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Biology and Control of Flies in Poultry Facilities

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Based on statistics published in 2012 by Economic Research Service USDA, poultry and eggs contributed over $3.7 billion to Arkansas' economy. While playing a vital role in the economy of Arkansas, high-density, confined housing systems used in poultry operations may greatly increase fly problems due to the large volumes of waste material produced. Fly populations, if not properly managed, can result in a public health nuisance around the poultry operation and neighboring rural non-farm communities. This can often lead to poor community relations and potential litigation. The primary flies encountered are the house fly, black garbage fly and little house fly. Generally, these flies remain relatively close to the original breeding source (location of egg, larvae and pupae). However, the house fly is known to disperse for over 25 miles, the black garbage fly for 4 to 5 miles and the little house fly for 1 to 2 miles.

The filth flies associated with poultry production are of greatest significance because they carry organisms that cause disease in poultry and humans. They are known to carry organisms associated with food poisoning in humans, such as *Salmonella*, *Campylobacter*, *E. coli* and *Listeria*, as well as pathogens that cause diseases in poultry (Exotic New Castle Disease, *E. coli* and Caronavirus).

Flies Associated With Poultry Manure/Litter

The **house fly**, *Musca domestica* L., (Figure 1) is the major species associated with poultry manure. This fly breeds in moist, decaying plant material, including refuse, spilled grains, spilled feed and in all kinds of manure. Poor sanitation around the poultry facility increases the probability of high house fly populations. House flies prefer sunny areas and are very active, crawling over filth, people and food products. This fly is an important mechanical vector of many human and poultry diseases (protozoa, bacteria, viruses, rickettsia, fungi and worms) and can cause fly-specking problems with eggs as well as windows and walls of buildings.

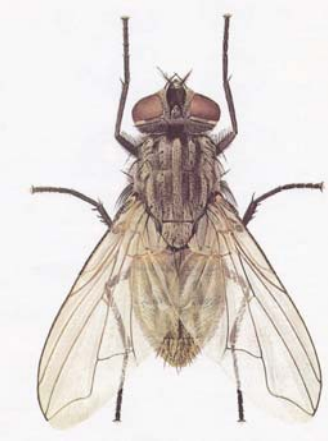

Figure 1. House Fly

Adults are about 1/4 inch in length, mostly dull gray in color, have four black stripes on the thorax and have sponging mouthparts. Females

Figure 2. House Fly Life Cycle.

lay two to seven batches of 100 to 150 eggs at 3- to 4-day intervals in cracks and crevices under the surface of the breeding material. Eggs hatch into white, cylindrical, anteriorly tapering larvae (maggots) in 12 to 24 hours (Figure 2).

Maggots pass through three growth stages to complete their development in 4 to 7 days. Mature larvae form a dark reddish-brown puparium from the larval skin and then pupate. The adult fly emerges after a pupation stage of 3 to 4 days. Generations overlap. The duration of the life cycle increases as the temperature decreases. Adult flies live an average of 3 to 4 weeks. Increased adult activity occurs during the day at temperatures of 80 to 90 degrees F. They become inactive at night or below 45 degrees F. Adults rest on ceilings, walls, posts and other surfaces inside and outside poultry facilities, including vegetation. The accumulation of "fly specks" (light-colored regurgitation spots and darker fecal spots) identify preferred resting areas.

The **little house fly**, *Fannia canicularis* (L.), (Figure 3) resembles the house fly but is smaller (adult 3/16 inch in length) and has three brown stripes on the thorax. This fly is normally associated with litter-type floor housing and open window ventilation. It prefers a breeding medium that is less moist than that preferred by the house fly. Poultry manure is a favored medium. This fly readily invades homes in nearby residential areas, but it is less of a nuisance because it does not settle as readily on people or food. Resting areas include weeds, branches and sides of buildings. The fly prefers shade and cooler temperatures and engages in distinctive aimless circling beneath hanging objects in the poultry facility or in outside shaded areas. Because of the preference for shade, this fly may hover in large numbers in nearby garages, breezeways and homes. Populations may be higher in the early spring, decline in midsummer and peak again in late fall due to the fly's lower heat tolerance. Eggs are laid on decaying organic material and hatch into larvae in 36 to 48 hours. Larvae are brown, flattened and spiny and require about 8 days, depending on temperature, to reach the pupal stage. Pupae resemble the larvae. The adult emerges from the pupa after about 8 days. The complete life cycle lasts 18 to 22 days depending on temperature. The little house fly has been known to be associated with outbreaks of Exotic New Castle Disease (ENC).

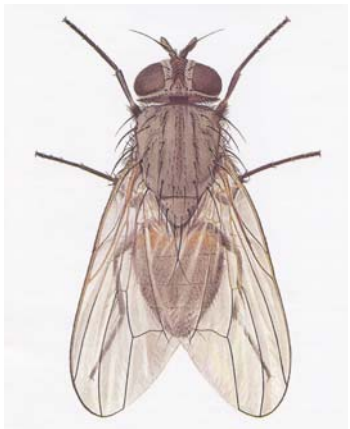

Figure 3. Little House Fly

The **dump fly (black garbage fly)**, *Hydrotaea aenescens* (Wiedemann), (Figure 4) is shiny bronze-black in color and is slightly smaller than the house fly. The life cycle of the black dump fly is similar to the house fly and is completed in 14 to 45 days. Black dump fly larvae closely resemble house fly larvae. Eggs hatch in 12 to 16 hours, the larval stage lasts a minimum of 5 days, the pupal stage lasts at least 4 days and adults live from 14 to 20 days. The black dump fly cannot withstand freezing temperatures but can be found year round under suitable conditions. Unlike the house fly and little house fly, black dump flies characteristically remain on their food source at night rather than rest on the ceiling or on outdoor vegetation. These flies have a more limited range (4 to 5 miles) than the house fly and little house fly. Larvae of the black dump fly can be predaceous on other fly larvae and have been known to decimate house fly populations. This beneficial aspect can be overshadowed by the fact that large numbers can develop on the farm, and adults will disperse into nearby communities. In addition, the black dump fly is now known to have organisms that cause disease (*Salmonella, Campylobacter, E. coli*) on its body surface or in its digestive system, much the same as the house fly.

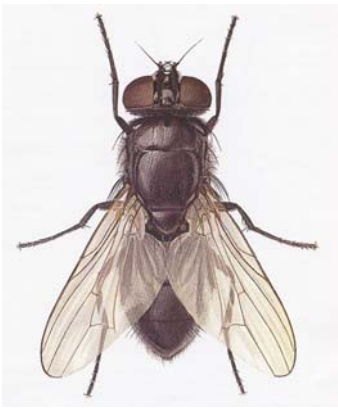

Figure 4. Dump Fly

Various species of the **blow fly** (Figure 5) can sometimes be found in poultry facilities. Finding blow flies in a poultry facility generally means dead birds are not being

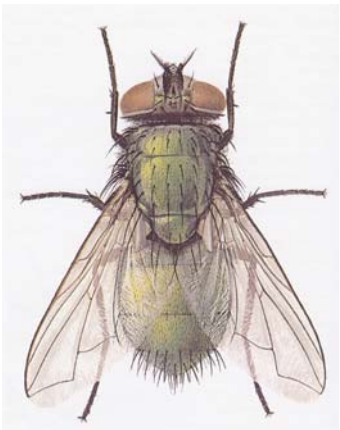

Figure 5. Blow Fly

removed. Most blow flies are similar in size or slightly larger than the house fly, and many are metallic blue or green. Most species of this fly are scavengers that breed and reproduce in decaying animal and bird carcasses, excrement, broken eggs and wet garbage. These flies can be held at low levels if good sanitation is in place (dead birds are removed from the facility and burned or otherwise disposed of properly).

Soldier flies (Figure 6a), **small dung flies** (6b), **fruit flies** (6c) and **rattailed maggots** (6d) are some of the other flies that can be found in poultry production facilities.

Figure 6. (a) Soldier fly, (b) small dung fly, (c) common fruit fly and (d) rattailed maggot

Fly Control

Flies can be controlled in poultry facilities through the integration of nonchemical and chemical control methods. The use of insecticides alone rarely results in satisfactory fly control. An integrated pest management program involving population monitoring, cultural control, mechanical control, biological control and chemical control is recommended.

Population monitoring is important when making fly control decisions. Documentation can be very helpful if the poultry facility becomes involved in litigation due to flies dispersing from the poultry facility to areas of human habitation. Control decisions based on visual observations should be avoided. This is a very unreliable method for estimating the size of fly populations.

One highly effective method of sampling is the **moving tape count**. Make this count daily. Use the same walk pattern at the same time of day (down and back in each house) carrying the sticky fly tape. A fly catch of 25 to 75 flies per 1,000 feet walked may indicate control is necessary.

An excellent and inexpensive monitoring method involves the use of hanging **sticky fly ribbons**. The fly ribbons should be counted and replaced weekly. A sticky ribbon should be placed at each end of the facility and placed on opposite sides. A weekly average count of 300 flies from the two ribbons indicates that the house fly population has reached a level where the adults will be dispersing away from the facility, indicating a need to initiate fly management procedures. Black garbage flies will also be observed on the sticky ribbons. Treatment should be initiated when fly numbers reach an average of 150 flies per ribbon. This method allows for easy identification and seasonal occurrence of the species present. However, ribbon location is important. Place the top of the ribbon approximately 6 feet above the floor and 3 feet out from the facility wall on both sides of the facility.

Fly spot counts are another monitoring tool. A 3 x 5-inch white card is fastened flush against feed troughs, ceilings, braces or other fly resting areas at each end and center of the facility and left for one week. When an average of 100 dark-colored fly spots are found on the cards in one week, management procedures should be initiated. The cards provide an index of fly activity over a period of time within a given house. At least three cards should be placed per house. Count fly spots on one side. Change cards weekly depending on populations present. Cards should be placed on a flat surface about 36 inches above the floor in the same position at each replacement. Fly species cannot be determined from the spots, but the cards are a very inexpensive method to use for control decisions and documentation.

Baited jug traps are more expensive than other sampling methods. They offer greater sensitivity to fly population changes. The device consists of a plastic milk jug with four 2-inch diameter access holes around the upper part of the jug. A wire is used to hang the trap about 3 feet above the floor around the pit periphery in a caged layer operation. The jug is baited with a commercial fly pheromone. The presence of flies in the jug may indicate the need for control.

In poultry operations where manure accumulates in pits, **larval sampling** should be carried out to identify hot spots that contain high numbers of fly eggs and maggots. Spot treatment of these hot spots with insecticide may be beneficial to halt excessive fly larval breeding. However, total coverage of manure pits with insecticide should be avoided so that fly control benefits received from predacious insects are not reduced.

Cultural control – consisting of manure management, water management and sanitation – is the most effective way to control flies. Fresh poultry

manure contains 75 to 80 percent moisture, which makes it ideal for fly breeding. Fly breeding can be practically eliminated in this material by reducing the moisture content to 30 percent or less or by adding moisture to liquefy it. Drying manure is preferred because the product occupies less space and usually has less odor.

Depending on the type of poultry facility, **dry manure management** is highly effective in reducing fly populations. Where applicable, frequent removal of manure (at least once a week) prevents fly buildup by breaking the breeding life cycle. It is important to scatter the manure lightly outdoors to kill eggs and larvae by drying. Avoid piles or clumps of manure. Enough land must be accessible so the manure can be spread thinly. This keeps excessive amounts of nutrients from building up in the soil. Manure should be spread based on a soil analysis at an agronomic rate for your area. If in-house storage of manure is available, the manure requires drying to a 30 percent moisture level and maintenance at this level. Dry manure can be held for several years. Any practice that limits moisture in the droppings or aids in rapid drying is important for fly control.

Water management with respect to the moisture content of manure is important for effective fly control. This can be accomplished through a variety of means. Regulate water flow to poultry watering sources and prevent/repair leaks. Adequate cross-ventilation should be provided in the facility. Ensure proper floor grade so that excess surface water drains away from the facility. Drain and fill low areas around the facility. Clean water for the birds should be maintained to prevent dysentery. Excessively high house temperatures that encourage high water consumption should be prevented.

Sanitation around the poultry operation is very important for maintaining fly control. Quickly remove and dispose of dead birds and broken eggs. Disposal should take place far from the poultry premises by burning in an incinerator or other approved management method. Clean up and dispose of feed and manure spills, especially if wet, immediately. Clean out weed-choked water drainage ditches. Install proper eaves, troughs and downspouts on poultry houses to carry rainwater far from buildings. Provide proper drainage in poultry yards. Minimize the migration of flies from other fly-infested animal operations close to the poultry house.

Mechanical control can be accomplished through the use of various types and styles of fly traps. Electrical traps employing a black light with an electrically charged grid to kill the insects are the most common. Some traps are baited with a fly attractant material. Traps may be helpful in tight, enclosed areas, such as egg rooms, if a breeding fly population is present. However, good sanitation practices must be followed. Where fly populations are heavy, traps are not effective in reducing fly numbers to satisfactory levels. Use traps in the middle of the night away from doors and windows. Judge a trap by the population of flies remaining in the area and not by the number of flies caught in the trap. Fly traps used alone are not effective in controlling flies, especially in and around poultry operations. A fan can be used to inhibit fly entry through doorways. A fan is used to blow air through a screened doorway connecting the egg room or other work areas to the main poultry house. Fly entry is prohibited because flies will not move against the wind. Commercial, electric-powered air curtain fans are available. However, certain state health departments may require solid doors to separate the main poultry house from the egg room or other main work areas. Use sticky fly strips where appropriate.

Biological control should be part of an overall fly control program in poultry operations. Through appropriate cultural practices, poultry manure accumulations can support large populations of beneficial predators and parasites that help suppress house fly populations. The macrochelid mite, *Macrochelis muscaedomesticae*, is reddish brown and less than 1/16 inch long. It feeds on house fly eggs and first instar larvae. These mites can be found on the outside layer of manure and consume up to 20 house fly eggs per day. Another mite is the uropodid mite, *Fuscuropoda vegetans*, which feeds only on first instar house fly larvae deeper in the manure. A hister beetle, *Carcinops pumilio*, is black and about 1/8 inch long and feeds on house fly eggs and first instar larvae. This effective beetle predator, common in both broiler and layer houses, can consume 13 to 24 house fly eggs per day. Both adult and immature hister beetles live in the surface layers of manure. Another hister beetle, *Gnathoncus nanus*, is present at lower numbers on poultry farms.

In addition to the above-mentioned predators, very tiny parasitic wasps are the naturally occurring enemies of manure-breeding flies. These minute parasites destroy flies in the pupal stage. The parasitic wasp, *Spalangia nigroaenea*, is about the size of a house fly's head (1/16 to 1/8 inch). This parasite is attracted to the manure environment and deposits an egg into the fly puparium (the hard case containing the pupa). The developing wasp larva consumes the pupa. Instead of an adult fly emerging from the puparium, an adult parasitic wasp emerges. Some wasp species deposit more than one egg into a pupa. These fly parasites are specific to flies and attack nothing else. They do not bite or sting humans and usually go unnoticed by those living near poultry operations. These wasp parasites self-propagate

in the process of controlling pest flies. However, naturally occurring species of parasitic wasps do not occur in sufficient numbers to provide adequate control of flies because the wasp lays fewer eggs than the fly over the same time period. If the poultry producer wants to maximize the benefit of this method of biological control, the use of supplemental releases of adult parasitic wasps to help reduce house fly population is required. The producer is cautioned that claims to date that wasps will provide long-term fly control have not always been backed by scientific research results. The producer should ensure that beneficial parasitic wasps purchased are adapted to the climate of the area. When using this method of fly suppression, it is necessary to start with an initial wasp release and follow up with weekly supplemental releases. The poultry producer should make these releases before and during fly season. Care with insecticides is essential when using beneficial insects. To prevent killing the parasitic wasps, restrict chemical sprays in areas of the poultry facility where these wasps are used. To improve the chances of successful biological control with these wasps, the producer should strictly follow the cultural control measures outlined in previous sections. It is also a good idea when cleaning out the poultry house to leave some areas of old, dry manure to provide a reservoir of beneficials to repopulate the house as new flies reappear.

Chemical control consists of the application of insecticides to control flies and should always be considered supplemental to sanitation and other management options employed to prevent fly breeding. The methods employed to deliver insecticidal control measures can be categorized as larvicidal sprays, larvicidal feed throughs, adulticidal baits, adulticidal space sprays and adulticidal surface treatments. Accurate records should be kept on the types and rates of insecticides used. Resistance to insecticides has developed at different levels in various poultry house locations, depending somewhat on prior exposure. Chemical rotation or the use of a variety of different classes or families of insecticides can minimize the chances of developing chemical resistance. Alternate the use of pyrethroids, carbamates, organophosphates and other classes of insecticides as needed.

Larvicidal sprays are applied directly to the manure surface to kill maggots. Larvicide applications to an entire house will give only short-term fly control and will kill natural biological control agents. Treatments will then need to be repeated. Poor penetration of the manure by the insecticide kills only a small proportion of maggots. In addition, these sprays add moisture to the manure making it more suitable for fly breeding. Consequently, care must be taken when using larvicidal sprays because they will destroy the predators and parasites associated with the manure. However, spot treatments of small areas with high numbers of maggots can be effective and yet have a minimal effect on the overall beneficial insect population in the manure.

Larvicidal feed throughs utilize cyromazine (Larvadex), an insect growth regulator. When blended into a poultry feed ration, this material controls manure-breeding flies in and around layer and breeder chicken operations. Do not feed to broiler poultry. An insect growth regulator kills flies during the immature life stages and does not adversely affect natural predators and parasites. This control method will provide a high degree of fly control; however, overreliance on this method will result in flies becoming resistant to Larvadex. Resistant flies have developed in large poultry operations where label directions have not been followed. Never feed continuously throughout the year.

First, monitor adult flies in and near the poultry house. When the population reaches a level to cause concern, spray or fog with a recommended adulticide to reduce the breeding potential. Spray adults for as long as possible. Then check the manure pits for hot spots of maggot activity. If maggots are active, start the feed-through insecticide in the ration. When little or no maggot activity is observed in the manure, discontinue the feed-through treatment. Continue monitoring manure pits for maggot activity and repeat the feed-through procedure as needed. Use baits, sprays or fogs as needed during and between Larvadex feeding periods to control flies. Do not spray manure pits.

During winter months or periods of low fly pressure, discontinue Larvadex for at least four consecutive months per year. Larvadex is limited to use as a feed through in chickens and may not be fed to any other poultry species. Manure from animals fed Larvadex may be used as a soil fertilizer supplement. Do not apply more than 3 tons of manure per acre per year. Do not apply to small grain crops that will be harvested or grazed as illegal residues may result. Larvadex and several other insect growth regulators (IGR) are registered for use as spot treatments where the spray is applied directly into the manure where the flies are breeding. While requiring more labor by the poultry producer than feed throughs like Larvadex, this method of application can be done easily using a hand-pump sprayer and spraying the insecticide directly into the manure when filth fly breeding is detected.

Adulticidal baits are excellent selective materials for suppressing low fly populations and maintaining populations at a low level. These inexpensive and easy-to-use materials are designed to kill flies that have escaped other methods of control and should be

a regular part of the house fly control program. For maximum effectiveness, combine baits with residual and space sprays. Use baits at the beginning of the fly season and renew at least once a week through warm weather. Place baits in containers (i.e., egg cartons) or glue onto cardboard panels so they will not fall into manure pits and cause the destruction of parasite and predator populations. Use baits where they will not be accidentally eaten by birds or mixed into their feed.

Adulticidal space sprays containing synergized pyrethrins or a combination of dichlorvos and synergized pyrethrins provide a quick knockdown of adult flies in enclosed air spaces. Because space sprays provide little or no residual activity, resistance to these insecticides is still relatively low. Unfortunately, however, resistance has become a rather severe problem in poultry operations where pyrethrins are applied with automated dispensing systems. Loss of effective fly control with these automated dispensing systems can occur in a single fly season. The key to successful fly management with these systems is to use sparingly (no more than once every 3 to 4 days).

Adulticidal surface residual treatments have a long residual life and can be used both inside and outside where flies congregate. Residual sprays usually are the most effective and economical method for controlling potentially heavy populations of adult flies of any species present. However, read the insecticide label because not all residual insecticides are registered to apply when poultry are in the facility. Apply to surfaces where flies rest – poultry house framework, the ceiling, walls, trusses, wires supporting cages, electric light cords and other areas marked by fly specking. Treat outside the poultry house around openings and on shrubs or other plants where flies rest. Because insecticide resistance is possible, apply residual sprays only to problem houses and areas where the moving tape counts indicate population growth is becoming serious. Avoid contamination of feed, water and eggs during spraying. Do not spray birds.

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Specific insecticide recommendations can be found in MP144, "Insecticide Recommendations for Arkansas" (www.uaex.uada.edu/publications/mp-144.aspx), which is updated yearly. Read and follow all directions included on the insecticide label. Please contact your county Extension agent if additional information is desired.

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