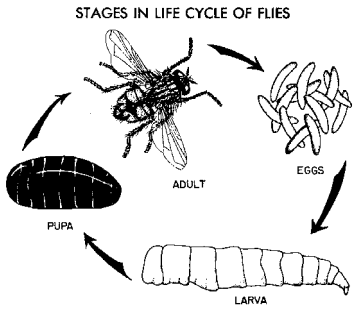
CHAPTER 10 b

Vector: Filth Flies

Jesse Adams

The house fly (*Musca domestica*) is the **primary** nuisance fly associated with hogs, dairy and poultry. Other species of the filth fly complex are the little house fly (*Fannia canilcularis*), soldier fly, stable fly (*Stomoxys calcitrans*) and syrphid fly (rat-tailed maggot). These may also be numerous at times during the year. Additional species of the biting fly group may be pests if the livestock facility is within flight range of their aquatic breeding areas. are mosquitoes, biting gnats, black flies and, tabanids (horse and deer flies).

The life cycle of a house fly from egg to adult has been completed in the laboratory in 6.5 days when the temperature of the larval development medium (habitat) is 91.8 °F. The life cycle from egg to egg laying adult under farm conditions will range from 8 to 14 days for house flies and 3 to 4 weeks for stable flies. Florida reports that under their conditions the complete life cycle to winged adults can occur in 6 to 10 days.



Egg & Larva

Manure is the house fly larvae favorite substrates on livestock and poultry complexes. If the manure is moist (70% to 80% moisture) larvae will stay beneath the surface and create a coffee grounds effect by their activity. Manure with less than 25% moisture or greater than 80% moisture will not support the flies' life cycle. If the manure is soupy, larvae will be on the surface. Wet manure lacks structure and larva must stay on the surface to get air. Larvae are restricted to a layer where temperatures from below and above are suitable.

When manure containing fly larvae is spread on land and turned in, the larva survival rate is unknown. If flocks of birds are feeding in the field, they are a good indication that larvae maybe present. Larvae that escape the birds will pupate below the surface and adult flies will appear in seven to ten days. In many instances, the manure will only support one generation of flies because it degrades and dries in the sun.

Fly larvae can be killed with increased temperature. At 115° F, larvae begin leaving a substrate. At 120° or higher, they are killed. Compost temperature easily reach 140° F or higher. It will be unsuitable for fly habitat after 10 to 14 days. Covering a pile of manure with black plastic will kill flies within the pile and prevent other flies from laying eggs in the pile. As the temperature

increase larvae will attempt to leave the pile. Many predators (example fire ants) will be waiting for them at the cooler edge.

Pupa

Fly larvae will move to a drier substrate when they are ready to pupate. This can be a few inches to one or more yards. In poultry houses, pupae can be found at or near the edge of the manure pack or where the floors meet walls. In wet manure in large poultry houses, pupae will form in drier areas where manure solids accumulate, such as support posts and along walls. In cattle lots, pupae can be found in the soil around the edge of concrete feed aprons, under feed troughs, and under fences. The optimal moisture levels for pupation range from 40 to 60 percent.

Pupae will float after a heavy rain. Concentration of clean pupae can be found in areas where water had puddled. This is a good indication that the nearby material is worked by larvae.

Adult

Activity of adults is very dependent upon weather. Adults like to rest on rafters walls high grass and weeds. Flies look for temperature to suit their needs. House flies do not fly at temperatures much below 60°F. If flight is difficult or overnight temperatures chill flies, they can warm themselves by resting on the warm or sunny sides of a building

If temperatures are too hot, flies will seek cooler places. Fly aggregation sites can be treated effectively with a pesticide if necessary.

Adult flies tend to stay in one location as long as they have adequate food and breeding sites. Adult flies are strong fliers and a 20-mile flight range has been documented for house flies. The documented flight range for stable flies is 135 miles. Flies have the ability to find a suitable habitat.

One major problem is the almost universal use of straw for bedding. Straw mixed with urine and manure provides an excellent medium for growing house flies and stable flies. Other absorbent materials such as wood shaving and peanut hulls, have shown to be superior for reducing fly breeding in calf hutches.

Fly Control in Livestock Operations

Despite many changes in the livestock and poultry industry which have helped with the control of flies, the industry still faces problems. Fly control is not a simple matter and takes a dedicated effort on producer's part to be successful. Each farm may have different problems. Fly control measure that work on one farm may not work on another.

Because the house fly has mouth parts and feeding habits that make it efficient in transmitting bacteria and virus, more than 100 different disease organisms have been recovered from house flies and the fly has been implicated in the transmission of 65 of these. The house fly can transmit more than 20 human and animal diseases. Mastitis, pinkeye, anthrax, typhoid fever, amoebic dysentery, tuberculosis, cholera, Newcastle disease, salmonellae are some of the diseases affecting man and animals that can be transmitted by flies. The house fly is also the intermediate host for some roundworms and tapeworms of poultry.

Continued population growth and current lifestyle choices will increase the potential for conflict over land access, land use and increase the likelihood of situations where livestock production may be perceived as a nuisance. Be a good neighbor. Neighbors have a right to enjoy their property without the nuisance of flies. As more people move to the rural areas and wanting the best of rural living, they will not be tolerant of odors or flies. When asked or visited be sure to show everyone what efforts you are making to prevent odor and fly problems.

In the final analysis the success or failure of a fly control program depends on the efforts of the producer. Half-hearted efforts are sure to be a failure. This will lead to complaints and possible legal actions.

Voluntary compliance is preferable to regulation. Both producers and the public can avoid some of the costs and inefficiencies inherent in regulation and more effectively reach their goals. Negative images are detrimental to the livestock industry and counteract promotion expenditures. Consumers must perceive agricultural products to be produced in a socially acceptable manner.

Each pound of manure can produce 100 to 1000 flies.

To control the house fly, one must understand the biology, ecology and behavior of the fly. For all practical purposes manure management is synonymous with fly control.

The key to fly control is management. Management must see that waste is handled in a way to minimize fly breeding. Fly populations should be managed for prevention and control. Prevention includes sanitation, habitat destruction and good facility design. Sanitation is at least 75 percent of a fly-control program. Control can be divided into residual and contact sprays, baits, larvicides, traps, electrically charged devices and biological agents. No insecticide can be effective against flies around livestock facilities as long as breeding sites exist.

Integrated Pest Management

Integrated Pest Management (IPM) is the ecological approach to pest control. It uses all suitable techniques to reduce the pest below economic levels. The purpose of IPM is not to do away with chemicals. If anything, IPM is designed to protect chemicals from being lost or becoming ineffective. When insect pest populations reach economic threshold levels, control measures must be taken. The ultimate line of defense against insect enemies is the use of chemicals. This

cost can be very expensive, but the cost of not controlling could be very destructive. With IPM, chemicals are used, when it is necessary; facts replace hunches.

Indiscriminate use of insecticides destroys beneficial insects. This can cause minor or secondary pests to become major pests and reach serious levels earlier. Overuse of insecticides may also contribute to a resistance buildup by the pests and make control even harder.

IPM should include sanitation or cultural control, biological control, mechanical control, and the use of insecticides.Economic thresholds can be defined as the pest population levels at which controls are employed to prevent the population from exceeding the economic injury level.

Row crop producers have been using IPM and economic thresholds to determine when to spray to prevent crop loss greater than the cost of control. Economic thresholds may be affected by such things as location, size of insects, presence of beneficial insects, time of growing season, stage of growth, and the size and condition of the crop plant. Economic thresholds are continually changing.

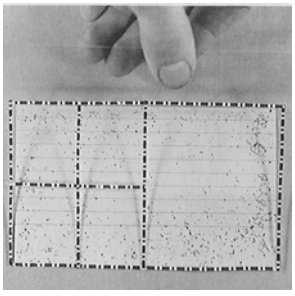
Livestock producers apply this principal also, but there is also an implied social threshold that can apply. Social threshold may not be officially recognized and may well be considered economic thresholds. The social and regulatory implications of vectors invading the adjacent communities include fines, legal fees, and irrate neighbors.

The economic threshold for livestock facilities can be defined as the pest population levels at which controls are employed to prevent the population from exceeding a population level where noticeable numbers migrate into the surrounding community. When the fly population explodes on a farm, flies can migrate up to 1 to 3 miles in search of food, shelter and breeding sites. A regulatory agency may set a threshold that is acceptable to the community. Close attention should be paid to monitoring fly populations to prevent a neighborhood invasion of flies from livestock operations. **Be a good neighbor!**

A good integrated management program should include a method of monitoring flies. This allows producers to maintain long term records of fly populations, which can be useful in event of disputes with none-farm neighbors over flies.

Monitoring

3x5 Index Card System These cards can be used to monitor adult fly populations. This monitoring tool or others should be use to help determine when to treat for adult flies. Using a system like this will help prevent the migration of flies away from the facility.



The white spot cards are attached to obvious fly resting surfaces. These are areas with large numbers of fly fecal and regurgitation spots. The

number of spot cards will vary depending on the size of the barn. At a minimum there should be five equidistant locations per animal housing unit. Spot counts are more than 100 per card per week are considered high levels of fly activity.

An alternate count method is divide the card into quadrants. You may wish to make a plastic overlay for this. Select the quadrant with the most "specks" and count. After reading all the cards, average the counts.

0-20 specks	=	Good Control
21-40 specks	=	Indication of trouble
41 or more	=	Completely Unsatisfactory

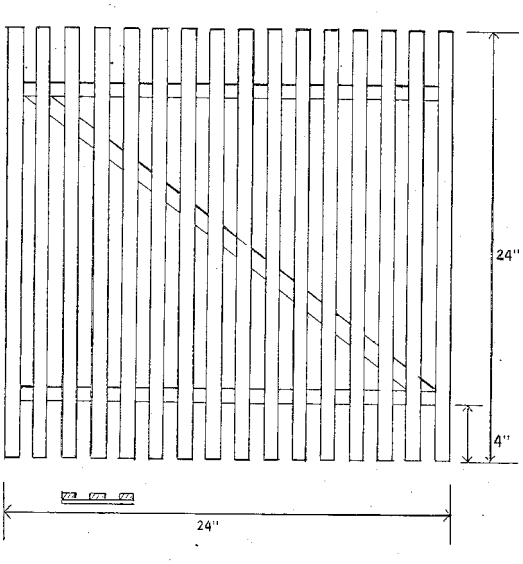
Baited traps These may be gallon plastic milk jugs hung from the rafter on 18-24 inch wires. The jugs have 2 inch round openings cut in the upper part of the sides to allow flies attracted to bait placed on the inside bottom of the jug to enter. When bait jugs fly, catches are greater than 250 flies per week, fly populations are considered high.

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

Moving Sticky Tape Count Ohio State suggest that this is the best surveillance method. Each day, walk about five minutes holding a sticky fly tape on a 1,000 foot walk (down and back) in each facility. Use the same walk pattern, the same time of day, carrying the same length of sticky fly tape. When more than 25 to 75 flies are caught, fly populations are considered high. This is cheap and easy

Hanging Sticky Fly Tapes. These often tell nothing. Tapes fill up fast during the summer months within a chicken house. However, one can determine fly species. Some producers hang sticky fly ribbons along aisles. Captured flies are counted weekly and ribbons replaced. A weekly count of 100 flies per ribbon may indicate fly control is required. Ribbons may become ineffective after two to three days due to dust and fly covering. They are messy to use and location is important.

Regulatory Agency uses the Scudder grill.



The Scudder system for estimating fly levels, is used as a guide by the South Carolina Department of Health and Environmental Control (SC DHEC). The Scudder technique measures "Fly Activity" in a given location. Consistent use of the grill on a daily basis will show a definite response in fly levels indicating an increase or decrease in the population. An arbitrary guide for using the grill is as follows:

0-2 flies/30 seconds	=	No Problem
3-5 flies/30 seconds	=	Flies not presently a problem - Trouble ahead
6-20 flies/30 seconds	=	Flies becoming a problem - take immediate action
20+ flies/30 seconds	=	immediate action necessary including manure removal required to abate problem.

To use the grill, select sites at entry ways of houses (where cages start), at random on walkways and around lurement areas. Drop the grill and allow 1 minute for flies to return to area. Count flies for 30 seconds which land on grill. For most effective use of the grill, do not use under windy conditions or when temperature has dropped (such as following a cooling rain) or after darkness.

Identification of the breeding areas.

Examples of fly breeding areas include feed spills, next to the feeding bunks or feeding aprons, under fences, along mounds, in debris basins that do not drain properly, along drainage areas, and in sick pens. At dairies, fly breeding can be found around forage racks, in calf rearing pens, feed storage areas, drainage areas of silage piles, another places where feed is spilled or manure accumulations are allowed to become moist.

<u>At swine units the most common fly breeding areas will differ to some extent with the type of facility but basically occurs at any location where swine manure or wet feed stuffs are allowed to remain for a period of 10 to 14 days.</u> In swine confinement buildings where is collected below the slatted floor pens, a crust

The potential reproductive capacity of flies is tremendous, but fortunately can never be realized. Hodge (1911) stated " A pair of beginning operations in April may be progenitors, if all were to live, of 191,010,000,000,000,000,000, flies by August. Allowing 1/8 of a cubic inch to a fly, this number would cover the earth 47 feet deep."

occasionally occurs unless some type of agitation is provided. House flies may breed in the crust just below the surface. The agitation of provided by the manure dropping from the slatted floor will suffice of enough liquid is available and the depth is greater than 1 foot. Manure may also accumulate in the upper corners just below the slatted floors. In modified open front or open lots, the main fly breeding areas may be under and around self-feeders or in the corners of the facility. While the accumulation of manure or spilled feed may be relatively small, an area about a square yard in size will allow several thousand flies to develop in a period of two or three weeks.

Residual treatments can be affected by sunlight, high temperatures, and rain. This may require repeated applications in two to three weeks. **READ, UNDERSTAND AND FOLLOW ALL INSECTICIDE LABEL PRECAUTIONS.** Fly Control should be broken into two control programs (larval fly control and adult fly control).

Larva Fly Control may include all or part of the following items:

1. Identify the larva. Be sure larvae are filth flies. You do not want to kill beneficial insect larva.
2. Remove the manure and spread it thin enough on fields to dry rapidly.
3. Bury it by plowing or subsoil injection.
4. Flushing into a lagoon or some other means of covering it with water.
5. Dry it
6. Releasing a sufficient number of an effective fly parasites.
7. Mechanical manipulation of manure. The agitation of manure may be enough kill larva.
8. By treating it with chemical, etc. Be constantly aware of insecticide resistance problems.

Adult Fly Control

Insecticides can be used in several different ways to control adult flies when the monitoring program indicates the need for treatment. Be constantly aware of insecticide resistance problems.

Residual sprays should be applied in the resting areas of flies. Most flies rest overhead on the ceiling rafters, overhangs and post. Apply residual sprays to these areas. Normally sprays are applied to the point of runoff.

The best adult fly kills with contact sprays are in enclosed areas. Good coverage is necessary to completely treat the infested area before flies escape. Contact sprays can be applied using automatic systems, ULV foggers, misters, etc.

Insecticide impregnated baits and fly traps can be used in certain areas for suppression. This method may be very expensive. It should be used where flies congregate. Flies can become bait and trap shy in several months and products should be changed or rotated.

Immature flies are controlled with insecticides for various reasons. This method has the potential to breed insecticide resistant flies. Also beneficial insects are often killed along with the fly larva. **READ UNDERSTAND AND FOLLOW ALL INSECTICIDE LABEL PRECAUTIONS.**

Insecticide resistance

Insecticide resistance develops rapidly in continuous exposure livestock insect control systems to residual pyrethroid spray, cyromazine feed through for house flies, and insecticide cattle ear tags for horn flies. All three of these systems selected for resistance in the field in two years. When used as discontinuous systems, these same chemicals have been used on the same insects in the field with much lower resistance or no resistance. Continuous exposure waste the resource of insect susceptibility, especially with short generation time.

It is normally best to use a combination of pesticide applications such as residual wall sprays, space or aerosol sprays, baits, and larvicides during the fly season. Because fly resistance is always a possibility, it is best to rotate different chemical family insecticides, especially when one group begins to lose effectiveness. Consider alternating synthetic pyrethroids such as permethrin or fenvalerate to organophosphates such as stirofos, dimethoate, or fenthion to carbamates such as methomyl. Do not wait for heavy fly populations. It is much easier and less expensive to prevent heavy fly buildup than to control heavy fly populations after buildup. As fly populations begin to build up, take time to treat, and treat regularly.

Pests are killed by different modes of action often according to Chemical Class. Pesticide rotations minimize problems of building up resistant pests.

CHLORINATED HYDROCARBONS- lindane, methoxychlor
ORGANOPHOSPHATES- chlorpyrifos, coumaphos, diazinon, dichlorvos, dimethoate, famphur, fenthion, naled, phosmet, pirimiphos- methyl, tetrachlorvinphos, trichlorfon
CARBAMATES-methomyl
PYRETHROIDS-cyfluthrin, cypermethrin, fenvalerate, lambdacyhalothrin, permethrin, zetacypermethrin
DIAMIDIDES- amitraz
AVERMETINS - ivermectin
INSECT JUVENILE HORMONE ANALOGS - methoprene
SUBSTITUTED UREAS - diflubenzuron
SYNERGISTS - piperonyl butoxide
TRIAZINES - cyromazine
BORATES - boric acid
DIATOMS - diatomaceous earth
BOTANICALS - pyrethrins

Each livestock unit is different and there may be fly breeding occurring in only two or three locations. However since even small amounts of fly breeding material can support large numbers of flies, these areas should be located and removed. Manure management and sanitation can be expensive but should be considered required management practice in livestock production. The benefits (reduced rick of nuisance lawsuits, better working conditions for the employees, more efficient use of insecticides) may offset the expense.

Biological Control means encouraging beneficial insects to flourish. Building large populations of predators in the manures (mites and beetles which feed on fly eggs and larva) and very small flying wasp which are parasites of the fly pupae. Usually with proper manure management, beneficial insects will become abundant.

Monitoring of flies and manure conditions are part of the fly management program. The abundance of flies can be estimated by looking at surfaces where flies rest, feed and the number of flies on the manure in the daytime. Monitoring of maggots in manures should also observed as well as the moisture content of the manure. These inspection and estimates should be made routinely every 2-3 days to detect problems before an outbreak occurs.

One of the best tools is to hang cards (3x5 Index Card System) in areas where flies have been observed. After one week the cards should be inspected and fly specks counted. Each of the cards should be marked for location and dated. This provides a visual record of the fly activities. These cards may provide a record in cases of possible lawsuits or provide a record on the progress of the fly control.

Using Natural Enemies for Fly Control Today

Strange as it seems the natural world is a very dangerous place for house flies. Altogether natural enemies take a heavy toll on each generation of flies by eating invading, parasitizing , infecting the fly at virtually every part of the life cycle. These predators generally go unnoticed.
The challenge is to learn how to use these natural biological control agents to take full advantage of their potential. Three ways in which this can be accomplished are conservation, inoculation, and sustained releases.

Conservation. Stable populations of beneficial insects ban be conserved by using cultural control and manure management practices that keep manure dry or to wet for house flies to multiply. Manure should be cleaned out as infrequently as possible to allow natural enemy populations to build. A manure clean out interval of 2-3 weeks is the worst case scenario; this is neither to short to break the life cycle of the fly nor long enough to allow good establishment of natural enemies. Manure should never be treated directly with pesticides except as a spot treating areas with very high maggot densities. If pesticides must be used to manage adult fly populations then it is best to choose baits and non-persistent space sprays. Residual premise treatment should be made sparingly and only in areas of high fly activity. A residue of old bedding or manure should be left at clean out to facilitate repopulation of fresh droppings.

Predaceous mites and parasitic wasps seen to be more effective in reducing fly populations in litter which has a moisture content below 50%. Solider larva tend to over compete for breeding area with fly larvae in litter which exceeds 50% moisture. A predatory fly, the dump fly, will comsume house fly larvae. Where practical it is important to manage manure in such a way that the benefits the beneficial insects. It is important to be able to identify beneficial insect larva to prevent making insecticides applications.

Inoculation. In some cases biosecurity or other considerations may prevent leaving residues of old manure at clean out. Fly invasion of sterile dropping that accumulate after total clean out often lead to fly explosions. In such instances it can be helpful to inoculate the fresh manure with small populations of natural enemies to help them get started. If biosecurity permits, manure maybe inoculated with manure from another production unit. At present the only naturel enemies that can be purchased commercially are the pupal parasitoids. The rates at which parasitoids are released must be determined by specific needs of the producers farm at that point in time. A good starting point is one parasitoids per hen for layer flocks and 1000 parasitoids per calf for dairies.

Sustained Releases as part of a IPM Program. In sustained release efforts, releases of parasitoids are made over a longer period of time, Perhaps the entire fly season, to maintain fly populations below the nuisance threshold.

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