



Bulletin

Extension

Poultry Pest Management

Bulletin 853

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Ohio's Restricted Pesticides

Under Ohio's Pesticide Use and Applicator Law, certain pesticides are restricted and can be obtained and used only by pesticide applicators and public operators licensed by the Ohio Department of Agriculture, and by those individuals who obtain a User's Permit from their county Extension agent.

Certain restricted pesticides, when used, require that notification be given to occupants of lands within 1,000 feet of the boundaries of an open area or field to be treated at least 24 hours prior to the application. Occupants should also be informed of the precautions necessary to be observed for safety of humans and animals.

Licensing

Any person who applies a pesticide on public property must be licensed by the Ohio Department of Agriculture or be a trained applicator working under the supervision of a licensed applicator. This is true even if the pesticide is not restricted. For application procedures and additional information, contact:

Pesticide Regulation Section

Ohio Department of Agriculture
Reynoldsburg, OH 43068
1-800-282-1955
614-728-6383
Fax 614-759-1467

Rinsing Containers

New hazardous waste regulations went into effect November 19, 1980. These regulations require that empty containers, which contained chemicals classified by EPA as hazardous waste, and waste pesticides be disposed of in a designated hazardous waste site, unless triple rinsing and other requirements are followed by commercial pesticide applicators. Farmers or private applicators are exempt from the new regulations, providing they follow the disposal instructions on the pesticide label when they dispose of waste pesticides and empty containers.

Triple rinsing each emptied pesticide container, using the rinse in the tank mix whenever possible or disposing of the residue on the farm, is required. Triple-rinsed containers may be disposed of at a sanitary landfill.

Disclaimer Clause

This publication contains pesticide recommendations that are subject to change at any time. These recommendations are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used.

Due to constantly changing labels and product registration, some of the recommendations given in this writing may no longer be legal by the time you read them. If information in these recommendations disagrees with the label, the recommendation must be disregarded. The label is the law.

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Control of Flies In and Around Poultry Houses

Ohio ranks second in the nation behind California in caged-layer egg production.

One of the largest management problems facing the poultry producer of today is fly control. The shift from many small farm flocks to fewer large poultry operations has greatly increased fly problems by providing concentrated breeding areas in large volumes of waste that cannot be removed frequently. As urbanization and rural nonfarm residence increase, poultry producers are faced with increasing pressures to reduce fly populations to low levels. Fly populations (manure breeding flies) may cause a public health nuisance, resulting in poor community relations and threats of litigation. A dedicated effort is necessary to achieve an acceptable level of fly control.

There are several kinds of flies common in and around caged layer houses in Ohio. Probably the most common flies are the house fly and the little house fly. About 95 percent of problems involve the house fly. Both of these flies are capable of movement up to 20 miles from the site of development, but normally move no more than a mile or two from the initial source.

House flies, *Musca domestica* L., about 1/4 inch long, breed in moist, decaying plant material, including refuse, spilled grains and spilled feed, and in all kinds of manure. Consequently, house flies are more likely to be a problem around poultry houses where sanitation is poor. These flies prefer sunlight and are very active, crawling over filth, people and food products. This fly is the most important species from the standpoint of spreading human and poultry diseases in addition to flyspecking of eggs. House flies are the intermediate host for the common tapeworm in chickens. Flies carry millions of bacteria.

The **little house fly**, *Fannia canicularis* (L.), about 3/16 inch long, is somewhat smaller than the house fly. This fly prefers a less moist medium than the house fly in which to breed and reproduce. Poultry manure is preferred over most other media. This fly prefers shade and cooler temperatures and is often seen circling aimlessly beneath hanging objects in the poultry house, egg room and feed room. It is less likely to crawl about on people and food. However, it does cause persons living near poultry establishments to complain about fly problems. The little house fly may hover in large numbers in nearby garages, breezeways and homes because it prefers shade.

The **black garbage fly**, *Ophyra aenescens* (Wiedemann), is slightly smaller than the house fly, shiny bronze-black colored, wings held straight back, tends to stay on the food source at night rather than resting on the ceiling or outdoor vegetation, as does the house fly. The female fly seems to have limited flight activity, but has been found about five miles from its breeding area. Although black garbage fly larvae have been known to exterminate house fly populations, they should not be considered entirely beneficial due to the buildup of large numbers on the farm and the ability to disperse as adults in nearby communities. All stages are found throughout the year under suitable conditions with rather good tolerance to cold weather. The life cycle is similar to the house fly.

Blow flies, sometimes known as green or blue bottle flies, are slightly larger than house flies and sometimes occur in poultry houses. They prefer to breed and reproduce in decaying animal and bird carcasses, dog manure, broken eggs and wet garbage. Generally, a good sanitation program will hold these flies in check.

Other flies found on the poultry establishment include **soldier flies**, **small dung flies**, **fruit flies** and **rattailed maggots**.

Fly Biology

All flies pass through four life stages: egg, larva, pupa and adult. Adult flies deposit small, white oval eggs on the breeding media, and creamy, white larvae (maggots) develop in this moist (wet) material. Mature maggots crawl out of this material and move to a drier place for pupation. The brown seedlike puparia finally yield adult flies. Development from egg to adult fly may take place as quickly as seven to ten days under ideal conditions. Adult house flies live about three to four weeks with females laying between two to twenty batches of 75 to 200 eggs at three to four day intervals. A pair of flies beginning operation in April, if all were to live, would result in

191,010,000,000,000,000,000 (191 quintillion, 10 quadrillion) flies by August. Allowing 1/8 cubic inch to a fly, this number would cover the earth 47 feet deep. Of course, this does not happen due to beneficial predators and parasites. Flies in the poultry house can be present the year around if there are warm temperatures and no true diapause.

Cultural Control

Manure management is the most effective means for fly control. As many as 1,000 house flies can complete development in one pound of breeding material. **Fresh poultry manure contains 75 percent to 80 percent moisture.** Fly breeding in this material can be practically eliminated by reducing the moisture content to 30 percent or less or by the addition of moisture to liquefy it. Drying manure is preferred because it occupies less space and usually has less odor.

Dry Manure Management

Frequent removal of manure (at least weekly or more often) prevents fly breeding because it breaks the fly breeding life cycle. It is important to scatter the manure lightly outdoors to kill the eggs and larvae by drying. Avoid piling or clumps of manure. Adequate agricultural land is needed to spread manure.

Manure drying time can be speeded up by providing 2 inch x 3 inch slats spaced at three inch intervals running lengthwise about 15 inches under each cage. This additional exposed surface causes droppings to dry more quickly and to accumulate in cones in narrow rows.

In-house storage of manure requires drying the manure to a 30 percent moisture level and maintaining this level where sufficient storage space is available. 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

- Prevent leaks in water troughs or cups. Regulating water flow to an on/off cycle may help eliminate the moisture problem. Use drip pans under water troughs, if necessary.
- Provide abundant cross ventilation beneath the cages, especially during hot weather. Thirty-six inch pit fans across the manure is good. A curtain above the manure every 100 feet, to keep air velocity over the manure, helps. Adequate house ventilation is important at all times.
- Should the water table be high, or if there is a danger of water running into the house from the outside, adjust the floor-grade relationship so that the house floor is higher than the outside surrounding ground. Have the surface water run away from the building. Drain and fill all low areas around the houses.
- Prevent dysentery by keeping waterers clean. Use recommended antibiotics should dysentery develop.
- Avoid laxative feed rations.
- Avoid excessively high house temperatures that encourage abnormal water intake.
- Practice good husbandry by restricting excess water consumption.
- There are new housing systems designed to dry manure in the pits.

Sanitation

Sanitation is the most important aid in successful fly control. Often, certain conditions in and around the poultry operation will encourage fly outbreaks. They must be eliminated. Sanitation actions to follow:

- Quick removal and disposal of dead birds and broken eggs. Dispose of far away from the poultry premises by burning in an incinerator, deep-ground burial or through commercial garbage collectors on at least a weekly basis during the damp, hot, summer months.
- Cleaning up and disposing of feed spills and manure spills, especially if wet.
- Reduce feed spills.
- Most egg collections today are by conveyor belts at a central location to reduce chance of broken eggs.
- Clean out weed-choked water drainage ditches.

- Install proper eave troughs and downspouts on poultry houses to carry rain water far away from the buildings. Provide proper drainage in poultry yards.
- Minimize sources from other fly-infested animal operations in close proximity to the poultry house.

Biological Control

Entomologists are quite interested in using biological control in poultry houses. It is important to purchase beneficials climatically adapted to the region where releases are made. IPM Laboratories, Main Street, Locke, NY 13092-0300, Telephone: 315-497-2063, Fax: 315-497- 3129 is one of the commercial companies currently selling fly parasites tailored to the northeast climates, such as Ohio, for fly control.

These fly parasites are the naturally occurring enemies of manure-breeding flies. Flies are destroyed in the pupa stages. These parasites are very tiny wasps, *Muscidifurax zaraptor*, about the size of the head of a house fly (1/16 to 1/8 inch) which live in the manure, feeding on fly pupa. Adult female parasites lay an egg on the fly pupa within the puparium. Then the developing parasite larva consumes the pupa and emerges as an adult parasite. These fly parasites are specific to flies and do not attack anything else. They are biteless and stingless to humans and go unnoticed. They self-propagate in the process of controlling pest flies. However, due to low parasitism levels, mass releases are needed. Also, each wasp lays less eggs than each fly over the same time period, making it necessary to start with an initial wasp release with weekly supplemental releases following. Releases occur before and during the fly season. Chemical sprays must be discontinued in areas of the poultry house where these wasps are used. Never treat the entire manure surface with insecticides, with the exception of cyromazine (Larvadex), otherwise, both beneficial insects as well as pest flies will be killed. A strict sanitation program is required under fly parasite releases involving manure management, water management, weed mowing, etc. Keep manure dry, since wet manure promotes fly pest breeding and inhibits beneficial insect breeding. Also, when the poultry house is cleaned out, leave areas of old dry manure to provide a reservoir of beneficials to repopulate the house as new flies occur.

The use of fly parasites for biological control in Ohio would reduce chemical residues to humans, birds, eggs and the environment. However, to date, claims that wasps will provide long-term fly control have not always been backed up by scientific research results. Remember to manage the habitat for biological control by keeping the manure dry. Remove manure only during the fly-free time of the year and eliminate insecticide sprays in the manure pits. Undisturbed poultry manure accumulations over long periods of time will support large populations of native fly parasites (wasps and mites) and fly predators (beetles). Be sure to encourage native strains of beneficials already present in the dry manure to populate.

According to a Cornell and Penn State Cooperative Extension Publication, titled "Pest Management Recommendations for Poultry," other beneficials in poultry manure include mites and beetles. Both are major predators in caged-layer operations. The macrochelid mite *Macrocheles muscaedomesticae*, is reddish-brown, less than 1/16 inch long and feeds on both house fly eggs and first-instar larvae. These mites found on the outside layer of manure can 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, 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. Also, another hister beetle, *Gnathoncus nanus*, is present at lower numbers on northeast poultry farms.

Mechanical Control

A paint roller sometimes can be a helpful tool used to crush (mash) concentrations of newly emerged flies, reducing needless and expensive insecticide applications. It takes newly emerged flies 24 hours before they can fly. Watch every day the stages of fly development. Mature, large fly larvae will slowly change into pupae in three to seven days out of the manure at edges around posts.

Operate manure scrapers every time the feeders are operated to effectively scrape fresh manure droppings down into the pits.

Many types and styles of fly traps appear on the market each year. These traps are usually electrical, employing a black light with an electrically charged grid to kill the insects. Some traps are baited with a fly attractant material.

Traps do appear to be helpful in tight, enclosed areas such as egg rooms, where there is a breeding fly population, if good sanitation practices are followed. However, in areas of heavy fly populations, traps are not effective in reducing fly numbers to satisfactory levels. Use traps in the middle of the night away from doors and windows.

One should judge a trap by the population of flies remaining in the area and not by the number of flies caught in the trap. Most entomologists feel that fly traps, especially where used alone, are not an effective method of controlling flies, especially in and around livestock and poultry operations.

Use good tight screens on the poultry house doors and windows. Use screens 14 to 16 mesh to the inch. Copper, aluminum, bronze, plastic or rust-resisting screens are best.

Use a fan to blow air through a screened doorway from the egg room or other work area into the main poultry house. **Flies will not move against the wind into the egg room or other work area.** There are commercial electric-powered air curtain fans. However, certain state health departments may require solid doors between the egg room or other main work area into the main poultry house.

Use sticky fly strips where appropriate.

Surveillance

It is important to monitor fly populations in order to make wise control decisions. Visual observations alone can be misleading. One needs to know the fly's behavior patterns and history. Documentation is very helpful in legal defense if needed.

Moving tape count-is the best surveillance method taking about five minutes each day walking on a 1,000 foot walk to catch 25 to 75 flies. Walking down and back in each house is cheap and easy. Use the same walk pattern, the same time of day, when carrying the sticky fly tape.

Sticky fly tapes-which hang, often tell nothing. Tapes fill up fast during the summer months within a chicken house. However, one can determine fly species. Some 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.

Speck fly count-a three inch by five inch white file card fastened flush against feed troughs, ceilings, braces or other fly resting areas, left for a period of several days to a week, will provide documented evidence as to the number of "fly specks" counted on a given date, over a period of time within a given house. Place cards on head rafters (three cards per house) and count fly specks on one side. Change cards once each day or week, depending on populations present. Fifty or more spots, per card per week, may indicate fly control measures are

required. Place cards in the same position at each renewal. Fly species cannot be determined from the spots. The spot card method is very economical.

Baited jug trap-is more expensive than other sampling methods, but offers greater sensitivity to fly population changes. A plastic milk jug, with four access holes (two inches diameter) around the upper part of the jug with a wire attached for hanging about three feet above the floor around the pit periphery, may indicate need for control. The jug is baited with a commercial fly bait (about 1 oz.) placed inside the jug bottom. Use fly pheromone muscalure (Muscamone) for effectiveness.

Larval sampling-It is most important to walk the pits to determine "hot spots" where the manure appears flattened, wet and contains heavy populations of fly eggs and maggots. Always take a hoe or trowel to sample the larvae present. Keep pits walkable, clean and water-free. "Hot spots" usually appear where water has laid in the manure. Some may carry a knapsack sprayer to treat only the "hot spots" to halt excessive fly larval breeding. Treating manure widely and excessively will kill beneficial agents. It is best not to treat with chemicals in the manure pits. Pit manure should appear tall, narrow, capped and dry with perhaps beetles present to assist in aerating the manure, making it drier. (Manure will cone with proper fly management.) Beneficial arthropods should be monitored and establishment encouraged to suppress fly populations.

Chemical Control

Insecticides should be considered **supplemental** to sanitation and management measures must be directed to prevent fly breeding. Accurate records should be kept on insecticides and dosage rates used.

Fly resistance to insecticides has developed at differing levels in various poultry house locations, depending somewhat on prior exposure. The use of a variety of different classes or families of insecticides can minimize the development of resistance. Rotate the use of organophosphate, carbamate, pyrethroid, and other classes of insecticides when necessary.

Residual Sprays

Residual sprays usually are the most effective and economical method for controlling potentially heavy populations of adult flies of any species present. These sprays should be applied in the spring at the beginning of fly season. Application after manure removal will reduce fly buildup that usually follows the house clean-out. A second application should be made five to six weeks later. (Two sprays are required.) Apply to surfaces on which flies locate, such as poultry house framework, the ceiling, walls, trusses, wires supporting cages, electric light cords and other areas marked by fly specking. Also, treat outside the poultry house around openings and on shrubs and other plants where flies rest.

Apply coarse, low-pressure sprays to the point of runoff at pressures of 80 to 100 pounds per square inch, using a power sprayer or good proportioner-type sprayer. Depending on the insecticide used and the type of surface sprayed, treated areas may remain toxic 2 to 15 weeks.

Avoid contamination of feed, water and eggs. Cover drinking and feed troughs during spraying. Do not spray birds.

Any of these residual sprays are recommended:

1. cyfluthrin (Tempo): Use 19 grams Tempo 20% WP per two gallons of water. Apply two gallons of diluted mixture per 1,000 square feet as a coarse wet spray. Birds have to be removed from the building before spraying. Follow label directions.
2. dichlorvos (Vapona): Use one quart Vapona 40.2% EC per 25 gallons of water. Apply one quart of diluted mixture per 1,000 square feet as a coarse, wet spray. Birds do not have to be removed from the building before spraying. Follow label directions.

3. dimethoate (Cygon, Residual Fly Spray): Use one gallon of Cygon or Residual Fly Spray 2 EC per 25 gallons of water. Apply one gallon of diluted mixture per 500 to 1,000 square feet of surface as a coarse wet spray. Birds must be removed before spraying. Do not contaminate feed or water. Follow label directions.
4. malathion: Use five tablespoons of 57% EC per gallon of water. Apply one to two gallons of diluted mixture per 1,000 square feet as a coarse, wet spray. Birds do not have to be removed from the building before spraying. Follow label directions.
5. permethrin (Atroban): Use 6.67 ounces permethrin 25% WP per five to ten gallons of water. Apply one gallon of finished spray per 750 square feet as a coarse, wet spray. Follow label directions. Permethrin (Insectaban, Insectrin, Insectrin X, Hard Hitter): Use one quart 5.7% EC per 10 gallons of water or six ounces 25% WP per 11 gallons of water. Apply one gallon of finished spray per 750 square feet as a coarse, wet spray. Follow label directions. Permethrin (Permethrin II): Use one quart 10% EC per 25 to 50 gallons of water. Apply one gallon of diluted mixture per 1,000 square feet as a coarse, wet spray. Permethrin (Expar, Permaban): Use one pint permethrin 11% EC to 10 gallons of water. Apply finished spray to surfaces where flies rest at the rate of one gallon per 750 to 1,000 square feet or to the point of runoff. Do not apply more than once every two weeks. Birds do not have to be removed from the building before spraying. Cover feed and water. Follow label directions.
6. tetrachlorvinphos & dichlorvos (Ravap): Use one gallon Ravap 28.7% EC per 25 gallons of water. Apply one gallon of diluted mixture per 500 to 1,000 square feet as a coarse, wet spray. Birds do not have to be removed from the building before spraying. Follow label directions.
7. tetrachlorvinphos (Rabon): Use four to eight pounds Rabon 50% WP per 25 gallons of water. Apply one to two gallons of diluted mixture per 1,000 square feet as a coarse, wet spray. Birds do not have to be removed from the building before spraying. Follow label directions.

Portable Mechanical Foggers or Misters

It is often not practical to treat large poultry houses with residual sprays. Portable, lightweight, mechanical fogging machines are convenient, efficient and labor-saving in caged bird operations to quickly reduce adult fly populations, providing quick fly knockdown with poor residual action. Gasoline powered side pack Ultra-Low Volume (ULV) aerosol generator spraying, utilizing micron particle size spray droplets, is a very effective contact application with little or no residual effect. Space applications should fill the room with fog or mist. For indoor space application to kill flies, close windows, doors and shut off all ventilating equipment. Natural pyrethrins, used inside for adult fly control through a ULV machine, are easy to use at 1% pyrethrins + 5% piperonyl butoxide. The ratio of 1:5 pyrethrin to P.b. is the most effective on fly control. When using this equipment, adjusted to deliver aerosol droplets (30 microns or less), apply one oz. of Pyrethrins 1% per 1,000 cubic feet of space. Direct spray toward upper areas of room. Leave room closed for at least one hour. Do not remain in treated areas and ventilate before re-entry. Repeat application as required.

For outdoor ground application to kill flies in open areas near buildings, use preferably when the temperature is cool (75°F or less) and the wind velocity is approximately five MPH or less. Apply at the rate of four ounces per acre in fifty foot swaths. Allow spray drift to penetrate dense foliage. Repeat application as required.

For additional information contact: The Lowndes Engineering Co, 125 Blanchard Street, Valdosta, Georgia 31601 and the Clarke Mosquito Control Products, Inc., 159 N. Garden Avenue, Roselle, Illinois 60172 (1-800-323-5727) have hand-held, backpack, 2-wheel and 4-wheel ULV sprayers for adult fly control inside the poultry house, as well as outside the building. Also, a Hudson Model 98600 Porta-Pack ULV sprayer is quite effective. *Brand names are listed for educational purposes only and must not be considered as an endorsement.* There are several other brands of machines on the market, producing various particle size sprays. Other treatments include using one pint of dichlorvos (Vapona) 1% oil base (Ready-to-use) per 8,000 cubic feet or permethrin (Ectiban)

5.7% undiluted at the rate of four fluid ounces per 1,000 square feet or one pint (16 ounces) permethrin (Permethrin II) 10% EC per 8,000 cubic feet. Rinse spray equipment after application. Fly kill is good. Never retreat more than once in two weeks. Follow label directions and safety precautions.

Stationary Building Atomizers

Treatments are especially useful in closed egg rooms or other work areas where there is little or no air movement. Use pyrethrum oil-base space sprays (0.06% to 0.1% pyrethrins) plus piperonyl butoxide as a mist or fog in the air throughout the poultry house at the rate of 1/2 fluid ounce per 1,000 cubic feet on an "as needed" basis for best fly control.

Baits

Baits are a supplement to residual and aerosol sprays. Place baits outside of cages upstairs in the high-rise house. They can be effectively applied on clean walkways by using a simple push-type Scott's fertilizer spreader. (Baits falling into the pit may destroy beneficial parasites.) These selective adulticides suppress low fly populations, maintaining them at a low level. Never apply baits where they could accidentally be eaten by the birds or mixed into the feed. Dry sugar baits of methomyl (Apache, Fatal Attraction, Improved Golden Malrin) are effective. (To reduce potential resistance, rotate the baits. Methomyl is a carbamate insecticide whereas other baits, wet or dry, using dichlorvos (Vapona), trichlorfon (Dipterex) and tetrachlorvinphos, (Rabon), mixed with sugar are organophosphate insecticides. Apply when mixed as soon as possible and do not store for later use.

Resin Strips and Fly Belts

Ready-to-use dichlorvos (Vapona) 20% resin strips can be used at the rate of one strip per 1,000 cubic feet of enclosed area. Strips will need to be replaced as they lose their effectiveness, which is about every three months.

Methomyl (Golden Malrin) fly belts can be attached to surfaces out of reach of food-producing animals. The belt may be cut to any desired length and attached to surfaces such as walls and ceilings. Follow label directions.

Both resin strips and fly belts may become dusty and dirty when in use for long periods of time.

Manure Treatments

Insecticides applied directly to the manure surface to kill maggots are not recommended since beneficial arthropods associated with the manure can be killed. Adding moisture to the manure may result in additional fly breeding. Even spot treatments in small areas have a minimal effect in reducing overall house fly populations. Effort should be made to keep all the manure dry.

Feed Additive

An insect growth regulator known as cyromazine (Larvadex), when blended into a poultry feed ration, will control manure breeding flies in and around caged or slatted flooring layer chicken operations and breeder chicken operations. Do not feed to broiler poultry. Larvadex 1% Premix, produced by Ciba-Geigy Corporation, kills fly larvae before reaching adulthood and does not adversely affect natural predators and parasites. The 1% Larvadex Premix is blended into the feed at the rate of one pound Premix per ton of feed. Larvadex will provide a high degree of fly control and a feeding program must be followed to prevent potential fly resistance. 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 an adulticide such as Rabon or Ravap to reduce the breeding potential. Spray adults for as long as possible. Then check the manure first at "hot spots" in the pits for maggot activity. If maggots are active, start Larvadex in the ration. Feeding could begin March 15 or April 15, depending on maggot activity. Feed

Larvadex continuously as directed for four to six weeks (minimum of four weeks) and, if little or no maggot activity is observed in the manure, discontinue Larvadex feeding. This is usually enough time to break the fly population life cycle. Continue monitoring manure pits and, if maggots become active again, repeat the procedure. 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 during periods of low fly pressure (October, November, December and January) or (November, December, January and February) discontinue Larvadex use for at least four consecutive months per year.

Larvadex use in poultry is limited to use as a feed-through in chickens only and may not be fed to any other poultry species.

To avoid illegal residues, Larvadex treated feed must be removed from layers at least three days (72 hours) before slaughter.

Manure from animals fed Larvadex may be used as a soil fertilizer supplement. Do not apply more than three tons of manure per acre per year. Do not apply to small grain crops that will be harvested or grazed, or illegal residues may result.

Liquid Spray

Larvadex 2SL is a soluble concentrate, which when diluted with water according to the Directions for Use, will act as a larvicide to control fly species which develop in poultry manure and refuse. Larvadex controls fly infestations by breaking the life cycle at the maggot stage.

Larvadex is labeled for fly control in and around chicken layer and breeder operations only.

Do not apply this product in such a manner as to directly or through spray drift expose workers or other persons, except those knowingly involved in the application.

For Housefly, Lesser Housefly and Soldier Fly Control in Poultry Operations Including Layer and Breeder Chickens

Fly control in poultry operations should include appropriate sanitary and management practices to reduce the number and size of fly breeding sites. A successful sanitary and management program may allow less than constant use of insecticides. This, in turn, should prolong the effective life of such control agents.

Northern Fowl Mite

The northern fowl mite, or feather mite, *Ornithonyssus sylviarum* (Canestrini and Fanzago), is a very important external parasite of poultry with heavy populations capable of reducing egg production up to 10 percent to 15 percent. Mites can also annoy egg handlers and other persons. Mites are often first noticed on the eggs. Check for mites first on the vent, then tail, back and legs of layers. Feathers become soiled from mite eggs, cast skins, dried blood from feeding and excrement.

The entire life cycle is completed on the bird and consists of the egg, larva, nymphal stages and adult. The eight legged adult is about 1/26 inch long and dark red to black in color. The entire life cycle can be completed under ideal conditions within a week.

With early detection, only a part of the caged-layer house may need to be treated. Monitor weekly at least 10 randomly selected birds from each cage row in the entire house. Mite populations will increase in cooler weather.

Lice

The chicken body louse, *Menacanthus stramineus* (Nitzsch), can decrease egg production in caged layer hens. The skin of infested birds becomes irritated and red with formation of localized scabs and blood clots. In addition to feeding on skin fragments, feathers and debris, lice can attack young quill feathers feeding on blood. Although found naturally infected with the virus of eastern encephalomyelitis, it is not considered an important vector. Adult chicken lice are flat-bodied, yellowish colored, 1/16 inch long with chewing mouthparts.

Chicken Mite

The chicken mite, *Dermanyssus gallinae* (DeGeer), sucks blood from poultry at night and remains secluded during the day and in cracks and crevices. When numerous, weight gains and egg production can be reduced. These red and gray mites barely can be seen without a magnifying glass. The life cycle may be completed in seven to ten days during warm weather with inactivity during cold weather.

Bed Bug

The common bed bug, *Cimex lectularius* L., occasionally attacks poultry. It hides in cracks within the housing during the day and feeds mostly at night on blood while the host is asleep, causing small, hard, swollen, white welts which become inflamed and itch severely. It is rarely seen on poultry during daylight hours. An infestation can sometimes be recognized by blood stains and dark spots of excreta. The adult is reddish-brown, oval-shaped, flattened and about 1/4 inch to 5/8 inch long. There may be three or more generations per year. No evidence indicates a disease is spread.

Flea

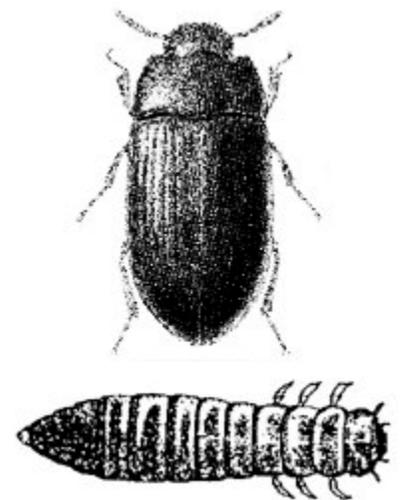
Occasionally the flea is found in the poultry house. It is usually first noticed in the litter where a wide range of hosts are attacked including rats, mice, chickens, humans, etc. Bites annoying egg handlers occur primarily on the ankles and legs causing a raised (swollen) itching spot. The adult flea is an excellent jumper passing through a complete life cycle consisting of egg, larva, pupa and adult. The life cycle varies from two weeks to eight months depending on temperature, humidity, food and species. The most common flea found in Ohio is the cat flea, *Ctenocephalides felis* (Bouche). The adult is 1/16 to 1/8 inch long, dark reddish-brown, wingless, hard-bodied, has three pairs of legs and is flattened vertically (bluegill fishlike).

Darkling Beetle

The darkling beetle or lesser mealworm, *Alphitobius diaperinus* (Panzer), is rapidly becoming more of a nuisance in the poultry operation. Large populations of beetles sometimes migrate into nearby residence areas, especially during litter clean-out time. Although beetles can fly up to one mile, most crawl at night from litter disposed to neighboring fields and homes. Beetles are frequently associated with poultry feed, preferring grain and cereal products that are damp, moldy and slightly out of condition. Both adults and larvae consume poultry feed in amounts costly to the producer. Larvae are known as lesser mealworms.

Increased importance has been placed on control of this beetle. Both adult beetles and larvae act as reservoirs for many poultry pathogens and parasites. Scientists have been able to transmit the causative agent of acute leukosis (Marek's disease) in chickens with this beetle. Positive confirmation of the transmission has been made under both laboratory and field research conditions.

Marek's disease usually affects birds between three and four months old. Symptoms are characterized by various degrees of paralysis, most easily observed in legs and wings. Droopy wings, gasping, loss of weight, pallor and sometimes diarrhea are also symptoms. Birds severely affected may be found lying on their sides



with one leg stretched forward and the other held behind. The disease affects both *broiler* and *egg laying* types of poultry. Losses can reach two percent of the flock *per day*, and mortality may exceed 30 percent of the flock within a few weeks.

Acute leukosis is highly contagious and has been shown to be airborne. Contamination may persist in the environment because the darkling beetle may serve as a reservoir for residual contamination. Beetles have been observed feeding on carcasses of poultry dead of leukosis, and it appears that beetles may become contaminated in the process. Adult beetles are capable of retaining the contamination and transmitting the leukosis when eaten by chickens, in the opinion of some scientists. Other diseases which are spread include the causative agents of avian influenza, salmonella, fowl pox, coccidiosis, botulism and new castle disease. They also act as vectors of cecal worms and avian tapeworms.

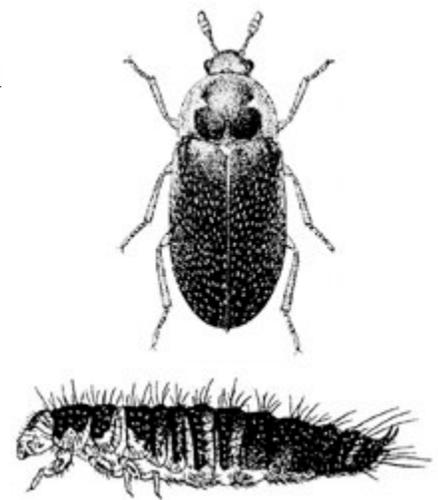
In the poultry house, the beetle can lay up to 800 eggs in litter during a 42-day period. Eggs develop into larvae in four to seven days. The life cycle requires about 42 to 97 days depending on temperature. Beetles live up to three months to a year. Adults are black or very dark, reddish-brown and about 1/4 inch long. Larvae are yellowish-brown (wireworm-like) up to 3/4 inch long and accumulate in dark corners of manure or litter, especially under sacks, in bins or in places where feed is stored. Pupation occurs in the litter, soil and side walls of poultry houses. They migrate frequently throughout the litter generally coming in soil contact.

Adult chickens and chicks are more likely to eat the beetles and their larvae than poults or turkeys.

Consumption of beetles and larvae, rather than providing "extra protein" in the diet, actually has a negative effect on feed conversion and rate of gain according to research.

Hide Beetle

Mature larvae of the hide beetle, *Dermestes maculatus* (DeGeer), have the habit of boring into various hard surfaces to pupate, usually preferring softwoods. Some may climb 24 to 36 feet and bore into wood posts, studs and rafters, seriously weakening and "honeycombing" these structures. Larvae are especially troublesome in poultry houses, damaging yellow pine, foam insulation, styrofoam air baffle boards, paneling, drywall and even PCP (Penta Ready) chemically treated wood in some cases. Larvae emerge from the litter, climb the walls and bore into soft building material, often escaping cannibalism during the pupation period. Hide beetles are larger than darkling beetles, about 1/3 inch long, dark brown on top, with a mostly white undersurface (belly). Each female lays about 135 eggs, which hatch in 12 or more days. The life cycle requires 40 to 50 days. Larvae are thickly covered with long, brown hairs, grow to about 1/2 inch long and have two spines on top near the tail end, which curve forward. Reasonable control has been achieved by applying tetrachlorvinphos (Rabon) 50% WP in the dry form to the building walls. Make treatments with an electrostatic duster so as to negatively charge the particles, providing better adhesion to the wall surface. A distributor for the duster (model DM-9) is Echo Inc., 3150 MacArthur Blvd., Northbrook, Illinois 60062. Hide beetles can be killed with a 1.35% pyrethrin residual emulsion concentrate.



Boric Acid

A new insecticide labelled for control of darkling beetles, hide beetles and flies, known as orthoboric acid (SafeCide), provides long residual control up to nine to twelve months or longer. Both adult beetles and larvae are killed by contact or ingestion.

Usually a quick-kill insecticide is used prior to SafeCide to kill beetles away from the litter. A 99 percent IC and/or 30% bait formulation is applied directly to the manure. For poultry houses in which birds are grown on litter, remove birds before applying the bait uniformly to the floor or to old litter by fertilizer or seed spreader at

the rate of one to two pounds per 100 square feet, in bands along feeder lines. Spread fresh litter at least four inches uniformly over all treated areas (floor or old litter), then introduce birds. Reapply after each growout, if needed.

For poultry houses in which birds are grown in cages (layer or high rise "pit type" houses), birds do not have to be removed prior to application of bait.

For control of beetle adults and larvae in poultry houses using SafeCide IC, remove birds before dry and wet applications. Use one to two pounds for each 100 square feet of treated surface for dry application, dusting side walls, top plates, posts and framing. For wet application, mix dust at the rate of one to two pounds per three gallons of water to apply over 100 square feet of treated surface.

For additional label information, contact:

Schering-Plough Animal Health

P.O. Box 529

Kenilworth, NJ 07033

Telephone (800-293-0477)

Resistance

House fly resistance is genetic in nature, developing more quickly under heavy doses of pesticide or very frequent application. Insects resistant to one insecticide can be cross-resistant to other insecticides of the same class or even having a similar mode of action. The only proven solution to resistance problems is to rotate the use of different classes of insecticides.

Chemical Class or Family

Boron Compound

boric acid (SafeCide)

Botanical

pyrethrins

Carbamate

carbaryl (Sevin)

methomyl (Apache, Improved Golden Malrin, Fatal Attraction)

Organophosphate

coumaphos (Co-Ral)

dichlorvos (Vapona)

dimethoate (Cygon, Residual Fly Spray)

malathion

tetrachlorvinphos (Rabon)

tetrachlorvinphos & dichlorvos (Ravap)

trichlorfon (Dipterex)

Pyrethroid

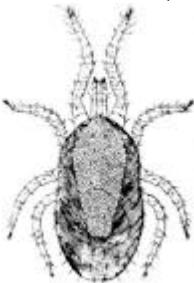
cyfluthrin (Tempo)

permethrin (Atroban, Expar, Insectaban, Insectrin, Insectrin X, Permethrin II, Hard Hitter)

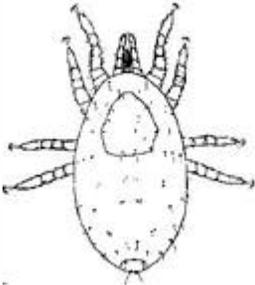
Triazine

cyromazine (Larvadex)

Treatment by Pest and Location of Infestation

Pests	Material and Formulation	Mixing Directions	Amount per bird or Area if Appropriate	Days to Slaughter	Application and Remarks	
Mist Sprays						
Chicken Mites Lice Northern Fowl Mites (Bird Treatment) 	carbaryl (Sevin) 50% WP	10 fl. oz. per gal. water	1 1/2 gals. per 1,000 birds	7	Repeat treatment in four weeks if needed. Ventilate while spraying. Do not spray nests, eggs, feed or water. Do not treat within 10 days of vaccination or other stress influence.	
	80% S	6 fl. oz. per gal. water		7		
	4F (43% suspension)	10 fl. oz per gal. water		7		
	tetrachlorvinphos & dichlorvos (Ravap) 28.7% EC	1 pint per 6 gals. water	1 gal. per 100 birds or 1 fl. oz. per bird	0	For cage birds, spray no less than 100 to 125 psi to the vent area from below (high pressure). For floor birds, spray lightly. Do not treat more often than every 14 days.	
	tetrachlorvinphos (Rabon) 50% WP	2 lbs. per 25 gals. water	1 gal. per 100 birds or 1 fl. oz. per bird	0	For cage birds, spray no less than 100 to 125 psi to the vent area from below (high pressure). For floor birds, spray lightly. Do not treat more often than every 14 days.	
	Coarse Sprays					
	carbaryl (Sevin) 50% WP	6 fl. oz. per 5 gals. water	1 gal. per 100 birds	7	Repeat treatment in four weeks if needed. Ventilate while spraying. Do not spray nests, eggs, feed or water. Do not treat within ten days of vaccination or other stress influence.	
	80% S	4 fl. oz. per 5 gals. water		7		
	4F (43% suspension)	6 fl. oz. per 5 gals. water		7		
	Dusts					
carbaryl (Sevin) 5% Dust	Ready to use	1 lb. per 100 birds	7	Use rotary or other duster. Do not treat birds more often than once every four weeks. Do not treat nests, eggs, feed or water.		
Dust Boxes						
carbaryl (Sevin) 5% Dust	Ready to use	2.5 lbs. per box 1 box per 50 birds	7	Mix dust evenly throughout top layer of box contents.		
tetrachlorvinphos (Rabon)	Ready to use	2.5 fl. oz. per 50 birds	0	Mix dust evenly throughout top layer of box contents.		

	50% WP				

Treatment by Pest and Location of Infestation					
Pests	Material and Formulation	Mixing Directions	Amount per bird or Area if Appropriate	Days to Slaughter	Application and Remarks
Northern Fowl Mites (Bird Treatment) 	Mist Sprays				
	permethrin (Insectrin X, Permethrin II) 10%	1 qt. per 50 gals. water	1 to 2 fl. oz. per bird	0	Aim spray at the vent area. Cover or remove feed and water. Can spray cages or nests. Do not treat more often than once every two weeks.
	Course Sprays				
	permethrin (Atroban, Expar) 11% EC	1 pt. per 25 gals. water	1 gal. per 100 birds	0	Pay particular attention to vent. One application should eliminate an infestation.
	(Insectrin) 5.7% EC	1 qt. per 25 gals. water		0	
(Permethrin) 25% WP	6 oz. per 11 gals. water	1 to 2 fl. oz. per bird	0		

Treatment by Pest and Location of Infestation					
Pests	Material and Formulation	Mixing Directions	Amount per bird or Area if Appropriate	Days to Slaughter	Application and Remarks
Lice Northern Fowl Mites (Bird Treatment)	Dusts				
	permethrin Insectrin GP, Permethrin) 0.25% Dust	Ready to use	1 lb. per 100 birds	0	Apply with shaker or hand duster. Treat vent area thoroughly.

Treatment by Pest and Location of Infestation					
Pests	Material and Formulation	Mixing Directions	Amount per bird or Area if Appropriate	Days to Slaughter	Application and Remarks
Chicken Mites Lice Northern Fowl Mites (House and Litter Treatment)	Sprays				
	permethrin (Permethrin) 25% WP	6 fl. oz. per 34 gals. water	1 gal. per 750 sq. ft.	0	Spray ceilings, walls, empty cages or nests to runoff. Repeat seven to ten days as needed

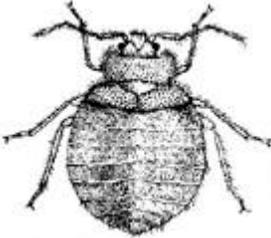


tetrachlorvinphos & dichlorvos (Ravap) 28.7% EC	2 qts. per 24 gals. water	1 to 2 gals. per 1,000 sq. ft.	0	Apply thoroughly to litter, walls, roosts, cracks and crevices.
tetrachlorvinphos (Rabon) 50% WP	2 lbs. per 25 gals. water	1 to 2 gals. per 100 sq. ft.	0	Apply thoroughly to litter, walls, roosts, cracks, crevices and interiors.
carbaryl (Sevin) 50% WP	2 lbs. per 25 gals. water	1 to 2 gals. per 1,000 sq. ft.	7	Do not treat poultry or game birds. Apply spray to wall, litter or roost surface. Force spray into cracks. Repeat as needed. Avoid contamination of nests, eggs and feeding and watering troughs. Ventilate while spraying.
80% S	1 1/2 lbs. per 25 gals. water	1 to 2 gals. per 1,000 sq. ft.	7	
4F (43% suspension)	4 qts. per 100 gals. water	1 to 2 gals. per 1,000 sq. ft.	7	
XLR (56.6% suspension)	4 qts. per 100 gals. water	1 to 2 gals. per 1,000 sq. ft.	7	
Dusts				
carbaryl (Sevin) 5% Dust	Ready to use	1 lb. per 40 sq.ft.	7	Treat litter evenly and repeat in 28 days if needed. Do not contaminate feed and water.
tetrachlorvinphos (Rabon) 50% WP 3% D	Ready to use	2.5 fl. oz. 50% WP or 1 lb. 3% D per 100 sq.ft.	0	Treat litter thoroughly and evenly.
Roost Paints				
tetrachlorvinphos & dichlorvos (Ravap) 28.7% EC	1 gal. per 25 gals. water	1 pt. per 100 ft. of roost	0	Spray or treat by brush (thoroughly), especially cracks and crevices.
tetrachlorvinphos (Rabon) 50% WP	4 lbs. per 25 gals. water	1 pt. per 100 ft. of roost	0	Treat by brush (thoroughly), especially cracks and crevices

Treatment by Pest and Location of Infestation					
Pests	Material and Formulation	Mixing Directions	Amount per bird or Area if Appropriate	Days to Slaughter	Application and Remarks
Northern Fowl Mites Cockroaches Mosquitoes (House and Litter Treatment)	Sprays				
	permethrin Insectin X, Permethrin II) 10%	1 qt. per 25 to 50 gals. water	1 gal. per 1,000 sq. ft.	0	Spray to the point of runoff. Cover birds, feed, water. Do not treat more often than once every

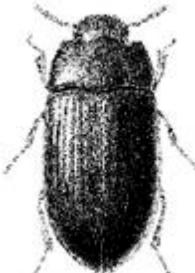
					two weeks.
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Treatment by Pest and Location of Infestation					
Pests	Material and Formulation	Mixing Directions	Amount per bird or Area if Appropriate	Days to Slaughter	Application and Remarks
Chicken Mites	Sprays				
	carbaryl (Sevin) 50% WP	2 lbs. per 25 gals. water	1 to 2 gals. per 1,000 sq.ft.	7	Repeat treatment in four weeks if needed. Ventilate while spraying. Treat walls, bedding, litter and roost surfaces. Force spray into cracks and crevices
	80% S	1 1/2 lbs. per 25 gals. water		7	
	4F (43% suspension)	1 qt. per 25 gals. water		7	
	tetrachlorvinphos & dichlorvos (Ravap) 28.7% EC	2 qts. per 24 gals. water	1 gal. per 100 birds or 1 oz. per bird	0	For cage birds, spray no less than 100 to 125 psi to vent area from below (high pressure). For floor birds, spray lightly. Do not treat more often than every 14 days
	tetrachlorvinphos (Rabon) 50% WP	2 lbs. per 25 ga;s. water	1 gal per 100 birds or 1 oz. per bird	0	

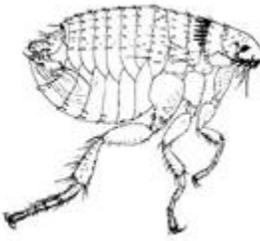
Treatment by Pest and Location of Infestation					
Pests	Material and Formulation	Mixing Directions	Amount per bird or Area if Appropriate	Days to Slaughter	Application and Remarks
Bed Bugs 	Sprays				
	carbaryl (Sevin) 50% WP	2 lbs. per 25 gals. water	1 to 2 gals. per 1,000 sq. ft.	7	Thoroughly spray walls, bedding, litter and roost surfaces. Force spray into cracks and crevices. Ventilate while spraying. Do not apply directly to poultry, nests or eggs. repeat as needed.
	80% S	1 1/2 lbs. per 25 gals. water		7	
	4F (43% suspension)	4 qts. per 100 gals. water	1 to 2 gals. per 1,000 sq. ft.	7	Ventilate while spraying litter surfaces. Repeat as needed.
	XLR (56.6% suspension)	4 qts. per 100 gals. water	1 to 2 gals. per 1,000 sq. ft.	7	Ventilate while spraying litter surfaces. Repeat as needed.

	cyfluthrin (Tempo) 20% WP	19 grams per 2 gals. water	2 gals. per 1,000 sq. ft.	0	Do not make applications while birds are present in the facility. Also, allow spray to dry before restocking facility.
Dusts					
	carbaryl (Sevin) 5% Dust	Ready to use	1 lb. per 40 sq. ft.	7	Apply evenly to litter and repeat in 28 days if needed. Do not treat feed, water, nests, or eggs.

Treatment by Pest and Location of Infestation

Pests	Material and Formulation	Mixing Directions	Amount per bird or Area if Appropriate	Days to Slaughter	Application and Remarks
Darkling Beetle (Lesser Mealworm) 	Sprays				
	carbaryl (Sevin) 4F (43% suspension)	50 qts. per 100 gals. water	2 gals. per 1,000 sq. ft.	7	Ventilate while spraying litter surface. Repeat as needed.
	XLR (56.6% suspension)	50 qts. per 100 gals. water	2 gals. per 1,000 sq. ft.	7	
	tetrachlorvinphos (Rabon) 50% WP	2 lbs. per 25 gals. water	1 to 2 gals. per 100 sq. ft.	0	Apply thoroughly to litter, walls, roosts, cracks, crevices and interiors
	Dusts				
	carbaryl (Sevin) 5% Dust	Ready to use	1 lb. per 40 sq. ft.	7	Do not treat more than once every four weeks. Do not apply to eggs or nests. Clean houses before treatment if mealworms are a great problem (sanitation). Avoid excess gain in litter and moisture. Treat floor litter.
	cyfluthrin (Tempo) 20% WP	Ready to use	19 grams per 1,000 sq. ft.	0	Apply Tempo 20 WP to litter, walls and enter posts inside the house. Best control will be obtained when application is made shortly after bird removal because larvae and adults begin to burrow deeper in the litter as surface temperatures begin to cool, making control difficult. Use a properly calibrated airblast, boom or power handgun sprayer that will achieve full coverage. Treat only when no birds are present.

	tetrachlorvinphos (Rabon) 50% WP	Ready to use	.75 fl. oz. per 100 sq. ft.	0	Treat litter evenly and thoroughly
Baits					
	carbaryl (Sevin) 10%	Ready to use	24 oz. per 1,000 sq. ft.	0	Spread evenly before new litter is applied or on top of built-up litter. Birds do not have to be removed during application. Optimum treatment is 10 to 14 days after birds are placed in the house. Repeat treatment two weeks later if needed. Follow label directions

Treatment by Pest and Location of Infestation					
Pests	Material and Formulation	Mixing Directions	Amount per bird or Area if Appropriate	Days to Slaughter	Application and Remarks
	Dusts				
Fleas 	Carbaryl (Sevin) 5%	Ready to use	1 lb. per 100 birds	7	Do not treat birds more often than once every four weeks. Do not treat eggs, feed or water.
	5%	Ready to use	1 lb. per 40 sq. ft.	7	Apply evenly to litter and repeat treatment in 28 days if needed. Do not treat feed, water, nests or eggs.
	10% Dust	Ready to use	1/2 lb. per 40 sq. ft.	7	