House Fly
(*Musca domestica* L.)

Figure 1: Female house fly. Image by David Theuret, UC Riverside.

General Information

The house fly *(Musca domestica*) is a cosmopolitan pest of humans and domestic animals. House flies are generally found in greatest numbers during the hotter summer months. While commonly associated with animal facilities, house flies can also be common in urban areas where garbage, particularly food waste, is not well managed.

Identification and Life History

House flies are less than 3/8 inch (5-10 mm) in length, mostly grey in body color with some yellowing on the sides of the abdomen, and have four dark longitudinal stripes on the thorax (Figure 1). Size and color patterns may vary considerably among individuals even within a single population of house flies.

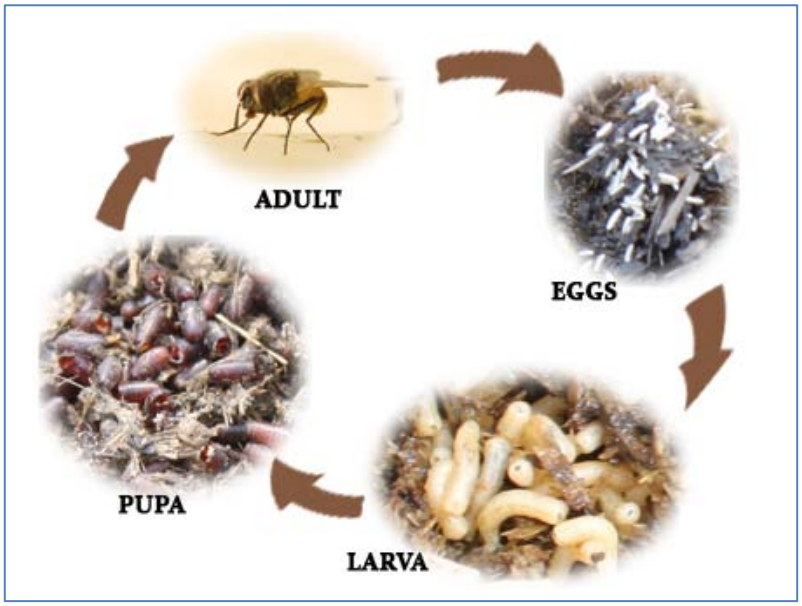

Figure 2: Life cycle of the house fly. Images by Alec Gerry and Kim Hung, UC Riverside.

Under favorable conditions the number of house flies can increase quickly because of their rapid larval developmental time and the large number of eggs produced by each female. A mated female house fly can lay several batches of about 100-150 eggs. All flies undergo complete metamorphosis with egg, larva, pupa, and adult stages in their development (Figure 2). Eggs are laid in warm, moist, organic materials such as manure, garbage, lawn clippings, decaying vegetables and fruits, or soils contaminated with any of these materials. Larvae (or "maggots") of the house fly are cream colored, have a blunt posterior end and taper to a point at the head (Figure 3). House fly larvae feed on bacteria associated with their larval development site. Larvae develop through three larval stages, with growth in size occurring between each stage. Young larvae respond negatively to light and will burrow into the organic material in which they are developing. Older larvae respond positively to light and will emerge from their organic habitat to seek drier and cooler areas in which they will transform into a

Figure 3: Lateral view of third instar house fly larva. Image by Stephanie Leon, UC

pupa. The pupa develops within a puparium which is the hardened outer skeleton ("skin") of the last larval instar. The puparium looks superficially like rodent feces; brown in color and with an oval shape. However, the ends of a puparium are rounded rather than tapered as for most rodent feces and regular striations are notable on the surface (Figure 4). Within the puparium, the pupa transforms into an adult fly. The rate of fly development is dependent upon external temperatures; under optimal summertime conditions, house flies can complete their development from egg to adult in as little as 7 days.

Damage

House flies can be a nuisance when large numbers of flies disperse from fly development sites (e.g., animal facilities or waste management facilities) and accumulate in areas where they impact human activities. Conflicts can arise between animal operations and nearby homeowners leading to economic loss from lawsuits citing flies as a nuisance. Typically, a proactive fly management program and a good relationship with regional health agencies and neighboring residents can keep conflicts to a minimum.

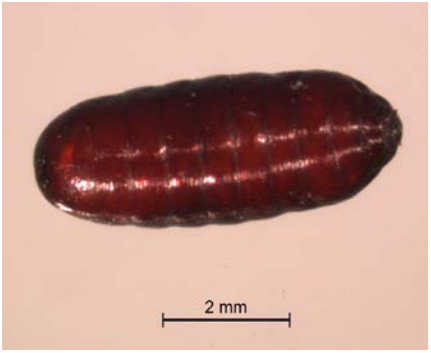

Figure 4: House fly pupa. Image by Stephanie Leon, UC Riverside.

House flies do not bite. Instead, they have sponging mouthparts and eat solid food by first liquefying it with their saliva. Due to their habit of feeding on animal waste, garbage, and human foods, they have been associated with the transmission of several human and animal disease agents. House flies are known to carry bacteria and viruses that cause disease conditions such as diarrhea, cholera, food poisoning, yaws, dysentery, and eye infections.

Integrated Pest Management

Monitoring: In any pest management approach, pest population information dictates management decisions such as when and how to control the pest. Pest population abundance must be regularly assessed or monitored so that changes in abundance over time can be readily determined. Pest monitoring methods typically provide a relative assessment of the pest population rather than an actual count of the number of pests in a given area. For this reason, it is important to use standardized monitoring methods so that direct comparisons can be made between different assessment periods. The best monitoring programs use the same methods of measuring fly activity from multiple locations at a single facility for a standard length of time. Results should be recorded and kept for several years in order to evaluate seasonal and long-term trends in pest population abundance. Understanding these trends will help to develop a proactive program for pest control.

Consistent monitoring also provides quantitative data to better address nuisance complaints commonly associated with house fly activity at animal production facilities. Casual observations are subjective, may be misleading, and are rarely helpful to demonstrate effectiveness of control measures.

Methods for monitoring fly activity include sticky traps, odor-baited traps, and spot cards. Sticky traps include colored traps, ribbons, or paper sheets coated with a sticky material to capture flies that land on the trap. Sticky traps should be placed at locations where adult flies are abundant. These traps can be messy and may work poorly in very dusty areas. However, insects that the traps collect are identifiable, making this useful for monitoring different types of flies in the area. Fly traps containing toxic granular bait or stinky liquid bait can also be used to monitor fly activity, but dead flies may be difficult to identify or count and fly resistance to the bait may compromise the monitoring program over time. Spot cards are white index cards that can be placed on vertical surfaces where flies are known to rest. Resting flies leave “spots” on these cards as they regurgitate or excrete components of a recent meal. Stable flies leave similar “spots” on these spot cards so counts probably reflect the combined activity of both fly species. Since flies do not occupy areas around the facility equally at all times, it is best to use these cards in areas of high fly activity during the peak season. The development of a software program (FlySpotter ©), that will count the spots on cards scanned with any flatbed scanner, has made monitoring fly activity with spot cards more cost efficient.

Management: While adult flies are responsible for causing nuisance, the larval stage is the main target for control efforts, and elimination of larval habitat is the preferred method of house fly suppression. Chemical pesticides may be necessary for suppressing adult fly populations in some situations, but they are not a substitute for proper sanitation and aggressive elimination of fly developmental sites. Because flies can quickly develop resistance to insecticides, use them only as a last resort to obtain immediate control of adult flies.

Residential and Food Production Areas

In almost all cases where house flies are seen inside a building, they have entered from the outside. Therefore, barriers preventing fly access to the building are the first line of defense. Cracks around windows and doors where flies may enter should be sealed. Well-fitted screens will also limit their access to buildings. Poor exclusion and lack of sanitation near buildings are the major contributors to fly problems in an urban setting.

In general, rigorous cleaning of the area surrounding a building will lead to a reduced number of flies by limiting adult fly attractants as well as larval development sites near building entrances. Regularly remove and dispose of organic waste, particularly animal feces, rotting fruit, and food waste. Garbage should not be allowed to accumulate and should be placed into sealed plastic bags. Garbage receptacles should be placed as far from building entrances as possible in order to keep flies attracted to the garbage odors from entering buildings. During warmer weather, increased fly numbers may require more frequent waste removal and sanitation.

Sticky fly papers or ribbons are effective at eliminating a few flies in relatively confined areas, but are not effective enough to manage heavy infestations or to provide control in an outdoor setting. Traps containing fly food attractants can be readily purchased commercially and may remove large numbers of flies when they are not competing with nearby garbage or animal waste. However, the fly attractants used in these traps are quite foul smelling and these traps should be placed at some distance from occupied structures. Fly traps using ultraviolet light as an attractant may be effective when used indoors where they are not competing with daytime sun light, and there are some commercially available models designed for the home or office that present a nice appearance and contain a hidden glue board (Figure 5) onto which attracted flies will become entangled. Of course, for control of just a few flies, the time tested fly swatter is always appropriate! But, do not swat flies in food preparation areas as food may become contaminated with insect body parts.

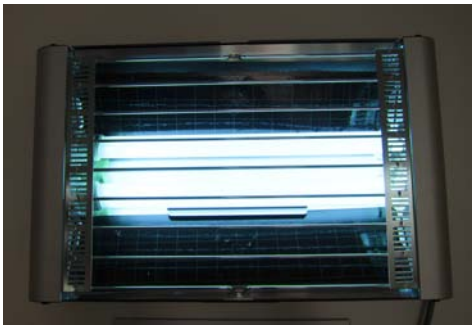

Figure 5: Ultraviolet light trap. Image by Kim Hung, UC Riverside.

Selective use of insecticides against house flies is one component of a fly management program, but should be considered only after non-chemical strategies have been employed. For the typical restaurant or residential home, chemical treatments are not commonly advised to control house flies. However, when sanitation efforts fail to control house flies, a non-residual pyrethrin aerosol and/or toxic fly baits can be used for immediate reduction of adult house flies. Fly baits should be placed in garbage collection areas or other areas where adult flies are noted to congregate. If the presence of adult house flies is a persistent problem, a residual insecticide may be applied outside the home or food facility to surfaces such as walls and overhangs that flies use as resting sites.

Animal Facilities

Management of house flies in animal facilities is considerably more difficult than in urban locations. The continuous and substantial production of animal feces in these facilities can provide an abundance of resources for larval fly development if not managed carefully.

At animal facilities, house flies are best managed through manure sanitation to reduce larval development. Larvae are less mobile and restricted to their developmental habitat (primarily manure), which makes them easier targets for control. When sanitation alone cannot reduce fly numbers sufficiently, chemical or biological control options may also be utilized.

Cattle Facilities: Elimination of larval development sites by regular manure removal is essential for reducing house fly abundance. It is particularly important to remove wet manure near watering stations, beneath fence lines, and adjacent to any structures within the pen where manure builds up and cannot be compacted by cattle as they move about their pen. Manure solids generated by screening effluent from flush-lane systems will also produce large numbers

of flies if not properly handled. Removed or separated manure should be composted to generate fly lethal temperatures or spread in a thin layer (by harrowing) within the animal pen for rapid drying and to be compacted by animals. Composting manure piles or windrows will need to be turned following rain or other wetting event to prevent fly development in the wetted and cool outer portion of the pile or windrow. Removal of manure buildup within animal pens and at manure separators should occur at least 1-2 times per week during the hotter summer months to prevent immature flies in the manure from completing their development.

Engineering controls to ensure proper drainage of drylot pens and flush lanes are also critical to reducing house fly production. Animal pens should be graded to allow rainwater to drain quickly for more rapid drying of manure within the pen. Drainage channels should be constructed outside drylot pens so that cattle cannot degrade the integrity of these drainage channels to cause pooling of water within the pen. Any water pooling within the pen will result in house fly production.

Poultry Facilities: Manure management in poultry facilities varies with facility design, but removal and rapid drying of wet manure and wet feed is the key to successful fly management in all designs. In high-rise egg-layer operations, manure is often allowed to build up beneath rows of hen cages forming a ridge of manure the length of the cage row (drying and coning method). Fresh, wet feces deposited on top of this ridge are expected to dry quickly reducing the opportunity for fly development. However, if the drying rate of the feces is reduced due to limited air movement, overstocking of birds, high humidity, or sick birds depositing particularly wet feces, then this method will be easily compromised and house fly production can be significant. Weekly removal of bird feces (frequent clean out) followed by composting of the feces or by spreading the feces in a very thin layer to dry quickly is often recommended when fly feces cannot be dried sufficiently beneath hen cages.

Biological control: The use of natural enemies, such as predators or pathogens, to reduce pest numbers is called biological control. Under natural conditions, there are several species of parasitoid wasps that lay their eggs on fly pupae, killing the pupae as the parasitoid larvae develop. Some of these parasitoid wasps may be purchased from commercial breeders and released at locations on the animal facility to augment natural populations of these parasitoids. Several species of beetles and mites that prey on fly eggs and larvae are also active under natural conditions. To promote the management of house flies by natural populations of parasitoids and predators, application of broad-spectrum insecticides to manure, where these biological control agents are active, should be avoided. Entomopathogenic fungi that kill flies are also common on animal facilities. However, the efficacy of these fungi depends on temperature and humidity, and the probability of flies being infected with these fungi is low during the hotter summer months when control of flies is most desired. This seasonal variation leaves entomopathogens as an unreliable control method.

Chemical control: Most chemical control methods target adult fly populations and should be used when non-chemical methods targeting larval development have failed. Perhaps the mostly commonly used chemical control products are granular baits which combine fly attractants,

such as the fly pheromone (Z)-9-tricosene, with an insecticide. Granular baits can be easily and quickly spread on the ground in outdoor areas inaccessible to animals, or they can be placed into fixed-site bait stations. Granular fly baits are most effective when placed near areas where fly activity is already high. Liquid insecticides can be applied as a spray to structures on which flies are noted to rest or can be applied as a mist or fog to achieve control in an enclosed area. Some insecticides targeting the immature fly stages can be mixed with animal feed and applied as a feed-through. Animals consume the feed, and insecticide is excreted with the animal feces preventing fly larvae from developing in the manure. House flies will quickly develop resistance to insecticides used continuously. To manage insecticide resistance, use insecticides only when needed for immediate control of adult flies and vary the chemical class (IRAC code) of insecticide used on a seasonal or annual basis. For your safety and the animals' safety, please observe the label instructions for proper application methods.

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AUTHOR: K.Y. Hung and A.C. Gerry (UC Riverside)

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