



## **HOUSE FLY CONTROL IN POULTRY BARNs**

*Publication 849*





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Ministry of Agriculture,  
Food and Rural Affairs



**Ontario**

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## Disclaimer

This document is intended for informational purposes only. This document is not intended to provide engineering, legal or other advice. Farmers are advised to consult with pest management companies to determine the best course of action for their individual farm.

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# 1. Introduction

Controlling the house fly (referred to as ‘flies’) population is important in maintaining a healthy poultry barn environment.

Large numbers of flies can negatively impact poultry farms operations including:

- some loss of poultry production
- increased biosecurity risk
- uncomfortable work environment
- increased time and cost for fly control
- damage to equipment
- extra cleaning costs between flocks, to remove fly excrement from equipment and building surfaces

Flies can sometimes act as vectors of food-borne diseases such as *Salmonella* and *E. coli* bacteria, as they are able to transfer pathogens from one location to another when they land to feed, rest or defecate.

Unfortunately, the presence of large numbers of flies in an area creates a strain on neighbour and community relations. For example, nearby homeowners have complained that excessive flies are a nuisance and is keeping them from using their decks or hosting family events, etc. And rural retail

and food service businesses have received complaints from customers about the high number of flies at their businesses. Although the impact is difficult to measure, this situation represents a problem that may take years to resolve.

The *Farming and Food Production Protection Act, 1998*, (FFPPA) was created to address nuisance complaints related to odour, noise, dust, light, smoke, vibration and flies from farming operations. A normal farm practice is defined as being consistent with proper, acceptable customs and standards of similar operations or uses innovative technology according to proper advanced farm management practices.

This guide presents a range of management options that have been field tested at various poultry farm operations. It also describes innovative fly control practices that are still under investigation. Acting on these options can increase productivity and avoid nuisance complaints from neighbours. Poultry farmers can tailor fly control strategies to match their unique circumstances. These strategies do not guarantee all flies will be eliminated from the farm, as they are part of the natural environment.

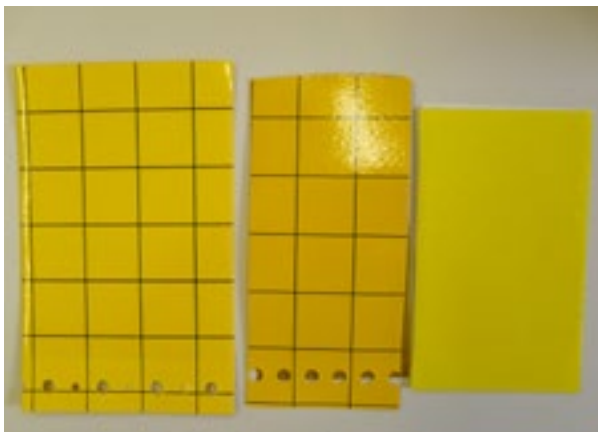




## 2. Integrated Pest Management and Monitoring

Integrated Pest Management (IPM) takes a balanced approach to control pests like flies by combining a number of methods. Farmers need to start by understanding the biology and life cycle (Appendix 1) of the fly and monitoring the population, in order to determine when to apply various control methods and get the most value from the treatment. This multi-phase approach targets flies at several points in their life cycle helping to gain control of the situation and reduce fly numbers.

An IPM program, monitors pests and continuously tracks population trends over a period of time (e.g., 30 days, 3 months, summer, etc.). Yellow sticky cards, approximately 75 mm x 125 mm (3 in. x 5 in.) (Figure 1) are commonly used to monitor adult housefly populations. These cards do not contain an attractant, just a sticky material on both sides of the card, to trap the flies that land on it. Cards are changed on a regular basis, usually weekly. Population trends are tracked by counting the trapped flies. Is the population increasing, decreasing or staying constant?



**Figure 1. Examples of sticky cards used for monitoring house fly numbers.**

Pre-determined thresholds are set to decide when to apply or stop applying specific control treatments. A common threshold is an average of 100 house flies per card (counting both sides of the card) per week, inside the barn. The threshold level may be lowered or increased based on proximity to neighbours, potential transmission of pathogens by flies, time of year or cycle of the birds, the costs of insecticides, etc.

Figure 2 shows a series of sticky cards that were changed weekly inside a poultry barn for an entire 15-week production cycle. The top left card caught flies in week 1, the next card shows week 2 and so on. Notice how the fly numbers start to rise significantly after week 5, peak around week 12 and drop off once the birds and manure are removed from the barn.



**Figure 2. An example of yellow sticky cards used to trap flies inside a poultry barn over a grow out period – starting from upper left.**

Successful monitoring depends on where in the barn the monitoring cards are hung. Preferred locations are those where flies tend to congregate or rest. This is usually any calm area along walls, below air inlet baffles or near posts. The end of the barn where the feed hoppers are located is often a preferred location for flies to gather. Avoid hanging cards in front of fans, air inlet openings or near climatic disturbances like drafts, heat sources, etc. (Figures 3 and 4). Install a minimum of 3 monitoring cards per floor.

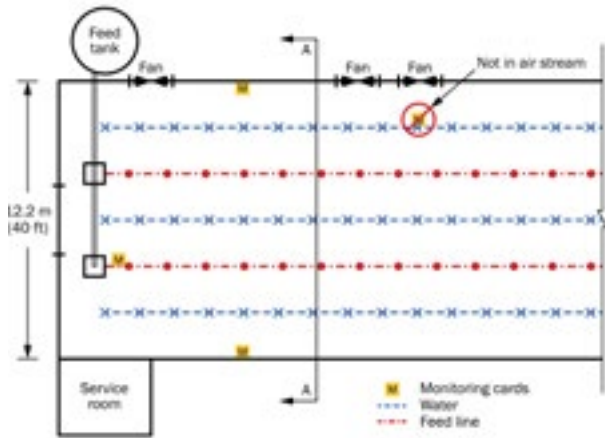


Figure 3. Overhead view of monitoring card locations.

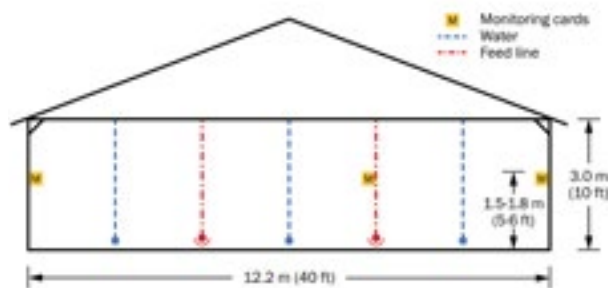


Figure 4. Barn cross-section showing monitoring card locations.

Keeping a regular schedule is also important. Replace cards on the same day every week so that sampling intervals are consistent for comparing results. It is recommended to wrap the used cards in cellophane and write the collection date in permanent marker on the card for future reference (Figure 5).



Figure 5. For record keeping purposes, wrap the used fly card in cellophane and date it.

### Monitoring TIPS

- Set a threshold and start monitoring when daytime temperatures stay above 10°C.
- Identify locations in the barn for installing monitoring cards.
- Hang cards where flies tend to congregate or rest.
- Install a minimum of 3 monitoring cards per floor.
- Replace cards on a weekly basis.
- Count flies on both sides of the cards.
- Take action, if the predetermined threshold is reached.
- Keep the cards for the duration of the monitoring period to track trends.

## 3. Control Methods

Controlling flies involves the combined use of several control methods:

- a) Barn Management
- b) Biological Control
- c) Mechanical Control
- d) Chemical Control

Poultry farmers should use whatever control options are necessary to manage their fly populations. Some control methods work well together and can be applied simultaneously. Biological and chemical controls must be properly timed to achieve the best results.

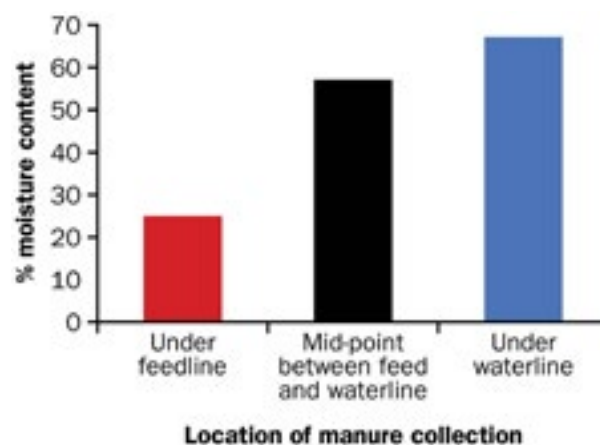
### A. Barn Management

The goal is to slow the rate of fly development and reproduction, or interrupt the life cycle, by creating a less-than-optimum environment for adult flies, eggs, maggots and pupae to thrive.

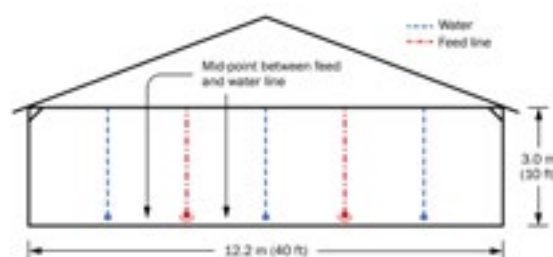
Poultry manure is warm and moist while fermenting, providing an ideal habitat for the development of large populations of *M. domestica*. (see Appendix 2 for more information on why poultry barns provide an ideal habitat for flies). Previous research found house fly population numbers were highest when poultry manure moisture content was between 70% and 80%. A significant decrease in population numbers was seen when moisture levels were below 60%. Keeping the litter as dry as possible (below 55%) will give the best results in fly reduction. This can be achieved by paying more attention to the management of the water equipment, ventilation equipment, etc.

#### Water Management

**Manure Moisture Content** – Manure moisture content across the barn varies greatly, and the manure under waterlines is usually more favourable to fly development (Figures 6 and 7). A poorly managed, maintained or designed water system can leak or spill water, creating wet spots in the litter or manure, making it ideal for fly breeding.



**Figure 6.** Example of moisture content of manure at three locations across the width of the barn.

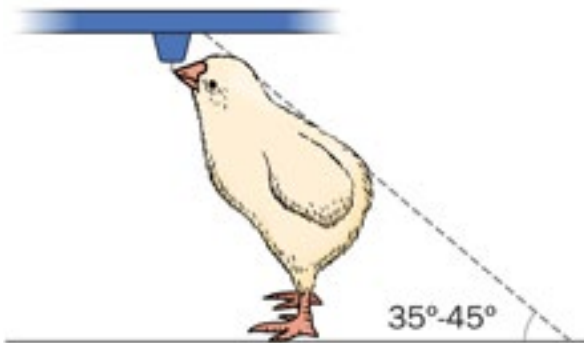


**Figure 7.** Barn cross-section showing manure sampling locations.

**Nipple Drinkers** – The height of nipple or cup drinkers and the operating pressure have a direct impact on the amount of water spillage that occurs when a bird is trying to drink. During the initial stages of brooding, place nipple lines at a height where birds are most able to drink. Normally nipple drinker lines are lowered to eye height above the litter for chicks, poults and ducklings. The water pressure is lowered in the lines to allow day old birds to access water by striking the nipple to release a drop of water (Figure 8). The back of the chick should form a 35°–45° angle with the floor while drinking is in progress (Figure 9).



**Figure 8. Chick drinking from nipple - Note the cup under nipple to catch spillage and keep litter dry.**



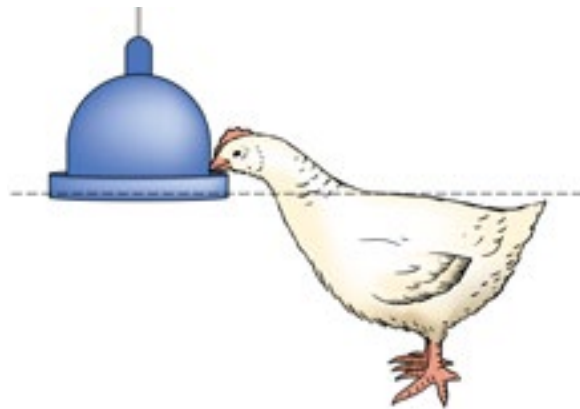
**Figure 9. The proper height of a water nipple drinker for chicks during the first week.**

Raise the water lines as the birds grow so that their backs form an angle of approximately 75°–85° with the floor, and they are stretching slightly to reach the nipple for water (Figure 10). Increase the water pressure to elevate the water flow rate, as required. If the water line is too low, the birds are not able to achieve the correct angle to allow water to run down their throats, so there is more spillage as they try to drink.



**Figure 10. The proper height of a water nipple drinker for older birds.**

Hanging bell drinkers spill easily when struck by birds moving about the barn. For farmers still using this type of drinker, it is recommended that they be set at the correct height for birds to access (Figure 11) and relocated on a regular basis to avoid wet spots in the litter.



**Figure 11. The proper height for a Bell drinker.**

**Water Line Maintenance** – Maintenance of water systems is an ongoing challenge. Equipment is suspended from the ceiling and is raised and lowered to match the flock’s stage of growth or allow for barn and equipment cleanout between flocks. This up and down movement and the occasional contact by birds on the waterlines can weaken or loosen joints. Inspect and repair pipes regularly to prevent leaks.

A nipple will be struck by birds looking for water over 1 million times during its lifespan. Replace nipples periodically as they are prone to wear over time. Expect a nipple to last 5–8 years depending upon water quality, quantity, bird size and line maintenance. The presence of hard water may cause issues with scaling that will affect the seal. Flush lines with an acid or peroxide solution between flocks to remove scale and biofilm.

Prevent leakage and reduce the need to replace bell drinkers through regular maintenance. Remove hard water scales and maintain valves. Inspect the bell daily for cracks that can lead to leakage.

### Ventilation Management

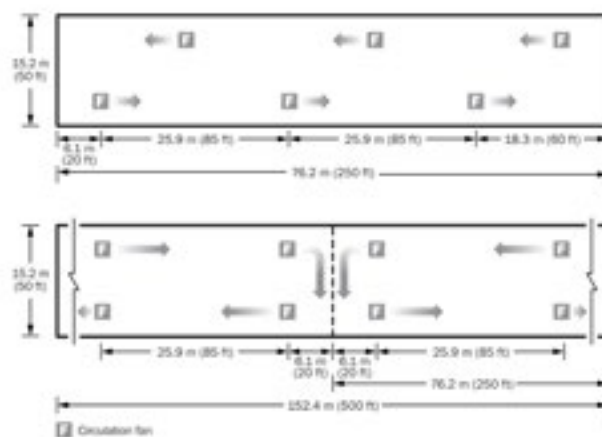
**Barn Ventilation** – Ventilation systems control temperature and moisture levels within the barn by exchanging barn air with fresh air from outside. During the warmest time of the year, temperature management is the primary driver of the system. However, during the spring, fall and winter months controlling humidity in the barn is the goal. Normally the relative humidity level is set below 70% for optimum bird health and fly control. Higher amounts of moisture in the air result in more moisture in the litter, creating ideal conditions for flies to breed and grow.

When warm moist air contacts cooler surfaces vapour condenses into liquid, saturating the litter and creating perfect conditions for fly growth. During cold weather, periodically inspect the structure for the presence of condensation on the inside of the foundation, barn walls and ceiling. Check the insulation levels in these locations and take action to replace or increase insulation where required.

**Air Flow** – Uneven air distribution patterns within the barn will result in wetter and dryer spots throughout the building. To overcome this problem, many farmers install air circulation fans to ensure air is evenly distributed throughout the entire structure. While there is an increased operating cost associated with this equipment, the uniform airflow will reduce moisture content of the manure and improve litter

quality across the barn, making the environment less suitable for flies to lay eggs and develop.

Internal air circulation fans are normally sized to provide 1–3 CFM/ft<sup>2</sup> of barn floor area. Avoid dead air spaces in the barn by correctly distributing individual fans. See Figure 12 for an example of circulation fans and their distribution patterns.



**Figure 12.** Examples of circulation fan layouts in a poultry barn.

### Manure and Other Organic Matter Management

Any activity that disturbs or changes manure conditions will impact the ability for flies to reproduce. Frequent manure cleanout (every 7–10 days) is a best practice recommended to control fly populations around livestock barns. This will prevent developing maggots from having enough time to emerge as adults, breaking the life cycle.

High-rise layer barns, where damp/wet manure is allowed to accumulate for extended periods of time, have a history of fly problems. Cage barns (Figure 13) with a manure belt system under each level of cage have noticeably fewer flies. The manure is able to dry and is typically removed on a regular basis (less than 7 days) to an external manure storage facility.



**Figure 13.** A cage barn, showing manure belts under each level of cages.

There is no practical way to remove manure every 7–10 days in litter type poultry production systems, because the barn is full of birds walking on the litter and feed/water equipment is in the way. Manure is usually removed only after birds are shipped and equipment is raised or removed from the barn for cleaning. Some farmers have experimented with roto-tilling the manure/litter in the barn while the poultry production cycle is in process, in an effort to dry manure and mechanically kill fly larvae and pupae. This may be good from a fly control standpoint, but there are some reports it can encourage ‘dust bathing’ by the poultry, which can cause skin abrasions and affects meat quality (e.g., breast blisters and cellulitis). Roto-tilling might also create air quality issues with dust and ammonia release. More investigation into this fly control technique is needed.

**Clean out** – It is recommended that manure be immediately land applied or composted, as a treatment option, especially if the manure contains many fly larvae and pupae when it is removed from the barn. If manure is stored onsite for any length of time new flies will likely continue to emerge from the material. Land applying the manure exposes fly larvae and pupae to light and dryer conditions,

destroying many of them. If immediate land application isn’t possible, cover the stored manure tightly with plastic to prevent the emergence of new adult flies.

During the summer months, neighbours next to barn sites have reported an increase in fly populations after barn cleanout. When manure is removed from the barns and properly handled, flies will leave the sites in search of new refuge and food to continue breeding. Therefore, applying an insecticidal spray prior to removing manure from the barn is helpful in preventing nuisance complaints from neighbours.

**Bedding** – The type of bedding used may influence the suitability of manure for fly breeding. Straw bedding does not absorb as much moisture as wood shavings, generally creating more favourable conditions for fly breeding, as the litter tends to stay moist. There are other factors besides the bedding type that influence litter moisture content. The amount of bedding used, the moisture content of added bedding, barn stocking rate, target humidity settings for ventilation control, type of birds, duration of the bird cycle, etc., can all affect moisture levels.

**Exclusion** – Prevent adult flies from gaining access to the barn by installing a fly screen over air inlet openings. Limiting adult fly access to the inside of the barn will reduce the chances of female flies laying eggs. Adding screens may restrict air flow, so check to ensure the ventilation system performance has not decreased.

**Mortalities** – Many poultry farms manage their mortalities by composting with wood shavings or poultry litter. When managed properly, the compost pile or vessel will reach temperatures of 45°C–60°C. These temperatures are too hot for fly development. Any leachate from this process or un-composted

materials that spill from the pile during transfer or mixing activities may attract flies (e.g., blow flies). It is important to keep the area around the compost pile or vessel clean to minimize or eliminate any leachate from leaving the compost area.

**Maintenance** – Regular maintenance is encouraged for fly control. To limit the resting and breeding places for flies:

- Avoid accumulating any organic debris around the farm including hay, silage, feed, pet food, dead animals, etc.
- Keep grass around buildings cut short.

### Barn Management TIPS

- Minimize or eliminate water leaks.
- Maintain a manure moisture level below 55% to give the best results in fly reduction.
- Properly adjust water equipment height to match the size of birds.
- Add insulation to eliminate condensation on walls, foundations and pipes and prevent moisture from dripping or increasing manure moisture.
- Increase ventilation rates to keep litter dry and reduce egg and larvae survival.
- Add circulation fans inside barn.
- Remove wet litter and add dry, fresh bedding where water leaks have occurred.
- Clean up feed spills immediately.
- Clean up known or potential breeding areas.
- Clean up spilled manure around manure storage places.
- For operations that have their manure trucked off site, don't let it sit around too long before being hauled away.
- Rapidly clean and sanitize between bird cycles.
- Stir compost piles to maintain proper composting temperatures.
- Keep dead stock disposal sites operating properly.
- Keep vegetation mowed around the barn site.

## B. Biological Control

Biological control uses the fly's natural enemies to help control its population. The most commonly used biocontrol agents are:

- a) Parasitic wasps
- b) Hister beetles
- c) Nematodes
- d) *Beauveria bassiana* fungus

The effectiveness of biological agents is highly variable, and is dependent on the conditions at the site. Selecting the proper application timing and location is critical to achieving the best results. Biological controls are a pro-active control method. They are usually introduced at the start of each new crop of birds, or grow out cycle, and between early May and mid-October, before fly problems start. It won't cure the problem once the fly population becomes excessive.

The goal is to have the natural enemies present in the barn before the fly population gets out of control. Biological controls are slower to show results than chemical insecticides. The natural enemy's life cycle will vary from that of the fly. They usually take longer to reproduce and are not as prolific as the house fly. They can be purchased from companies that sell biological control products.

### Parasitic Wasps

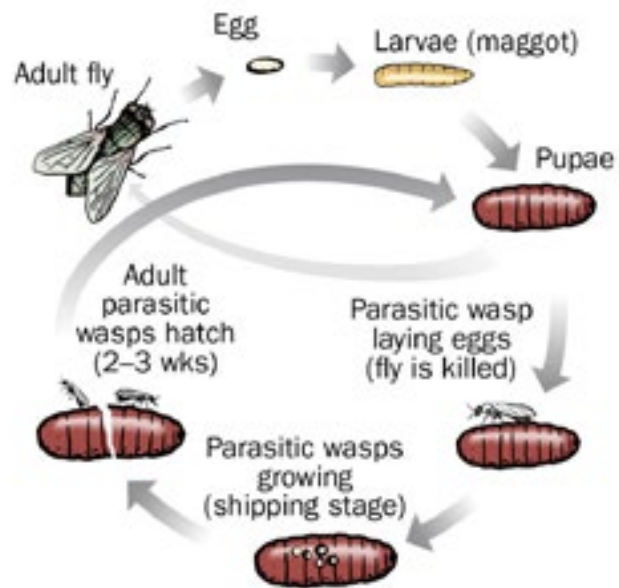
Parasitic wasps are very small, do not sting people and usually go unnoticed. There are several species of wasps that are used to control flies. *Muscidifurax raptor* and *Spalangia cameroni* are two common species often available from commercial suppliers. Parasitic wasps are purchased as a mixture, containing 2 or 3 species. The mixture is determined by barn conditions and geographic location. Using several species of wasps in the mix provides better control in the barn, as they have different habitats, temperature tolerances and searching behaviors for seeking out pupae.

### Parasitic Wasp Life Cycle

Adult female wasps lay their eggs inside the fly pupa (Figure 14). They complete their life cycle (egg, larvae and pupa) inside the fly pupa, killing it in the process (Figure 15).



**Figure 14. Adult parasitic wasp laying eggs inside a fly pupa.**



**Fig 15. Parasitic wasp life cycle.**

Source: *Buglogical Control Systems, Inc., Tucson, Arizona*

Parasitic wasps occur naturally in the environment. But their numbers are too small to control large fly populations. The same insecticides used to control flies, kill wasps. Solid bait can be used as long as it is inaccessible to the wasps.

The wasps are purchased in large numbers and they arrive in containers of parasitized fly pupae (Figure 16). The recommended application rate varies between 3–6 parasitized pupae/bird. Wasps are introduced into areas of the barn where fly pupae are likely to be found. As they emerge, females seek out new fly pupae in which to lay their eggs. The wasps



have a limited flight range. Several weekly introductions of wasps are usually required to build up the population in the barn and keep ahead of the emerging flies. As long as there are fly pupae, the wasp population will continue to grow, both from new ones being introduced and wasps emerging from previously parasitized pupae, until the barn is cleaned out.



**Figure 16. A bag containing 25,000 parasitized fly pupae and wood shavings.**

Store the parasitized fly pupae at room temperature until the first tiny wasps are observed walking in the bags. **DO NOT DELAY!** Distribute the pupae in the barn immediately, so the emerging parasitic wasps can start searching for fresh fly pupae. Figure 17 shows bags of parasitized pupae where distribution was delayed and wasps have hatched in the bags. This makes spreading them throughout the barn more difficult.



**Figure 17. Packages containing parasitized fly pupae with large numbers of hatched wasps.**

Spreading the parasitized pupae on the litter and covering them with 2–3 cm (0.78–1.18 in.) of loose litter is recommended. If the pupae are left uncovered, birds may eat them. Another way to keep birds away from the pupae is to place them in eaves troughs, approximately 30.5 cm (12 in.) long, mounted at approximately 76 cm (30 in.) (Figure 18). When the wasps emerge, they will fly down to the litter in search of new fly pupae in which to lay their eggs.



**Figure 18. An example of eaves troughs used to distribute parasitic wasps throughout the barn.**

Choose a supplier that provides technical support services. This will ensure a high rate of success when using this perishable product.

In addition to the cost to purchase wasps, there will be additional weekly labour costs to walk the barns and release the parasitized pupae. No licence or certification is required to apply wasps.

Suppliers should provide farmers with the following information:

- guidelines for the handling and storage of parasitized fly pupae, including storage temperature, light exposure and timing of application
- locations in the barn to release parasitized pupae for best results
- application method
- rate of wasp application based on type of production
- frequency and timing of wasp application

### Hister Beetle

The Hister Beetle, *Carcinops pumilio* (Erichson), is a predator of house flies in poultry production facilities (Figure 19). Larval and adult stages feed on house fly eggs and larvae. The beetles can survive in both wet and dry manure. This biocontrol method works best at operations with longer production cycles. Similar to parasitic wasps, pathogen free beetles can be purchased in large quantities from a commercial supplier.



body length 2mm

**Figure 19. Hister beetle.**

Delay the introduction of beetles until 3–4 weeks after the birds are placed in the barn, to ensure there will be some fly eggs and small larvae for the beetles to hunt. If they are introduced too early, the beetles may leave the barn.

In theory, the beetles can be recaptured at the end of the bird grow out cycle. A trap with a specially designed lure has been used to capture beetles and transfer them to another barn. In practice, this has not been very successful and there are concerns about beetles carrying pathogens from one flock to the next.

### Nematodes

Laboratory studies on the use of nematodes to manage house flies in poultry manure look promising. However, field applications have been relatively unsuccessful.

A few species of nematodes (microscopic worms) (Figure 20) can be applied to “hot spots” in the barn, where high numbers of fly eggs and larvae are present. To improve nematode survival rates, mix them into the litter so they remain in a moist environment. In the studies, nematodes left on the manure surface died within 18 hours of release because they dried out.

The nematodes poor survival rate and limited movement in a realistic production environment makes them a less than optimal candidate for inclusion in biological control programs for flies. Further research of this method is required.



**Figure 20. Nematodes.**

### *Beauveria bassiana* Fungus

This fungus is found in soils throughout the world. Flies die within 1.5–5 days after coming in contact with the fungal spores. Spores are picked up by adult flies and larvae. The fungus germinates. Then it invades the insect’s body, killing it as it multiplies (Figure 21). This is an insect specific pathogen. There is no impact on chickens, humans or the environment, with limited impact on beneficial insects. If birds consume the fungus, it passes through their bodies with no side effects.



**Figure 21. A dead fly covered with *Beauveria bassiana*.** Source: J. Skinner, Terregena Inc.

Commercially, this product is registered as a low-risk insecticide. It is available as a dry fly bait (balEnce™ ES Biological Fly Bait) in cracked grain, with the fungal spores impregnated inside, or as a concentrated liquid (balEnce™ ES) with the fungal spores suspended in a soy oil solution.

The solid bait is only effective on adult flies. The solid bait is put in trays or bags and placed in target areas where adult flies gather (Figure 22).



**Figure 22. balEnce™ ES biological solid fly bait.**

The liquid spray is only effective for controlling flies during the larval and adult stages, not the pupae stage. The liquid spray concentrate (Figure 23) is diluted with water and applied to target surfaces using a backpack sprayer. This product needs to be applied pro-actively to control flies before they become a problem. Target areas for application include litter under feed and water lines to attack larvae, and wall and ceiling surfaces where the adult

flies rest. Regular applications (e.g., weekly or bi-weekly) are required. Soaking the surface with spores will maximize the opportunity for flies to be infected when they contact these areas. The manufacturer claims the spores will remain viable on barn surfaces for up to 21 days after application.



**Figure 23. balEnce™ ES biological liquid fly bait.** Source: J. Skinner, Terregena Inc.

When deciding to use this product, factor in labour costs to apply the liquid spray in the barn. Repeated applications are required to build up the spore populations. It is a labour intensive process. Barn washing and disinfection between flocks removes or destroys the fungal product from barn surfaces, so farmers will need to re-apply product to achieve fly control in the following flock.

**Biological Control TIPS**

- Contact the biological control supplier prior to flock placement, to establish a product delivery schedule.
- Consult the supplier for the best time to start application.
- Install fly monitoring cards to track fly population and keep records to identify trends.
- Continue regular applications (e.g., weekly) of the control agent, as recommended by the supplier.
- Handle and manage the biological controls according to the information from the supplier.

**C. Mechanical Control**

This method relies on light traps, bag traps, baited or sticky traps to capture and kill adult flies (Figure 24). Traps effectively reduce the number of adult flies, especially inside buildings, and are used when birds are present. Some of these traps contain an attractant to lure adult flies to the trap where they are caught. Farm supply stores usually carry a range of traps.



**Figure 24. Example of a commercially available bag fly trap.**

**Sticky Traps**

The most effective sticky traps are usually the “clothes line” type (narrow sticky tape) (Figure 25). Sticky tape (i.e., mechanical control) is a good method to use when fly numbers are low. Capturing female adults this way limits egg-laying early in the production cycle. Sticky traps are often affected by dust or feathers and effectiveness may be reduced over time. It is important to replace them, as needed, to provide fresh sticky surfaces to catch flies.



**Figure 25. Clothesline style white sticky tape (red arrows) trap suspended in a turkey grow barn.**

**Light Traps**

Light traps or electrocution traps are another method of reducing house flies. They come in various sizes and shapes and may help in reducing the number of adult flies. Avoid operating these traps close to processing areas such as egg packaging, to ensure zapped and disintegrating flies do not contaminate these areas.

**Outdoor Traps**

Some outdoor traps use bait to attract adult flies (Figure 26). Efficacy varies greatly, mostly depending on the type of bait used. Traps like these may be helpful in some circumstances.



**Figure 26. Solar fly-trap for use outside the barn with lid open showing inverted cone used for trapping flies.**

Mechanical trapping is a safe and simple method to use in the barn. Installing and replacing bait/traps is often labour intensive. These traps only catch adult flies so other life stages (larvae, pupae) are not affected. This method is non-selective and other species of flying insects, including beneficial ones, may also be trapped and killed.

#### Mechanical Control TIPS

- Install traps at first sight of flies.
- Place traps where flies tend to rest or gather.

#### Mechanical Control TIPS

- Replace the traps if dust or flies accumulate.
- For bait traps, replace bait as recommended by the manufacturer.

### D. Chemical Control

Most farms tend to rely on the repeated application of insecticide sprays because they are easy products to use, and the results can be seen immediately. But, insecticides only work directly after they are applied, or for a very short time afterwards. And they only work on adult flies. Insecticides are ideal for killing newly emerging adults before they can mate and lay their eggs. Note that most commercial insecticides also kill beneficial insects that like to prey on fly eggs, larvae and pupae.

Chemical control products have a role to play in a balanced approach to fly control. There are some concerns with using them including:

- Most insecticides also kill beneficial insects that like to prey on fly eggs, larvae and pupae.
- The effectiveness is eventually lost as flies become resistant to them with repeated use.
- Insecticides can harm the environment, and affect birds, if applied improperly.
- Insecticides only control the adult flies. Any pupae in manure will still emerge as adults.

Farmers need a valid Ontario pesticide applicator

license to purchase and apply these products. The cost of insecticides is relatively inexpensive compared to other control methods. But labour costs to apply them, and environmental concerns should also be factored into the decision.

#### Liquid Spray or Fogging

These products are known as knockdown kill treatments due to their rapid effect. Results are seen immediately. Applying a knockdown treatment immediately after birds are removed and prior to manure cleanout is recommended, especially in cases of high adult fly populations in the barn at the end of the bird production cycle. Decreasing the adult fly population before cleanout will prevent them from moving to neighbouring rooms or barns in search of food. It will also give other fly control methods a better chance to succeed.

For best results, prior to spraying or fogging the barn, shut off ventilation fans, close tunnel inlets and dim barn lights to keep flies docile and in resting mode (Figure 27). Fly density often rapidly increases a few days after spray/fog, as un-hatched pupae or larvae contained in barn litter are not affected.



**Figure 27. Pesticide application inside a poultry barn.**

Historically, the poultry industry has used organophosphorus insecticides (OPs) to control flies. They are readily available to farmers and relatively inexpensive. In addition to the use of OPs (Class 1B), Carbamates (Class 1A) and Pyrethroids (Class 3) can also be used.

Pyrethrins are natural compounds derived from the flowers of the Chrysanthemum plant. Space sprays (liquid insecticide applied as a fog) comprised

of pyrethrins enable farmers to perform a quick knockdown of adult flies in their barns. Pyrethroids are synthetically produced pyrethrins that contain similar insecticidal and toxicologic properties, but are more stable compounds.

Table 1 shows a list of common fly control insecticides registered for use in 2015, their active ingredient and the class of insecticide.

**Table 1.** Common Fly Control Insecticides (2015)

Class	Active Ingredient	Commercial Trade Name
1A	Carbaryl	Wilson Vet-Tek louse powder
1B	Malathion	Malathion 50 Insecticide, Pro Malathion 50 EC
1B	Dimethoate	Cygon 480, Cygon 480 EC, Lagon 480 E, Dimethoate 480 EC, Cygon 480-ORN, Cygon 480-AG
1B	Naled	Dibrom
1B	Chlorpyrifos	3M Livestock Premise Spray MEC concentrate
1B	Dichlorvos	Wilson Barn and Livestock Spray, Dichlorvos Plus #1, Pro DDVP-20 ULV, DDVP 20% insecticide, Vapona -20 ULV concentrate
3	Lambda-Cyhalothrin	Masterline Lambdacy, Demand CS, Saber ER Premise insecticide, Prescription Treatment Brand Residual Insecticide 2, Lambda-cyhalothrin CS insecticide
3	Pyrethrins	Wilson Barn & Livestock Spray II, Disvap IV, Konk, Synerol and others
3	Permethrin	Ectiban 25 Fly-Killer, Pounce 384EC, Co-op Sentinel Fly-Killer, Disvap V, Dragnet FT EC, Prelude 240 Synthetic Pyrethroid, Perm-Up Emulsifiable Concentrate, Bugwacker 240, Tengard Emulsifiable Concentrate
3	Cyfluthrin	Tempo 20 WP insecticide

*Note: Contact a farm supplier for the current list of available commercial products.*

When selecting insecticide products, it is important to remember that products in the same class (e.g., Class 1B) have the same mode of action for killing the pest. Switch product class regularly/periodically to slow resistance development in the target pest population.

It is important to follow label recommendations. There is some evidence that spraying or fogging at temperatures above 28°C reduces the efficacy of some of the products. Combining insecticides with disinfection products allows for a “one-time pass” application, saving on time and labour. This approach may reduce the efficiency of the insecticide product.

Water quality is important when spraying:

- Alkaline water is known to reduce the effectiveness of insecticides such as chlorpyrifos, dimethoate and cypermethrin.
- Hard water and the presence of organic matter may reduce the efficacy of some formulations of insecticides.

It is best to test the water used for mixing and verify with the supplier if there are concerns.

### Solid Bait

Solid bait products are used when birds or animals are present. Use extreme caution to ensure that animals or poultry do not come into contact or eat the bait. Solid bait has a residual effect on fly control, as the product remains viable for several weeks in the bait trays/bags (Figures 28 and 29). Adult flies land on the surface of the bait and die upon making contact with the insecticide or by ingesting it. Only two classes of insecticides are registered for solid baits – carbamates (Class 1A) and neonicotinoid (Class 4). Rotate the insecticide bait between pesticide classes so resistance does not develop.



**Figure 28. Commercial bait tray.**



**Figure 29. Commercial bait bag suspended in barn.**

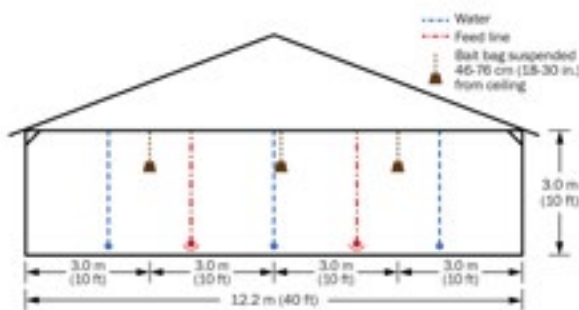
Table 2 provides the insecticide class, the active ingredient and the commercial name of insecticide baits available in 2015.

**Table 2.** Common Fly Control Insecticide Baits (2015)

Class	Active Ingredient	Commercial Trade Name
1A	Methomyl	Stimukil, Starbar, Blue Streak, Fatal Attraction
4	Thiamethoxan	Agita

*Note: Contact a farm supplier for the current list of available commercial products.*

Manufacturers normally recommend an application rate of 200–250 g (7–9 ounces) of bait product per 100 m<sup>2</sup> of floor area (1075 ft<sup>2</sup>). Hanging bait trays/bags from the ceiling spaced 3–6 m (10–20 ft.) apart in both directions has proven to be an effective delivery method for solid bait. A barn measuring 12.2 m x 76.2 m (40 ft. x 250 ft.) could have 2 or 3 rows of bait trays/bags across its width (Figure 30) and 12–22 rows down its length, for a total of 36–66 bait trays/bags. Similar to monitoring cards, do not place bait tray/bags in direct air currents, as this discourages flies from landing on them.



**Figure 30.** Barn cross section showing the location of bait bags

Manufacturers recommend replacing bait products, as needed, to ensure flies have access to fresh bait. Since adult flies must come into direct contact with bait, or ingest it, it is important to replace it often

enough to ensure active bait can be picked up by the flies, and attractants present in the bait are still enticing the flies. Be aware that using solid baits for fly control requires a considerable amount of labour to fill bait bags/trays and replace old bait with fresh.

Collect used chemical baits and properly dispose of them through a pesticide recycling program. Check with the local municipality for dates and locations of collection depots.

**Product NOT REGISTERED for use in Canada cannot be legally used.**

Larvadex™ is a United States (US) insecticide product that is added to poultry feed. It passes through the birds to control fly larvae in the manure. Some US research indicates this product may be losing some of its effectiveness, as it appears that flies have developed resistance due to repeated use.

**Manure & Bedding Additives**

Many products that are added to manure for other purposes make claims that they aid in the control of flies in the barn. With most of these products, the fly larvae or maggots need to crawl through or make contact with the material in order for it to have an effect. There is generally no data to support these claims, only anecdotal observations from farmers. These products are not registered for use against house flies at the moment.

**Hydrated lime** (Ca(OH)<sub>2</sub>) is sometimes used as a sanitizing agent, reducing pathogenic bacteria numbers and increasing the pH of the litter. Studies reveal limited impacts as a fly control product.

**Boric acid** (H<sub>2</sub>BO<sub>3</sub>) has low mammalian toxicity and is used as a litter treatment for darkling beetles (Farm and Ranch Brand Darkling Beetle Control) in the barn. Laboratory trials have shown significant results regarding fly larvae mortality, where boric acid was applied to poultry litter containing fly larvae. Manufacturers will have to complete the registration process with the Pest Management Regulatory Agency (PMRA) to have the label amended to include use for fly control.



Spot treat wet litter located under the water drinker lines with boric acid, as this is a likely location for fly larvae. Note that more research and lab trials are needed to determine how much product to apply in a barn environment to achieve desired results.

**Citric acid** ( $C_6H_8O_7$ ), **Acetic acid** ( $CH_3COOH$ ), and **Diatomaceous earth** (silicon dioxide) are other products with low mammalian toxicity that may prove helpful in controlling flies. Diatomaceous

earth is used often for stored products. It works by disrupting the water balance of fly larvae by affecting its exoskeleton. It does not work well if the substrate is wet. More research is needed.

Products like Stalosan FTM are sold as drying agents that may help maintain drier bedding and may cause dehydration of fly larvae, negatively affecting its survival. However, these claims are not confirmed by research.

### Chemical Control TIPS

- Set up a monitoring program in the barn to track flies numbers.
- Acquire a pesticide applicator license to purchase and apply insecticide products.
- Always read and follow the manufacturer's label recommendations.
- Add solid bait bags/trays in the barn during flock, if adult flies are present.
- Use a fog or spray knockdown treatment at end of flock, immediately after birds are shipped and prior to manure cleanout, if fly numbers on monitoring cards approach or exceed 100 flies/card over a 7-day period.
- Regularly rotate between different chemical control products used to avoid flies developing resistance.



## 4. Case Study

The following is a fictitious example of one fly control strategy implemented on a poultry farm during a summer flock.

### Background

Farmer John raises 4 flocks of broiler turkeys/year on a 13-week cycle, in two single storey barns 12 m x 92 m (40 ft. x 300 ft.) each. The birds are in the barn for 11 weeks followed by 1–2 weeks for cleanout. In mid to late summer of 2014, he experienced a serious fly problem that also affected his neighbours living within 1 km of the farm.

John recognized that the previous flock had experienced some higher than desired fly numbers in the barns and this may have contributed to problems seen later in the summer. The situation was difficult to resolve once the fly population reached elevated levels, as large numbers of flies were being blown out the ventilation fans. John spent more time than usual washing his barns, after the problem summer flock, due to the large amount of fly excrement on the interior barn surfaces and equipment.

### Action Plan

John decided to be proactive in his approach to fly control, heading into the summer of 2015. On May 31, 2015, prior to a new flock of birds going into in the barns, John pressurized the water system in each barn and checked for leaking joints and nipples. All identified pipe leaks were repaired and worn nipple drinkers replaced, to reduce wet litter problems that contributed to the 2014 fly problem.

Birds were placed in the barns on June 2<sup>nd</sup>. The same day John hung 3 yellow sticky monitoring cards in the barn to begin measuring fly numbers. Two cards were placed along the side walls, away from airflows. One was placed near the feed hoppers. Fly numbers were counted and recorded. Monitoring cards were replaced every 7 days.

On June 16<sup>th</sup>, John started to see some flies caught on the monitoring cards. Cards averaged 3 flies captured over a 7-day period. He decided to install 2 rolls of sticky tape down the length of each barn. John advanced the tape 76 m (250 ft.) to expose a new sticky surface every 2–3 weeks, due to the collection of dust and flies on tape surface. On July 7<sup>th</sup>, John noticed an increase in the flies in the barn. Monitoring cards captured an average 17 flies per card over a 7 day period. He decided to add 60 bait bags containing 37 grams each of solid insecticide bait (as per the label) around the barn. He installed them in the barn three rows wide, every 3 m (10 ft.) and 20 rows along the long axis, spaced every 4.5 m (15 ft.).

July 15<sup>th</sup>, one week after the bait bags were installed, John noted a decrease in fly numbers, with the monitoring cards averaging 9 flies captured over a 7 day period.

John regularly raised the water lines during the flock grow out, to ensure birds were striking nipple at the correct drinking angle (back of the bird forms an angle of approximately 75°–85° with the floor). This prevented birds from spilling water while drinking.

On August 16<sup>th</sup>, with the birds just 2 days away from the shipping date, the monitoring cards averaged 25 flies captured in the barn, with few flies noticeable around the fans on the outside of the barn. At this point John stopped monitoring.

John was prepared to apply a knockdown spray in the barn if fly numbers had averaged 100 flies captured per card over this 7-day period. This would have taken place during manure cleanout, immediately after the last bird was loaded on the truck. This would prevent flies from escaping into the neighbourhood. John had spoken with a barn spraying contractor (a certified pesticide applicator) about coming to the farm after 11 pm on August 18<sup>th</sup> (after the last bird was loaded), if necessary, to spray the interior barn surfaces.

On August 18<sup>th</sup>, John cleaned the manure out of the barn onto a paved pad where it was immediately taken offsite to a mushroom composting site.

**Lessons Learned**

John found that keeping on top of fly monitoring improved his decision-making and the timeliness of treatment applications (Figure 31). Due to the use of these control strategies, he had less flies in the two barns and fly numbers at the neighbours were drastically reduced, compared to the summer

of 2014. As a result, he spent less time washing the barns and used less cleaning product too.

Fly control is not free. Based on 2015 prices, approximate material cost for John’s fly monitoring and control program for this one flock was approximately \$550.00 including monitoring cards, bait bags, bait, sticky fly traps, etc. John realizes it takes commitment, time and labour to adopt new practices throughout the flock cycle. He plans to continue to use the monitoring cards with future flocks to help him decide on his fly control strategy.

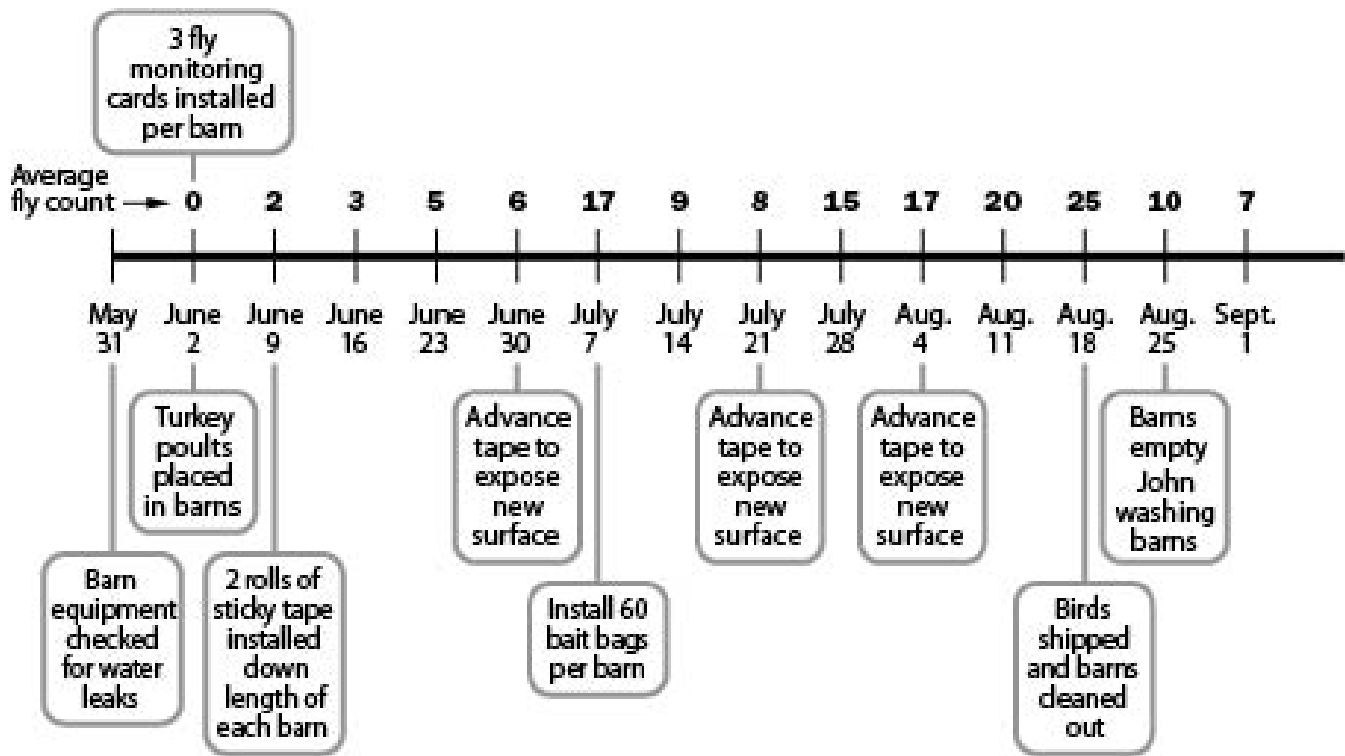


Figure 31. Case study timeline.

## 5. Summary

It is unrealistic and unnecessary to eliminate all flies in the environment. Flies play an important role in the recycling of organic matter. Nobody likes flies, not even livestock or poultry farmers because if there are flies present, there is the risk of lost production. Rural homeowners can expect to have some house flies during the warmer months of the year, since no control strategy is 100% effective and flies are a part of the natural environment.

House fly control is not just important for livestock and poultry farms, but for the rural community in general. Once house flies are in a neighbourhood, they will search out sources of food and places to live, breed and survive. It is essential for anyone with a backyard composter, a waste bin, a pile of lawn clippings, or pet droppings sitting on their lawn, to take action to prevent flies from breeding in this material. Commercial, agricultural and industrial businesses can also contribute to lowering the fly number by limiting the source of organic matter for flies to breed and feed.

It is important to begin fly control on the farm early in the production cycle, to prevent the environment becoming conducive for fly breeding. Take the time to locate areas where flies breed and eliminate the source or make the conditions less than ideal for breeding. Prevention is key. The longer adult flies are kept out of the barn, the less time they have to lay eggs and produce the next generations.

There is no one specific solution to fly control. It takes an integrated, site-specific program for every farm, or even for every barn. Barn management, mechanical control, biological control and chemical control can be used in combination, or alone. Although each method may only slightly reduce fly numbers, the cumulative impact of multiple methods will have an overall beneficial result on reducing flies in the barn. Table 3 summarizes the fly stages affected by each of the control methods described in this document.

**Table 3.** List of control methods and the direct potential impact on life stages of house flies

Control Method	Egg Stage	Larval Stage	Pupal Stage	Adult Stage
Water equipment management	X	X		
Ventilation management	X	X		
Manure management	X	X	X	
Exclusion of adult flies by screening inlets				X
Parasitic wasps			X	
Hister Beetles	X	X		
Nematodes	X	X		
Beauveria bassiana fungus		X		X
Sticky traps				X
Light traps				X
Baited traps				X
Insecticide spray /fog				X
Insecticide baits				X
Bedding Additives	X	X		



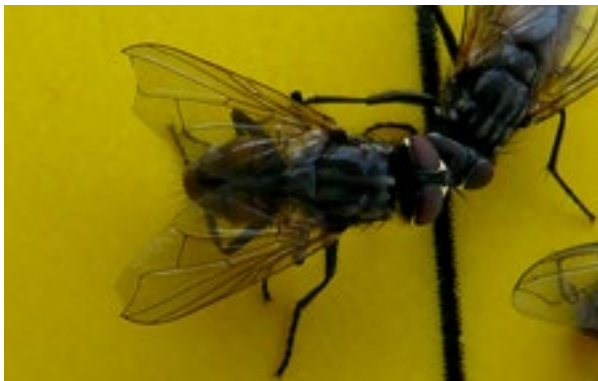
## Appendix 1. House Fly Life Cycle

In order to effectively control fly populations, it is important to understand their life cycle, preferred habitat and what they need to survive and reproduce. Use this knowledge to monitor and select the most effect control strategies.

The most common fly found in Ontario poultry facilities is the house fly (*Musca domestica L.*). It is a non-biting, 6–9 mm long fly, with four black stripes on the thorax. The sides of the abdomen are beige in colour (Figures 32 and 33).



**Figures 32. House fly.**



**Figure 33. House fly.**

House flies absorb liquid or semi-liquid foods and feed on solid material by softening it with regurgitate. They spit out saliva on solid foods to predigest it then suck up the liquefied materials with their mouth. Flies are especially attracted to foods that contain sugars (e.g., molasses) and protein

(e.g. poultry feed). Because of their high intake of food, they deposit feces constantly.

Other flies in agricultural settings that resemble house flies include the Face Fly (*Musca autumnalis*), which is 6–10 mm (0.24–0.40 in.) long and very similar to the house fly (Figure 34). It is also a non-biting fly found mostly around pastured animals. It feeds on animal secretions around the eyes, mouth and muzzle.



**Figure 34. Face fly.**

The Stable Fly (*Stomoxys calcitrans*) is 5–8 mm (0.20–0.32 in.) long with a gray abdomen and biting mouthparts. It often bites the legs of animals and sometimes humans (Figure 35).



**Figure 35. Stable fly.**

The Cluster Fly (*Pollenia* spp.) is 8–10 mm (0.32–0.40 in.) long, has a checkered abdomen and its wings overlap and lay flat at rest (Figure 36). It often congregates in large numbers on buildings during the fall to find overwintering places. It is often seen in the spring as well, when sunny days warm up their hiding places. The larvae of the cluster fly are parasitic on earthworms.



**Figure 36. Cluster fly.**

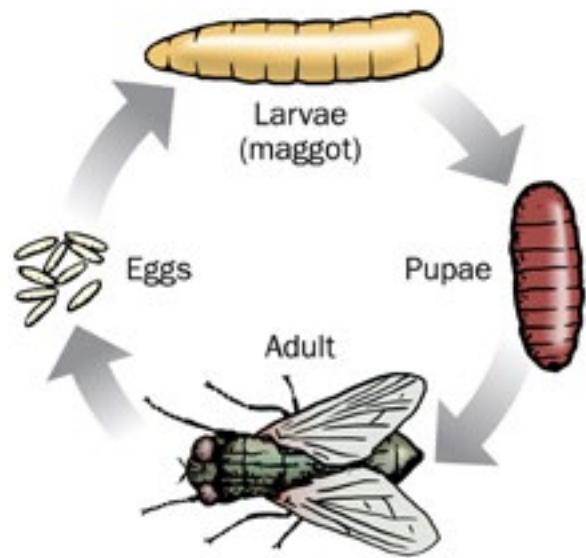
Blow Flies are metallic green or blue and are sometimes mistakenly identified as “house flies” (Figure 37). Blow flies are attracted to dead animals and their maggots devour the carcasses.



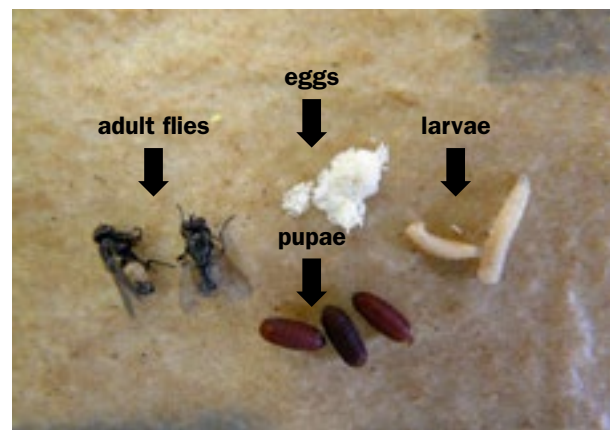
**Figure 37. Green Bottle Blow fly.**

## Life Cycle

The fly life cycle is divided into four distinct stages: egg, larva (maggot), pupa and adult (Figures 38 and 39). Adult flies represent a small percentage of the total fly population present as the eggs, maggots and pupae are located in the bedding or organic matter and out of sight. Adult flies tend to spend their entire lives within 1 km (3,280 ft.) of where they emerged, if there is food and the right conditions for breeding and laying eggs. Adults will move if they have to find food and the right environment.



**Figure 38. Life cycle of the house fly.**



**Figure 39. Life stages of the House fly, moving clockwise — adult flies, eggs (white), larvae (brownish-grey) and pupae (reddish-brown).**



### Adult (Egg Laying Stage)

Female flies like moist areas to lay their eggs. If conditions are too dry, the eggs dry up and die. Female flies prefer to lay their eggs in material with moisture content between 60%–80%. The sex ratio of adult house flies produced is approximately 50:50.

Male house flies can begin mating as early as 10–12 hours post emergence. Females only mate once, however males are capable of mating with 4–8 females in a 24-hour period. A female fly will start laying eggs 3–4 days after its emergence from the pupae. Eggs are laid in areas with the most attractive odour and moisture content (e.g., manure).

The eggs are individually laid and piled in small groups. Normally the female house fly lays 75–150 eggs at a time and she will repeat this process several times for about 500 eggs total in her lifetime. Often, several flies will lay their eggs close together, creating large numbers of larvae and pupae in one particular area. Female flies need access to suitable food to allow them to produce eggs.

### Egg

House fly eggs are white, and approximately 1.2 mm (0.05 in.) in length. During warm weather the eggs normally hatch within 8–20 hours after being laid.

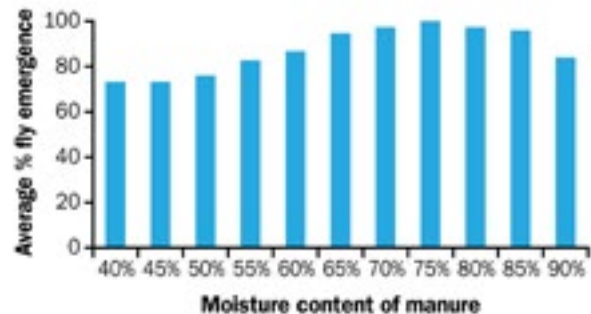
### Larva (Maggot)

After the eggs hatch the larvae or maggots grow rapidly through three progressively larger larvae stages. Nutrient rich organic materials such as rotting vegetation, garbage, spilled feed and livestock manure are ideal food sources for the growing larvae (Figure 40). Larvae require a relatively moist environment to survive. A 65%–85% moisture content range is ideal.



**Figure 40. House fly larvae in manure.**

Research shows that 75% moisture content is ideal for larvae survival. In each of the trials, all of the fly larvae (100%), emerged as adults. Above and below this moisture content there was some death loss observed in the fly larvae. Litter moisture content below 60% showed a thirty percent reduction in larval survival, which is significant. Farmers could use ways to reduce moisture, as a partial control method. Targeting a moisture level below 55% will give the best results in fly reduction (Figure 41).



**Figure 41. Adult emergence from duck manure of different moisture contents.** (Source: Shiell, 2015)

Fly development and activity is temperature dependent. Maggots grow faster in warmer temperatures, and adults will emerge sooner. The fastest development occurs in organic material at 30°C–38°C. This temperature is often found in litter and fermenting organic materials. Larvae will develop in material having a temperature as low as 12°C, but at a slower rate of growth. If material temperatures exceed 55°C, the larvae will die. This is the temperature found in a good composting pile of organic materials. Note that air temperatures are not the same as the litter temperature because of the fermentation process happening in organic material.

### Pupa

The pupa is the last stage before the adult emerges. Fly larva stop eating and crawl as far as a few meters to find drier areas to pupate. The larva forms a hard outer shell to prevent moisture loss and protect the developing adult fly. The shell is light orange to brown to almost black as time progresses. The time to complete the pupa stage in the fly life cycle is dependent on the temperature of the materials surrounding them, but usually lasts about 6–7 days at room temperature (Figure 42).



**Figure 42. Close up of fly pupae.**

### Fly Lifespan

The complete life span, from egg to sexually mature adult, can take as long as 50 days at 16°C or as little as 11 days at 30°C. Adult house flies normally live 15–25 days but may survive up to 70 days. Their longevity is enhanced by cooler temperatures and by the availability of suitable food, especially sugar. Without food they will only survive two to three days.

Flies are diurnal (they are active during daylight hours). As night-time approaches they tend to look for places to rest.

As colder weather and shorter day length approaches (Fall), adult flies that are outside, slow their metabolic process, stop laying eggs and seek shelter. They crawl inside cracks and small openings of buildings to overwinter until temperatures warm up in the spring. The management of poultry barns with controlled temperature and long photoperiods (>14 hours light), allows for year-long reproduction of flies, without this overwintering period.

Under ideal conditions fly populations can increase rapidly. As many as 10–12 generations of flies can occur in one year in climates like Ontario.

## Appendix 2. Why Poultry Barns are Ideal for Flies

In 2013, OMAFRA and the University of Guelph began a two-year on-farm research project to investigate the issue of excessive fly populations on poultry farms and develop fly control strategies to share with the poultry industry.

It is unclear why there has been an increase in the number of complaints about flies around poultry facilities. Possible causes include:

- warmer climate that improves their survival, growth and number of generations per year
- increased rural and urban pressures (i.e., more people living and working closer to farms)
- resistance to current fly control insecticides
- incorrect use of fly control products (i.e., incorrect timing, location and method of application)
- withdrawal of some insecticides from the marketplace

The presence of some flies in and around barns and rural properties is expected during the course of normal farm practices, particularly during warmer months.

Flies can travel fairly long distances and complaints have been received from neighbours living up to 1 km (3,280 ft.) away from turkey, duck, broiler, layer or broiler breeder farms. The common factors with fly complaints are barns housing poultry and the storage of solid manure in the barn for an extended period of time (7–51 weeks, depending on type of poultry and production system).

Turkeys, ducks or broiler chickens are housed in barns with birds running loose on the floor, with free access to feed and water (Figure 43). Bedding material (chopped straw or wood shavings) is spread on the floor and the birds are placed (as day olds) into the barn. Manure is deposited on top of the bedding material and allowed to accumulate for the duration of the bird grow out cycle. The manure is normally removed prior to the next flock arriving and the barn floor, walls, ceiling and equipment are

thoroughly cleaned. Depending on the bird species housed, the entire cycle can vary from 5 weeks for broiler chickens to 17 weeks for turkey toms.



**Figure 43. Birds have free access to feed lines (blue pans) and water lines with nipple drinkers (red cup) in barns with poultry raised on litter.**

Some turkey growers may re-use the litter (e.g., grow another flock or more in the barn prior to cleanout) so the manure can be in the barn for almost one year. Longer bird grow out cycles are more problematic from a fly breeding perspective, as more generations of flies are produced without a break in the fly lifecycle.

Watering equipment varies with bird species. This plays an important role in the moisture management of litter. Water leaks or spillage cause wet spots in the litter, creating an ideal environment for flies to grow. Most commercial poultry producers use a nipple type drinker on a suspended water line that is raised or lowered depending on the growth and size of the birds. Turkeys may also use a bell or special inverted nipple type drinker that is suspended from the ceiling and raised or lowered to match bird size.



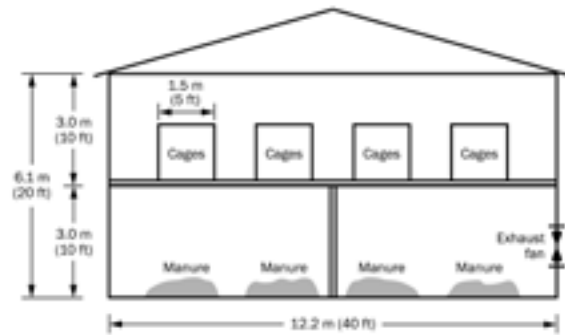
**Figure 44. A broiler breeder barn showing a slatted floor area in front of the nests, where wet manure deposits on the floor underneath, and litter lies on a lower floor area.**

Barns used to house broiler breeders (hens that produce fertilized eggs for the chick hatchery) or free-run layers (hens that produce eggs for human consumption) have longer cycles where birds are housed for 40–51 weeks per year and the manure is stored within the barn. Both of these production systems are normally housed on a partial litter system with a raised slatted area where the watering equipment, hen feeding equipment and nest boxes are located (Figures 44 and 45). The majority of manure is deposited on the slatted area and allowed to accumulate under the slats. The presence of fresh droppings in this area is ideal for flies to lay their eggs and for larvae to develop.



**Figure 45. A broiler breeder hen walking on the slatted area with manure deposited underneath.**

Some cage layer barns have generated fly complaints. These are older style barns that house birds in multi-deck cages. Manure is scraped or falls by gravity to storage below where it accumulates for 40–52 weeks (Figure 46). No bedding is used in this type of system.



**Figure 46. Cross-section view of a high rise layer barn.**

The presence of broken and/or cracked eggs around egg handling and packing equipment in both of these types of facilities represents another food source for flies.

Poultry manure is more suitable for fly reproduction over other types of manure. A 2012 study (Khan et al.) compared the effects of various livestock manures on house fly health and population growth rate. House fly larvae reared on poultry manure developed faster than on any of the other host manures (e.g., buffalo, cow, nursing calf, dog, horse, sheep and goat). The nutrient composition of the poultry manure also had an effect on the adult fly, as they lived longer and produced more eggs, compared to flies grown on other livestock manures.

Poultry production systems have evolved in the last 20 years. Poultry diets have been reformulated to balance and concentrate the nutrients to support rapid bird growth while using less feed. This high quality feed is also beneficial to flies and is easily accessible in the barn through the feeding equipment (Figure 47).



Figure 47. Flies in a feed pan.

Overlapping production cycles between poultry barns on the same property or nearby (< 1 km or 3,280 ft.) contributes to the problem during the warmer months of the year. Adult flies that escape or are released from one barn travel quickly to a new barn to find food and the ideal habitat. In a perfect world, all barns in a 1 km area would coordinate their schedules to be empty at the same time to allow for fly control measures to be applied and to prevent the mass migration of flies from one site/barn to another. However, this is not a practical option as farmers are operating on different schedules based on different market drivers and operating styles.



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# Emergency and First-Aid Procedures for Pesticide Poisoning

For a major spill, a theft or a fire involving a pesticide call the Ministry of the Environment and Climate Change at **1-800-268-6060**.

For pesticide poisonings and pesticide injuries call the Poison Information Centre:

Toronto 1-800-268-9017  
1-877-750-2233 (TTY)

## PREVENT ACCIDENTS

- **Read the label.** Follow all the precautions the label recommends. Read the First Aid section of the label **BEFORE** you begin to handle any pesticide.
- **Make sure that someone knows** what pesticides you are working with and where you are.
- **Keep a file of labels and product Material Safety Data Sheets (MSDS) for the pesticides you use.** Make sure everyone knows where to find this in case of an emergency.
- **Post emergency numbers near all telephones.**
- **Keep clean water, paper towels, extra gloves and clean coveralls close by** in case you spill pesticide on yourself.

**If someone has been working with pesticides and you see any possible symptoms of pesticide poisoning or injury, take emergency action immediately.**

## IF AN ACCIDENT OR POISONING HAPPENS

- Protect yourself from injury first.
- Stop the exposure to the pesticide. Move the victim away from the contaminated area.
- Check the four basic facts — identify the pesticide, the quantity, the route of entry and time of exposure.
- Call an ambulance or the Poison Information Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, MSDS sheet or container to emergency personnel** at the scene — or take it with you to the hospital. Do not transport pesticide containers in the passenger compartment of the vehicle.

## FIRST AID

### If a pesticide comes in contact with skin:

- remove all contaminated clothing; wash skin thoroughly with lots of soap and warm water
- dry skin well and cover with clean clothing or other clean material.

### If pesticide comes in contact with eyes:

- hold eyelids open; wash the eyes with clean running water for 15 minutes or more.

### If pesticide was inhaled:

- move the victim to fresh air and loosen tight clothing
- give artificial respiration if the victim is not breathing.

**Do not breathe in the exhaled air from the victim — you could also be poisoned.**

### If a pesticide was swallowed:

- **call the Poison Information Centre IMMEDIATELY.**

**Emergency numbers are listed at the front of each Bell telephone directory.**

