5cm index cards fastened in multiple locations within barns where a large number of flies are present. The number of fliespecks (vomit and excreta) on each card gives an indirect estimate of fly populations, and cards should be replaced weekly. Average fliespecks of 50-100 per card indicate a high fly activity and a need for intervention.</td>
<td><strong>Sticky ribbons</strong> — tapes with sticky surfaces placed at different locations in barns should be replaced weekly. The tapes can either be stationary or an individual can walk them through the barn for monitoring purposes. The stationary tapes are 3-4cm wide ribbons hung from beams, pillars and other structures, whereas moving sticky paper ribbons are 45cm tapes fully unrolled, suspended about 5-7cm off the floor and carried throughout the barn; the observer should use the same walking pattern at the same time of the day for more accuracy. An average weekly count above 100 flies per stationary tape, or after walking 300m in the barn in case of moving tapes is considered a high fly activity.</td>
<td><strong>Scudder grid</strong> — a standard 60cm square grid consisting of 16-24 wooden slats, which is fastened at equal intervals to cover an area of approximately 0.8m². After a period of 30-60 seconds, the flies resting on the grid are quickly counted and recorded. The count is repeated 10-15 times in areas with high fly numbers. Sampling should be conducted 2-3 times per week and counts should be carried out at times when flies are active, typically between 10:00 and 16:00 hours. A count of less than 20 flies on a scudder grid is likely to indicate satisfactory fly control.</td>
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### Sanitation

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### Ensure proper floor grading so that excess surface water drains away from the facility. Drainage problems that allow manure to mix with mud and accumulate along fence lines in exercise yards should be eliminated. Gaps under feed bunkers where moist feed can accumulate should be sealed. Cut grass and vegetation short to remove fly resting areas.

### Table 2. Methods of monitoring fly populations
Mechanical control
Mechanical control involves the use of devices to control flies or remove manure. This may include physical exclusion with screens or fans to prevent entry into dairy houses, fly traps, and electric insect killers automatic scrapers for constantly removing manure from buildings.

Biological control
Biological control should be part of an overall fly control program in dairy operations. The conservation biocontrol includes practices such as provision for temporary manure-refuge of natural fly enemies, selective use of less toxic pesticides and manure moisture management at low levels, all to increase the efficiency of natural enemies. The parasitoid wasps, predatory beetles and mites are used for control of juvenile stages of flies. In addition, several species of entomopathogenic nematodes have been extensively studied for their potential as biocontrol agents against flies.

Chemical control
Chemical use around lactating dairy animals is limited. Labels should be read and instructions followed. Use of insecticides for fly control is an important component in an integrated fly control program directed at reducing fly populations to tolerable levels (see Table 3). Producers must monitor fly populations on a regular basis to evaluate the fly management program and decide when insecticide applications are required.

ADULTICIDES
- **Surface residual spray applications** can also be used for long-term population suppression. They are an effective and economical method to control high infestations of flies and should be applied in the places where the flies rest, including walls, roof, cords, pipes, both inside and outside the buildings. Surface residual spray applications are typically pyrethroids which control the adult flies upon contact with the surface. Pyrethroids will have some repellent activity.

- **Space sprays or mist sprays** are used to quickly knockdown adults. Misting fly resting surfaces with these chemicals is the most common way to suppress overwhelming populations with short residual actions. The low residual activity in turn reduces the possibility of resistance. They should be applied sparingly, maximum twice a week, at regular intervals. Space sprays are applied with ultra low volume sprayers or foggers resulting in small particles hitting the adult flies. Space sprays are natural pyrethrin based with the synergist piperonyl butoxide or organophosphates.

- **Baits** are effective for maintaining low fly populations. They are scattered, in bait stations or, in some cases, as a spray or paint-on application. Most baits contain the sex attractant (Z)-9-tricosene and a neonicotinoid (chemical class). The bait formulations are very useful in trapping and killing adult flies, but the bait stations should be positioned to avoid food and water contamination.

- **Spray baits** are effective as a spot treatment when applied to surfaces. One third of the surface is treated vs 100% with the surface residual treatment. Spray baits typically include an attractant like 2,9-tricosene, and non-repellent insecticide (neonicotinoid). Adult flies are attracted to the treated surface by the attractant and then consume the bait in order to be controlled.

- **Paint baits** are effective when applied to surfaces such as hang boards. They are made by dissolving a water soluble powder in water to form a thick paint solution. Paint bait ingredients are similar to spray baits with adult flies attracted to the treated surfaces to consume the paint and subsequently die.

LARVICIDES
- **Larvicidal feed-throughs** are feed additives that render manure toxic to fly larvae. The great advantage is that this does not require labour.

- **Larvicidal sprays or liquid solutions** are applied directly to the manure surface to kill fly larvae. It is recommended to apply only as a spot treatment with high numbers of larvae to reduce the toxic effect on populations of beneficial insects in the manure.

- **Larvicidal granules** can be applied to difficult-to-reach breeding areas. A small fertiliser spreader drops granules into the spaces between the slats allowing a consistent application to breeding areas below the slats.

Table 3. Chemical fly control application methods.

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**Stable fly treatments:** Whole-animal sprays can be made directly on the animals. This can provide relief from stable fly bites but the control is short-lived.

Community issues
A confined animal feeding operation (CAFO) is a specific type of large-scale industrial agricultural facility that raises animals, usually at high-density, for the production of meat, eggs, or milk. Residences closest to these operations experience a much higher fly population than average homes. Conflicts between CAFOs and local residents have resulted in public health actions including litigation. As a result, CAFOs must develop and maintain a successful IPM program in order to reduce and control fly populations.

References are available from the author on request

KEY POINTS
- **House flies and stable flies** are a major pest in dairy facilities due to available breeding areas.
- **House flies** are disease carriers and stable flies are blood feeders that contribute to economic losses.
- **Even in small numbers, stable flies** reduce productivity and milk production.
- **House fly and stable fly populations grow fast** and quickly become uncontrollable.
- **Flies from CAFOs invading** nearby neighbours can result in public health and/or legal interventions.
- **A successful IPM program** reduces fly populations to tolerable levels.
- **Rotating classes of insecticides used is key to avoiding resistance**
- **Sanitation, the removal or treatment of breeding sites** is key to successful fly control.