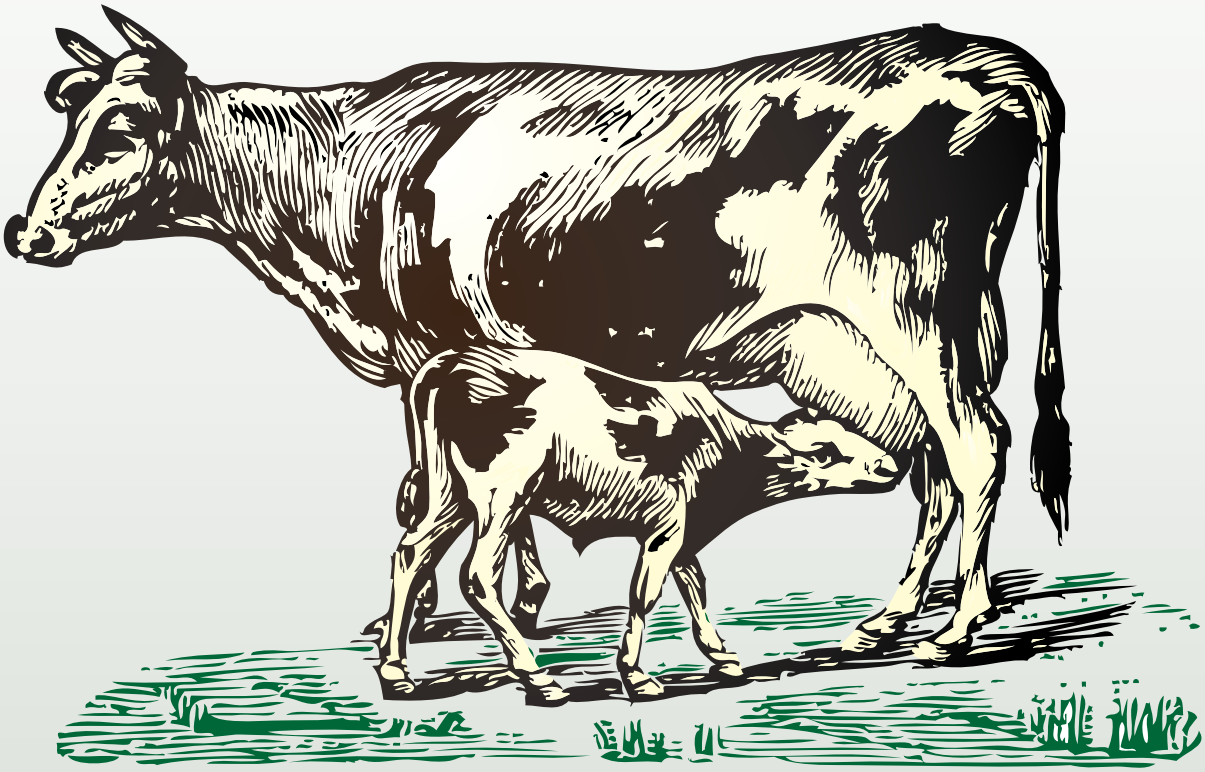
2011

Integrated Pest Management (IPM) Guide for Organic Dairies



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Integrated Pest Management Guide for Organic Dairies

2011

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Integrated Pest Management Guide for Organic Dairies

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Photo by Keith Weller, ARS Photo Gallery

1. Introduction

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This guide provides an outline of practices for the management of external arthropod pests such as flies, lice, mites and grubs on organic dairy farms. Left uncontrolled, these pests negatively impact animal health and production.

While organic production has recently increased, information about how to farm organically is still in need of considerably more research. This guide compiles the most currently available information on dairy arthropod pests, but acknowledges that effective means of organic control are insufficient for some of these pests. As new information becomes available, it will be incorporated into future revisions of this guide. While critical to organic dairy production, this guide does not include information on nutrition, feed stocks, or internal parasites of dairy cattle.

This guide is broken into sections beginning with a brief overview of the certification process. Sections on fly management are broken down into those found in and around confined areas and shelters, as well as those found when cattle are on pasture. Each section reviews the biology and importance of each pest along with monitoring and assessment recommendations followed by pest management techniques. A separate section addresses management of lice and mange. Specifics on biological control, trapping, and pesticide options conclude the guide.

This guide uses the term organic integrated pest management (IPM), which utilizes a series of decision-making steps to manage pests. To ensure success, dairy producers need to properly identify pests, understand pest biology, monitor pest populations, assess the need for control, and then reduce pest populations to acceptable levels through cultural, biological, mechanical, and chemical management techniques.

1.1 Economic Impacts

Controlling arthropod pests on dairy cattle improves their general living conditions, which can directly affect farm profitability. Inadequate pest control can cause pain and irritation to animals resulting in reduced milk production and a decrease in the rate of weight gain due to interupted grazing time. Animal health is compromised through blood loss, hide damage, and hair degradation as well as providing routes for diseases such as pink eye, *Thelazia* eyeworms, and mastitis (reference 30a). It is difficult to assess the impact of any one pest species on overall production, but an accumulation of multiple stresses from pests throughout the year will reduce production over time, with conservative estimated losses of five percent or more. Younger animals are particularly at risk since stress can interfere with early weight gain, resulting in a negative effect on productivity over their lifetime.

Flies emigrating from farms can cause friction between neighbors, sometimes to the point of litigation. The economic effect cannot be accurately calculated but these cases can severely impact farm profitability, community cohesion, and can also be considered a public health issue.

Potential Annual Loss in Milk Profits Due to Accumulated Stresses from all Arthropod Pests

Percent Loss	Loss per Cow	Annual Loss/100 Cows*
5%	$238	$23,800
10%	$476	$47,600
20%	$952	$95,200

*Estimates of annual losses are based on U.S. Department of Agriculture data for all dairy pests and assumes 17,000 pounds of milk per animal per year at a price of $28 per 100 weight.

2. Certification and Regulation

Organic agriculture emphasizes the health of the agricultural ecosystem, and only allows the use of certain pesticides when all cultural, biological, and mechanical means of control are exhausted. Farmers promote animal health through sound nutrition, pasture rotation, effective and timely manure management, proper housing, preventative health care practices, and minimizing animal stress. Herbicides, genetically-modified organisms, hormones and antibiotics are prohibited. Organic dairy producers must develop a high level of farm management skill, approach their farms as a whole system, and use an integrated approach to solve the problems they face.

Understanding the organic certification process is a critical first step to becoming a certified organic dairy producer and communicating with your organic farm certifier cannot be overemphasized.

2.1 Certification Background

The U.S. Department of Agriculture's National Organic Program (NOP) regulations (reference 5) provide detailed requirements for producers who wish to sell their products as certified organic. The regulations specify the need for third party independent verification by an organic certifier. Any organic farming operation grossing more than $5,000 per year must be certified as organic. A list of accredited organic certifiers (reference 16) can be found at the New York State Agriculture and Markets Organic Farming Resource Center website (reference 3).

2.2 Organic System Plans

The Organic Farm Plan, covering all aspects of organic production, is written by the producer and reviewed by the farm certifier, and when considered along with on-farm records, constitutes an Organic System Plan.

Organic Farm Plan

An Organic Farm Plan demonstrates to certifiers that the producer understands organic practices. The farm certifier requires producers to furnish an outline of planned production practices and products they will use on their farms. The process of developing the plan can be valuable in terms of anticipating potential issues and challenges, as well as in thinking of the farm as a whole system.

For the applicant, the Organic Farm Plan provides a flexible and affordable tool to outline and evaluate farm management practices, making improvements over time if necessary. For the certifier, the Organic Farm Plan provides information for assessing the applicant's compliance with regulations governing organic production. Certifying organizations often provide templates for the Organic Farm Plan.

On-Farm Records and Audit Trails

Keeping accurate records, sometimes referred to as an audit trail, will help verify that a farm has complied with organic farming requirements outlined in the Organic Farm Plan. Farm records also act as an aid for producers to track problems and their successful solutions from year to year. Failure to keep proper records can jeopardize certification.

Record keeping requirements for dairy farms are determined by the certifier, but often include items such as:

- A farm map;
- Applied amendments or sprays, along with receipts of purchases;
- Animal inventory identifying animals originally on the farm from the start of the transition period, new animals, or those that leave the farm;
- Health records identifying the condition of sick animals, veterinary visits, and the treatments used to remedy the condition;
- Feed sources and rations;
- Sales records including milk pickup and quality reports, sales invoices, and income ledger.

The intended outcome of this guide is to outline an external arthropod control plan which can be included with the farm Organic System Plan. The plan will focus on preventing arthropod pest populations from increasing to a point where they negatively impact the animal or dairy operation. More information on organic certification is available in the resources section of this publication.

2.3 PESTICIDE REGULATIONS

Organic production focuses on cultural, biological, and mechanical techniques to manage pests on the farm, but in some cases organically approved pesticides, which include repellents, are a necessary option. Pesticides mentioned in this organic production guide must be registered and labeled at the federal level for use, like any other pesticide, by the Environmental Protection Agency (EPA), or meet the EPA requirements for a "minimum risk" pesticide, making it exempt from normal registration requirements as described in FIFRA regulation 40 CFR Part 152.25(b) (reference 18).

"Minimum risk" pesticides, also referred to as 25(b) pesticides, must meet specific criteria to achieve the "minimum risk" designation. The active ingredients of a minimum-risk pesticide must be on the list of exempted active ingredients found in the federal regulations (40 CFR 152.25) (reference 18). Minimum-risk pesticides must also contain inert ingredients listed on the most current List 4A published in the Federal Register (reference 19).

In addition to meeting the active and inert ingredient requirements above, a minimum-risk pesticide must also meet the following:

* Each product must bear a label identifying the name and percentage (by weight) of each active ingredient and the name of each inert ingredient.
* The product must not bear claims to either control or mitigate microorganisms that pose a threat to human health, including, but not limited to, disease-transmitting bacteria or viruses, or claim to control insects or rodents carrying specific diseases, including, but not limited to, ticks that carry Lyme disease.
* The product must not include any false or misleading labeling statements.

Besides registration with the EPA, pesticides sold and/or used in New York State must also be registered with the New York State Department of Environmental Conservation (NYS DEC). However, pesticides meeting the EPA "minimum risk" criteria described above do not require registration with the NYS DEC.

To maintain organic certification, products applied must also comply with the National Organic Program (NOP) regulations as set forth in 7 CFR Part 205, sections 600-606 (reference 17). The Organic Materials Review Institute (OMRI) (reference 15) is one organization that reviews and publishes products they find compliant with the NOP regulations, but other entities also make product assessments. Organic growers are not required to use only OMRI listed materials, but the list is a good starting point when searching for potential pesticides.

Finally, each farm must be certified by an accredited certifier who must approve any material applied for pest management. ALWAYS check with the certifier before applying any pest control products.

Some organic certifiers may allow "home remedies" to be used to manage pests. These materials are not labeled as pesticides, but may have properties that reduce the impact of pests on production. Examples of home remedies include the use of beer as bait to reduce slug damage in strawberries or dish detergent to reduce aphids on plants. Home remedies are not mentioned in this guide, but in some cases, may be allowed by organic certifying agencies. Maintaining good communication with your certifying agent cannot be overemphasized in order to operate within the organic rules.

RESOURCES

National Organic Program (reference 5)
National Sustainable Agriculture Information Service (formerly ATTRA) (ref 7)
NYS Ag. and Markets Organic Farming Resource Center (reference 3)
NOFA-NY Organic Dairy Transitions Project (reference 10)

3.1 HOUSE AND STABLE FLIES

Organic Integrated Pest Management (IPM) begins with proper identification of pests, understanding their biology, and realizing their importance in the production process. Once identified, pest populations are monitored and assessed to determine if the population requires management to reduce potential damage. If damage is determined to be likely, the safest effective means of controls are recommended. For additional details, see Appendix 1: *Integrated Management of Flies in and around Dairy and Livestock Barns*.

House Fly Facts

- **4 to 6 batches** -of 150 to 200 eggs are laid in the life of a female house fly.
- **7 to 10 days** - Average life cycle from egg to adult.
- **10 to 21 days** - Average lifespan depending on temperature**.**
- House flies **do not bite**.
- **250** - Threshold of flies/tape/ week OR
- **100** - Threshold of fly "spots"/ monitoring card

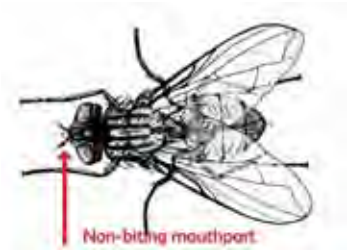


Figure 3.1: House fly.

Figure 3.2: Comparison of house and stable flies. Photo by James Kalisch, Department of Entomology, University of Nebraska-Lincoln.

3.1.1 Biology and Importance

The two principal fly pests of livestock in and around confined areas are house flies and stable flies. Where these flies are found on the farm depends on the availability of appropriate breeding habitat.

House Fly: House flies, *Musca domestica*, are non-biting insects that breed in manure, decaying silage, spilled feed, soiled bedding, and other decomposing organic matter. Adults are gray with four black stripes on the thorax. See figure 3.1. They can complete their life cycle from egg to adult in 7 to 10 days under the ideal conditions of warm summer months. Each female can produce 4 to 6 batches of 150 to 200 eggs over her lifetime, which she lays at 3- to 4-day intervals. Although house flies may cause only minor direct annoyance to animals, their potential for transmitting diseases and parasites is considerable, and they have been implicated in diseases such as *Salmonella, Escerichia coli,* and *Staphylococcus aureus* (references 25, 29, 30, 30a). House flies in the Northeast are active from May through October, with peak populations occurring from mid-July through mid-September.

Severe house fly infestations may increase bacterial counts in milk, and state inspectors routinely note fly abundance in milk rooms. Flies can also become a serious nuisance both around the production facility and in nearby communities. Demographic changes in the Northeast in recent years have placed many once isolated dairy producers in closer proximity to their neighbors. These new neighbors are often intolerant of flies, putting greater pressure on producers to keep house fly populations to a minimum.

Stable Fly: The stable fly, *Stomoxys calcitrans*, is slightly smaller than a house fly but is dark gray. Its abdomen has seven rounded dark spots on the upper surface. The piercing mouthparts of the adult protrudes like a spear from under the head and is used to cause extremely painful bites. See figure 3.3. They aggravate dairy cattle both in the barn and on pasture.

Stable flies breed in wet straw, manure, spilled feeds, silage, grass clippings, poorly managed compost piles, damp round bales, and vegetation washed up on lake shores; in other words, in any damp, decaying organic matter.

Each female fly lives about 20 to 30 days and lays 200 to 400 eggs during her lifetime. Larvae, or maggots, hatch from the eggs and develop for about a week before they reach the pupal stage. The pupal case is reddish-brown. Stable flies develop slightly slower than house flies, but under warm summer conditions, the life cycle from egg to adult is about 3 weeks. Fly development is affected by temperature and moisture; under cooler conditions, flies develop more slowly, and when warmer, more quickly. Stable flies are vigorous fliers and may travel long distances to find a host (reference 25).

Cattle are most irritated by stable flies during the warm summer months when both males and females feed on blood several times each day. They take only one or two drops at each meal, with the female requiring blood to produce viable eggs. Animals will give an indication that stable flies are present by stomping their legs, since these flies normally attack the legs and bellies. Production declines in herds plagued by stable flies because the painful biting activity causes animal fatigue from trying to dislodge flies. Annoyance from the blood feeding causes

cows to bunch together in the pasture (figure 3.6) and in free stalls leading to heat stress and reduced feed intake causing potential economic losses. Stable flies emigrating off farm will bite humans, giving rise to their alternate name of the "biting house fly".

Horn Fly: While normally a pest of dairy cattle on pasture, the horn fly has recently been observed inside barns in New York. See more information about the horn fly in section 4.1and Appendix 2: *Pest Flies of Pastured Cattle and Horses*.

3.1.2 Monitoring and Assessment

House flies can be monitored using sticky ribbons or spot cards. Spot cards are 3-by-5-inch white file cards that are placed on obvious fly resting surfaces. They reflect the relative population of house flies by showing the number of fly fecal and regurgitation spots left when flies land to rest.

Sticky ribbons are 2 inch wide strips and normally a couple of feet long. The sticky material covering the ribbons immobilizes insects when they land to rest. They provide an easy method to monitor fly populations over time.

The number of spot cards, or sticky fly ribbons needed will vary according to which is used and the facility size, but place them in at least **5 to 10 locations** throughout each animal housing unit. If possible, mount at equidistant locations on posts, beams, and walls, or other areas where flies tend to rest, making sure to include some wind-free locations. Leave cards or ribbons for 7 days, count and record the number of flies on the sticky ribbons, or the number of fecal and regurgitation marks on the spot cards, then hang fresh dated cards or ribbons to provide a record over time (see Section 8: *Trapping*).

Although either device is effective for monitoring house flies, dated and numbered spot cards have the additional value of providing a long-term historical record of fly activity. Kept over time, the cards can be particularly helpful in assessing management success and resolving conflicts with neighbors over claims of increased fly abundance. Spot cards can also help detect fly breeding areas by comparing spot density on the cards when placed in various locations in and around the barn.

Thresholds: House flies

Each individual farm threshold may differ, but consider action when sticky ribbon counts are in excess of **250 flies/tape/week**, or spot card counts of over **100 spots/card/week**. These thresholds may be higher or lower depending on the chosen means of control and tolerance for fly populations on the individual farm. Being in close proximity to a residence or community may also alter these thresholds. See figures 7.1 and 7.2 for photographs.

Thresholds: Stable flies

Stable flies are monitored weekly by counting flies on all four legs of at least **15 animals** in the herd. In general, treatment is warranted when counts reach an average of **10 flies per animal** although the number can be adjusted based on personal preference and experience. See figure 3.4.

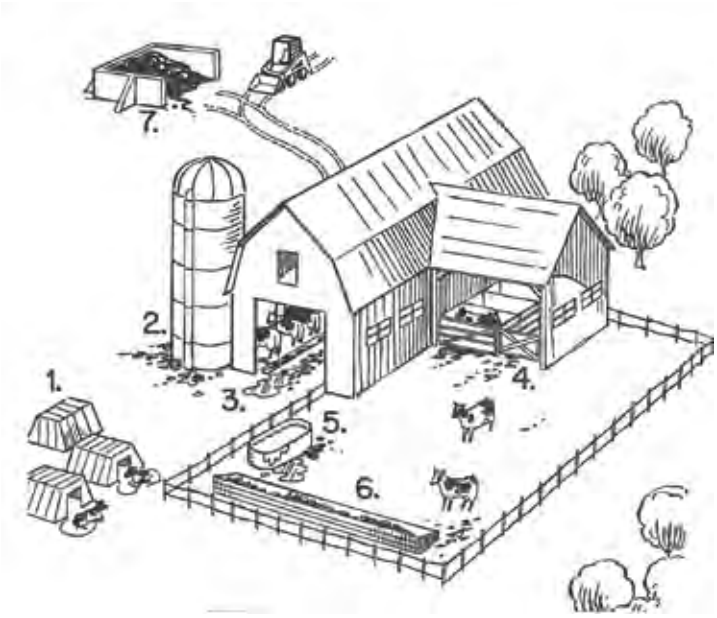
Stable Fly Facts

- **200 to 400** - Average number of eggs female/ lifespan.
- **21 days** - Average life cycle from egg to adult.
- **20-30 days** - Average lifespan depending on temperature**.**
- **Stable flies cause extremely painful bites.**
- **10 flies** = Average count per animal on 15 animals.

Figure 3.3: Stable fly

Figure 3.4: Monitor stable flies on the legs of cows. Photo by Keith Waldron

Diagram 3.1: Common Fly Breeding Areas



1. Calf hutches
2. Silo leak and spill areas
3. Animal stalls and pens, feed and feed storage areas.
4. Calf, hospital, maternity
5. Water tanks
6. Feed troughs
7. Manure handling areas

3.1.3 Management Options

Cultural Practices

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

Sanitation: Both house and stable flies need moist decomposing organic matter for the immature life stages (eggs, larvae, pupae) to survive. Manure, moist hay, spilled silage, and wet grain are good examples of what to avoid. In the warm summer months, house flies need these conditions for an average of 7- 10 days; stable flies need about 21 days. **Waste management is therefore the first line of defense in developing an effective fly management program**. Removing and spreading fly breeding materials weekly in the warm summer months helps to break the cycle, but since development is temperature dependent, sanitation efforts can be stretched out during the cooler spring and fall months.

Remember, dry is good. Cleaning up debris and decaying organic matter deprives flies of breeding areas. Prevent egg laying by drying out old hay and bedding through spreading or composting these materials to reduce potential populations. Turning compost regularly exposes immature flies to the lethal inner heat of the pile. Grade and drain areas where farm animals congregate to deprive flies of breeding sites. **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 fly sources in confined areas are animal pens, especially calf housing. The pack of manure and bedding under livestock should be cleaned out at least once a week. In free-stall barns the most important fly breeding area is the stalls, which should be properly drained and designed to encourage complete manure removal and adequate ventilation. In stanchion barns, drops should be cleaned out daily. Left over wet feed around mangers, as well as green chop and other forage and feed accumulations around silos, breed flies and should be cleaned out at least weekly. Protect enclosures from becoming wet from wind-driven rains, and remove or cut weeds around buildings to deprive flies of resting areas. Hay feeders should rest on cement pads which can be cleaned more easily.

Alternative bedding sources show some promise in reducing fly populations especially for calf pens, but may not always be economical or practical. Substituting sand, gravel, wood chips/shavings or sawdust bedding has significantly reduced house and stable fly maggot populations (reference 23). The ability of wood-based bedding to reduce fly populations may differ depending on the source of wood used (reference 24). Diatomaceous earth or lime, when dusted on bedding, will dry out bedding making it less conducive to fly larval development but check with your certifier before applying any products.

Key Management Tips for House and Stable Flies

- **Dry it:** Spread or compost decaying organic matter.
- **Move it:** Clean up manure and other breeding sites every 7 to 10 days to break the fly cycle.
- **Watch it:** Assess and monitor populations.
- **Catch it:** Use appropriate traps.
- **Feed it:** Feed flies to predators for dinner.
- **Spray it:** If all else fails, use repellents and pesticides to break the fly life cycle.

Figure 3.6: Cows may huddle in response to stable fly stress resulting in less grazing time. Photo by Bill Clymers. Department of Entomology, University of Nebraska-Lincoln.

Even a perfectly tended farm can experience damaging stable fly populations emigrating from damp decaying material on neighboring sites or transported in by storm fronts.

Mechanical Controls

Trapping: Sticky tapes, strings, and ribbons, especially the giant ones, are very effective for monitoring as well as managing small to moderate fly populations. Traps vary in their ability to retain effectiveness and may require changing as often as every 1 to 2 weeks if they dry out, become coated with dust, or are "saturated" with flies. See Section 8: *Trapping* for more information and photographs of various traps and how to use them.

Screens: Maintain a fly-free zone in the milk room. Sometimes fly location is more important than total fly numbers. Installing and maintaining tightly closed screen doors and windows to the milk room can greatly reduce fly numbers in this sensitive area where control options are limited. Keep traffic in and out of the milk room to a minimum. The occasional flies that still enter can be controlled with sticky tapes.

Fans: Large fans move air throughout the facility drying out damp potential breeding areas and discouraging flies from resting.

Biological Controls

Parasitoids, also referred to as predators, parasites, and parasitic wasps, can be used as an effective tool to help manage fly populations. Several closely related parasitoids, *Muscidifurax raptor* and *Muscidifurax raptorellus*, when released on farms, can significantly reduce house fly and stable fly populations over the season. See Section 6: *Biological Control Strategies* for details on how to use these and other insects as pest management tools.

Allowing poultry to range in proximity to dairy barns can contribute to fly control. Birds, such as purple martins and swallows, feed indiscriminately on flies of all kinds. Encouraging these populations through providing nesting boxes will enhance fly management. See more information in Section 6.2.2.

Chemical Controls

As an organic grower, the use of pesticides is only recommended after all other measures to manage fly populations are exhausted and since few products are available, the potential for resistance is high, reinforcing the need to use these tools sparingly. Avoid repeated use of the same product over short periods of time to preserve their effectiveness. Organically approved products can be used as space sprays but are more often targeted toward the affected part of the animal. A list of approved materials is in Section 8, but **always check with your certifier prior to making any insecticide applications**.

Some repellents are made from materials the EPA generally recognizes as having a minimum safety risk (FIFRA 25b) and are exempt from many of the EPA labeling requirements (See section 2.3 and reference 18), but use of these materials must still be approved by your certifier. See Section 2 for more information on certification.

Space sprays with pyrethrins provide a quick knockdown of adult flies in an enclosed space. Because space sprays have very little residual activity, resistance to these insecticides is still relatively low in fly populations in the Northeast. Unfortunately, space sprays with pyrethrins will also kill adult parasitoids, but not in their immature form. To maximize the effectiveness of parasitoids, avoid spraying immediately after releases. If a pesticide is necessary to reduce large fly populations, spray 2 weeks in advance of parasitoid releases.

To manage stable fly problems, sprays should be directed to the area where the flies most often occur, especially the belly and legs. Although this approach can provide needed relief from biting fly pressure, the control is short-lived. Spraying manure for fly control is ineffective and kills exposed parasitoids and predators. House and stable fly populations can be reduced by spraying barn walls and other areas where flies tend to congregate.

Several fly pests attack cattle while they are out on pasture especially horn, face, stable, horse and deer flies. Each has distinctive habits, life histories, and management options. See more information on these flies in Appendix 2: *Pest Flies of Pastured Cattle and Horses.*

Figure 4.1: horn flies penetrate the skin to obtain a meal of blood.

Figure 4.2: Horn flies often face the same direction when resting on the backs of animals.

Figure 4.3: Horn flies clustering on the back of a cow.

4.1 HORN, FACE, AND STABLE FLIES

4.1.1 Biology and Importance

Horn fly: The adult horn fly, *Haematobia irritans*, is about half the size of a house fly or stable fly. Both males and females have piercing mouthparts which they use to penetrate animal skin to obtain blood meals. Horn flies take blood meals intermittently 20 or more times each day. The flies normally congregate on the shoulders, backs, and sides of the animals but move to the underside of the belly during very hot or rainy weather. Horn fly adults tend to align their bodies in the same direction with their wing tips facing up while resting on animals.

Unlike other flies, horn flies remain on the animals almost constantly leaving only briefly to lay eggs on very fresh (less than 10-minute old) droppings. Development from egg to adult is completed in 10 to 20 days. The average life span is 30 days depending on the temperature. The flies overwinter as pupae in or under dung pats. Adults are strong fliers and can travel many miles. This serious pest of pastured cattle causes reduced milk production, poor weight gain, blood loss, animal annoyance and fatigue. The weight of calves plagued by horn flies is often reduced by 12 to 20 pounds over a summer (reference 26).

Face fly: The face fly, *Musca autumnalis*, is a robust fly that superficially resembles the house fly. It is a non-biting fly that feeds on animal secretions, nectar, and dung liquids. Female adult face flies typically cluster around the eyes, mouth, and muzzle of dairy cattle, causing extreme annoyance. As they move from the eyes of one animal to the next, they serve as vectors of eye diseases and parasites such as pinkeye and *Thelazia* eyeworms. They also gather around wounds to feed on blood and other exudates. Face flies avoid shady areas.

By contrast, male face flies feed only on nectar and dung. They spend much of their time resting on branches and fences and attempting to catch and copulate with female flies as they move about. Eggs are laid on very fresh droppings and take about 2 to 3 weeks to develop from egg to adult. Adults live an average of 28 days, depending on temperature. Pupal casings are very hard making it difficult for parasitoids to penetrate.

Face flies are strong fliers that can travel miles to find animals. Unlike house flies, face flies do not enter darkened barns or stables during the summer months. Cows are attracted to shade, so offering shelter from the sun can reduce the incidence and ease the distress caused by face flies. In the fall, however, face flies enter buildings and overwinter as adults indoors in a state of diapause, or hibernation.

Stable flies can also be a problem on cows in the pasture. See section 3 for more information on stable fly biology and importance.

Figure 4.4: Female face flies congregate on the faces of animals where they tend to feed on secretions from the eyes.

4.1.2 Monitoring and Assessment

Horn Flies: Horn flies are monitored by counting flies on the heads, shoulders, backs, and sides of at least **15 pastured dairy cows**; counts in excess of **50 flies** per side warrant treatment.

Face Flies: Face flies are monitored by counting flies on the faces of at least **5 but preferably 15 pastured animals** since the number of flies on individual cows naturally varies; average counts in excess of **10 flies** per face are considered of economic importance. Face flies avoid shade, therefore make sure to monitor them in full sun.

Stable Flies: Monitor stable flies weekly by counting flies on all four legs of at least **15 animals** in a herd. In general, treatment is warranted when counts reach an average of **10 flies per animal** although the number can be adjusted based on experience.

4.1.3 Management Options

Cultural practices

Horn flies and face flies breed exclusively in very fresh droppings in pastures not in decomposing materials like house and stables flies. As a result, cultural controls such as manure management in and around barn areas that are highly effective against house flies and stable flies will have no impact on horn fly and face fly populations. Practices that disturb fresh manure pats, such as using a chain or drag harrow in pastures, will break the life cycles of horn and face flies but also hinder the work of dung beetles and may deter animal grazing. Moving animals to fresh pasture every 3 days will provide them with unspoiled grass.

Figure 4.5: Life stages of the face fly.

Biological Controls

If enough natural enemies are present on the farm, they will work to disassemble the manure-filled part of the pasture. More than 125 different species of arthropods live part of their life cycle in manure pats in pastures when pesticides are absent, and only three of these are considered pests (reference 35). One of the most active natural enemies are scarab or dung beetles.

Biological control against horn and face flies is limited to beneficial organisms occurring naturally in the field, especially those spending part of their life in cow dung. Face flies have very hard pupal casings, which many parasitoids cannot penetrate but they can be attacked by parasitic nematodes. Predaceous mites and beetles prey on the immature stages of both horn flies and face flies. Adult flies are attacked by yellow dung flies. Face

Figure 4.6: Small dung scarab and red dung scarab beetles.

Figure 4.8: Adult horse fly

Figure 4.7: Muscovy ducks eat many fly larvae. Photo by Lee Karney, U.S. Fish and Wildlife Service.

Figure 4.9: Adult deer fly

flies are occasionally attacked by pathogenic fungi. Birds, bats, and spiders also contribute to overall reductions in flies of all types. See Appendix 3: *Common Pest Flies Found in the Urban/Rural Environment and Their Biological Control Agents*.

Dung Beetles: Horn and face flies require fresh manure to complete their life cycle, but dung beetles can dramatically reduce these pest populations by competing for the manure and depriving horn and face flies of a habitat for their larvae to develop. A single manure pat can produce 60 to 80 horn flies if left unprotected from predators. One of the most beneficial dung beetles has a habit of forming balls from dung in which they lay their eggs. These balls are rolled into tunnels the beetles have dug in the soil, away from the access of horn and face flies. Some studies indicate that healthy dung beetle populations can bury up to 90% of cow manure within a pasture in one week (reference 40).

The benefits of dung beetles go well beyond reducing face and horn fly populations. Burying manure reduces runoff problems and increases nutrient availability from the manure, improves organic matter in the soil, and is a general benefit to soil health resulting in improved pasture growth. Removing manure makes more area available for grazing. In addition, dung beetle activity breaks the cycle of some internal pests of dairy cattle which are dependent on manure pats remaining undisturbed.

Under ideal conditions, dung beetle larvae will pupate in about 3 weeks and the life cycle is completed in about 6 weeks. Dry spells will reduce dung beetle activity. Even though dung beetles are thought to be capable of flying up to 10 miles in search of fresh dung, their populations can be improved by planning to graze animals in pasture areas where new adult beetles are expected to emerge from the soil. This effectively decreases the time beetles spend looking for fresh manure (reference 36, 40).

In some emergency cases, a farm certifier may allow the use of ivermectin for control of internal parasites, but use of this pesticide is detrimental to dung beetle populations for weeks after treatment (reference 42) and the NOP rules restrict the sale of milk after treatment.

To assess dung beetle activity, check the outside of manure pats for holes in the surface, or the inside for tunneling or a shredded appearance (reference 40 and 41).

Poultry: When allowed to range in pastures, poultry, particularly Muscovy ducks, assist to reduce fly populations through their habit of searching for larvae in manure pats. See Section 6.2.2 for more information (reference 32).

Mechanical Controls

Face flies: Face flies do not enter darkened barns or stables during the summer months. Offering shelter can reduce face fly incidence on cows.

Horn Flies: The only effective traps mechanical controls are walk through traps that can assist in reducing horn fly populations. See information on this trap in Section 7.

Chemical Controls

Remember: In organic systems, all cultural, biological, and mechanical methods of control should be used first. Insecticides should only be used after all other control options are exhausted. Insecticidal control options for horn flies and face flies include repellents and animal sprays and wipes directed at the face and back. Self-application devices, or back rubbers, are made from absorbent material treated with an insecticide-oil solution placed where animals will make frequent contact, such as in gateways. Make sure to read the label and check with your certifier to determine allowable methods. See Section 8 for information on specific pest management products.

4.2 HORSE AND DEER FLIES

4.2.1 Biology and Importance

Horse flies and deer flies belong to the fly family *Tabanidae*. Female flies typically lay their eggs on vegetation near marshes, ponds, or streams. Development from egg to adult requires 70 days to 2 years, depending on the species. Horse and deer fly pressure is generally higher during the hot summer months.

Dairy cattle on pasture can be severely attacked by these flies, particularly where pastures border woodlands or wet, marshy areas. Female horse and deer flies cut through the skin of the animal with knife like mouthparts, then feed on the blood that pools around the wound. The wound continues to bleed after the fly leaves often attracting face flies. Large numbers of these flies can cause extreme annoyance, fatigue, blood loss, decreased milk production, and reduced weight gain. Some species have also been implicated in the transmission of tularemia, anthrax, anaplasposis, and leukosis. See Appendix 2: *Pest Flies of Pastured Cattle and Horses* for more information.

4.2.2 Monitoring and Assessment

No exact thresholds exist for deer and horse flies, but these flies are easy to identify. Deer flies tend to hover near the head of a moving animal. Signs of agitation among cattle often signify the presence of deer and horse flies. Keep watch for these flies while monitoring for other pasture pests. Attacks only occur during daylight hours. Both horse and deer flies tend to avoid the inside of buildings.

4.2.3 Management Options

Cultural Controls

Deer and horse flies tend to be more prevalent near marshy or poorly drained areas. Wooded areas also harbor populations. If at all possible, locate pasture land away from these areas or move cows to higher pasture to help reduce fly pressure during periods of peak activity (reference 34).

Figure 4.10: Left: Cattle grub emerging from warble Right: Heel fly adult.

Biological Controls

Various predators feed on *Tabanids*, but none are available commercially for release on farms.

Mechanical Controls

Several traps are attractive to horse and deer flies. See specifics on these traps in Section 7: Trapping.

Chemical Controls

Horse flies and deer flies are notoriously difficult to control. They are strong fliers that move large distances between breeding areas and hosts. Because they land on host animals to feed for only a very short time, it is difficult to deliver a lethal dose of insecticide to them. Moreover, because livestock represent only one of many host animals, treating the cattle will have a negligible impact on total fly populations.

4.3 HEEL FLY OR CATTLE GRUB

4.3.1 Biology and Importance

Cattle grubs are the larval stage of heel flies, but are also known as warble flies, bomb flies, or gad flies. Two species of these flies occur in the Northeast: the common cattle grub (*Hypoderma lineatum*) and the northern cattle grub (*Hypoderma bovis*). Both have similar life cycles with adult flies emerging during the spring and summer. The large, hairy flies (figure 4.10) mate and then lay their eggs exclusively on pastured cattle. Cattle often panic in the presence of the fast moving flies and may run wildly with their tails high in the air (known as gadding) in an effort to escape. This gadding response is an extreme behavior, considering the flies neither bite nor

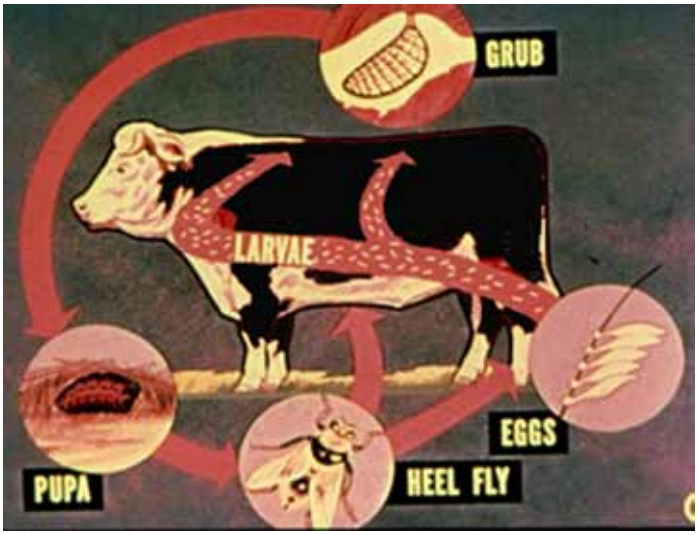


Figure 4.11: Cattle grub emerging from hole and heel fly adult

sting the animals. In fact, the adults do not feed at all and survive only 3 to 8 days.

Egg laying occurs between late May and August with peak activity occurring in June and July. Female flies attach their eggs to hairs on the lower part of the cow's body but typically on the legs, givng rise to the term "heel fly". Each female can lay up to 600 eggs, which hatch in 4 to 7 days. Newly hatched larvae burrow into the skin of their host, causing considerable irritation. They then migrate through the connective tissue during the winter. By February, larvae reach the back of the animal and cut a breathing hole through the skin forming a swelling called a warble. Within the warbles, the grubs grow rapidly for about two months, reaching a final size of about an inch in length. When mature, the grubs emerge through the breathing holes, drop to the ground, and pupate in pasture litter and soil. The metamorphosis from grub to adult fly takes from 2 to 8 weeks. Figure 4.11 illustrates the life cycle.

Older animals develop a degree of immunity to the grub larvae whereas young animals are often more heavily infested.

Economic losses from cattle grubs are due to a decrease of grazing efficiency and an increase in risk from self-inflicted wounds due to the gadding behavior. Larval tunneling through the animal tissue can result in poor weight gain, delayed first lactation, and long-term production losses. Breathing holes damage the hide and require extra trimming at slaughter reducing the carcass value.

4.3.2 Monitoring and Assessment

Examine the backs of cattle during March and April for the presence of warbles by rubbing along the back and feeling for the cyst-like bumps. When the hair around a warble is parted, the breathing hole may be visible. Because animals develop some immunity to infestation by grubs, the most important animals to examine are those under 5 years of age. Calves born after the fly season and animals kept indoors during the summer will not have cattle grubs and need not be monitored. Gadding behavior during late spring and summer indicates that female heel flies are laying eggs. Examine pastured animals for the presence of eggs on the hair of their legs, escutcheon, thighs, rump and udder.

4.3.3 Management Options

Cultural Controls

Heel flies lay their eggs only during the day and will not enter stables and shelters. Providing shelter to pastured cows will help reduce damage due to heel flies.

5.1 CATTLE LICE

5.1.1 Biology and Importance

In contrast to the fly pests, lice are relatively small and inconspicuous. Four species of lice attack dairy cattle in the Northeast. By far the most common is the **cattle chewing louse**, *Bovicola bovis*. This species is about 1/8 inch long when fully grown, has a yellow-brown appearance, and is most commonly found on the neck, back, hips, and tailhead. *B. bovis* are not blood feeders, but they use their mouthparts to rasp away and eat animal skin and hair.

In addition to chewing lice, three species of sucking lice feed on the blood of dairy cattle: the **long-nosed cattle louse** (*Linognathus vituli*), the **short-nosed cattle louse** (*Haematopinus eurysternus*), and the **little blue louse** (*Solenopotes capillatus*). Sucking lice have mouthparts specialized for penetrating animal skin. They spend most of their time with their heads firmly attached to the skin. Sucking lice often take on a darker appearance than chewing lice as they become engorged with blood.

Fig. 5.1: chewing long-nosed cattle short-nosed little blue USDA graphics.

Female lice lay their eggs by attaching them to hairs with a strong glue. The eggs, known as nits, hatch in 10 to 14 days, and the young lice (nymphs) complete their development within several weeks. Lice spend their entire lives on the host animal.

All four types of lice cause extreme annoyance to host animals. Milk production declines in heavily infested cattle, and their preoccupation with rubbing leads to hair loss, reduced feed conversion efficiency, and a general reduction in health. Infested animals become irritable and difficult to work with, especially during milking, exposing people to greater risk of injury.

Lice are generally considered a problem in fall and winter months, although infestation levels vary among different age groups. On mature cows, lice populations peak from December to March, whereas lice populations on calves can remain high throughout the year peaking in June. Lice populations are consistently higher on young stock. This difference may be due to the fact that mature cows are placed on pasture in spring where direct sunlight heats the skin to lethal levels for most lice, while calves kept in cool shelters, are not able to take advantage of the curative properties of sunlight.

Animal housing conditions also affect louse populations. Cows in stanchion barns are twice as likely to be infested as cows in free stalls since unrestrained animals can groom themselves. Calves housed in communal pens inside barns are 10 times as likely to be infested as calves in individual hutches due to a combination of isolating animals from one another and availing calves time to spend in direct sunshine.

5.1.2 Monitoring and Assessment

Because lice often are inconspicuous, many producers do not detect them until their cattle begin to show hair loss at which point populations of lice have grown well above economic injury levels, and treatment becomes very difficult. Always quarantine animals brought onto the farm to ensure lice are not present. If lice are discovered, keep infested animals separate to prevent movement of these pests to unaffected animals. Effective management of cattle lice requires sampling of apparently healthy, as well as noticeably infested, animals for the presence and relative numbers of lice. Sample every 2 to 3 weeks throughout the fall, winter, and spring months.

Lice can be monitored easily with a flashlight by carefully inspecting sections of skin on either 10 percent of the herd or 15 animals in each of the following groups: mature cows, heifers, and calves. The best regions to inspect are the head, neck, shoulders, back, hips, and tail. If the cattle chewing louse is the dominant species, assessment of the neck and tailhead alone is sufficient to detect most infestations. Treatment is recommended when any adult lice or nits are detected.

5.1.3 Management Options

Cultural Controls

Replacement animals should be isolated and carefully inspected for lice before they are allowed to mingle with the rest of the herd. Regular monitoring for lice can detect problems before an infestation gets out of control. Housing calves in individual hutches rather than collective pens will reduce infestations by 90 percent without any insecticide applications. Exposing animals to sunshine while on pasture increases their skin temperature to a level lethal to lice.

Mechanical Controls

Devices are available for free roaming animals to rub on to alleviate the itching caused by lice, but they will not provide control. Excessive use of these devices is an indicator that lice may be present.

Chemical Controls

Self-application devices such as back rubbers must be placed in areas where animals will contact them frequently and treat themselves with repeated, small doses. Whole-animal sprays have the advantage of ensuring good coverage over the entire animal, but severe louse problems are most common in winter, and it generally is wise to avoid soaking animals in periods of cold weather.

At this time, PyGanic is the most effective OMRI approved pesticide available for use against lice in organic livestock production, but check with your organic farm certifier before use. PyGanic

must be used properly to achieve satisfactory control of lice. Two treatments are required, 10 to 14 days apart. T**he second treatment is essential** to kill newly hatched lice that were present as eggs during the first treatment and were therefore not killed. Failure to make the second treatment in a timely manner will require many more subsequent treatments and adds to the risk of lice developing resistance to this one available product. See section 8 for information on specific pest management products.

5.2 MANGE MITES

5.2.1 Biology and Importance

Chorioptic Mange or Barn Itch: Two economically important species of mites infest dairy cattle in the Northeast. One species, *Chorioptes bovis*, lives on the skin and hair resulting in a condition known as chorioptic mange or barn itch and is generally characterized by dermatitis, hair loss, and scabbiness in small areas around the feet, legs, and tail head. The skin underneath the affected areas becomes swollen and inflamed. Infestations by this mite are usually localized, although in some cases the lesions can spread to cause a more generalized dermatitis resembling sarcoptic mange. Chorioptic mange mites live on the surface of the skin and feed on lymph fluid as well as dead cells and other debris. Mites develop from egg to adult in about 2 weeks. Mite populations usually are very low in the summer months, and symptoms typically disappear during this time. Populations increase again in the fall, with the most severe problems occurring in winter. High levels of chorioptic mange in dairy herds can reduce milk production.

Sarcoptic Mange: Sarcoptic mange is caused by a smaller species of mite, *Sarcoptes scabiei*. The skin lesions arising from infestation are severe. Unlike lice and *Chorioptes* mites, the microscopic sarcoptic mange mites burrow and lay eggs deep in the skin. Larval mites leave the burrows, move to the skin surface, and begin tunneling in healthy skin tissue. Development from egg to adult is completed in about 2 weeks. A small number of mites can produce widespread lesions and generalized dermatitis however the response can differ due to the variation in immune responses of individual animals.

5.2.2 Monitoring and Assessment

Mange lesions often first appear around the tail, anus, thighs, udder, legs, and feet indicated first by hair loss from rubbing as animals try to relieve the itching. As the infestation progresses, the lesions become larger and bloody or moist, followed by the formation of thick, crusty scabs. If left untreated, the lesions may eventually cover the animal's body. When this happens, the entire hide may take on a thick, wrinkled appearance.

Sarcoptic mange mites are nearly invisible to the naked eye therefore the only way to diagnose it accurately is through skin scrapings taken by a veterinarian or other trained professional. Deep scrapings, made with a scalpel, are examined under a microscope to determine if mites are present and what species.

5.2.3 Management Options

Cultural Controls

Mange mites, like lice, are permanent external parasites that do not survive away from the host for long. Minimize the risk of introducing the mites into a herd by using caution when bringing new animals onto the farm. Avoid animals that show visible skin lesions or that appear to be abnormally itchy or agitated. Segregate all newly purchased animals from the rest of the herd for several weeks and keep them under observation. Call a veterinarian if any animals show signs of unusual itchiness.

Chemical Controls

Cattle lice and chorioptic mange mites can be treated with pesticides on organic farms. But because of the severity of sarcoptic mange, it is particularly difficult to manage on organic farms due to the lack of available pesticides. It must be reported to the Department of Agriculture and Markets. The threshold for placing a herd under quarantine is the discovery of a single mite on one animal. Once a herd has been placed under quarantine, animals may not be moved off the farm except for slaughter. Although the National Organic Program rules state ivermectin may be used in some emergency situations, such as for sarcoptic mange, there are restrictions to its use (NOP section 205.603(a)(18)) and ivermectin applications are only recommended as a last resort. Applications of lime-sulfur applied to the entire herd with high pressure hydraulic spray equipment is preferred over ivermectin if allowed by the organic farm certifier. Three repeat applications at 12-day intervals have proved effective. Make sure to consult your farm certifier to determine the allowable treatment for this pest and the subsequent potential for loss of organic status for cows that have been treated.

The quarantine is lifted when post-treatment skin scrapings demonstrate the infestation has been eradicated. Because high-pressure spray equipment is necessary to ensure penetration by the spray into the skin, "home remedies" applied with low to moderate pressure gear of the type owned by many dairy producers are never successful. See Section 8 for information on specific pest management products.

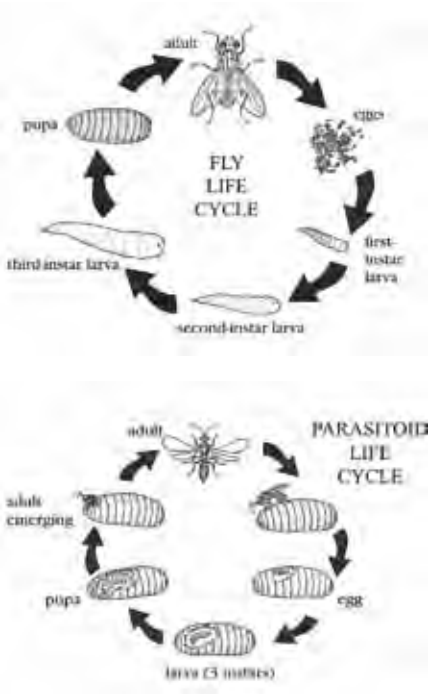
Figure 5.2: Symptoms of sarcoptic mange.

New York dairy farms offer a favorable setting for a variety of natural enemies of flies especially in the absence of insecticides. Unnoticed and unaided by humans, these naturally-occurring biocontrol agents can take a heavy toll on the fly population especially when used in conjunction with a foundation of farm sanitation and supplemented by imported predator populations. Mites and beetles devour fly eggs and small larvae (figure 6.3); adult house flies are prone to diseases such as *Beauveria bassiana*, and *Entomopthora muscae*; house fly pupae are attacked by small parasitoids. A complex of insects, including dung beetles, reduce fly populations through competing for fresh manure breeding habitats. Rove beetles (*Staphylinid spp.*) eat larvae and eggs anywhere prey are found. Adult yellow dung flies wait near fresh manure for adult flies to eat and also compete with pest flies for habitat to raise their young. The presence of specific beneficial species varies with the time of year and location. For more information on the large community of natural enemies, see Appendix 3: *Common Pest Flies Found inthe Urban/Rural Environment and Their Biological Control Agents.*

6.1 BIOLOGICAL CONTROLS OF FLIES IN CONFINED AREAS.

This guide uses the term "parasitoid" to describe insects that attack and kill fly pupae. This same group is sometimes referred to as parasites, parasitic wasps, or wasps, but all are beneficial to dairy farms and should not be confused with injurious internal parasites of dairy cattle.

Diagram 6.1:
Life Cycles of House and Stable Flies and their Parasitoid



Parasitoids: A number of parasitoids are found in and around dairy farms but those that are most common and found to work best in the Northeast are two species of parasitic wasps, *Muscidifurax raptor* and *M. raptorellus.* These versatile species attack both house and stable fly pupae.

The female stinger is used for killing flies but never stings humans or cows. A female will sting a fly pupa, and often feeds on its contents. She then lays an egg inside the puparium which hatches and feeds on the rest of the dead pupa. The young adult chews its way out of the fly's pupal case and begins the cycle again (see figure 6.5). Development from egg to adult is completed in about 3 weeks generally lagging behind the house fly and stable flies.

Since the house fly develops twice as fast, lives longer, and lays more eggs than *M. raptor* and *M. raptorellus*, the parasitoid populations naturally lag far behind. As fly populations begin to grow more quickly in May and June, it may be necessary to supplement the parasitoid populations by releasing additional parasitoids purchased from an insectary.

Successful fly control requires a whole system approach involving multiple control tactics. Releases of parasitic wasps can be effective as part of an overall management strategy if certain conditions are met:

- **Waste management is a must**; parasitoid releases complement manure management but cannot replace it.
- Parasitoids should be released on a weekly or biweekly basis.
- Suppliers ship containers of immature parasitoids living in dead fly pupae.
- Release parasitoids near areas where flies pupate focusing on the normally highly infested areas such as calf housing and breeding locations inside barns. If calves are housed in hutches, place about 3 heaping teaspoons of pupae in each hutch weekly.
- To enhance fly management in and around animal confinement areas, dairy farmers should use *Muscidifurax raptor* and/or *M. raptorellus* rather than *Nasonia vitripennis*, which are inexpensive but inappropriate for northeastern dairy farms. See reference 43 for a source of *Muscidifurax* parasitoids. Recent studies indicate exclusive releases of *Muscidifurax raptorellus* are slightly more effective than a 50:50 mix of *M. raptorellus* and *M. raptor* (reference 45). Assess the health and effectiveness of the parasitoids by using monitoring devices such as spot cards. Parasitoids raised in the Northeast tend to be better adapted to New York climate conditions.
- In New York, start releases early, preferably in middle to late May, and continue

weekly until the middle of August for a total of 10 to 12 weeks.

- **Weekly release rates of either 200 parasitoids per milking cow or 1,000 parasitoids per calf** have proven effective in research trials. Every farm is different, and release rates and schedules may require adjustment to achieve both effective and affordable levels for an individual farm.
- Costs have run at about $14.00 per 10,000 parasitoids. A release rate of 200 per cow per week (= 28 cents), brings the total season costs for 10 to 12 weeks of treatment to between $2.80 and $3.36 per cow, depending on the release rate and period.
- When insecticidal treatment is necessary, only space sprays should be used. These sprays may kill adult parasitoids, but will not affect the immature parasitoid still within the fly pupal casings.
- To maximize the effectiveness of parasitoids, avoid spraying immediately after releases. If a pesticide is necessary to reduce large fly populations, spray 2 weeks in advance of parasitoid releases.
- Parasitoids are most often recommended for confined areas. More research is necessary to determine their usefulness on pastures. Please share any successes (or failures) with us at organicguides@gmail.com.

Figure 6.2: Muscidifurax raptor adult (top) and larva on house fly pupal case.

Predaceous Beetles: Various beetles, such as (*Carcinops pumilio*) (figure 6.4), feed on both house fly eggs and larvae. They can eat up to their own weight each day (reference 44) and preliminary research shows, when added to pens as a biocontrol, they can help reduce fly populations (reference 27).

Figure 6.3: Predaceous mites.

Fungal Pathogens: Research is on-going into the use of fungal pathogens such as *Beauveria bassiana* and *Entomopthora* to reduce fly populations in buildings. Research indicates these fungal controls have a narrow range of favorable environmental conditions (reference 30).

6.2 BIOLOGICAL CONTROL OF FLIES ON PASTURES

A number of predators and parasites of **face** and **horn** flies help reduce fly populations on pastures.

Dung Beetles: Dung beetles compete with flies, especially horn and face flies, for manure in which to raise their young. For more information and photos of dung beetles, see Section 4.1.3.

Parasitoids: The white casing of the face fly pupa is calcified and hard making it difficult for some parasitoids to penetrate, whereas parasitoids are able to succeed in laying eggs inside horn fly pupal casings. Work is on-going to determine whether distributing parasitoids on pastures near undisturbed manure will help to reduce horn and face fly populations.

Figure 6.4: Carcinops beetle feeding on fly larva.

6.3 GENERAL BIOLOGICAL CONTROLS

Some predators and parasites are common both in structures and out on the pasture.

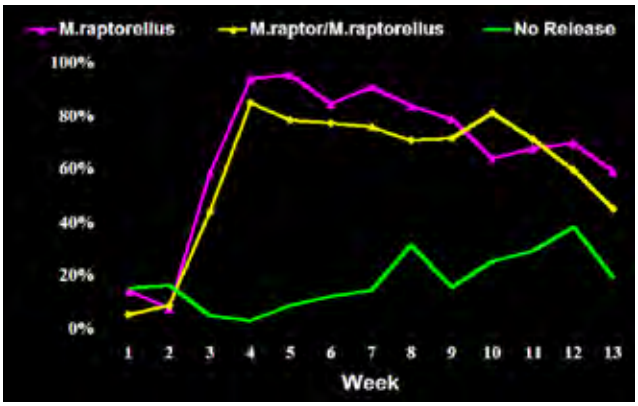
Mites: Although small, mites easily colonize manure since they are often transported on the bodies of adult flies. These hungry little creatures, feed efficiently on fly eggs and larvae. Keeping manure dry discourages fly population growth while mite populations thrive.

Birds: Allowing poultry to range in proximity to dairy barns helps reduce fly populations. Ducks and chickens disrupt fly breeding habitats while they search through manure pats and decomposing organic matter for insects to eat. Muscovy ducks (figure 4.7) are particularly good at reducing flies in confined areas such as calf pens (reference 32). Some farmers claim that 5 ducks per cow can virtually eliminate a house and stable fly problem (reference 46). Purple martins and swallows eat great quantities of insects. Install nesting boxes to assist the population.

Dung Flies: Dung flies are found in the vicinity of fresh manure and while sometimes numerous, are not considered a pest of dairy cattle. In fact, adults are predators of other flies, while larvae feed on dung, rotting vegetation and pest fly larvae.

Understanding how to use biocontrols is a work in progress. Please share your observations, successes, and disappointments so that we can all learn together. Call Don Rutz at 315-787-2353 or Keith Waldron at 315-787-2432; or contact your local Cooperative Extension agent

Diagram 6.5: Total Fly Parasitism in Calf Pens with and without Parasitoid Releases



Traps provide not only a method to monitor fly populations, but some traps reduce pest populations. Costs and effectiveness will vary depending on the pest, population, location, and grower tolerance. Some traps, such as the walk-through trap for horn flies, are an expensive investment initially, but become more economical when the cost is spread over the years of use. Nearly all the traps need regular maintenance in order to continue to be effective. In general, traps should be placed out of reach of dairy cattle to keep them from damaging the traps or becoming entangled.

Figure 7.1: From top: a) sticky ribbon, b) spot cards indicating population densities of house flies, c) fly tape, and d)fly string on a reel.

7.1 TRAPS FOR MONITORING HOUSE FLIES

House flies can be monitored using sticky ribbons or spot cards (figure 7.1a and b). Spot cards are 3-by-5-inch white file cards attached to obvious fly resting surfaces. They reflect the number of house flies present by showing the number of fly fecal and regurgitation spots. Sticky ribbons are 2 inch strips that are normally 2 feet long. The sticky material covering the strips immobilizes the insect and provides an easy method to monitor fly populations over time.

The number of spot cards, or sticky fly ribbons to place will vary according to the type used and the facility size, but place traps in a minimum of 5 to 10 locations throughout each animal housing unit. If possible, mount at equidistant locations on posts, beams, and walls, making sure to include some wind-free areas within the barn where flies tend to rest. Leave cards or ribbons for 7 days, count and record the number of flies on the sticky ribbons, or the number of fecal and regurgitation spots on the spot cards, then replace with fresh dated cards or ribbons.

Although either device is effective for monitoring house flies, dated spot cards have the additional value of providing long-term historical records of fly activity. Dated and numbered spot cards kept over time can be particularly helpful in assessing management success and resolving conflicts with neighbors over claims of increased fly abundance. Spot cards can also help detect fly breeding areas by comparing spot density on the cards when placed in different locations in and around the barn.

7.1.1 Spot card:

Advantages: inexpensive, easy to use, provides a good historical record of fly populations. May help to detect breeding areas.

Disadvantage: will not reduce fly population.

7.1.2 Sticky ribbons:

Advantages: inexpensive, easy to use, traps as well as monitors flies.

Disadvantages: difficult to handle, cannot store for historical record.

7.2 TRAPS FOR REDUCING FLY POPULATIONS

7.2.1 Fly Ribbons, Tapes, and Paper

These traps are attractive to house flies and stable flies and come in a variety of sizes and shapes but all act to trap flies on their sticky surfaces (figures 7.1a and c). They range from the typical house fly ribbon running about 2"x 24" to giant sticky traps like the Spider Web ™ which are approximately 1' x 24'. These huge sticky tapes are placed high above stable stanchions. Both their color and scent enhance their attraction to flies. These wide tapes have a capacity to trap thousands of flies before requiring replacement.

Figure 7.2 (below): Flies stuck on fly string.

Any of the types of sticky traps should be located on posts, high beams, or in other areas out of the wind where flies tend to rest. The number of traps required depends on the tolerance of the dairy operator and the fly population. Sticky traps must be replaced when the surface becomes dry or when saturated with flies and dust.

Advantages: Inexpensive.

Disadvantages: Difficult to handle, can also catch birds and bats.

7.2.2 Fly Strings

The fly string system includes two reels, one empty and one wound with sticky string that is hung across the barn near the stable ceiling above rows of animals. As the string fills with flies, the empty reel is cranked, winding in the fly-saturated string and laying out fresh sticky string (figure 7.1d and 7.2). Install parallel strings every 60 feet or more depending on the fly population and tolerance for fly presence.

Advantage: Inexpensive, easy to use.

Disadvantage: Requires installation.

7.2.3 Alsynite Trap

This cylindrical fiberglass sheet reflects light in a way that is particularly attractive to **stable flies** but will attract **house flies** also (figure 7.3e). Sticky translucent fly paper is wrapped around the outside and replaced when saturated with flies. When Alsynite panels are painted white instead of clear, they select for house flies instead of stable flies (reference 25, 11). Place out of reach of animals in a sunny location since they attract flies by visual means. The trap is should be set 1 to 2 feet above the ground and placed about 10 feet from building walls or on pastures in those areas where the animals will be concentrating, such as near water troughs.

Advantage: Easily installed, moveable, no resistance.

7.2.4 Horse Pal

The 2 x 2 x 5 ½ foot Horse Pal ® is specifically designed to attract and catch **horse, deer, and stable flies** by mimicking the underside of a cow (figure 7.3c). Flies land on the surface of the swaying dark sphere, migrate up toward the light in the screened area, and are ultimately trapped in the jar on top. The jar is removed periodically and emptied. Begin by placing 1 to 2 traps in the field and increase as necessary. Traps should be placed near, but out of reach of curious animals to prevent damage.

Advantages: Easy to install, movable.

Disadvantages: Relatively expensive.

7.2.5 Epps Trap

Figure 7.3: Traps clockwise from the top: a) Epps trap, b) attractant trap, c) Horse Pal, d) blue bucket for horse and deer flies (courtesy of the University of Florida, Department of Entomology), and e) Alsynite trap.

a

e

b

c

Biting flies, such as **stable, horse, and deer** flies, are attracted to the large shape of the Epps Trap made to resemble a cow. Biting flies tend to circle their host before landing for a meal and perceive the clear plastic spaces of the trap as open space under the animal. They fly into the clear plastic and ricochet into trays of liquid where they drown. Maintain the trap by skimming dead insects from the liquid and replacing the liquid when fouled. Mow weeds beneath the trap to preserve the contrast between light areas and dark. Traps work best placed in a sunny part of the pasture near historic fly problem areas. Use one trap per 20 acres of pasture, or place in a sunlit spot outside stables. Placing the trap out of reach from curious livestock is highly recommended. A new, more portable version of this trap is now available.

Advantage: Can be very effective in catching horse flies in particular.

Disadvantage: Keeping the water tray full and clear of dead flies is time consuming, the stationary version of this trap is difficult to move, expensive.

7.2.6 Attractant Traps

These traps are most commonly used for **house flies.** A scented liquid lures flies into one-way openings where they then fall into a bottle or disposable bag below (figure 7.3b). Many manufacturers make traps that use a similar trapping techniques such as Big Stinky, Apache, Final Flight, Magnum, and Fly Terminator. Traps can attract flies from a radius of about 100 to 150 feet and are particularly useful for keeping flies from migrating off the farm to residential areas (reference 47). Set traps near or upwind from breeding sites but be aware, these traps can attract neighboring flies too. Place near the ground in sunny areas.

Advantages: inexpensive, reusable, easily installed, movable.

7.2.7 Blue Tabanid Trap

This homemade trap attracts **deer and horse flies** when attached to a slow moving vehicle such as a tractor. The trap is simply a blue cylinder coated with sticky material such as Tanglefoot ® (reference 34 and figure 7.3d). Remove flies when trap becomes saturated and recoat the trap when contaminated with dust and dirt.

Advantages: Very inexpensive

Disadvantages: Messy. Not sure how effective.

7.2.8 Walk-through Traps

This trap is specifically for **horn flies**. Several versions of this trap are available, but all require cows to walk through the trap where flies are dislodged from the animal's back and then trapped in some way. One version has a set of special screens on the right and left. Fabric hanging from the ceiling dislodges flies

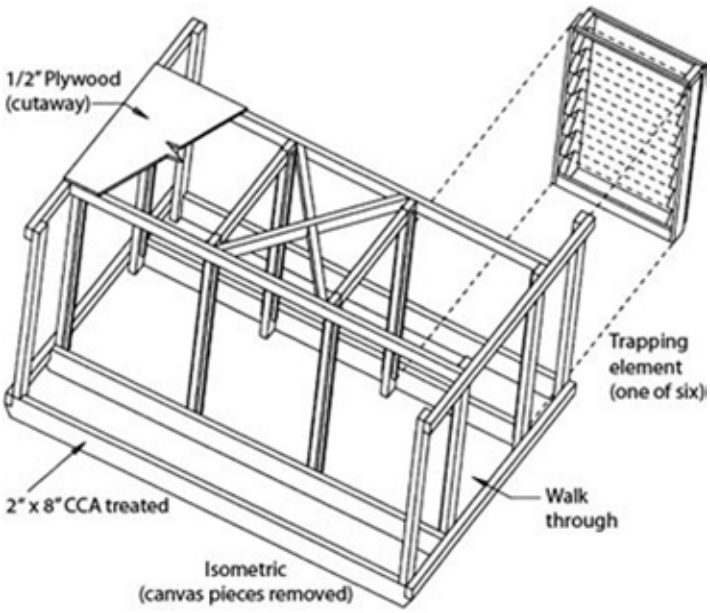


Figure 7.4: Plans for building a walk through trap. From University of Missouri publication (reference 48) by Robert D. Hall.

Figure 7.5: Walk through trap. Photo by Keith Waldron

causing them to instinctively fly toward the natural light beyond the trapping system of screens. The trap works on the same principles as a lobster trap. Placed at pasture gates where cows must pass through regularly, the trap can reduce fly numbers by 40 to 70% over time (reference 48, 26). Plans for building this trap are on the University of Missouri Cooperative Extension website (reference 48).

Advantages: Reusable, easily installed, movable, durable.

Disadvantages: Large initial investment, may not be commercially available.

Estimated cost per trap (2009)

Trap	House fly	Stable fly	Deer & Horse fly	Horn & Face fly	Approx. $ /Unit (2009)	Comments
Spot cards	x	x	-	-	$0.01 per card	Used for monitoring
Sticky tapes	x	x	-	-	$0.50 per roll	Used for monitoring and reduction of small populations
Spider web fly glue trap	x	x	-	-	$13.00 per roll	Can trap thousands of flies with one trap, replace when full, dried out, or dusty.
Fly string	x	x	-	-	$71.00 for hardware and 1600ft string	Capacity – 150 flies/linear foot
Attractant trap	x	-	-	-	$25.00 / trap and lure	
Alsynite trap	x	x	-	-	$18.00 for trap $20.00/10 sticky paper replacements	Alsynite traps painted white attract house flies (reference 25).
Epps trap	-	x	x	-	$300/trap	
Blue Tabanid	-	-	x	-	>$5.00/trap	
Horse Pal	-	x	x	-	$270 / trap	
Walk-through trap	-	-	-	x	varies	Price varies widely depending on whether unit is built or purchased

8. Pest Management Products for Organic Dairies

2011

Organic dairy farms have a limited number of pesticides (which include repellents) available as tools to manage flies and other external pests of cows. According to the National Organic Program rule 205.206 (e) (reference 17), synthetic substances are only allowed as a last resort after all cultural, biological, and mechanical means of control have proved insufficient. Alternate control methods such as sanitation, trapping, screening, drainage, proper pasture management, and use of biological controls must be the first line of defense against pests prior to considering the use of a pesticide. See more specifics about organic certification and pesticide regulations in Section 2.

Producers should always check with the certification office before using any product to be sure it is currently allowed since pesticide status can change and certifiers may differ in how they interpret the National Organic Program rules, for example NOFA-NY Certified Organic, LLC allows OMRI listed products. Many certifiers will provide a list of permissible products. The list of pesticides below MAY not be allowed by your particular certifier.

Organic Farm Certifiers may allow the use of PyGanic which is an OMRI approved and effective pesticide often used for killing flies on organic and non-organic dairy farms. Due to its overuse, resistance within fly populations is prevalent. Flies traveling from farm to farm can easily spread this resistance even to farms where PyGanic is rarely used.

Warning. *Always read product labels carefully before applying any insecticide including repellents; mix and apply as directed, do not overdose, do not treat too often, and follow all precautions exactly. Remember that improper practices can lead to illegal residues even when correct materials are used. It is illegal to use an insecticide in any manner inconsistent with the label and will result in loss of organic certification.*

At the time this guide was produced, the following materials were labeled in New York State for managing the listed pests and were allowable for organic production. Listing a pest on a pesticide label does not assure the pesticide's effectiveness. The registration status of pesticides can and does change. Pesticides must be currently registered with the New York State Department of Environmental Conservation (DEC) to be used legally in NY. Those pesticides meeting EPA Ruling 40 CFR Part 152.25(b) (also known as 25(b) pesticides) do not require registration. Current NY pesticide registrations can be checked on the Pesticide Product, Ingredient, and Manufacturer System (PIMS) website (reference 20). ALWAYS CHECK WITH YOUR CERTIFIER before using a new product.

8. Pest Management Products for Organic Dairies (continued) 2011

Pesticides Labeled for Organic Management of Dairy Pests

Product (*active ingredient*)	Rate	Repellent or insecticide	House flies	Stable flies	Face flies	Horn flies	Deer & Horse flies	Lice	Mange	Comment
EcoExempt IC (*rosemary & peppermint oils*)	1-3 oz/gal mineral oil	R. I	x	x	x	x	x	x		25(b) pesticide. Exempt from EPA registration. Apply after milking or at least 20 minutes prior to milking. Not OMRI listed; check with your certifier before using.
Nature's Balance Care Face Formula (*citronella, lemongrass, geranium oils*)	use as formulated	R			x					Use around eyes, nose, muzzle and ears. 25(b) pesticide. Exempt from EPA registraton, but not OMRI listed. Check with your certifier before using.
NocDown III (*cedar oil*)	1 gal/50 gal water	R	x	x	x	x	x		x	25(b) pesticide. Exempt from EPA registraton but not OMRI listed. Check with your certifier before using.
Crystal Creek No-fly (*soybean, cedar, peppermint, cinnamon, geranium, geraniol, lemongrass, rosemary, thyme, eugenol*)	5-33 gal/100 gal water	R	?	?	x	?	?			25(b) pesticide. Exempt from EPA registration but not OMRI listed. Check with your certifier before using. Water and oil based formulations available.
PyGanic EC 1.4 (*pyrethrin*)	5-10 oz/gal	R, I	x			x				
PyGanic EC 1.4 (*pyrethrin*)	9-14 oz/gal	R, I		x			x			
PyGanic EC 5.0 (*pyrethrin*)	1.5-3 oz/gal	R, I	x			x				
PyGanic EC 5.0 (*pyrethrin*)	2.5-4 oz/gal	R, I		x						Mix is applied at 1 qt. / adult animal.
PyGanic EC 5.0 (*pyrethrin*)	2.5 oz/gal	R, I			x					Apply to sufficiently wet the face but do not apply more than 1.5 oz. of spray solution per animal.
PyGanic EC 5.0 (pyrethrin)	1.5 oz/2 gal	R, I						x		
PyGanic Pro (pyrethrin)	2.5 oz/gal	I	x	x		x				Only for use in buildings, not on animals. Apply as a fine mist at approximately 2.5 fl. oz. /1000 cubic feet of space.
Stall Dry (*Diatomaceous earth*)		-						x		Not used as a pesticide but used to dry out stable bedding to discourage fly breeding.
Vegetable and Mineral oils (*corn, soy, cottonseed*)	use as directed	I						x		25(b) pesticde. Exempt from EPA registration. Use direct to sooth sores and smother lice. Check with your certifier for specific products.

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Cornell University

IPM Integrated Pest Management

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 5.

Figure 3.

Figure 4.

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 dally and livestock farms. These new neighbors often put great pressure on farmers to keep house fly populations to a minimum.

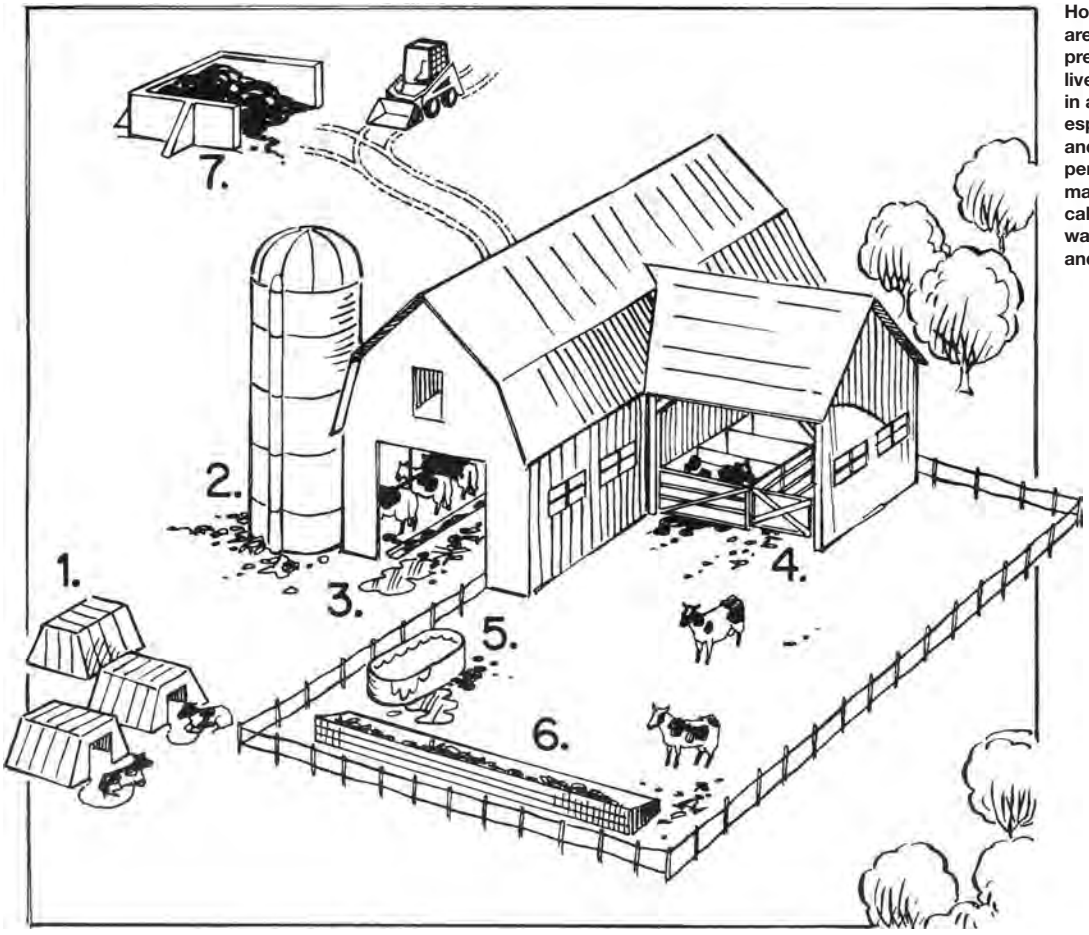
The stable fly, *Stomoxys calcitrans,* (fig. 3) IS about the size of a house fly, but the adult has piercing mouthparts that protrude spearlike from under its head. Stable flies breed in wet straw and manure, spilled feeds, silage, grass clippings, and various other types of decaying vegetation. Stable 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 at 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- 5inch white tile cards that are attached to obvious fly resting surfaces (areas with large numbers at fly fecal and regurgitation spots) (fig 6)

The number of baited traps or spot cards required will vary according to the size at 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

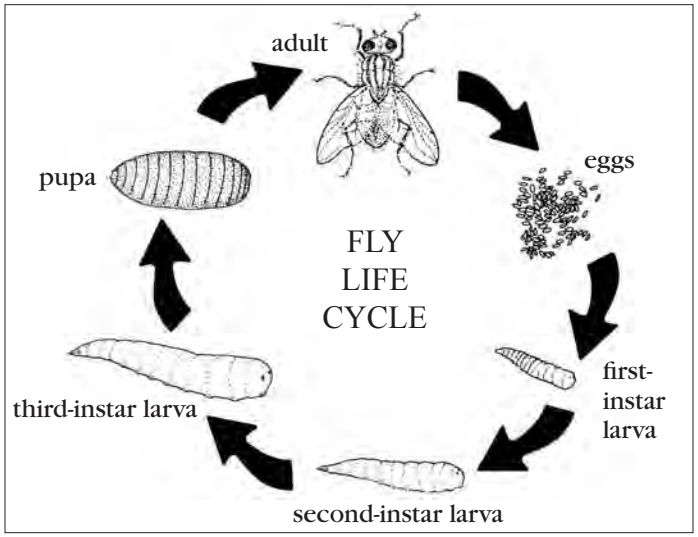
Cultural Control

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 tine 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 teed 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.

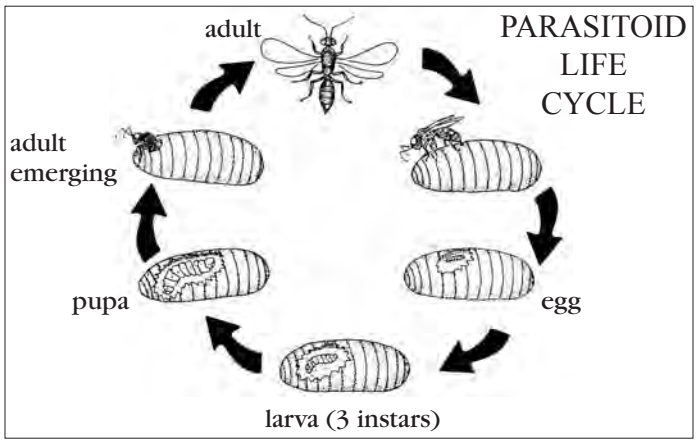
Parasitoids are among the most important of these natural biocontrol agents. Some species perform better in different climates, and some prefer different kinds of manure and other fly breeding materials. The species that is best adapted to farms In the Northeast is *Muscidifurax raptor,* which attacks 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 $2,60 and $4.70 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 soley 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.

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A Cornell Cooperative Extension publication IPM Fact Sheet 102IPMFS2

Pest Flies of Pastured Cattle and Horses

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Introduction

Integrated pest management (IPM) of pest flies, midges, and mosquitoes of pastured cattle and horses incorporates several key components: correct arthropod pest identification, monitoring, management action (i.e., treatment), and evaluation of the action. This fact sheet is intended to help the livestock producer identify arthropod pests and not to be a how-to document. For information on the other steps to successful pest management please consult one or more of the suggested readings or web sites provided in the references section.

Flies often associated with pastured livestock include face flies, horn flies, stable flies, horse flies, deer flies, cattle grubs, horse bots, black flies, biting midges (no-see-ums), mosquitoes, small dung flies, and yellow dung flies. Although several of these flies are important pests, the latter two are not. In fact, yellow dung flies are known to be important fly predators.

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Pest Flies of Pastured Cattle and Horses

Common Pests

Common Name	Species Name	Photo Number(s)	Life Cycle (egg to adult)	Breeding Habitat	Adult Life Span	Adult Dispersal
Face fly	*Musca autumnalis*	1 (on front)	12 to 20 days	Fresh, undisturbed cattle dung	14 to 28 days	Several miles per day
Remarks: Transmit pink-eye; only females visit host; hibernate in homes.						
Horn fly	*Haematobia irritans*	2 (on front)	12 to 20 days	Fresh, undisturbed cattle dung	30 days	Generally < 5 miles
Remarks: Adults remain on host's back, side, or belly.						
Stable fly	*Stomoxys calcitrans*	3 (on front)	21 days	Wet straw and manure, spilled feed, silage, grass clippings, decaying vegetation	20 to 30 days	> 20 miles
Remarks: Blood feeding results in decreased performance production. Foot stomping is good indication of fly presence.						
Horse fly, several species	*Tabanus atratus*	4, 5 (on front)	1 to 3 years	Margins of ponds, marshes, or streams	Approximately 35 days	Strong flier
Remarks: Bites are very painful; can transmit anaplasmosis.						
Deer fly, several species	*Chrysops* spp.	6	1 to 3 years	Margins of ponds, marshes, or streams	Approximately 35 days	Strong flier
Remarks: Very painful and persistent biter.						
Cattle grub	*Hypoderma bovis, H. lineatum*	7	1 generation per year	Larvae develop within cattle	2 to 3 days	< 5 miles
Remarks: Attack only cattle.						
Horse bot flies	*Gasterophilus nasalis, G. intestinalis*	8	1 generation per year	Larvae develop within digestive tract of horse	<1 week	Strong flier
Remarks: Attack only horses.						
Black flies, several species	*Simulium vittatum*	9	Usually 1 year or more	Fast-moving streams	Approximately 2 weeks	Often downwind
Remarks: Large numbers of adult flies emerge at once, particularly in spring, and attack animals; daytime feeders.						
Biting midges,	*Culicoides* spp.	10	Several months	Margins of streams and lakes,	20 days	< 1 mile

no-see-ums, several species			to one year	water-filled holes, animal wastes, swamps		

Remarks: Transmit bluetongue and encephalitis; feed in evening and at night.

Mosquitoes, several species	*Culex* spp. *Aedes* spp.	11	7 to 30 days	Stagnant water containing organic matter	Approximately 2 weeks	Some species 10 to 20 miles

Remarks: Transmit disease, including encephalitis.

12

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14

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16

17

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Beneficial Species

Common Name	Species Name	Photo Number(s)	Life Cycle (egg to adult)	Pests Attacked	Habitat	Life Span	Dispersal
Parasitoids, several species	*Muscidifurax raptor** *Nasonia vitripennis** *Spalangia cameroni**	12	14 to 28 days	House fly, stable fly, blow fly pupae	Livestock and poultry facilities, compost piles	7 to 14 days	Probably < 500 ft.
	Aleochara tristis	13		Face fly pupae			

Remarks: *Available through commercial insectaries.

Predators, several species	Beetles (*Carcinops pumilio*, rove, ground)	14, 15, 16	Generally 4 to 6 weeks	Egg, larval, and adult fly stages	Generally anywhere prey is available	1 to 3 months	Adult beetles capable of flight; immature beetle and other predator dispersal limited
	Mites (*Macrocheles muscaedomesticae*)	17					
	Spiders						

Remarks: Adult and immature often predaceous on pest species.

Pathogens	*Beauveria bassiana* *Entomophthora muscae*	18	Influenced by physical and environmental conditions	Adult house flies	Infest immature and adult flies	Influenced by physical and environmental conditions	Several yards from cadaver

19

20

Common Nonpest Flies

Common Name	Species Name	Photo Number(s)	Life Cycle (egg to adult)	Breeding Habitat for Immatures
Small dung fly, several species	*Sphaerocerid* spp.	19	Generally < 21 days	Dung pats

Remarks: Important dung decomposer.

Yellow dung fly	*Scatophaga stercoraria*	20	About 20 days in the summer	Cattle dung pats

Remarks: Adults feed on adult pest flies.

Biological control is an extremely important component in a successful livestock IPM program. In pasture and grazing situations, we are currently limited to conserving the beneficial organisms that occur there naturally—parasitoids, predators, and pathogens.

Parasitoids

Parasitoids are tiny wasps or beetles that attack only fly pupae. The wasp parasitoid adult stings and paralyzes the fly pupa and lays an egg inside the pupal case. After hatching, the larval parasitoid kills and consumes the fly pupa before emerging as an adult. The immature beetle parasitoid locates a face fly pupa, drills a hole, and enters the pupal case. The immature beetle begins feeding on the fly pupa, eventually killing it. Neither of these parasitoids bother humans or livestock and generally go unnoticed. Currently, releases of commercially reared parasitoids are not available or appropriate for pasture situations.

Predators

Predators attack and kill several fly stages, including the egg, larva, and adult. The fly stage attacked depends on the predator. Spiders, beetles, and mites are the most important predators. At present, predators are not available from commercial insectaries for release into pastures.

Pathogens

Although pathogens that attack flies occur naturally on all farms, they are probably the least understood beneficial organisms. Pathogens usually kill adult flies but have also been recovered from dead fly pupae. These organisms are most effective under moist, dark, and warm conditions.

Using the photographs and information provided in this document in combination with the pest management recommendations in the readings listed below, pest flies of pastured cattle and horses can be effectively managed.

Suggested Publications, Videos, and Web Sites

Kaufman, P. E., D. A. Rutz, and C. W. Pitts. 2000. *Pest Management Recommendations for Horses*. University Park, Pa.: Cornell and Penn State Cooperative Extension Publication. 8 pp.

Lyon, W. F. 1995. *Livestock and Livestock Building Pest Management*. Ohio State University Extension Bulletin 473.

New York State Integrated Pest Management Livestock and Field Crops web site: www.nysim.cornell.edu/lfc.html

Rutz, D. A., and C. W. Pitts. 1999. *Pest Management Principles for the Pesticide Applicator*. Cornell University and Penn State University. Ithaca, N.Y.: Cornell University. 132 pp.

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Watson, D. W., J. K. Waldron, and D. A. Rutz. 1994. *Integrated Management of Flies in and around Dairy and Livestock Barns*. Cornell University Fact Sheet 450.00. Ithaca, N.Y.: Cornell Cooperative Extension.

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Photographs 1, 2, 5, 6, 8, 9, 13, 14, 15, 16, 19, 20 by Kent Loeffler. Photograph 10 by Ed Schmidtmann. All others courtesy of the authors.

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A Cornell Cooperative Extension publication IPM Fact Sheet 102IPMFS1

Common Pest Flies Found in the Urban/Rural Environment and Their Biological Control Agents

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Introduction

The integrated pest management (IPM) of house flies and stable flies incorporates several key components. The first is correct pest identification. This fact sheet provides color photographs and important biological and ecological information on both pest and beneficial organisms often associated with livestock and poultry production.

Other components of IPM include monitoring, management action (i.e., treatment), and evaluation of the action. This fact sheet is intended to aid the livestock and poultry producer with arthropod pest identification and not to be a "how-to" document. For information on the other steps to successful pest management please consult one or more of the suggested references provided below.

Biological control, whether the organism occurs naturally or is commercially produced and released, is an important component in a successful livestock and poultry IPM program. The three types of beneficial organisms are parasitoids, predators, and pathogens.

Biological Control Agents

Parasitoids

Parasitoids are tiny wasps that attack only fly pupae. The parasitoid stings and paralyzes the pupa and lays an egg inside the pupal case. After hatching, the larval parasitoid kills and consumes the fly pupa before emerging as an adult. These parasitoids do not bother humans, livestock, or poultry and generally go unnoticed. Although parasitoids occur naturally, many producers release commercially produced colonies to augment the population and thus improve fly suppression.

Predators

Predators attack and kill several fly stages, including the egg, larva, and adult. The fly stage attacked is dependent on the predator. Beetles, mites, and spiders are the most important predators. At present, predators are not as readily available from commercial insectaries as are parasitoids.

Pathogens

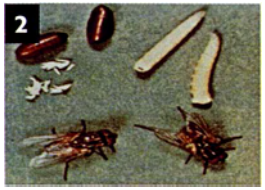
Pathogens that attack flies are probably the least understood beneficial organism, but they occur naturally on all farms. Pathogens, primarily species of fungi and bacteria, usually kill adult flies but have also been recovered from dead fly pupae. These organisms are most effective under moist, dark, warm conditions. One such pathogen, *Entomophthora muscae*, can reach epizootic status in adult house flies, virtually wiping out the fly population on a farm.

Nonpest Flies

Other flies often associated with livestock and poultry facilities include blow flies, flesh flies, cluster flies, soldier flies, and rat-tailed maggots. Although they can breed on farms, blow flies, flesh flies, and cluster flies also breed in large numbers in nonagricultural environments. Soldier flies and rat-tailed maggots are associated with agricultural operations, but their adult stages are generally not considered to be pests.

A Cornell Cooperative Extension publication IPM Fact Sheet 102IPMFS1

Common Pest Flies Found in the Urban/Rural Environment and Their Biological Control Agents

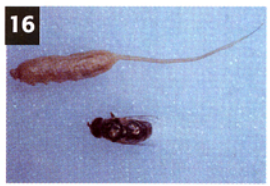


Common Pests

Common Name	Species Name	Photo Number(s)	Life Cycle (egg to adult)	Breeding Habitat for Immatures	Adult Life Span	Adult Dispersal
House fly	*Musca domestica*	1, 2	10 to 21 days	moist organic matter, animal droppings, manure piles, decaying silage, spilled feed, soiled bedding	30 days	generally <0.5 mile, up to 20 miles
Remarks: potential disease transmission, dispersal to neighbors						
Stable fly	*Stomoxys calcitrans*	3	21 days	wet straw and manure, spilled feeds, silage, grass clippings, decaying vegetation; does not breed in poultry manure	20 to 30 days	20 miles, probably more
Remarks: blood feeding causes decrease in animal performance/production; typically bites lower leg/ankle; foot stomping good indication of fly presence						
Blow fly, several species	*Phanicia sericata, Phormia regina*	4	10 to 25 days	carrion, animal droppings, wounds, garbage containing meat scraps	adults live approximately 35 days	unknown
Remarks: larvae often found in sites contaminated with milk or broken eggs						
Flesh fly, several species		5	14 to 18 days	carrion, animal droppings, wounds, or decaying vegetation	unknown	unknown
Remarks: flies generally deposit larvae rather than eggs on breeding substrate						
Cluster fly	*Pollenia rudis*	6	27 to 39 days	parasitizes earthworms	unknown	unknown
Remarks: large numbers of adult flies enter houses and barns during fall to overwinter						

Beneficial Species

Common Name	Species Name	Photo Number(s)	Life Cycle (egg to adult)	Pests Attacked	Breeding Habitat for Immatures	Adult Life Span	Adult Dispersal
Parasitoids, several species	*Muscidifurax raptor, Nasonia vitripennis, Spalangia cameroni*	7, 8	14 to 28 days	house fly, stable fly, blow fly pupae	livestock and poultry facilities, compost piles	7 to 14 days	probably <100 ft.
Remarks: available through commercial insectaries; photo #7: *M. raptor* parasitoid on house fly pupa; photo #8: house fly pupal cases with round parasitoid escape holes							
Predators, several species	Beetles (*Carcinops pumilio*, rove, ground), Mites (*Macrocheles muscadomesticae*), Spiders	9 10 11	generally four to six weeks	egg, larval, and adult fly stages	generally anywhere prey is available	one to three months	adult beetles capable of flight, immature beetle and other predator dispersal limited
Remarks: adult and immature often predaceous on pest species							
Pathogens	*Beauveria bassiana, Entomophthora muscae*	12 (not shown)		adult house flies	infests immature and adult flies	influenced by physical and environmental conditions	
Remarks: several yards from fly cadaver							



Other Common Flies

Common Name	Species Name	Photo Number(s)	Life Cycle (egg to adult)	Breeding Habit for Immatures	Adult Life Span	Adult Dispersal
Soldier fly	*Hermetia illucens*	13, 14	2 to 12 months	animal manure and sewage, occasionally found in decaying organic material	unknown	weak fliers
Remarks: larval habits in poultry manure reduce suitablity for fly breeding; adults may be found in chimneys; photo #14: larva and adult						
Rat-tailed maggot	*Eristalis tenax*	15, 16	about 30 days in summer	highly polluted liquid environments such as dairy, swine, and poultry manure lagoons; silage seeps; decaying animal carcasses; and poorly kept drains	unknown	unknown
Remarks: during mass migrations maggots may find their way into barns, milking parlors, or homes; photo #16: larva and adult						

Managing Pest Fly Populations

House fly and stable fly populations can be successfully managed on livestock and poultry facilities by using the photographs and information provided in combination with the pest management guidelines listed in the references below.

Suggested References

Kaufman, P. E., D. A. Rutz, and C. W. Pitts. 2000. *Pest Management Recommendations for Sheep, Goats, and Swine.* University Park, Pa.: Cornell and Penn State Cooperative Extension Publication. 8 pp.

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DAIRY IPM

CORNELL COOPERATIVE EXTENSION

Cattle Lice

Bovicola bovis
Linognathus vituli
Haematopinus eurysternus
Solenopotes capillatus

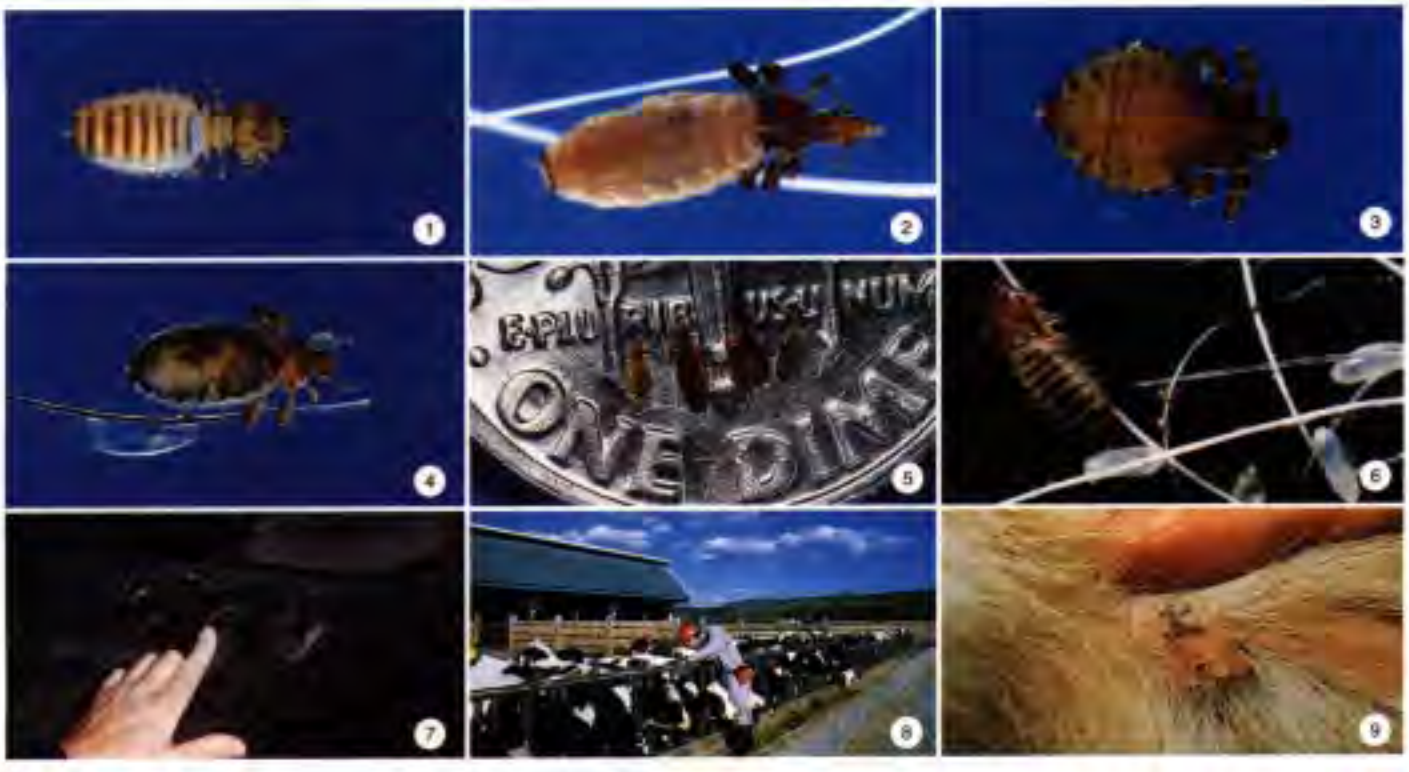
Cattle lice are among the most important arthropod (insect and mite) pests affecting dairy cattle in New York State and elsewhere in the United States. Lengthy, cool winters are particularly favorable to populations of lice, which thrive on animal skin that is protected by the long, winter-hair coat. Unlike fly pests, which feed on a variety of livestock and engage in many behaviors off the animals, lice are very host-specific and can survive for only very short periods of time off the host animal. Management of lice populations below economically injurious levels requires systematic monitoring and identification of these pests.

Adults

Four species of lice feed on dairy cattle in New York. The most common is the little red cattle chewing louse (*Bovicola bovis*, fig. 1). Adults of this species can be recognized by their relatively broad head and characteristic reddish-brown and yellow coloration. These lice do not feed on blood but instead use their mouthparts to rasp animal skin and hair.

In addition, there are three species of blood-sucking lice on dairy cattle: the long-nosed sucking louse (*Linognathus vituli*, fig. 2); the short-nosed sucking louse (*Haematopinus eurysternus*, fig. 3), and the little blue sucking louse (*Solenopotes capillatus*, fig. 4). Sucking lice are blood-feeders, and can be easily recognized by their firm attachment to the animals' skin and by the dark coloration that their abdomens take on as they fill with blood.

Although there is some size variation among these four species of lice, all of them are small insects that reach a maximum size of about 3.0 mm (1/8 in.; fig. 5). They are permanent parasites, which means that they spend their entire lives on the animals. Development from egg to adult takes four to six weeks.



Eggs

Female lice lay their eggs, known as nits, by attaching them to hairs with a strong glue to prevent them from falling off (fig. 6). The nits can be seen on heavily infested animals as white specking on the hair coat (fig. 7). The hard shell of the nit protects it from most hazards, including insecticide treatments.

Nymphs

Eggs hatch into nymphs one to two weeks after being laid. Lice have a simple metamorphosis; therefore, the nymphs resemble the adult lice quite closely except for their smaller size. The nymphs feed on host animals in the same manner as the adult lice. Development from egg hatch to adult is completed in two to three weeks, with the nymphs passing through three instars (stages between molts).

Damage

Regardless of the species involved in an infestation, cattle lice cause extreme annoyance to the host animals. In heavily infested milking cows, milk production declines and the animals' preoccupation with rubbing leads to hair loss, reduced feed conversion efficiency, and general unthriftiness. Infested animals are irritable and difficult to work with, especially during milking.

Heavy louse infestations on calves and heifers also contribute to the many stresses that can have adverse effects on growth, time to first lactation, and overall future production performance of replacement animals. In addition, people working around heavily infested animals are exposed to greater risk of injury and are annoyed by stray lice acquired from infested animals during handling.

Infestations with lice are aggravated by other stresses on the animals. Cattle that are stressed by crowding, infection, or inadequate nutrition often have exceptionally severe louse infestations.

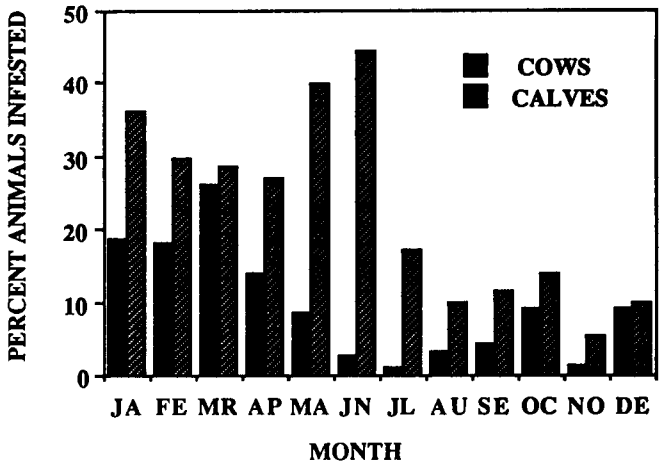
Monitoring

Lice are more abundant on young animals than on mature milking cows. In general, infestations are heaviest during cool weather, although high populations of lice are commonly found on calves as late as June, as shown in the chart on this page.

Early detection and treatment is essential to prevent infestations from causing economic losses. Therefore, animals should be monitored between the months of September and June.

It is best to inspect 30 animals every two to four weeks; choose 10 calves, 10 heifers and 10 milking cows. Healthy-looking animals should be inspected as well as noticeably lousy ones in order to detect populations approaching economically injurious levels. Ideally, a headband light or hard hat-mounted light should be used so that both hands are free to work with the animals (fig. 8).

The neck, shoulders and tailhead should be inspected on each animal by parting the hairs and estimating the numbers of lice present per square inch (fig. 9). Animals should be treated if more than 10 lice per square inch are found. If replacement animals are brought into the herd from off of the farm they should be examined and treated, if necessary, before allowing them to mix with the other animals.



Management

A form of cultural control that is highly effective is the use of individual outdoor hutches for calves instead of housing the animals in collective pens inside barns.

Many insecticides are registered for louse control. Read the label carefully to insure that the insecticide may be used on milking animals; concerns about residues may limit the number of choices. Most insecticides require two treatments spaced 10 days apart to kill the nymphs that hatch after the first treatment (eggs are resistant to most insecticides).

A variety of application methods are available for controlling lice, including whole-animal sprays, mists, dusts, back rubbers, pour-ons, and dust bags. Each method has certain advantages depending on individual production and management practices. Whole-animal sprays give good coverage, but should be avoided during cold weather when chilling the animals is a concern. Mist-blowers may be used to minimize the amount of liquid required for treatment. Dusts are convenient, may be used any time of the year, and require no mixing. Self-application and forced-use devices such as dust bags are effective only if they are positioned so that the animals make frequent contact with them. Consult local Cooperative Extension personnel for a louse management program that is appropriate for your farm.

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