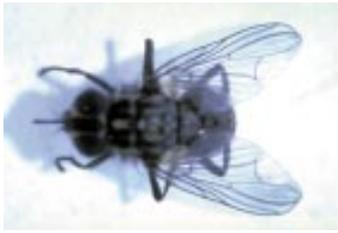


Biological Fly Control for Kansas Feedlots

By Gerald L. Greene, Phillip E. Sloderbeck and James R. Nechols



Stable fly

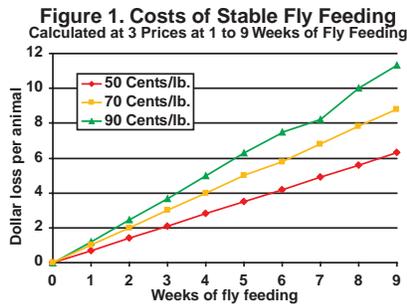


House fly

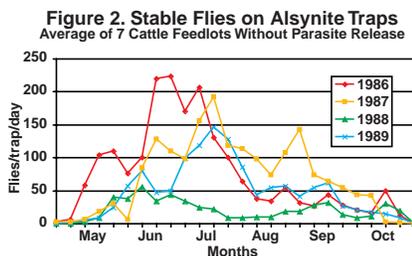
Flies in Feedlots

Two species of flies occur in Kansas cattle feedlots—house flies and stable flies. The house fly is only a nuisance, whereas the stable fly causes economic loss. Adult stable flies attack the legs of cattle to secure blood meals necessary for them to mature and lay eggs. The feeding flies disturb the cattle to the point of reducing weight gain and feed conversion efficiency. The cattle bunch together, stamp their feet and switch their tails, thus reducing their own feeding time. House flies cause much less loss because they cannot bite—they have sponging mouthparts and feed on free-standing liquids or solids that they can dissolve with saliva.

The economic loss due to stable flies has been reported to be 0.2 pound/day when four or more flies per leg were observed on feedlot cattle (Campbell et al. 1977). The longer the fly season and the higher the cattle prices, the greater the loss (Figure 1).



Stable flies are abundant during the spring, then typically decline in number in conjunction with hot, dry conditions during July or August. However, high stable fly populations may occur for 16 weeks in cool, wet summers (Figure 2).



House fly populations are low until July, reach peaks in August, then decline with dry, cool, fall conditions. However, they can remain a public relations problem into the fall because they enter buildings and vehicles as cool nights occur with the onset of fall.

Both the stable fly and house fly breed in manure that often is abundant around a feedyard. Stable flies are believed to overwinter as larvae or pupae in the manure. During the warm months of the year, breeding is continuous. The egg stage lasts 12 to 18 hours, larvae take one to three weeks to become pupae, and the adult fly emerges in one to three weeks. Female flies live seven to 10 days and may produce 200 or 300 eggs during their short life. Thus, the total life cycle can vary from 14 to 40 days. House flies can complete their life cycle in a slightly shorter time period; eggs hatch in about a day, larvae feed for five to 14 days, and flies emerge from pupae in three to 10 days.

Manure Management

The key to fly control around the feedlot is manure management—without a sound manure management system no fly control program is going to be useful. Only after the fly breeding areas have been reduced as much as possible can other management practices be useful and/or economical in further reducing fly populations.



Wet pens resulting from poor drainage will have many more fly problems than properly graded pens.



Steps to Reducing Fly Numbers

1. Keep undisturbed manure as dry as possible. Manure inside pens is constantly being stirred and trampled, so regardless of how wet it is, flies cannot breed there. However, manure that is undisturbed, like along feed bunks, under fences, around waterers, and between pens and alleyways provides ideal fly breeding areas. Keep waterers in good repair to avoid leaks, and grade lots and alleyways to provide good drainage.
2. Scrape empty pens, alleyways, and fencelines to remove as much manure as possible and to improve drainage.
3. Clean up spilled feed, decaying hay and silage.
4. Control weeds to remove fly resting areas.



Manure and weeds around pens provide excellent fly habitat and need to be controlled to reduce fly numbers as part of a total fly management program.

Going the Next Step

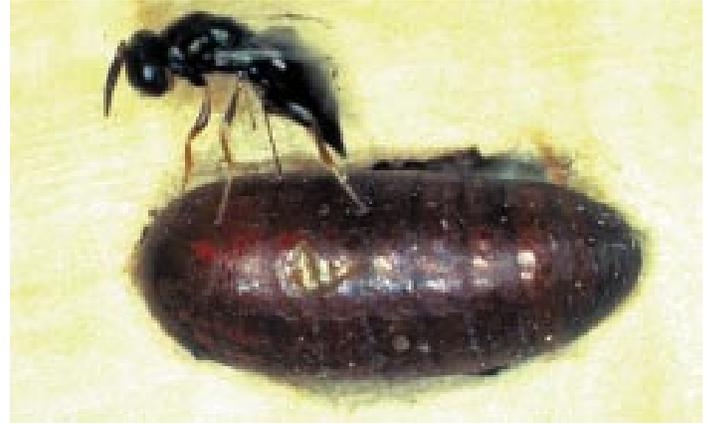
Once a good manure management system is in place, the feedlot manager is ready to take the next step and consider releasing parasites to help reduce the number of flies emerging from fly breeding sites that cannot be eliminated.

Parasite Biology

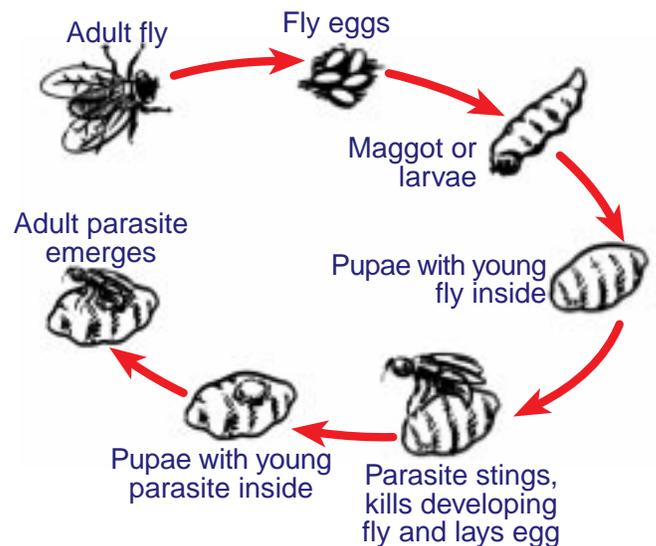
The parasitic wasps used in fly control programs kill flies to provide a place for their larvae to develop. Females search through manure to find fly pupae. When a female parasite finds a pupa she will insert her ovipositor into the pupa and lay an egg. Some of the fly pupae will die from the sting alone (up to 30 percent); most will be consumed by the parasite larva that hatches from the egg laid inside the fly pupa. Each female will lay 20 to 45 eggs. Eggs hatch in about two days, larvae feed for seven to nine days, and the parasite pupal stage lasts seven to nine days. The adult parasites then emerge by cutting a hole in the fly pupal case and start the cycle over again by

mating and searching for more fly pupae. The adult parasite lives about seven to 10 days.

Fly parasites are obligate parasites of flies—they cannot live without flies. When fly parasites are



introduced into manure and other breeding sites, the only way they can survive is to find and lay their eggs in fly pupae. When enough fly parasites are released into an area, the fly population can be dramatically reduced. This is the basic principle of biological fly control. Fly parasites need to be added to the breeding sites in sufficient numbers to inflict heavy damage on the fly's ability to survive and reproduce. This does not mean that by releasing a large number of fly parasites at one time



they will eliminate the flies for that season. Fly parasites reproduce very slowly compared to flies. House flies can turn over an entire generation in less than 10 days and each generation can live approximately 30 days. Fly parasites, on the other hand, take about three weeks to produce a generation. Multiple releases are required to

keep sufficient numbers of fly parasites in the manure to stop flies from simply out-breeding them.

Periodic releases should continue through the entire fly season to ensure plenty of fly parasites are available to control flies. Remember, the idea is not to balance nature, but to have enough fly parasites present to keep fly populations as low as practical.

When people learn about fly parasites it is sometimes difficult for them to understand how these wasps work. Some people picture large, stinging wasps swooping down and knocking flies out of the air or carrying them off for dinner; some have a fear that the parasites will decide to sting people or cows instead of flies!

Fly parasites are very small—about the size of a gnat or a small ant. Parasites cannot bite or sting a human; they are only concerned with finding the pupal or cocoon stage of the fly. They must use this stage to feed themselves and for the development of their offspring. They are so dependent on this stage of the fly, we must raise flies in order to raise the parasites for shipment.

Fly parasites can fly, but not very well. Their wings are used primarily to flit from place-to-place on the manure. They cannot attack the adult fly, therefore, parasites cannot directly reduce fly numbers. Instead, they work in the manure killing fly pupae before they reach the adult fly stage.

Selecting the Right Parasite

The first attempts at releasing parasites to control flies in Kansas feedlots relied on parasites not native to the area and results were questionable. Recent research has centered on determining which species of parasites are native to the area in an attempt to improve the effectiveness of future releases.

Spalangia endius and *Nasonia vitripennis* have been sold and released in feedlots but are seldom retrieved from fly pupae. This demonstrates that these species have not established in Kansas feedlot environments and probably are not adapted to the conditions.

The two main groups of pupal parasites occurring naturally in Kansas cattle feedlots are *Spalangia* and *Muscidifurax*. In the genus *Spalangia*, *S. nigroaenea* dominates *S. cameroni* by about three to one. While in the genus *Muscidifurax*, *M. zaraptor* outnumbers *M. raptor* by about the same ratio.

Muscidifurax zaraptor is predominantly collected from house fly pupae, suggesting this parasite might be the species of choice for house fly control and it is probably the most common of commercial parasites sold because it is easy to rear. However, since it is only occasionally found in stable fly pupae it should not be the sole species used for a feedlot fly control program.

Spalangia nigroaenea appears to be well adapted to the feedlot environment of Kansas. It is commonly found in both stable fly and house fly pupae and is the most common parasite found in stable fly pupae in Kansas. Thus, *S. nigroaenea* appears to be the appropriate parasite species for stable fly control in Kansas feedlots.

Quality Control is Important

Selecting the right insectary for providing the parasites is a very important decision. Two important considerations are viability of the parasites and purity of the sample.

Commercially produced fly parasites arrive at the feedlot inside parasitized house fly pupae. Parasite emergence from pupae must occur if releases are to effectively reduce fly numbers. Emergence has never been high, averaging 50 to 60 percent from the best material we have sampled. This is an area where further improvement is needed.

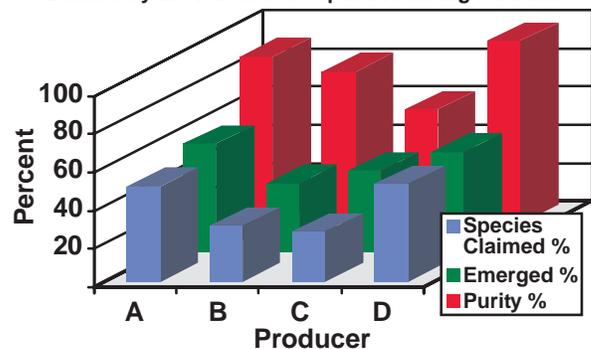
The other recurring problem is contamination. Only the desired species of parasites should emerge from parasitized fly pupae delivered to the feedlot. Too often, less than 80 percent of the emerging parasites are species adapted to Kansas cattle feedlots. Commercial insectaries rearing several species of parasites have difficulty rearing pure fly parasite colonies, because the parasite species adapted to cattle feedlots are not very competitive and their colonies often become contaminated by other species of parasites.

In the future there may be a service or regulatory program to reduce these problems. For now, a producer should find a reputable supplier that understands the feedlot fly problem, and check to ensure the shipments are viable when they arrive for release. However, most producers will not be able to determine the actual species being released and, thus, must rely on the reputation of the dealer.

When to Get Started

Timing the first parasite releases in the spring is critical to a successful fly management program. Fly parasites are a long-term solution to fly problems, not a

Figure 4. Insectary Parasite Purity
Percent of Pupae Where the Species Claimed Actually Emerged Divided by the Percent of Pupae Producing Parasites



quick fix. They take time to establish, so don't wait until you're overrun with flies to start releasing parasites. Parasite releases should start when the stable flies are noticed bothering horses or cattle. In Kansas, stable fly problems begin about the first of June.

Determining the Number of Parasites to Release

Ideally, the number of parasites to release would depend on the number of fly pupae being found. However, more work needs to be done to develop better scouting methods before this will be practical. For now, most people rely on making releases based on the number of animals present in the feedlot, with 20 to 50 parasites per animal in the feedlot being released each week.

Where and How to Release Parasites

We have already talked about a few of the places where flies breed. These also are excellent places to release the parasites. Other areas to put fly parasites would include exposed hay and silage. Flies, especially stable flies, breed in decaying organic matter as well as manure.

It is not necessary to put fly parasites on every square inch of breeding site. The fly parasites have wings and can migrate short distances. Since you will receive shipments weekly, it is a good idea to put them in different areas each week. Be careful to avoid placing parasites where animals will walk on them, or in areas that may be cleaned during manure removal.

Remember, these are living insects. Even though they are shipped in an easy to handle, immature stage, they must be put where they will survive long enough to hatch and go to work—avoid direct sun, pooled water, and pesticide treated areas. The parasites should be covered with a small amount of soil or manure to protect them from the sun.

Gerald L. Greene, Retired Professor and Livestock Entomologist, Southwest Research Center; Phillip E. Sloderbeck, Professor and Extension Specialist, Entomology, Southwest Area Extension Center; James R. Nechols, Professor, Research and Teaching, Entomology, Manhattan

Integration of Parasites and Pesticides

An appropriate use for chemicals is to knock down existing flies before you begin releases of fly parasites. Some also can be useful as residual treatments on buildings and nearby windbreaks.

Chemicals, however, have their limitations. Unless you hire a licensed commercial applicator, or you are certified as a private applicator, you cannot apply restricted use pesticides. The chemicals must be mixed properly, stored properly, and proper protective gear must be worn.

If the same chemical is used repetitively over a long period of time, flies become resistant. Put simply, susceptible flies are killed and the surviving flies pass their resistance on to their offspring. Switching to new chemicals doesn't always work because sometimes the mechanism that allows flies to be resistant to one chemical also makes them resistant to other chemicals. Thus, using good manure management and biological control agents can help prolong the effective life of chemical controls.

References Cited:

Campbell, White, Wright, Crookshank and Clanton. 1977. Effects of stable flies on weight gains and feed efficiency of calves on growing or finishing rations. *J. Econ. Entomol.* 70(5):592–594.

Acknowledgements

Funding for this publication was provided by a grant from the National Biological Control Institute. The authors would like to thank Jerome Hogsette, Jr., USDA Gainesville, Florida and Don Mock, Kansas State University, for reviewing an earlier version of this document. We also express appreciation to Anna Barrett and Bob Holcombe, Department of Communications, Kansas State University, for their help with editing and designing the document. We also thank Dave Mandeville, University of California, Riverside, for use of the slide of the fly parasite.

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned.

Publications from Kansas State University are available on the World Wide Web at: <http://www.oznet.ksu.edu>

Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. In each case, credit Gerald Greene, Phillip Sloderbeck, James Nechols, Biological Fly Control for Kansas Feedlots, Kansas State University, April 1998.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF 2223 (Revised)

April 1998

It is the policy of Kansas State University Agricultural Experiment Station and Cooperative Extension Service that all persons shall have equal opportunity and access to its educational programs, services, activities, and materials without regard to race, color, religion, national origin, sex, age or disability. Kansas State University is an equal opportunity organization. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, Extension Districts, and United States Department of Agriculture Cooperating, Marc A. Johnson, Director.