

# Livestock & Poultry

Department of Entomology

## CONTROL OF POULTRY PESTS

*Ralph E. Williams, Extension Entomologist*

Several kinds of flies, beetles, and external parasites are a major concern facing poultry producers. The shift from small farm flocks to larger commercial poultry operations has greatly increased these pest concerns. The high-density, confined housing systems used in poultry production today create conditions that favor the development of manure-breeding flies and beetles associated with poultry litter accumulations. External parasites (e.g., northern fowl mite, lice) are also of concern in confined housing systems.

### FLIES

#### Important Species

##### **House Fly – *Musca domestica***

The house fly is considered the major pest species associated with poultry manure, especially in caged-layer operations. Accumulated poultry manure can be highly suitable for house fly breeding, especially where general sanitation is poor and when there is excessive moisture. They prefer manure as a breeding source but have been found breeding in moist, spilled feeds and other moist, warm decaying organic matter.

With today's concern about environmental conditions, fly control takes on added importance. Flies are considered environmental pollutants just by their presence. Fly populations may create a public health nuisance in nearby communities, resulting in poor community relations and threats of litigation. Unfortunately, as urbanization and rural non-farm residences increase, poultry producers will be faced with growing pressure to reduce fly populations. Also, flies are suspected of harboring numerous disease organisms.

The female house fly produces up to six batches of 75 to 200 eggs at 3 to 4 day intervals. Larvae (maggots) hatch in 12 to 24 hours. The maggots complete their development in 4 to 7 days and then form into dark reddish-brown pupae. The pupal stage usually lasts 3 to 4 days, after which adult flies emerge. A complete life cycle can occur in 7 to 10 days under optimal conditions, longer in cooler temperatures. Adult flies live an average 3 to 4 weeks.



They are most active during the day at temperatures above 70°F and become inactive at night and at temperatures below 45°F. Resting adults can be seen on ceilings, walls, posts, and other surfaces inside a poultry house, as well as outside on the building and surrounding vegetation. Preferred resting places can be detected by the accumulation of “fly specks,” light colored spots formed from regurgitation and darker fecal spots. The effective house fly dispersal range appears to be 1/2 to 2 miles from their preferred breeding sources. This will vary somewhat with different environmental conditions.

##### **Little House Fly – *Fannia sp.***

The little house fly is generally smaller than the house fly and not as common in Indiana. When it does occur, high populations can develop on poultry farms. Although this fly may invade homes in nearby residential areas, it tends to be less annoying in that it does not readily settle on food or people. Adult males show a distinctive aimless hovering or circling flight behavior of long duration within the poultry house or at outside shaded areas. Females are less active and more often found near breeding sites.

Because this fly is less tolerant of hot, midsummer temperatures than the house fly, it often emerges in large numbers in early spring, declines in midsummer, and may peak again in late fall. The little house fly prefers a less moist medium in which to breed than the house fly. Poultry manure generally is preferred over other media. Little house fly larvae are quite different than the creamy white cylindrical house fly larvae. They are brownish red, flattened, and spiny. The complete life cycle ranges from 18 to 22 days but may be longer depending upon temperature.

##### **Black Garbage Fly – *Hydrotea (Ophyra) aenescens***

Black garbage flies (also called “dump flies”) can be found in large numbers in poultry facilities. They are shiny-black in appearance and a little smaller than house flies. They prefer moisture manure to breed in than the house fly. Their life cycle ranges from 14 to 45 days. They will breed throughout the year in poultry houses.

These flies are generally considered to be beneficial, especially in enclosed egg-layer houses. Black garbage fly larvae will actually kill house fly larvae and often dominate the manure habitat when present, especially in moist manure. Adult black garbage flies tend to stay on and around the manure surface in enclosed facilities. In poultry housing exposed to the outside, these flies are sometimes considered as nuisance pests.

### **Blow Flies – Calliphoridae**

Numerous species of blow flies (green or black bottle flies) may occur in poultry houses. They breed in decaying animal carcasses, dead birds, broken eggs, and wet garbage. Prompt removal of dead birds and rodents, preventing accumulation of broken eggs, and daily cleanup of processing areas is usually sufficient to prevent the build-up of these flies.

### **Small Dung Fly – Sphaeroceridae**

Small dung flies, along with several other small gnats, readily breed in poultry manure and other decaying materials. They can occur in large numbers in poultry operations but generally are not a nuisance on the farm or in nearby communities. Population levels are often higher in spring and late summer.

## **Fly Control**

Successful fly control in poultry operations should be an integrated approach with emphasis on proper manure management. Four basic management strategies make up a successful integrated fly control program:

- cultural/physical,
- biological,
- mechanicals, and
- chemical control.

### **Cultural/Physical Control**

Management of poultry manure so that it is not conducive to fly breeding is the most effective means of control. Fresh poultry manure generally contains 60 to 80 percent moisture. Flies can readily breed in manure with a moisture content of 50 to 85 percent. Manure moisture below 50 percent is less suitable for fly breeding, and fly breeding usually does not occur at 30 percent moisture or less.

Dry manure management is practiced under two types of systems: 1) frequent manure removal (at least weekly) and 2) long-term, in-house storage of manure. Frequent manure removal systems to prevent fly breeding are based upon weekly (or more frequent) removal and field spreading it or transporting it to a holding area/composting site for drying/composting. This can be effective if done regularly and thoroughly, but it does require adequate and available agricultural land where manure can be spread or suitable facilities for holding manure or for composting. With in-house storage of manure, efforts should be made to reduce manure moisture below 50 percent (preferably to about 30 percent or less) and to maintain this level.

In either system, any practice that limits moisture in the droppings or aids rapid drying is helpful. A few practices to follow include:

1. Prevent leaks in waterers. Inspect the pit daily to check for leaks, and repair them when found.
2. When the water table is high or there is a danger of water running in from the outside, adjust the floor/grade relationship so that the floor of the house is higher than the surrounding ground and water runs away from the building.
3. Provide abundant ventilation both in the manure pit for effective drying and in the house for bird comfort.
4. Avoid excessively high house temperatures that encourage abnormal water intake.
5. Avoid rations that are laxative.
6. Use absorbent litter where practical.
7. Maintain proper insulation on water lines to prevent condensation.

In facilities designed for in-house storage of manure, accumulated droppings, if left undisturbed with adequate ventilation and free of additional moisture, will form a cone-shaped mound under the cages and allow for natural composting.

Undisturbed manure accumulations normally support large populations of parasites and predators of breeding flies. These parasite/predator populations primarily consist of predaceous beetles, mites, and parasitic wasps. The build-up of these natural fly enemies is usually slower than that of flies. Populations high enough to substantially benefit fly control can develop only if the manure is not disturbed for relatively long periods of time. To encourage parasites and predators:

- Maintain dry manure,
- Remove manure in cooler months when flies are less active,
- Stagger manure removal over a few weeks to preserve beneficial insect populations, and,
- Minimize the use of insecticides in the manure pit/storage area.

Additional sanitation practices are also important in fly control. Remove dead birds daily and dispose of them properly. Minimize accumulations of spilled feed and broken eggs that attract flies and pest beetles. On the outside, keep grass and weeds adjacent to poultry houses mowed to eliminate resting areas for adult flies and to allow for adequate air movement around the buildings.

### **Biological Control**

As indicated above, cultural/manure management practices encourage the survival and buildup of beneficial predators and parasites that can suppress house fly populations. Keeping manure dry also encourages the increase in other insects that compete for nutrients in the manure habitat.

Such beneficial organisms as predaceous mites and small black hister beetles (*Carcinops pumilo*) will readily feed

on house fly eggs and first-instar house fly larvae. Another group of beneficial insects is tiny parasitic wasps. Female wasps oviposit their eggs in fly pupae. Inside the fly pupa, the developing larval wasp kills and consumes the fly before it emerges.

With proper dry manure management predaceous mite and hister beetle populations often build up in higher numbers. Parasitic wasps (often called “parasitoids”) usually occur naturally in lower numbers. Control using these parasitoids is sometimes based on mass releases of commercially reared parasitoids. Parasitoids are currently available from several commercial insectaries. For a release program to be successful, the producer needs to consider which parasitoid species are best suited for their particular operation and in what numbers to release them and when. Check with the suppliers of these parasitoids for recommendations.

Other insects, such as the darkling beetle (lesser mealworm) and dermestid beetles, often build up in high numbers under dry manure management. They can be beneficial in competing for the nutrients in the manure and prevent house fly buildup. However, they are responsible for damaging poultry structures (wood and insulation), harboring poultry disease organisms, and often being the cause of nuisance complaints when manure is transported and field applied with higher beetle populations. Control of these beetles is addressed later in the publication.

### Mechanical Control

Screens and fly traps are two methods of mechanical fly control, if used properly. Where possible, doors and windows should be screened to prevent entry of flies, especially in processing areas. Several kinds of fly traps are available. Usually, these traps are electrical, employing a black light with an electrically charged grid to kill the insects, or they may be baited traps with a fly attractant material. Traps do appear to be helpful in tight, enclosed areas where good sanitation practices are followed. However, in areas of heavy fly populations, traps are not effective in reducing fly numbers

to satisfactory levels. They are best used as a supplement to other fly control procedures.

### Chemical Control

Insecticides should be considered as supplementary to sanitation and management measures aimed at preventing fly breeding. Producers should monitor fly populations on a regular basis (as described below) to evaluate their fly management program and to decide when insecticide applications are needed. Chemical insecticides can play an important role in an integrated fly control program. However, improper timing and indiscriminate insecticide use can lead to increase fly populations. Also, selective application of insecticides can avoid killing beneficial fly predators and parasites.

Insecticide applications may be directed to adult flies (adulticides) or fly larvae (larvicides). Methods of application include sprays (knockdown, residual), baits, and feed additives. Recommended insecticides for fly control in poultry are listed in Table 1.

#### Space Sprays, Mists and Fogs

These sprays are designed for quick knockdown and kill of flies with no residual action. They are usually the most effective and economical method to control potentially heavy populations of adult flies. Because they do have very little residual activity, resistance to the insecticides recommended as space sprays is low, especially when using products containing synergized natural pyrethrins. There are many machines on the market designed to produce the small particle spray desired for this type of application.

Space application should be made to the point of “filling” the room with the spray mist. Treatments should be made as frequently as needed to keep fly numbers down below identified nuisance levels. This method of fly control is best achieved in the cooler early morning hours when flies are resting higher up in the house and ventilation fans can be safely turned off during the time of spraying without causing increased house temperatures.

**Table 1. Insecticides For Fly Control**

Method of Application	Active Ingredient/Product
Space Sprays	synergized pyrethrins - several formulations permethrin (Ectiban, Atroban, others) - several formulations
Residual Sprays	permethrin (Ectiban, Atroban, others) - several formulations cyfluthrin (Tempo) lambda-cyhalothrin (Demand) tetrachlorvinphos (Rabon) tetrachlorvinphos (Rabon) + dichlorvos (Vapona) - (Ravap)
Baits	methomyl (Blue Streak, Golden Mairin, Stimukil)
Larvicides (Manure Treatments)	pyridine (Pyri-Shield, Archer) cyromazine (Larvadex 2SL) tetrachlorvinphos (Rabon) tetrachlorvinphos (Rabon) + dichlorvos (Vapona) - (Ravap)
Larvicide (Feed Additive)	cyromazine (Larvadex 1% premix)

### **Residual Sprays**

Treating building surfaces with residual sprays has been a common practice over the years. Dependence on this method has led to high levels of fly resistance of the available insecticides used as residual sprays. Also, treated surfaces tend to quickly get covered over with dust, and this could reduce fly exposure on the treated surface. Residual sprays should be used sparingly and only as a last resort to control fly outbreaks that cannot be managed with other techniques.

### **Fly Baits**

Baits are a viable part of an integrated fly control program to maintain low fly populations. They are a very effective supplement to sprays. Commercial dry baits, in granular form, are readily available. Bait placement should be on walkways/aisles, avoiding application into the manure pit and other areas where flies tend to congregate. Baits must also be placed out of reach of birds and placed so they don't contaminate food and water sources.

### **Larvicides**

Direct application of chemical larvicides to the manure surface to kill fly maggots should be avoided, except for spot treatments. This is especially so with products (e.g., pyrethroids, organophosphates) that will destroy beneficial insects inhabiting the manure. Cyromazine and pyridine spot treatments of small areas with high numbers of maggots can be effective and yet have a minimal effect on the beneficial insect population and potential fly resistance development in the manure.

### **Feed-Through Larvicides**

Cyromazine (Larvadex) is the only feed-through insecticide for breeding flies registered for caged layers. It is an insect growth inhibitor and kills fly larvae before development is completed. Its selective mode of action does not adversely affect natural fly predators. Larvadex premix is blended into the egg layer ration at the rate of 1 pound of premix per ton of feed for fly control. It passes through the bird's digestive tract and is present in the manure essentially in its unaltered state. It has no adverse effect on feed palatability or consumption, or on eggs or meat.

Cyromazine will give best results when intergraded into a well-managed fly control program. Use of this product too frequently can be expensive. Also, where it has been used extensively, high levels of fly resistance have been reported. It is best to use Larvadex after a complete manure. After cleanout, it can be fed to the birds continuously for 4 to 6 weeks. Its use after that should be avoided until the next cleanout. This will reduce the chance of development of fly resistance. If adult flies should become a problem during its use or after the time it is used, then proper adult fly control measures should be carried out.

### **Monitoring Fly Populations**

A standardized, quantitative method for monitoring fly populations should be part of a fly control program for making control decisions. Visual observations of fly populations alone

are subjective. Of sampling methods available, the use of spot cards and/or sticky ribbons is most widely accepted.

Spot cards are 3 by 5 inch white file cards placed in a poultry house upstairs in high-rise or shallow pit caged layer operations and/or in the manure pit. They can be suspended from strings or fastened to support posts, ceilings, or other areas where flies tend to settle. Placement is also best where there is little air movement and where workers or equipment will not disturb the cards. Several cards can be placed in a facility, with date of placement and location noted on the cards.

Once placed, cards should be left for a period of 7 days and replaced with new cards at the same place each week. The number of "fly specks" on the exposed side (one side) of each card should be counted and recorded in a record keeping notebook. Generally, 100 or more spots per card indicates the need for fly control measures. The use of spot cards is a simple, cost-effective, and widely adapted method for assessing fly populations week after week. It also provides documentation of fly activity over the course of time.

Sticky fly ribbons/tapes are another means of monitoring fly activity in a facility. One method to use them is to select locations to hang them up for weekly intervals. However, used this way, they often tend to dry and get dirty over time and become less effective in capturing flies. A more suitable way to use them is to take a fresh tape, hold it out in front at waist level, and walk at a steady pace the length of the house down one walkway between cages and back another walkway. Flies caught on the tape can then be counted and recorded. One to two fly tapes should be used per house at least once a week. Generally, 100 or more flies caught per tape indicates the need for fly control measures.

## **BEETLES**

### **Important Species**

Two species of beetles that commonly inhabit poultry manure and litter accumulations are the lesser mealworm or darkling beetle (*Alphitobius diaperinus*) and the hide beetle (*Dermestes maculatus*). Adults and larvae of both species can become extremely abundant in poultry manure and litter, especially in drier poultry wastes that accumulate in poultry buildings.

On one hand, these beetles can be considered beneficial in that they compete in the same habitat as house flies and can help aerate and dry manure, making it unsuitable for house fly development. On the other hand, both beetles can cause extensive damage as mature larvae bore into structural materials seeking areas to pupate and complete their development. They are also known as potential vectors of several poultry disease pathogens (e.g., acute leukosis-March's disease, fowl pox, numerous pathogenic bacteria, and poultry tapeworms). Large beetle populations, especially of darkling beetles, may become a public nuisance at cleanout time because of adult beetle migration from fields where manure is spread into nearby residential areas.

The adult lesser mealworm is dark brown or black and about 1/4 inch long. Larvae are wireworm-like, yellowish brown, and up to 3/4 inch long. They spend most of their

time in the manure or litter feeding on damp and moldy grain sources. Development ranges from 40-100 days, depending on temperature. When mature, larvae seek drier areas of the manure or litter and crack and crevice areas to pupate. They will bore into walls and can destroy house insulation in seeking areas to pupate. Once adult beetles emerge, they can live from 3 months to a year.



Lesser mealworm beetle adults  
(Photo courtesy: Van Waters & Rogers Inc.)

Hide beetles are larger than darkling beetles, about 1/3 inch long. Scavenging hide beetles feed on bird carcasses, skins, hides, feathers, dead insects, and other animal and plant products. Broken eggs and dead bird accumulations in the manure enhance hide beetle populations. Development ranges from 20 to 45 days or more. Mature larvae often bore into wood posts, beams, and paneling to pupate. Adult hide beetles can live from 60 to 90 days.



Lesser mealworm larva and adult  
(Photo courtesy: Van Waters & Rogers Inc.)

## Beetle Control

In controlling these beetles in infested poultry houses, applying dusts and sprays to manure and litter is fairly effective, but it can destroy other beneficial insect populations. A thorough house cleaning, combined with chemical control when the birds are removed, will usually suppress beetle populations, at least for a short time. Migration within the poultry house may be reduced by applying insecticide sprays to pit walls and posts.

During time when manure is removed from a building, especially during warmer weather, efforts should be made to treat the manure to control developing flies and beetles. Treating the manure pit with a recommended insecticide, a few days before it is removed, will kill active stages of these insects. Once manure is removed from the building, if it is immediately spread, treatment of the field may be necessary to kill surviving beetles. If stockpiled, treatment of the manure surface will provide further control. Thorough tarping of stockpiled manure will also kill developing flies and beetles in the manure. A minimum of 2 weeks under the tarp will assure proper insect kill.

Recommended insecticides for beetle control are listed in Table 2.

## EXTERNAL PARASITES

Several species of lice and mites make up the complex of external parasites of poultry. The physical damage caused by these pests may result in lowered egg production, reduced weight gain, and carcass downgrading. Also important is the nuisance to people handling eggs that are crawling with mites.

## Poultry Lice

There are several species of chewing lice that may attack chickens, turkeys, ducks, and other domestic fowl. These lice do not suck blood. Most species chew dry skin scales, feathers, or scabs on the skin. Some species may ingest blood exuding from irritated skin.

**Table 2. Insecticides for Beetle Control**

Method of Application	Active Ingredient/Product
Residual - Premise	Cyfluthrin (Tempo) - spray, dust Lambda-cyhalothrin (Demand) - spray Tetrachlorvinphos (Rabon) - spray dust Tetrachlorvinphos (Rabon) - dichlorvos (Vapona) - (Ravap) - spray Carbaryl (Sevin) - spray, dust Pyridine (Pyri-Shield, Archer) - spray
Manure/Litter Treatment	Cyfluthrin (Tempo) - spray, dust Tetrachlorvinphos (Rabon) - spray dust Tetrachlorvinphos (Rabon) + dichlorvos (Vapona) - (Ravap) - spray Carbaryl (Sevin) - spray, dust Pyridine (Pyri-Shield, Archer) - spray
Bait	Carbaryl (Sevin) Boric acid (SafeCide)

Poultry lice are wingless, six-legged insects with a flattened body and broadly rounded head. Lice eggs are laid on the host's feathers, and most species complete a generation from egg to adult in 2 to 7 weeks. The entire life cycle is spent on the host, and lice are not found elsewhere except by accident. They are considered host specific and feed on poultry only. With normal poultry management, lice are seldom encountered except in small farm flocks or in floor-raised birds.

### Poultry Mites

#### Chicken Mite (*Dermanysus gallinae*)

The chicken mite feeds by sucking blood from the birds at night. It hides in cracks and crevices in the poultry house during the day. If you examine crack and crevice areas, you may see masses of these small mites, their eggs, and the silvery skins cast by the immature mites. Chicken mites are more of a warm weather (summer) pest and may go unnoticed unless you examine birds at night. In heavily infested flocks, the birds have pale combs and wattles. They become droopy and weak, may have feather loss, and may become more susceptible to other parasites and to disease. Chicken mites probably prefer to feed on chickens but will feed on all kinds of domestic fowl (including turkeys and ducks) and wild birds.



Chicken lice

#### Northern Fowl Mite (*Ornithonyssus sylviarum*)

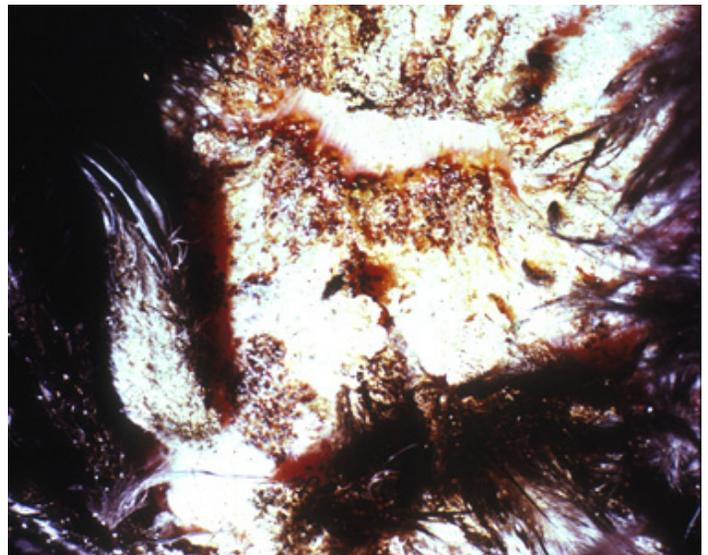
The northern fowl mite is the most important and common external parasite infesting poultry. It infests a wide variety of domestic fowl and wild birds and is found throughout many temperate regions of the world.

These small blackish-brown pests spend their entire life cycle on a host. They congregate near the vent, tail, and, occasionally, the back. Adult female mites lay their eggs on the host bird in the fluff feathers. The entire life cycle can be completed within a week under favorable conditions. Populations can rise rapidly after a bird has been initially infested. When conditions are optimal, newly infested birds may support mite populations in excess of 20,000 per bird by 9 to 10 weeks. The feathers will darken because of the excrement and eggs from the mites. Scabbing of the skin may develop in the vent region.

Severe anemia and death may result in birds infested with large northern fowl mite populations. Mite-stressed birds usually reduce food intake, lose weight rapidly, and exhibit a pale pink comb, and there can be lowered egg production in layers (up to 10 to 15% in higher infestations). Mites can also annoy egg handlers and other personnel.

Northern fowl mites are more of a problem in cool weather (winter), but they may be found on birds the year round. Also, even though they normally live on the host, northern fowl mites can survive for 2 to 3 weeks, at room temperature, off the host. Therefore, removing birds from an infested house and replacing them 2 weeks later may not solve the pest problem.

Northern fowl mites are normally transmitted from bird to bird by contact or simply by crawling to new hosts. Mites may be introduced into a clean house by introduction of infested birds or by wild birds. Populations can readily build up on young birds 20 to 30 weeks of age. Birds older than 40 weeks usually do not support many mites.



Northern fowl mite infestation

The detection of an initial low mite population that can be controlled effectively and economically is important in a mite-monitoring program. With early detection, only part of the caged-layer house may need to be treated. At least 10 randomly selected birds from each cage row in the entire house should be monitored weekly. The vent area should be examined under a bright light, and the feathers parted to reveal the mites. Cages with one or two birds often have more

mites than those with more birds, and, because of variation in susceptibility among birds, one bird may have mites while its cage mates have few or no mites.

The following index can be used for estimating infestation levels:

- 0 = no mites
- 1 = 1 to 50 mites (light)
- 2 = 50 to 1000 mites - small clumps of mites on skin and feathers with beginning frass on some feathers (moderate)
- 3 = 1000 to 25,000 mites - more frass accumulation on feathers and around vent (moderate to heavy)
- 4 = 25,000+ mites - numerous large clumps of mites on skin and feathers with dense frass on at least 25% of feathers and skin pocketed with scabs (heavy)

Control efforts should be considered when index ratings of 2 or higher are detected.

### Lice and Mite Control

Sanitation and cleanliness help prevent infestations of lice and mites. A poultry house should be clean and parasite free before new birds are moved in. New birds should be checked and free of infestation before being brought in. Once a flock is in the facility, care should be taken to prevent contamination from workers and equipment. Mites and lice can be transferred from an infested house to an uninfested house by contaminated egg flats, bird crates, and other equipment. Wild birds and rodents can harbor and disseminate these parasites as well (especially mites).

The decision to treat a flock is influenced by age of birds, time of year, and distribution of the infestation. It is not economical to treat older birds, because external parasite populations are unlikely to increase as compared to a younger

flock. With lice and northern fowl mites, infestations are likely to increase in cooler months.

Chemical control of lice and northern fowl mites requires direct pesticide application to the bird, especially the vent region for northern fowl mites. Use sufficient pressure (100–125 psi) to penetrate the feathers. A thorough premise treatment should be made as well, especially for chicken mite infestations.

Recommended pesticides for lice and mite control are listed in Table 3.

### Chiggers

Chiggers that attack poultry are the same tiny larval stage of mite that attack people. They attach themselves to the skin of poultry, causing abscesses and extensive areas of inflammation. Infested birds may become droopy and emaciated, and refuse to eat. Chiggers feed in clusters that may result in scabby lesions that require 3 weeks to heal after the chiggers leave the host. These lesions result in the downgrading of the bird carcass if slaughtered at this time. Because chiggers are found on grass, weed, and other low growing vegetation, they are a problem to poultry on pasture.

To control chiggers on poultry range or pens, carbaryl or malathion (sprays or dust) can be used.

### FOR ALL RECOMMENDED INSECTICIDES/ACARICIDES FOR POULTRY PEST CONTROL

For all insecticides/acaricides listed in this publication, read and follow all label directions for proper mixing instructions, application rates, and precautions. It is illegal to use any pesticide in any manner inconsistent with the label. Any trade names listed are for convenience only. No endorsement of products is intended, nor is criticism of unnamed products implied.

Method of Application	Active Ingredient/Product
Bird Treatment	Permethrin (Ectiban, Atroban, others) - spray, dust Malathion - spray Tetrachlovinphos (Rabon) - spray, dust Carbaryl (Sevin) - spray, dust
Premise Treatment (for Chicken Mite)	Permethrin (Ectiban, Atroban, others) - spray, dust Malathion - spray Tetrachlorvinphos (Rabon) - spray, dust Tetrachlorvinphos (Rabon) + Dichlorvos (Vapona) - (Ravap) - spray Carbaryl (Sevin) - spray, dust

READ AND FOLLOW ALL LABEL INSTRUCTIONS. THIS INCLUDES DIRECTIONS FOR USE, PRECAUTIONARY STATEMENTS (HAZARDS TO HUMANS, DOMESTIC ANIMALS, AND ENDANGERED SPECIES), ENVIRONMENTAL HAZARDS, RATES OF APPLICATION, NUMBER OF APPLICATIONS, REENTRY INTERVALS, HARVEST RESTRICTIONS, STORAGE AND DISPOSAL, AND ANY SPECIFIC WARNINGS AND/OR PRECAUTIONS FOR SAFE HANDLING OF THE PESTICIDE.

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