

Crop Profile for Chicken in Virginia

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Photography Center

General Production Information ^{1, 2}

- In 2003, Virginia farmers ranked 9th nationally in broiler chicken production. 1.34 billion pounds worth \$590,172,000 were produced in 2004.
- 21,099,000 chickens worth \$1,329,000 were produced in 2004.
- In 2003, Virginia farmers ranked 31st nationally in egg production. 761 million eggs worth \$69,758,000 were produced in 2004.

PRODUCTION REGIONS ¹

The Shenandoah Valley has approximately 590 chicken farms and is Virginia's top poultry-producing region. Rockingham County is the nation's second largest turkey-producing county. The top five poultry-processing companies in Virginia are Cargill Turkey Products, George's Foods, Pilgrim's Pride Corporation, Perdue Farms, and Tyson Foods.

Cultural Practices ^{3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14}

Poultry Housing: Poultry houses must protect the birds from predators, weather, injury, and theft. Birds are kept in either wide-span or high-rise (deep-pit) houses. It is important that the facilities are dry and draft free, with doors or windows that can be opened if necessary. Houses should be well insulated and built on high areas with floors that slope toward the door to prevent flooding. Doors should be installed so they open into the poultry house, not out. The windows, exercise pen, and front of the building should face south so poultry will get plenty of sun and warm air. Newly constructed facilities should be laid with a concrete floor and a border of cinderblocks at the base of the walls. Windows and doors should be covered with heavy gauge mesh or screening to keep out predators and pests. Wire fencing enclosing outdoor pens should be buried 1 ft. deep and extend out 6 inches so that burrowing animals will not be able to dig under the fence. Hazardous objects, including perches that are 4 ft. or more above the floor, should be removed from the poultry house. Feeders and waterers should be kept with the bottoms and top lips at back height to prevent spillage. When possible, waterers should be placed outside to reduce humidity in the poultry house. Poultry houses should not be downwind from others, nor should gas or dust be exchanged between houses. Trim foliage around outdoor fencing to remove groundcover for predators or rodents. Cross ventilation should be provided under cages in hot weather to keep birds cool and manure dry.

Good Rearing Practices: To prevent leg and foot disorders in young poultry, feed hens adequate rations with plenty of vitamins and minerals, especially D3 and riboflavin. Soon after being laid, put eggs into incubators that are held at an adequate level of humidity. Feed young birds rations developed specifically for their type of poultry.

Chicks should not be reared on slippery surfaces or they will develop leg problems. Walking surfaces should be absorbent and should give birds good traction in the first two weeks of life. Burlap, cloth towels, or paper towels are recommended flooring materials. After two weeks, a 3-inch base of pine shavings, straw, or peanut shells should be provided. However, do not use corncobs and sawdust because these materials can pack down and get moldy. Remove wet litter before it can lead to foot infections. Keep other animals and children away from young poultry because of the risk of injury to both parties. Do not catch young poultry by their legs because they can become crippled as a result.

Use cooling pads, foggers, and roof sprinklers to keep poultry cool in hot weather. Stress and cannibalism can be reduced by providing enough room for each bird, maintaining even temperatures, using soft light for no more than 16 hours a day, ensuring that birds have enough room at feeders and waterers, supplying a balanced diet, and keeping different species or varieties of poultry apart.

Meat Chickens: The best broiler chicken breeds are the *Rock-Cornish* crossbreed and the *Cornish*, *Plymouth Rock*, or *White Jersey Giant* breeds. Birds with light-colored plumage are preferred because they produce more attractive carcasses after slaughter. Broiler chickens need 1.5 - 2 sq. ft. of floor space per bird. Remove wet litter before it causes breast sores and leg problems. Broiler and fryer chickens need a balanced ration of starter mash or crumble pellets with 20%-23% protein. Roasters require a 20% protein starter feed for the first six weeks, but they are later switched to an 18% protein grower ration. Another option is to initially feed roasters a ration of 90% starter with 10% corn for the first six to ten

weeks, followed by 80% starter and 20% corn. Birds need 3 inches of feeder space per individual. Feeders should be only one-third to one-half full to reduce waste. Broiler chickens require at least 6 gal. of fresh water per 100 birds daily. Clean waterers daily, and repair leaks immediately. Light is important; one 25- to 40-watt bulb should be installed every 100 sq. ft. Meat birds do not require roosts or nests because they are slaughtered before they reach production age. Fryers are slaughtered at four to five weeks (2-3 lbs.) or six to nine weeks (4-5 lbs.). Roasters are slaughtered between nine and 14 weeks.

Egg-Layer Chickens: The best layer breeds are *White Leghorn*-type hybrids that produce white eggs and are most efficient at converting feed to egg production. *Reds* or *sex-linked* hybrids give large brown eggs and are appropriate for small family flocks. These birds are known for both their good meat and good supply of eggs. Chickens that lay brown eggs are more docile than the white egg-laying breeds. Purebred poultry are not as efficient producers as are crossbreeds. It is most economical to get started pullets that are 18-22 weeks old and ready to lay eggs. Layer hens should be brought into production at around five months old. Layer hens need 1.5 sq. ft. of space per bird. There should be 3-6 inches of litter on the floor. Pine shavings are best, but anything virtually dustless and absorbent will suffice. Layers need a balanced ration; they should not be fed table scraps or whole grains because production may decrease. Hens should receive an 18%-20% protein starter feed for their first two months, followed by a 14%-15% protein grower or developer until they reach five months of age. Thereafter, give them a 16%-18% protein layer ration along with free-choice grit and oyster shells in a separate feeder. Layers need 5 gal. of water per 100 birds daily. Waterers should be erected so that the lip is level with the back of the birds to prevent contamination. There should be 1 inch of water space per bird, and waterers should be cleaned and refilled daily. In caged-layer facilities, poultry are provided with food and water within their cages. Use windows and fans to keep the henhouse dry and aerated. Hang one 25- to 40-watt bulb above the feed and water area, with one additional bulb per 40 sq. ft. of pen. To achieve maximum production throughout the year, birds must be exposed to 14-16 hours of light daily. If light decreases, hens will stop producing-thus, extra light is needed in fall and winter. Unlike meat birds, layers need 6 inches of roost space set 2 ft. above the floor per bird. There must be at least one nest (10 sq. in.) for every five hens. Place nests 2 ft. off the floor and away from the roosts. Nesting material should be kept clean (or replaced), and eggs should be collected two or three times a day. Exercise yards are not necessary, but if they are used, confine the birds to an area with 5-10 sq. ft. per bird. Some causes of reduced egg production include shorter day length, improper nutrition, too little water, disease, old age, and stress (e. g., cold, rough handling, fright, predators, or parasites). Eggs are typically collected via conveyer belts, but occasionally by hand. Henhouses may hold between 10,000 and 50,000 birds.

Biosecurity: Adopt safety measures to minimize losses due to diseases and pests, as well as to prevent their spread. People, birds, and contaminated equipment are the most frequent sources of infection. Clean and disinfect poultry facilities thoroughly between flocks to minimize the spread of disease. Use only healthy, uninfested birds to restock poultry houses. If brooder houses are on the same property as growing houses, they should be upwind and at least 0.5 to 1 mile away. Visitors that come in contact with breeders or experimental birds must be free of contamination. Install fence enclosures, and keep unnecessary visitors, children, and pets away from the flock. Provide footbaths, showers, and protective clothing for workers to disinfect themselves. Trucks and equipment should be cleaned and disinfected frequently. Workers should not come into contact with different species or age classes of poultry without

changing clothes and disinfecting themselves first. Control rodents and wild birds to minimize exposure to infectious diseases or pests.

Manure Management: Remove manure annually (or more frequently, if possible). In deep-pit houses, manure accumulates for two to four years and is removed by a tractor. Manure is removed in wide span houses by scraping (shallow pits located behind the cages are cleaned frequently) or flushing (pits are cleaned with water that flows to a waste lagoon). One thousand birds can produce between 1.1 and 1.4 tons of litter each year. Broiler litter can be used as a feed supplement for cattle or to fertilize field crops. Litter must be stored and applied properly to avoid contaminating water sources. Methods to keep litter dry (thus maintaining the nitrogen content) include reducing water spillage and providing proper ventilation/heating. There are three types of litter storage: temporary (stockpiling), open, and permanently roofed. Poultry litter should be stored on high ground with good drainage that is no closer than 100 ft. to streams or drainage ways. Use concrete or compacted clay at the bottom of the pile to limit leaching into soil and groundwater. The distance between the base of the pile and the highest level of the groundwater table should be at least 4 ft. Litter piles should be at least 100 ft. from wells or drinking water and no closer than 150 ft. to dwellings or production facilities. Manure cleanouts should be scheduled just before fertilizing crops. No more than 5 tons should be applied per acre. Do not apply litter in or just before rain or snow. For temporary stockpiling, cover litter with plastic sheets held in place with old tires. Litter can be stored over longer periods on top of concrete ground liners, which prevent nitrogen leaching and bacterial contamination. Poultry litter may also be composted, which can take anywhere from two to six months to complete. Add materials that are high in carbon, such as leaves, paper, and sawdust, to reduce the amount of nitrogen that is lost to the environment during the composting process. Poultry manure is typically composted in windrows or bins. Bin composting is the easiest method. You may use grain bins, bulk storage buildings, or wooden structures with slatted floors and a roof.

Worker Activities

Take appropriate protective measures depending on what activity is in progress in the poultry facilities. Risks of exposure to pesticides are greatly reduced by wearing personal protective equipment such as glasses, boots, coveralls, gloves, masks, and hats. Poultry handlers are most likely to be exposed to pesticides while handling or mixing products before they are applied. Exposure via the skin, mouth, or nose is possible if pesticides are spilled, splashed, or become airborne during preparation. Dermal, oral, and inhalation exposure are also possible during the treatment itself. Workers are more likely to be exposed to pesticides when using high-pressure sprayers (75-100 psi) or power dusters to control pests. In addition to being sprayed, poultry may be dipped to treat for ectoparasites. Dipping increases the risk of exposure because the animals must be handled directly, and splashing is very likely to occur. There is a decreased risk in treating poultry facilities when low-pressure sprayers (< 50 psi) or dusters are used. Dust is rarely used to treat large commercial flocks, but it is still used by those with smaller flocks. Pesticide-impregnated plastic strips hung in poultry houses pose a risk of dermal or oral exposure to

those who hang them. Gloves should be worn when placing rodent-control products on the premises to prevent skin contact with pesticides. The risk of exposure to pesticides via contact with eggs, surfaces, or animals is very minimal unless the treatment has occurred recently. Once poultry have been treated initially, they are not usually handled again until they are moved to other facilities or taken to slaughter. Typically, poultry houses are treated just before a new flock arrives. The risk of worker exposure to pesticides increases with each additional pesticide application. Since broilers and turkeys are raised on open floors, the greatest risk of pesticide exposure is through the litter. Pesticides may be broken down within one to two weeks by naturally occurring chemical and biological agents. Litter is sometimes treated with larvicides. The risk of exposure is small, however, because workers rarely contact the poultry waste directly. Insect growth regulators (e.g., cyromazine) may still be present in litter during cleanout. However, most pesticides will decompose by that time. Nonetheless, workers should still take precautions and wear protective equipment when removing poultry litter.

Special Use Labels

Section 18 Emergency Use Exemption and Special Local Need 24(c) labels are used to supplement the chemical tools available to producers for pest control. Once the problem or gap in pest control has been identified, specialists submit the proper documentation for the Emergency Use/Special Local Need label. Thus far, Extension specialists have been successful in obtaining these labels. Special Local Need (SLN) labels in Virginia are granted by the Virginia Department of Agriculture and Consumer Services (VDACS) and are usually only valid for limited time intervals. However, a fee must be paid annually by the registrant to keep the product registered for use in Virginia. Section 18 Emergency Use labels are evaluated and granted by the Environmental Protection Agency (EPA) and can be renewed annually.

Arthropod Pests 5, 6, 15, 16

Control recommendations found below were modified from information presented in the 2005 Virginia Pest Management Guide (Field Crops), unless otherwise noted.

General Guidelines for Pest Control

Residential areas are increasingly encroaching on poultry facilities as more and more farms are sold to make way for housing developments. Consequently, a greater effort is required to control disease-carrying pests in order to avoid disturbing neighbors and incurring lawsuits. Poultry facilities are growing ever larger. This means more manure and flies are being produced with an even greater potential to annoy neighbors. One pound of manure with a moisture content of 50%-85% can yield 1,000 house flies. Fresh poultry manure is 75%-80% moisture, which is perfect for fly breeding. Large

populations of flies are difficult or impossible to control without using integrated pest management. General fly management techniques follow, along with descriptions of specific pests and treatment recommendations.

Monitoring: There are several ways to monitor pest populations, each with its own pros and cons. The easiest way to monitor fly populations is to use the *moving tape method*. A roll of fly tape is unfurled completely and held by the tape loop with the carton almost touching the floor. The surveyor walks the length of the poultry house at least twice, holding the tape by his/her side or slightly in front. The number of flies caught on the tape is recorded twice a week at the same time each day and then compared. The moving tape method is used to determine whether it is appropriate to begin chemical or mechanical control. Sticky fly tapes also tell what fly species are present in the poultry facilities. Typically, if the weekly fly count is more than 100 flies, treatment should begin. Tapes are easy to use, but they can be messy, and location is important. Also, they are not as useful as other methods. A cheap way to monitor fly populations is to do a *fly-speck count* using a white 3x5 card affixed for up to a week to surfaces upon which flies rest. If more than 50 specks/card/week are found, then the fly population should be treated. Place new cards in the same spot as the old card. A more expensive-but more reliable-method to monitor fly activity is to use a *baited jug trap*. Drill four access holes (2 inches wide) into the upper part of a plastic milk jug, which is hung by wire 3 ft. above the pit edge. The jug is most effective when baited with 1 oz. of commercial fly bait and the fly pheromone Muscalure. In addition to monitoring adult fly populations, *larval counts* may be taken. Manure pits should be walkable, water free, and clean in order to facilitate larval monitoring. Manure will "cone" with proper fly management; it should not be flattened and wet. If larval "hot spots" are found in the pit, only these areas should be treated. Otherwise, beneficial insects will be harmed.

Chemical Control: Use chemicals only as a last resort if biological, cultural, and mechanical controls are ineffective. Areas where beneficial insects live should not be treated with broad-spectrum pesticides. When possible, use specific baits in order to attract and control only the pests of interest. Space sprays have little residual activity, so flies are less likely to develop chemical resistance to them than to other types of chemical applications. However, this is not true of automated dispensing systems. Pesticides applied in this manner will work only one fly season, and by the end they do not work well at all. As a general rule, **DO NOT** use pesticides indiscriminately without monitoring the pest population first. Pesticides can be administered in several different forms, including:

- **Fly Baits:** Baits are cheap, easy, and kill adult flies that are not controlled during the larval stage by natural enemies. They are first administered at the start of fly season and then reapplied once a week through summer and early fall. Baits are put into containers or glued to cardboard so they do not fall into manure pits and kill natural enemies. Baits should be used after all floor litter and manure have been removed. To be most effective, bait should be applied liberally and in conjunction with other control methods, such as contact sprays. Do not use baits where animals or children may find them. Alternate chemical classes of baits to limit fly resistance.
- **Contact Sprays:** Contact sprays should be used if moving tape counts indicate that the fly population is growing unchecked by natural control agents. These sprays kill upon contact and have a very quick knockdown action. They also have a short residual life and will not prevent

later infestations. Do not use contact sprays in manure pits or apply directly to birds, eggs, feed, or water.

- **Residual Sprays:** Residual sprays, which last longer than other sprays, can be used both indoors and outdoors in fly congregation areas. These include buildings, walls, ceilings, partitions, stanchions, posts, and other resting spots. To decrease fly resistance, residual sprays should be used only in houses where the moving tape count indicates the fly population is becoming a problem. Take care to avoid contaminating feed or water. Apply residual sprays immediately after manure is removed to avoid an explosive increase in the fly population. A second application should be made five to six weeks later. **DO NOT** spray birds. Treated areas will remain toxic two to 15 weeks later.
- **Spray-on Larvicides:** Larvicides should be used until moving tape counts indicate a significant decrease in fly numbers. Spot treatments of manure are acceptable, but widespread coverage kills only some of the fly larvae while killing most biological control agents. Adding moisture may actually make the manure a better breeding ground for flies. Use larvicides with other sanitation efforts for best results.
- **Feed Additives:** Cyromazine is an effective feed additive for the control of flies. It does not affect beneficial insects, but its use can lead to fly resistance. Feed additives should be used with other control methods to be most effective.

Biological Control: Biological control agents are also known as beneficial organisms or natural enemies. Natural enemies can significantly impact fly populations in caged-layer and breeder houses when used in conjunction with cultural controls. Poultry manure should be kept very dry and undisturbed in order to encourage reproduction of control agents. Beneficial organisms can be *parasitoids*, which are tiny, stingless wasps that lay their eggs inside immature insects; *predators*, which are insects and mites that feed on fly eggs and larvae and breed in manure like the pests; or *pathogens*, such as viruses, bacteria, and fungi. The most common house fly parasitoids are *Muscidifurax* and *Spalangia* species. Predatory organisms include *Macrochelis muscadomesticae*, a reddish brown mite that eats house fly eggs and young larvae on the manure surface; *Fuscuropoda marginata*, a mite that feeds on young fly larvae living inside manure piles; and hister beetles (*Carcinops pumilio* and *Gnathoncus nanus*), which eat house fly eggs and young maggots. The predaceous black garbage fly larva, *Hydrotaea aenescens*, has been mass reared and released in Virginia to control fly populations. Natural pathogens of poultry pest insects include *Entomophthora muscae* and *Beauveria bassiana*. High-rise poultry houses should never be completely cleaned out. One quarter of the manure should remain so that beneficial insects may breed within the material. Biological control is not as effective in shallow-pit houses, but if the manure is kept dry, it is more successful.

Mechanical Control: Mechanical control methods consist mainly of traps and screens. Traps alone are not effective; they must be used in conjunction with other control methods. They are virtually useless in areas of high infestations, but they can be helpful in tight quarters such as egg rooms if they are used with good sanitation practices. Electrical traps can be equipped with a black light and baited with fly attractant to be more effective. Traps should be used at night, away from doors and windows. Flypaper should be changed every few weeks to remain effective. Door and window screens must be maintained and patched, if necessary, to keep flies out of facilities. Fans can be used to blow air out of egg rooms-

flies will not travel against the wind to get into a room.

Cultural Control/Sanitation: Dead birds should be buried, incinerated, composted, or rendered. Remove garbage, spilled feed, manure, and broken eggs regularly. Diseases and parasites are spread within a flock via carriers; newly introduced birds; eggs from infected flocks; humans; dust, feathers, or manure on equipment or supplies (e.g., trucks, coops, and egg flats); wild animals; and contaminated feed, water, or air. Delivery or veterinary personnel should be required to wear sanitized boots, coveralls, and caps provided by the poultry farm to minimize the risk of spreading pests or diseases. Poultry facilities should be disinfected and left empty for two weeks before the arrival of new birds. Flies breed in moist manure. Leaky waterers are the major source of wet manure, so they should be inspected daily and fixed immediately. Ventilation is important because it helps to reduce moisture and rid the poultry house of noxious odors. Manure should be liquefied or dried out to 30% moisture. Litter should be removed annually during the cooler months when flies are less active. Spread it thinly on fields, or disk it under immediately. Stored manure should be covered with black plastic. Keep poultry houses cool to keep birds from consuming too much water, thus increasing the moisture content of their manure. Vegetation should be trimmed around the houses. Remove junk, trash, and equipment to more effectively control flies and rodents. Equip facilities with proper eave troughs and downspouts to carry rainwater away from the buildings. Adequate drainage in yards and roadways is also important.

Insect Pests 4, 17

The major pest insects of chickens and poultry facilities are flies, feather lice, northern fowl mites, darkling beetles, and rodents. Ectoparasites (lice, mites, fleas, and bed bugs) are also common on breeding flocks. Birds, along with their housing structures, should be monitored for pests and parasites. If ectoparasites are found, the whole flock should be treated. Flies are not as troublesome for turkeys and broilers as they are for caged-layer birds because the litter usually stays too dry for flies to breed. Northern fowl mites are also more common in caged-layer facilities than in other types of poultry operations.

Poultry-Area Flies 18

Black Flies and Biting Midges 20, 21, 22

Simuliidae and Ceratopogonidae spp.

Black flies are also known as buffalo gnats or turkey gnats, and, along with biting midges, transmit *Leucocytozoon* parasites, which cause a malaria-like illness in turkeys, geese, ducks, and chickens. Female black flies also feed on humans and domestic or wild animals. Black flies appear during the first warm spell of late winter and early spring. Female black flies typically lay their eggs on the surface of or near cool, fast-flowing water from spring through fall. Biting midges are also known as "no-see-ums" and transmit haemoproteus to turkeys, pigeons, and quail. Biting midges are less than 1/8 inch long with narrow spotted, or clear, wings. Biting midges are frequently found at seashores, rivers, and lakeshores.

Females lay their eggs in stagnant water, sand, mud, decaying vegetation, and water-filled tree holes. Biting midges do not move far from breeding sites, but black flies will travel far to find a blood meal. Black flies and biting midges feed during the day, particularly at mid-morning and dusk. Black flies are also very active right before storms. Only female black flies bite, attacking birds around their eyes.

Monitoring: Look for tiny black flies biting birds' faces.

Chemical Control: Chemical controls are largely ineffective against these flies, but see the *Chemical Arthropod Control* section for more information. Chemicals recommended for mosquito control may be used. Black flies are hard to treat because they migrate long distances to feed.

Biological Control: The bacterium *Bacillus thuringiensis v. israelensis* (*Bactimos* or *Vectobac*) is used for mosquito and black fly control. Natural predators include dragonflies and birds.

Cultural/Mechanical Control: Improve sanitation and keep poultry in dark barns during the day. Also, keep birds away from wooded areas and streams, drain stagnant water, and empty containers that collect water.

Black Garbage Fly, *Hydrotaea aenescens* ²²

Black garbage flies, or dump flies, are ¼ inch long, shiny, and a bronze-black color. Adults stay on the food source at night, unlike house flies and little house flies. Females lay their eggs on dead birds, spoiled feed, or very wet manure. Black garbage flies prefer the darker areas of poultry houses and will congregate in manure pits. The life cycle is completed within two to six weeks in summer. Black garbage fly larvae are biological control agents of house fly maggots. They can be mass reared on poultry premises for inundative releases in infested houses. Black garbage flies are not entirely beneficial because populations can explode and move to neighboring homes.

Monitoring: See the *Monitoring* section under *General Guidelines for Pest Control*.

Chemical Control: See the *Chemical Arthropod Control* section for more information.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: See the *Cultural* and *Mechanical Control* sections under *General Guidelines for Pest Control*.

Blow Flies

Lucilia, Calliphora, and Phormia spp.

Blow flies, also known as green or blue bottle flies, breed on bird carcasses, broken eggs, dog feces, and

other garbage. Blow flies are metallic blue, green, or black and are ¼ to ½ inch long.

Monitoring: No monitoring protocol is necessary.

Chemical Control: Chemical control is unnecessary.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: Good sanitation practices will control or eliminate blow fly populations.

Fruit Fly, *Drosophila melanogaster*

Fruit flies are common around rotten or fermented food. They are 1/8 inch long, gray or brown, and usually have red eyes. Fruit flies lay their eggs on the surface of rotting organic materials, such as wet feed, manure, or broken eggs. The most common breeding sites are on dropping boards, or in belt houses where belts are run less than once a week. They are also common in egg rooms, offices, and other cool, shady areas. Fruit flies are annoying and can transmit bacteria or other diseases. Fly populations are highest in the winter months and early spring but decline by summer. Fruit flies are weak fliers and seem to "swarm" when workers walk through poultry facilities.

Monitoring: See the *Monitoring* section under *General Guidelines for Pest Control*.

Chemical Control: Chemical control is unnecessary if proper sanitation procedures are maintained, but see the *Chemical Arthropod Control* section for more information.

Biological Control: No commercial biological control agents are recommended. There are several natural enemies of fruit flies that occur naturally and should be conserved, if possible.

Cultural/Mechanical Control: Sanitation is important. See the *Cultural* and *Mechanical Control* sections under *General Guidelines for Pest Control*.

House Fly, *Musca domestica*

House flies are gray, about ¼ inch long, and present year-round in poultry facilities. Not only are they annoying, but they can spread more than 100 diseases to animals and humans, including avian flu. Flies also carry flatworm and nematode eggs on their feet and in their digestive tract. They later transmit the worms when they are eaten by poultry. They do not affect livestock directly but can cause public health problems, disturb neighbors, and incite legal action by offended parties. House flies can potentially travel up to 20 miles away, but they are usually found within 1-2 miles of their breeding grounds. They reproduce in moist manure, spilled feed, and other decaying organic materials. The house fly life cycle can be completed in as little as a week at optimum conditions. Maggots are white and resemble grains of rice. House flies are active during the day, particularly when temperatures are between 80°F and 90°F.

They are inactive at temperatures below 45°F.

Monitoring: See the *Monitoring* section under *General Guidelines for Pest Control*.

Chemical Control: House flies are highly resistant to many insecticides. See the *Chemical Arthropod Control* section for more information.

Biological Control: See the *Biological Control* section under *General Guidelines for Pest Control*.

Cultural/Mechanical Control: See the *Cultural* and *Mechanical Control* sections under *General Guidelines for Pest Control*.

Lesser House Fly, *Fannia canicularis*

Lesser house flies resemble the house fly but are smaller. Also, they are not as annoying—they do not land on food or people as frequently as house flies. However, they can spread Newcastle disease among poultry. Lesser house flies are not very heat tolerant; their numbers grow in spring, drop off in summer, then increase in the fall. These flies prefer shade and a slightly drier environment than the house fly. Moist or watery poultry manure is their preferred breeding material, but the females will also lay eggs on wet feed or broken eggs. The life cycle takes about three weeks. Females are not very active and are usually found near floor litter and manure while adult males tend to hover aimlessly. Lesser house fly maggots are flat, brown, and spiny, unlike house fly larvae.

Monitoring: See the *Monitoring* section under *General Guidelines for Pest Control*.

Chemical Control: See the *Chemical Arthropod Control* section below for more information.

Biological Control: See the *Biological Control* section under *General Guidelines for Pest Control*.

Cultural/Mechanical Control: See the *Cultural* and *Mechanical Control* sections under *General Guidelines for Pest Control*.

Rat-Tailed Maggot, *Eristalis tenax* ²³

Rat-tailed maggots are large, round, and have a ½-inch-long "tail" through which they breathe. They are found in manure-polluted liquid environments such as runoff ditches, manure pits, and waste lagoons. The adults are known as drone flies and have a fuzzy appearance resembling a honey bee. Adults are actually considered beneficial because they eat aphids.

Monitoring: Rat-tailed maggots are not problematic unless they leave the breeding environment and contaminate feed, cause short circuits in electrical boxes, or congregate in egg carton stacks.

Chemical Control: There are no good chemical control measures, but see the *Chemical Arthropod Control* section for more information.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: Keep waste lagoons in optimum, nearly anaerobic, condition. Solid manure should not be allowed to accumulate at the top of the water. Waste lagoon banks should be kept steep, and weeds must be trimmed regularly. Pump pits once a week to disrupt maggot development. Construct liquid manure tanks according to EPA or Health Department codes.

Mosquitoes, *Culex quinquefasciatus*, *C. pipiens*

Mosquitoes are small flies that can breed in stagnant water near poultry facilities, especially waste lagoons. Female mosquitoes are blood feeders and can spread fowl pox or other diseases, while males feed only on nectar. Mosquitoes are more active at dawn, dusk, and during the night. The mosquito life cycle is completed within one to two weeks in summer.

Monitoring: If more than 20 mosquitoes land to feed per minute, a severe infestation is present.

Chemical Control: See the *Chemical Arthropod Control* section.

Biological Control: No commercial biological control agents are recommended; however, mosquitoes have several natural enemies, including fish, dragonflies, bats, and birds.

Cultural/Mechanical Control: Improve sanitation, keep animals away from wooded or marshy areas, drain wet areas, and empty containers (e.g., tires, clogged gutters, and tree holes) that collect water.

Small Dung Flies, Sphaeroceridae spp.

Small dung flies are minute black or brown flies that are present year-round. They breed in manure or other decaying organic matter and are the first insects to colonize fresh manure. Small dung flies are **NOT** a problem for farm residents or neighbors and do not need to be treated.

Monitoring: No monitoring is necessary.

Chemical Control: Small dung flies should not be chemically treated because they serve as an alternate food source for beneficial hister beetles.

Biological Control: Natural enemies in the environment will keep populations under control.

Cultural/Mechanical Control: Good sanitation practices will help control all types of flies, including

small dung flies.

Soldier Fly, *Hermetia illucens* ²⁴

Soldier flies can be control agents of other, more serious, fly pests, as well as pests themselves. They are more common in high-rise, deep-pit, caged-layer houses. Soldier flies are bluish black and ¾ inch long, with large eyes and long antennae that project forward from the head. Females choose to lay their eggs in drier manure. Soldier fly larvae are large. They churn manure as they develop, which makes the environment less hospitable to house fly maggots. They also inhibit the egg laying of house flies. However, they can liquefy manure until it is hard to remove and may flow into walkways or the foundation of the poultry house. Larvae will also feed on dead birds. Soldier fly adults are weak fliers and spend their time resting in bright, sunny areas on structures or vegetation.

Monitoring: See the *Monitoring* section under *General Guidelines for Pest Control*.

Chemical Control: See the *Chemical Arthropod Control* section for more information.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: See the *Cultural* and *Mechanical Control* sections under *General Guidelines for Pest Control*.

Other Poultry Insect Pests

Bed Bug, *Cimex lectularius* ²⁵

Bed bugs are flat, 1/5 inch long, wingless, and bloodsucking. Bed bugs feed at night, hide during the day, and lay their eggs in cracks of walls and other dark crevices. They can survive one to five months without feeding. Poultry may contract bed bugs from wild birds. Bed bugs release a distinctive raspberry-like smell when crushed. The bed bug life cycle is completed in one to four months. Bed bugs are similar to house flies in that they leave fecal spots on walls, roosts, and eggs. Humans may contract bed bugs from poultry.

Monitoring: Search around cracks and crevices for cast skins, eggs, bloodstains, and spots.

Chemical Control: Call a pest management professional because infestations are typically difficult to control. Inorganic dusts or pyrethroid insecticides can be used to control bed bugs.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: Keep wild birds and rodents away from poultry. Fill cracks and crevices

in which bed bugs may hide.

Darkling Beetle, *Alphitobius diaperinus* ²⁶

Lesser mealworms are immature darkling beetles and are very common in floor-raised poultry and caged-layer flocks. They feed on anything, including animal feed, litter, manure, carcasses, and each other. Mealworms bore holes in wood, fiberglass, polystyrene, and polyurethane, thus causing significant structural damage. Small, round holes in structures are the first obvious sign of infestation. They also vector at least 23 diseases or pests, including Marek's disease, avian flu, coccidiosis, botulism, Newcastle disease, fowl pox, *E. coli*, salmonella, and tapeworms. When consumed by poultry, they cause a drop in production and growth. Adults are reddish brown or black, ¼ inch long, and occur in damp, rotting grain. Females deposit their eggs in manure or litter. Larvae are ¾ inch long, yellow, and resemble wireworms. The life cycle is completed within one and a half to three months. Darkling beetles can become a public nuisance when they disperse to neighbors after poultry manure is removed and spread on the fields. They indirectly control flies in caged-layer facilities by utilizing litter that would otherwise be used for fly breeding. Darkling beetles can fly up to a mile away, but they usually travel by crawling.

Monitoring: Look for beetles in litter, on carcasses, or in crevices. Check for damage at 30- to 40-ft. intervals. Traps can be constructed using 12-inch-long pieces of 2-inch-diameter black PVC pipe filled with rolled-up cardboard. Check traps weekly and count the number of beetles. Treat when beetle presence is over 50 per sq. ft.

Chemical Control: Chemical control is difficult. Clean the poultry house thoroughly, and then administer treatment after the birds are removed. Apply sprays to pit walls, posts, soil, and litter to minimize migrations. Manure may be dusted or sprayed, but natural enemies will be killed. See the *Chemical Arthropod Control* section for more information.

Biological Control: Natural enemies include the fungus *Beauveria bassiana*, mites, and nematodes.

Cultural/Mechanical Control: Cover stored manure with tarps. Angled metal flashing can be affixed to pit walls at masonry-frame wall joints and posts. Beetles will migrate at cleanout time, so remove manure and litter immediately after the birds leave. Darkling beetles are attracted to light, so security lights will keep them near poultry facilities and away from neighbors. Fill cracks and crevices in which darkling beetles may hide.

Hide Beetle, *Dermestes maculatus* ²⁷

Hide beetles, like darkling beetles, are pests associated with poultry manure and litter in high-rise deep-pit houses. Mature larvae stay in poultry litter or bore into structures (wood-paneling, dry wall, insulation, or PCP-treated wood) to pupate. As a result, "honeycombing" and structural weakness may occur. Hide beetles become a public nuisance when they migrate. Adults are 1/3 inch long-slightly larger

than darkling beetles. Hide beetles are dark brown with a white underside. They are scavengers and will feed on dead birds, skins, hides, feathers, dead insects, or broken eggs. Females lay their eggs on manure and litter in poultry facilities. The hide beetle life cycle is completed in four to nine weeks.

Monitoring: Begin treatment when beetles are first observed.

Chemical Control: See the *Chemical Arthropod Control* section for more information.

Biological Control: No commercial biological control agents are recommended. Nematodes are natural enemies of litter beetles.

Cultural/Mechanical Control: See the *Cultural/Mechanical Control* section under darkling beetles.

Lice

Chicken Body Louse, *Menacanthus stramineus*

Shaft Louse, *Menopon gallinae*

Chicken body lice and shaft lice are chewing lice that feed on dry skin and feathers in breeder facilities. The shaft louse is also known as the feather louse. These lice also feed on the blood in young quill feathers. The feeding habits of poultry lice actually make the avian host inhospitable to northern fowl mites. Poultry lice are yellowish and approximately 1/16 inch long. They cause irritation, which leads to loss of appetite and an increased susceptibility to other diseases. They are not specific to particular species of birds. Symptoms include red, scabby, irritated skin and reduced egg production.

Monitoring: Spread the feathers and look for lice on the vent, head, and under the wings. These lice are most abundant in summer but are present throughout the year.

Chemical Control: See the *Chemical Arthropod Control* section for more information.

Biological Control: No commercial biological control agents are recommended.

Cultural Control: Keep wild birds away from poultry facilities, restock with lice-free birds, and decontaminate workers/equipment.

Fleas

Cat Flea, *Ctenocephalides felis*

European Chicken Flea, *Ceratophyllus gallinae*

Human Flea, *Pulex irritans*

Sticktight Flea, *Echidnophaga gallinacea*

Fleas are rare in poultry facilities, but when they do occur, they are more common in breeder and grow-out houses. The sticktight flea is also known as the southern chicken flea. Adults are permanently

affixed to the host by their mouthparts, which are tightly embedded in the skin. Females attach themselves and lay their eggs on the face and wattles of poultry. Sticktight fleas also attack mice, rats, cats, dogs, horses, and humans. Their bites will leave itchy spots on the legs and ankles of poultry handlers. The life cycle of the sticktight flea lasts between two weeks and eight months. Young fowl may die, while older birds exhibit reduced egg production and anemia. Other symptoms include reduced growth, blood loss, and skin irritation. Sticktight fleas are more common in late spring and early summer. Fleas congregate in numbers greater than 100.

Monitoring: Look for small brown dots on the fleshy parts of the head or fleas moving on the skin under the feathers. Poultry exhibit skin irritation and ulcerations.

Chemical Control: Thoroughly clean and disinfect poultry facilities before treating. See the *Chemical Arthropod Control* section for more information.

Biological Control: Beneficial nematodes are sometimes used to control fleas.

Cultural/Mechanical Control: Keep infested animals away from poultry. Remove fleas with tweezers, or smother them with petroleum jelly. If poultry are put into cages raised at least 3 ft. off the ground, they are not as likely to be infested.

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Chicken Mite, *Dermanyssus gallinae*

The chicken mite, also known as the red mite or roost mite, is an occasional problem in breeder facilities but not caged-layer flocks. These parasites are visible to the naked eye and complete their life cycle in as little as seven to ten days. Chicken mites have been known to spread fowl cholera. They are transmitted to poultry via wild birds or rodents. Unlike the northern fowl mite, chicken mites spend only part of their time on the poultry host. Chicken mites feed on the blood of poultry at night and hide in crevices during the day. They can survive off their host for up to a month and will infest poultry workers or nearby facilities when infestation levels are high. In high numbers, chicken mites cause a reduction in weight gain and egg production.

Monitoring: Symptoms include dirty feathers, scabs, and pinkish combs. If you do not see pests during the day, you must monitor at night to capture and identify the mites.

Chemical Control: Chicken mites are rare, so few pesticides are labeled for their control. See the *Chemical Arthropod Control* section for more information. Spray pesticides in cracks and crevices and on roosts. Remove nesting material and spray nest boxes.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: Keep wild birds and rodents from nesting in poultry facilities. Clean and disinfect poultry facilities/equipment before introducing new flocks to prevent infestations. Fill cracks and crevices in which chicken mites may seek refuge.

Northern Fowl Mite, *Ornithonyssus sylviarum*

The northern fowl mite, or feather mite, is more common on four-to-ten-month-old birds but can occur in younger birds. This pest is the most important mite on caged layers, range turkeys, and pheasants. The infestation first begins on the vent and then moves to the tail, back, and legs of females; the mites are more scattered on male birds. Infested poultry have feathers soiled with mite eggs, cast skins, dried blood, and excrement. The most obvious signs that a bird is infested with northern fowl mite are black feathers and/or scabs in the vent area. Northern fowl mites cause anemia, itching, irritation, and can reduce egg production by 10%-15%. Heavy infestations (> 50,000 mites) can drain up to 6% of a bird's blood daily. Northern fowl mites flourish in colder weather and become well established in large numbers after poultry reach sexual maturity. The life cycle of the mite is completed in as little as one week. Mites can survive for a few weeks off of the avian host. Rodents and wild birds are reservoirs for the mites and help spread them to poultry.

Monitoring: Monitor often and detect early for best control. You may first notice mites crawling on eggs. Randomly select ten birds from each cage row on a weekly basis. Examine the vent area under a bright light, and part the feathers to look for mites. Watch for fast-moving, tiny white or dark spots on skin and feathers. If the average is more than 100-300 mites per bird (or an index = 5), then begin treatment. Index: 1= one to two mites, 2= three to nine mites, 3= ten to 31 mites, 4= 3 to 99 mites, 5= 100 to 300 mites, 6= 301 to 999 mites, 7= 1,000 to 3,000 mites, 8= 3,001 to 9,999 mites, 9= 10,000 to 32,000 mites, 10= more than 32,000 mites. If mites are detected in broiler houses, all birds must be treated. With caged layers, the infestation may be confined, and only one location needs to be monitored and treated.

Chemical Control: There is no need to treat older birds. Treat vents from underneath with a 100-125 psi sprayer. Split the treatment (one-half the product with the full amount of water, two times) so it sticks to the feathers better. Floor birds may be bunched into a corner and treated with spray. When dealing with small flocks, birds may be dipped in the treatment solution individually.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: Make sure the poultry house is clean and mite free before introducing a new flock. Avoid contaminating clothing/equipment (e.g., egg flats) and transferring the infestation. Keep wild birds from roosting in poultry facilities. Make sure new poults are uninfested.

Scaly Leg Mite, *Knemidocoptes mutans*

Scaly leg mites bore under the leg scales of chickens, turkeys, pheasants, and other birds to lay their eggs. They are thought to be transmitted by wild birds. Scaly leg mites complete their life cycle within ten to 14 days.

Monitoring: Leg scales get rough and infected. Scabby, red patches develop on the feet and legs. Poultry will then pick at their legs and feet. Other symptoms include loss of appetite, reduced egg production, emaciation, lameness, toe loss, and death.

Chemical Control: Treat by soaking legs in hot water and then in linseed oil. Wipe off the oil and coat the legs with petroleum jelly to suffocate the mites. Treat every three to four days for two weeks. The old scales fall off and are replaced. See the *Chemical Arthropod Control* section for more information.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: Make sure the poultry house is clean and mite free before introducing new birds. Avoid contaminating clothing and equipment (e.g., egg flats). Keep wild birds from roosting in poultry facilities.

Depluming Mite, *Neocnemidocoptes laevis* var. *gallinae*

Depluming mites are similar to, but smaller than, the scaly leg mite. They are present throughout the United States on chickens, geese, and pheasants. Depluming mites burrow into the skin at the base of feathers on the back, wings, vent, breast, and thighs, causing intense itching and feather pulling. They are more prevalent in spring and summer, with very low levels in autumn. The life cycle takes between ten and 14 days to complete. Depluming mites are more common in noncommercial flocks.

Monitoring: Feather pulling and molting at the wrong time of the year indicate a depluming mite infestation.

Chemical Control: See the *Chemical Arthropod Control* section for more information on mite control.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: Make sure the poultry house is clean and mite free before introducing new birds. Avoid contaminating clothing and equipment (e.g., egg flats). Keep wild birds from roosting in poultry facilities.

Fowl Tick, *Argas persicus*

Fowl ticks, or blue bugs, are rare pests of breeder poultry. They are light red to dark brown, 6-9 mm long as adults, and have wrinkled skin. Female fowl ticks lay their eggs in cracks and crevices. All life stages of fowl tick feed on blood. Fowl tick nymphs are active only at night and will cause roosting birds to act flustered. The life cycle can be completed in as little as one month. Fowl ticks can live for up to a year without feeding. Ticks can transmit various bacterial and rickettsial diseases.

Monitoring: Symptoms include red feeding spots, anemia, reduced egg production, paralysis, depression, and weight loss.

Chemical Control: Clean poultry houses thoroughly, then treat cracks and crevices with appropriate chemical agents. See the *Chemical Arthropod Control* section for more information.

Biological Control: No commercial biological control agents are recommended, although ticks have several natural enemies in the wild.

Cultural/Mechanical Control: Fill cracks and crevices in poultry houses. Remove ticks with tweezers, or smother them with petroleum jelly.

Chiggers, *Trombicula splendens*

Common Chigger, *T. alfreddugesi*

Turkey Chigger, *Neoschongastia americana*

Chiggers, also known as jiggers, harvest mites, and red bugs, are bright red and about 1 mm long. *Trombicula splendens* feed on all kinds of animals and are most common in swamps, bogs, and rotten logs. Common chiggers are prevalent in areas between forests and grasslands, swamp margins, berry patches, and thickets. They occur on a variety of animal hosts, as well. The chigger life cycle takes between 50 and 55 days, but the duration depends on soil, temperature, humidity, and food quality. Larvae do not burrow or suck blood. Instead, they inject an enzyme into the animal host that causes irritation and a raised bump. Carcass quality is greatly reduced due to raised, red chigger bite marks. Nymphs and adults feed on insect eggs or immature arthropods. Turkeys are affected more often than chickens. Young poultry may refuse to eat and eventually die. *N. americana* is prevalent in the southern states of the United States in dry areas with hard, rocky soils. The population peaks in June, decreases in late summer, may increase in fall, and declines in the winter. *N. americana* infests chickens, turkeys, and wild birds. The chiggers feed in clusters on the thighs, breast, underside of the wings, and around the vent. Scabby lesions result and take three weeks to heal. This feeding damage causes turkeys to be devalued by more than \$1/bird.

Monitoring: Look for red bumps on wings, breasts, and necks of poultry.

Chemical Control: See the *Chemical Arthropod Control* section for more information.

Biological Control: No commercial biological control agents are recommended.

Cultural/Mechanical Control: Keep birds away from chigger-infested rangeland.

Chemical Arthropod Control

The list below contains all of the products available to producers for insect control in poultry production along with the recommended application rates. REIs are not listed here because the Worker Protection Standard (WPS) only covers pesticides that are used in the production of agricultural *plants*, not animals.

- **Boric Acid** (*Safecide 99IC*) - Inorganic
 - For control of litter beetles, flies, bed bugs, and fire ants in poultry facilities, use as directed. For poultry grown on litter, first remove the birds. Apply 10-20 lbs. of product/1,000 sq. ft. using a fertilizer or seed spreader in bands along feeder lines. Birds may re-enter the building immediately after the product is applied. Reapply product between grow-out groups.
- **Carbaryl** (*AllPro 50WP*) - Carbamate
 - For control of chicken mites, northern fowl mites, lice, fleas, bed bugs, and ticks in poultry facilities, use as directed.
 - (*Hi-Yield 10% Carbaryl Dust*) - For control of chicken mites, northern fowl mites, lice, fleas, and bed bugs in poultry litter, follow label directions.
- **Chlorpyrifos** (*Duratrol Darkling Beetle Spray*) - Organophosphate
 - For control of darkling beetles, ticks, fleas, and lesser mealworms in enclosed or open poultry premises, use as directed.
- **Cyfluthrin** (*Tempo Ultra 11.8SC*) - Pyrethroid
 - For *spray* control of litter beetles, bed bugs, flies, and other pests in poultry facilities, mix 8 mL of product in 1 gal. of water, or 16 mL of product in 1 gal. of water for severe infestations. Spray mix where pests have been seen, onto surfaces, and into cracks and crevices. For best results, clean facilities before applying and treat outdoor perimeters. Animals **MUST** be removed from the facilities before treatment. Do **NOT** contaminate food and water. Reapply 7-10 days later, if necessary. Wait until spray is dry before allowing people and animals to re-enter the facilities.
 - (*Tempo 1% Dust*) For control of beetles and bed bugs in poultry houses, apply dust lightly and uniformly by hand or using a power duster to walls, floors, and bedding at a rate of 0.5 to 1 lb. of dust per 1000 sq. ft. Remove animals before applying.
- **Cyromazine** (*Larvadex 1% Premix*) - Triazine, Insect Growth Regulator
 - For *feed-through control* of fly maggots, mix 1 lb. of product per ton of feed. Follow directions according to the label. Feed to egg-laying hens **ONLY**. **DO NOT** feed to broiler birds or other poultry. Safe for use with beneficial insects. Follow directions completely to reduce risk of fly resistance. Feed beginning in March or April for 4-6 weeks (at least 4 weeks). If few or no maggots are observed, discontinue use. Repeat if maggot activity resumes. During periods of cold weather or low fly activity, discontinue use for at least 4 months in a row. Remove the product from layer feed at least 3 days before slaughter. Manure from chickens treated with pesticide CAN be used on field

crops, but no more than 3 tons a year. Do NOT apply to small grain crops to be harvested or grazed.

- (*Larvadex 5% SC*) - For *spray* control of rat-tailed maggots, mix 1 qt. of product in 25 gal. of water and apply at a rate of 1 gal. / 100 sq. ft. of pit surface.
- **Deltamethrin** (*Annihilator 5WP*) - Pyrethroid
 - For control of beetles, ticks, fleas, and mosquitoes in poultry houses, use as directed.
 - (*Suspend 4.75SC*) For control of fleas, flies, beetles, lice, and ticks in poultry houses, mix 0.75 to 1.5 oz. per gal. of water and apply using a power sprayer.
- **Dichlorvos** (*Prozap Insect Guard 18.6%*) - Organophosphate
 - For the control of flies, gnats, and mosquitoes, hang the appropriate size and number of strips for the area to be treated (one 10.5 g strip treats 50-100 cu. ft.).
- **Dimethoate** (4EC) - Organophosphate
 - For the control of fly maggots in manure, mix 4 oz. of product in 5 qt. of water and apply as a coarse spray (or with a sprinkling can) to fly breeding areas in caged-layer houses. Reapply as new manure is added.
- **Esfenvalerate** (35WP) - Pyrethroid
 - For control of crawling/flying insects in poultry houses, use as directed.
- **Imidacloprid** (*Quickbayt 0.5%*) - Neonicotinoid
 - For *bait treatment* control of flies, scatter ready-to-use bait around the inside and outside of poultry houses using 5.7 - 6.3 oz. per 1,000 sq. ft. Reapply at 7-day intervals, if necessary. DO NOT contaminate food or water. Keep bait away from children, pets, and food-producing animals.
- **Lambda Cyhalothrin** (*Demand 9.7CS*) - Pyrethroid
 - For control of carrion beetles, darkling beetles, litter beetles, and flies in poultry houses, use as directed.
- **Malathion** (57EC) - Organophosphate
 - For control of northern fowl mite and lice on poultry and in poultry facilities, use as directed.
- **Methomyl** (*Starbar Golden Malrin Fly Bait 1%*) - Carbamate
 - For *bait treatment* control of flies, scatter ready-to-use bait around the OUTSIDE of broiler houses, walkways in caged-layer houses, feedlots, and livestock barns. Use approximately ¼ lb. bait per 500 sq. ft. of fly-feeding area, with particles spaced 1-2 inches apart. Keep away from children and pets.
 - (*Golden Malrin Fly Belt*) For the control of flies, cut to desired length and attach to wall or ceilings out of reach of poultry.
- **Nicotine Sulfate** (*Black Leaf 40*) - Botanical
 - For control of feather mites and lice in **small flocks**, paint a thin coating of the product on the tops of roosts approximately 1 hr. before roosting time. Use 1 oz./15 ft. of roost. Provide ventilation, but avoid strong drafts. For feather mites, paint the roost 3 times, with 3 days between applications. Do **NOT** use on immature chickens or mothering hens. Avoid contaminating feeding and watering troughs.
- **Permethrin** (*Ectiban 5.7EC*) - Pyrethroid
 - For treatment of northern fowl mites and house flies on **caged-layer birds**, mix 1 qt. of

product in 25 gal. of water. Apply 1 gal. of diluted spray/100 birds. Treat vent area thoroughly.

- (*Permethrin II 10%*) - For *long-term residual spray* control of flies, mix 1 qt. of product in 25 gal. of water and apply at a rate of 1 gal. of spray per 750 sq. ft. Can be used in barns, dairies, feedlots, stables, and poultry houses.
- (*Astro 36.8%*) - For control of darkling beetles and flies in poultry houses, use as directed.
- **Pyrethrins** (*Pyganic 1.4EC*) - Botanical
 - For control of flies and fleas on poultry, mix 9-14 oz. per gal. of water and spray roosts, walls, nests, cages, then mist birds lightly afterwards. For control of bedbugs and mites on poultry, use the same rate as above, but apply to cracks and crevices, as well as the birds themselves. For control of darkling beetles, mix 1-3 oz. per gal. of water and use a power sprayer (80-100 psi) to apply the product at a rate of 1 gal. per 250-500 sq. ft. Apply following each grow-out or sanitation procedure. To prevent darkling beetle immigration, spray a uniform band 2 ft. up and 1-4 ft. out from the building foundation. For control of flying insects, mix 9 oz. of product per gal. of water and apply as a fine mist at a rate of 2 oz. per 1000 cu. ft. to ceilings and upper corners. Close windows/doors and vacate the treated area. Ventilate the room before returning.
- **Pyriproxyfen** (*Indoor/Outdoor IGR 1.3%*) - Insect Growth Regulator
 - For the control of fly maggots, lesser mealworms, flies, fleas, ticks, mosquitoes, and litter beetles in poultry houses, mix 1 oz. of product in enough water to thoroughly wet 1000 sq. ft. of litter or surface area.
- **Spinosad** (*Elector 2.46%*) - Spinosyn
 - For *space treatment* of house flies on poultry premises, mix 20 oz. of product per 5 gal. of water and apply at a rate of 1 gal. of solution per 500-1,000 sq. ft. Remove animals before applying. Do **NOT** use in overhead sprinkler system. Safe for use with beneficial insects.
 - (*Extinosad PSP 44.2%*) For control of darkling beetles and hide beetles in poultry houses, mix 2 oz. of product in 10 gal. of water and apply at a rate of 1 gal. per 500 sq. ft. Remove birds first and let surfaces dry before restocking the facilities.
- **Sulfur** (*Clean Crop Microfine Sulfur 90WP or Dust*) - Inorganic
 - For control of depluming mites on poultry, dust birds liberally and rub into feathers. To treat poultry houses, mix 20-25 lbs. of product per 100 gal. of water, and apply at a rate of 200-250 lbs. per 20,000 sq. ft. Make sure to treat all surfaces, including cracks and crevices.
- **Tetrachlorvinphos** (*Rabon 50WP*) - Organophosphate
 - For *contact spray control* of flies, mix with water as instructed on label and apply to inside or outside walls and ceilings.
 - For control of lice and mites on **caged-layer birds**, mix 8 lbs. of product in 100 gal. of water. Apply at a rate of 1 gal of solution/100 birds. Spray vent, and fluff areas from below. For northern fowl mite, use a power sprayer at 100-125 psi. Repeat as necessary, but **NOT** more than once every 14 days. Carefully treat roosters individually to avoid re-infestation of breeding flocks.
 - For control of lice, mites, and litter beetles in poultry litter, mix 4 lb. of product in 50 gal of water. Apply 1-2 gal. of spray/100 sq. ft. For use as a *dry dust*, apply 0.75 oz. of

product/100 sq. ft. using a rotary, mechanical, or electrostatic duster. Wear a face mask while applying the product.

- For *long-term residual spray* control of flies in poultry buildings, follow label directions. Animals may be returned to the building after 4 hours. Do **NOT** contaminate feed and drinking water.
- For *larvicidal treatment* of fly maggots in manure in poultry facilities, apply 1 gal. of 1% solution per 100 sq. ft. of manure piles. Repeat every 7-10 days until control is achieved. Do **NOT** spray animals directly. Toxic to bees and fish. Do **NOT** mix with dodecane or alkaline compounds.
- **Tetrachlorvinphos (23%) + Dichlorvos (5.3%) (Ravap EC) - Organophosphates**
 - For treatment of lice and mites in **caged-layer birds**, mix 1 gal. of product in 50 gal. of water. Apply at a rate of 1 gal. of solution/100 birds under high pressure (not less than 100-125 psi) to the vent and fluff areas from below. For northern fowl mite, use a power sprayer at 100-125 psi. Repeat as necessary, but **NOT** more than once every 14 days. Carefully treat roosters individually to avoid re-infestation of breeding flocks.
 - For *long-term residual spray* control of flies in animal buildings, mix 1 gal. of product in 25 gal. of water (or 1 gal. product in 12.5 gal. of water for heavy infestations) and apply at a rate of 1 gal. of spray per 500-1,000 sq. ft. of walls, ceilings, or other areas flies congregate. Remove animals before spraying. Animals may be returned to the building after 4 hours. Do **NOT** contaminate feed or drinking water. Can be used in dairy barns, poultry houses, swine buildings, livestock sheds, and other animal buildings.
 - For *larvicidal treatment* of fly maggots in manure in poultry facilities, mix 1 gal. of product in 25 gal. of water and apply at a rate of 1 gal. of spray per 100 sq. ft. of manure. Repeat at 7-10 day intervals until droppings cone up; thereafter, treat only hot spots with large numbers of maggots. Do **NOT** spray animals directly.
 - For *spray* control of rat-tailed maggots, mix 1 pt. of product in 3.5 gal. of fuel oil and apply at a rate of 1 gal. of spray /100 sq. ft. of manure pit surface. Repeat as necessary, but not more than once every 7-10 days.

Diseases 31

Poultry farmers rely mainly on biosecurity, good cultural practices, drugs, and vaccinations/immunizations to prevent or treat diseases in their chicken flocks. There are two kinds of immunity in poultry-passive and active. Passive immunity is conveyed from the mother to the offspring and lasts for two to four weeks. It is very effective against viral diseases but nearly useless against bacteria. Active immunity is developed when a vaccine is administered, or a bird is exposed to an illness. Vaccinations can be given individually or to an entire flock, but they should not be administered during times of stress.

One very serious poultry disease is *avian influenza*, which can wipe out poultry flocks and has the potential to mutate into a "super flu" that could infect and kill humans. The symptoms of avian influenza

include reduced egg production, respiratory problems, sneezing, coughing, chronic respiratory infections, plugged sinuses, drowsiness, head swelling, and high mortality. Consult a veterinarian to get a definitive diagnosis. *Marek's disease*, or *acute leukosis*, is another serious disease that can be spread by darkling beetles. It can cause paralysis and slower growth and feathering, but it is frequently has no symptoms. This disease is airborne and highly contagious. Poultry farmers should buy fowl vaccinated against Marek's disease because there is no other treatment.

Bacterial, viral, and fungal diseases of chickens include (but are not limited to) infectious coryza, anaplasmosis, aspergillosis, avian encephalomyelitis, botulism, breast blister, campylobacter, candidiasis, cellulitis (inflammatory process), chicken anemia, psittacosis (chlamydiosis), colibacillosis (colisepticemia), dactylariosis, endocarditis, bacterial enteritis, epiphysiolysis, equine encephalitis, erysipelas, favus, femoral head necrosis, fowl cholera (pasteurellosis), fowl pox, hexamitiasis, infectious laryngotracheitis, lymphoproliferative disease, inclusion body hepatitis, infectious bronchitis (IB), infectious bursal disease (IBD or gumboro), mycoplasma, mycotoxicosis, ornithobacterium infection, Newcastle disease, paramyxovirus, rotavirus, respiratory disease complex, salmonellosis, salpingitis, spirochaetosis, staphylococcosis, tuberculosis, and avian rhinotracheitis.

Round Worm and Protozoan Pests 32, 33

In general, to prevent roundworm and protozoan infections, implement good sanitation practices, disinfect poultry facilities between old and new flocks, manage litter properly, make sure birds are not overcrowded, minimize contact between poultry and wild birds, control secondary hosts (flies, beetles, cockroaches, grasshoppers, and earthworms), and keep different age groups or species apart. Birds may be treated with drugs and dewormers such as piperazine, phenothiazine, hygromycin B, and levamisole.

Roundworms

Roundworms, or nematodes, are the most important group of parasitic poultry worms. Adult roundworms lay their eggs in the avian host, which are then passed in the feces. Roundworms become infective in the soil and are later consumed by poultry. If birds are kept in wire cages above the ground, there is less interaction with secondary hosts. *Large roundworms* may cause wing drooping, head bleaching, emaciation, and reduced egg production. *Small roundworms* may cause droopiness, anemia, weakness, loss of appetite, bad breath, emaciation, neck twisting, and leg paralysis. *Cecal worms* are vectored by earthworms and may cause listlessness, depression, or reduced production. These roundworms may carry the protozoan that causes blackhead in poultry. *Eye worms* lay their eggs on the eye, which pass down the tear duct and into the intestinal tract. Later, the eggs are passed in the feces and consumed by cockroaches. Worm larvae become infective in the cockroaches, which are then consumed by chickens, turkeys, peafowl, or ducks. Larvae are released in the crop, then move to the esophagus, tear ducts, and back to the eye. Symptoms of eye worms include scratching of the eyes and blindness. Eye worms are treated by removal under local anesthesia. Eye worms are less common than

other parasitic worms. *Gapeworms* and *gizzard worms* are also occasionally found parasitizing poultry.

In addition to roundworms, *flatworms* (or *tapeworms*) may occur in the intestines of poultry.

Protozoans ³⁴

Symptoms of blackhead, *Histomonas meleagridis*, include head/wing drooping, partly closed eyes, enlarged cecae with a cheese-like core, and saucer-shaped lesions on the liver. Mortality can reach 50% within 15 days. Blackhead is transmitted by cecal worms, which are common in chickens and turkeys, and earthworms. Chickens are not as susceptible to blackhead, so they may transmit the disease to turkeys despite appearing healthy. Outbreaks are more common in spring and fall, and are more serious in wet weather. Drugs and treated feed are available for prevention and treatment of blackhead. As a rule, keep different species of poultry, particularly turkeys and chickens, apart from one another. Also, do not mix age classes of poultry. Rotate ranging areas, and do not let turkeys consume earthworms. Symptoms of *coccidiosis* include weight loss, reduced growth, bloody droppings, bloody mucous, and swollen cecae or intestines. Coccidiosis is treated with a coccidiostat supplement in the food, sulfa drugs, or vaccines. To prevent coccidia infestations, implement good sanitation practices and make sure poultry litter remains fairly dry. Other protozoan parasites of poultry include *trichomoniasis* and *leukocytozoonosis*. The latter is spread by biting insects.

Vertebrates 5, 6, 16

Rodents

Norway Rat, *Rattus norvegicus*

House Mouse, *Mus musculus*

Rodents are a year-round problem in livestock facilities. They cause sanitation problems and food contamination or loss. Rats eat 1-2 oz. of food per day, while mice consume only a tenth of that. In large numbers, rodents can cost farmers a lot of money. Rats eat up to 25 lbs. of food a year and contaminate 250 lbs. of feed with their feces and urine. Rats and mice also cause structural damage to buildings by chewing on wood and cinderblock, removing insulation from the walls for their nests, and stripping wiring, which can lead to fires. Rodents are also disease/parasite vectors, and their bites can lead to injury or infections. Rats will sometimes kill young poults and chickens. Their reproductive potential is very high; rodents produce four to eight generations per year. Rats and mice need three things to survive: food, water, and a nesting site. Rats require a water source, unlike mice, which are able to extract enough moisture from their food. Rats typically live in underground burrows near foundations, feed bins, or secluded areas around livestock facilities. Mice can live nearly anywhere. Rats are up to 18 inches long from head to tail. Rat burrows may be identified by the presence of dirt piles near entry holes. They are active only at night-if they are seen above ground during the day, there is a very large population present. Both rats and mice are good climbers. Mice are between 5 and 7 inches long from

head to tail and have light brown or black fur with a light underbelly. Mice are active during the day, particularly at dawn and dusk. Mice tend to be curious, while rats are cautious and harder to kill.

Monitoring: Look for signs of infestation, including droppings, structural damage, burrows, tracks, or rodents themselves. Treat if rodent pests are present. Rats produce capsule-shaped feces (about ½ inch long) along walls or rat trails. Mice produce smooth, ¼-inch-long droppings.

Chemical Control: Anticoagulants are used most commonly in livestock facilities. Different formulations such as tracking powders, bait pellets, bar baits, and concentrates are available. Follow label directions explicitly; otherwise, rodenticides are ineffective and dangerous. Rats do not take baits as readily as mice, unless the baits are left in their path and better food is unavailable. Place baits in locations where rodents travel or congregate such as along walls, in corners, or in concealed places.

Biological Control: Cats and predatory birds can help control small rodent populations. Remove poisoned rodents quickly to prevent secondary poisoning.

Cultural/Mechanical Control: Keep facilities clean and free of debris (e.g., old lumber and equipment), remove spilled grain, mow 50 ft. around buildings and waste lagoons, install gravel barriers around buildings, and use rodent-proof food storage bins. Snap traps, glue boards, and live traps are only useful in areas where rodent infestations are low. Seal openings surrounding water pipes, drain spots, floor drains, and vents using concrete or heavy mesh. Use flashing to seal corrugated siding and corner seams.

Birds ³⁵

Birds that nest in or near livestock facilities may cause damage or carry various pests and diseases. Bird droppings corrode farm equipment, and nests may plug drains or gutters. Birds will also destroy insulation. Avian pests include pigeons, European starlings, house finches, and house sparrows.

Chemical Control: Avitrol is a RESTRICTED USE pesticide that may be used to control birds.

Biological Control: Natural enemies of birds include predatory birds and cats.

Cultural/Mechanical Control: Clean up spilled grain, store grain in pest-proof containers, use covered feeding troughs that exclude birds, and keep water at a level deep enough that birds cannot stand in it, but shallow enough that they cannot drink it by perching on the lip. To keep birds out of buildings, hang plastic strips in doorways, use wire and mesh to seal openings, and cover rafters with netting. To keep birds from nesting or roosting, change the roosting ledge angle to at least 45°, install porcupine wires, use electronic bird-control devices, install catwalks, or use chemical perch repellents. Other methods to control birds include destroying nests, puncturing eggs, and trapping.

Chemical Vertebrate Pest Control

The list below contains all of the products available to producers for vertebrate pest control in poultry production along with the recommended application rates. REIs are not listed here because the Worker Protection Standard (WPS) only covers pesticides that are used in the production of agricultural *plants*, not animals.

- **Aluminum Phosphide** (*Weevil-Cide Pellets*) - Inorganic
 - For control of rodents on agricultural premises, follow label directions. **RESTRICTED USE PESTICIDE.**
- **Avitrol** (*Avitrol Corn Chops Bird Repellant*) - Organic
 - For control of birds on agricultural premises, follow label directions. **RESTRICTED USE PESTICIDE.**
- **Brodifacoum** (*D-Con Bait Pellets II*) - Anticoagulant Rodenticide
 - For *bait control* of rats on agricultural premises, place 4-16 baits per placement at 15-30 ft. intervals. For control of mice, place 1-2 baits per placement at 8-12 ft. intervals. Maintain bait supply for 10-15 days, or until rodent activity ceases.
- **Bromadiolone** (*ROC-622 Rat & Mouse Bait Packs*) - Anticoagulant Rodenticide
 - For *bait control* of rats on agricultural premises, place 3-10 packs per placement. For control of mice, place one pack per placement. Maintain bait supply for 10-15 days, or until rodent activity ceases.
- **Bromethalin** (*Clout All Weather Bait*) - Benzenamine
 - For *bait control* of rats on agricultural premises, place 2-12 baits at 20-30 ft. intervals. For control of mice, place 1-2 baits at 8-12 ft. intervals. Maintain bait supply for at least one week, or until rodent activity ceases.
- **Difethialone** (*D-Con Rat & Mouse Bait Blocks*) - Benzothiopyranone
 - For *bait control* of rats on agricultural premises, place 6 to 23 blocks per placement, spaced at 15 to 30 ft. intervals. For control of mice, apply one or two blocks per placement, spaced at 8 to 12 ft. intervals. Provide an uninterrupted supply of bait for 10 to 15 days, or until rodent activity ceases.
- **Diphacin** (*Ramik Green Mini Bait Packs*) - Anticoagulant Rodenticide
 - For *bait control* of rats on agricultural premises, place 3-10 packs per placement. For control of mice, place 1-2 packs per placement, spaced at 8-12 ft. intervals. Maintain bait supply for 10-15 days, or until rodent activity ceases.
- **Methyl Bromide** (*MetaBrom Q9 WP*) - Gaseous fumigant
 - For *fumigant control* of rodents in **EMPTY** poultry houses, use 0.2 to 0.4 lbs. per 1000 cu. ft. over a period of 8 to 16 hours. **RESTRICTED USE PESTICIDE.** Workers and animals may reenter the facilities only after fumigant concentration levels have dropped to ² 5 ppm.
- **Warfarin** (*Ra-Mo-Cide WF*) - Anticoagulant Rodenticide
 - For *bait control* of rats, place 2-5 packs per placement, providing a supply of bait for at least 10 days. For mice control, open the pack and apply 0.25-0.5 oz. of bait at 8-12 ft. intervals.
- **Zinc Phosphide** (*Eraze Rodent Pellets*) - Inorganic

- For *bait control* of rodents on agricultural premises, follow label directions.

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On-Line Resources

- Virginia Agricultural Statistics Service
<http://www.nass.usda.gov/va>
- Virginia Cooperative Extension: Field Crops Pest Management Guide
<http://www.ext.vt.edu/pubs/pmg/>
- Virginia Poultry Federation
<http://www.vapoultry.com/index.html>
- The Poultry Site

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