BIOSECURITY IS CRITICAL!

Highly Pathogenic Avian Influenza (Bird Flu) has been detected in Florida and multiple states.

Poultry owners (large scale and small backyard flocks) need to:

- Practice good biosecurity.
- Wash your hands before and after encountering poultry.
- Monitor your flock's health.
- Keep visitors to a minimum.
- Provide disposable boot covers and/or disinfectant footbaths for anyone having contact with your flock.
- **REPORT SICK BIRDS:**
  Call the Florida Department of Agriculture and Consumer Services at **(850) 410-0900**, after hours at **(800) 342-5869** or by email at **RAD@FDACS.GOV**
- Questions about HPAI? Call **(850) 410-0900** or email at **poultryprograms@FDACS.gov**

For more information on biosecurity, scan the QR code.

FDACS-P-02190

INTERNAL PARASITES OF POULTRY

Written by: Dr. Jacquie Jacob, University of Kentucky

A parasite is an organism that lives in or on another organism (referred to as the host) and gains an advantage at the expense of that organism. The two types of internal parasites that affect poultry are worms and protozoa. Usually, low levels of infestation do not cause a problem and can be left untreated. Clinical signs of a parasite infestation include unthriftiness, poor growth and feed conversion, decreased egg production, and, in severe cases, death. Also, parasites can make a flock more susceptible to disease, or worsen a current disease condition.

WORMS

Roundworms
Roundworms (nematodes) are common in poultry, waterfowl, and wild birds. Species of roundworms that affect poultry include species of large roundworms (Ascaris sp., also known as ascarids), species of small roundworms (Capillaria sp., also known as capillary worms or threadworms), and cecal worms (Heterakis gallinarum). Roundworms can cause significant damage to the organ(s) they infest. Most roundworms affect the digestive tract; others affect the trachea (windpipe) or eyes.

Large roundworms are the most damaging of the worms common to backyard flocks. A severe infestation can cause a reduction in nutrient absorption, intestinal blockage, and death. Easily seen with the naked eye, large roundworms are about the thickness of a pencil lead and grow to 4-1/2 inches long. Occasionally, they migrate up a hen's reproductive tract and become included in a developing egg. The life cycle of a roundworm is direct; that is, worm eggs are passed in the droppings of infected birds and then directly to birds that consume contaminated feed, water, or feces. Also, worm eggs may be picked up by snails, slugs, earthworms, grasshoppers, beetles, cockroaches, earwigs, and other insects. Known as intermediate hosts, these insects carry the eggs and when eaten by a bird pass the eggs to the bird. Identifying and minimizing the number of intermediate hosts that poultry have contact with helps prevent the birds from being infected with worms. Because approved wormer medication in poultry is limited, you should check the US Food and Drug Administration (FDA) Approved Animal Drug Products list (known as the Green Book) for currently approved medication. Medication containing the active ingredient piperazine is available for use against large roundworms in poultry but is not effective against other internal parasites of poultry. As with all medications, read the label concerning dose to administer and withdrawal period before consumption of eggs or harvesting for meat.

Several species of **small roundworms** can affect different parts of birds and cause a variety of symptoms. Species that infect the crop and esophagus cause thickening and inflammation of the mucus membranes located there. Turkeys and game birds are most commonly affected by such species, and producers can suffer severe losses due to these parasites. Other species of small roundworms are found in the lower intestinal tract and cause inflammation, hemorrhage, and erosion of the intestinal lining. Heavy infestations result in reduced growth, reduced egg production, and reduced fertility. Severe infestations can lead to death. If present in large numbers, these worms can be seen during necropsy (examination after death). Small roundworm eggs are very small and difficult to see in bird droppings without a microscope. Medications that contain levamisole are effective in treating small roundworms.

Cecal worms are commonly found in chickens. As the name implies, they grow in the ceca (two blind pouches at the junction of the small and large intestines). Although cecal worms typically do not affect chickens, the worms can carry Histomonas melegridis, a species of protozoan parasite that causes histomoniasis (blackhead) in turkeys. Turkeys can contract histomoniasis by eating chicken manure containing infected cecal worm eggs or earthworms that have ingested infected cecal worm eggs. So, although chickens generally are immune to problems caused by cecal worms, controlling the worms is still important for turkey health. Levamisole is effective in controlling cecal worms. A veterinarian's prescription is required for use of the drug in poultry.

TAPEWORMS

Several species of tapeworms (cestodes) affect poultry. They range in size from very small (not visible to the naked eye) to more than 12 inches long. Tapeworms are made up of multiple flat sections. The sections are shed in groups of two or three daily. Each section of tapeworm contains hundreds of eggs, and each tapeworm is capable of shedding millions of eggs in its lifetime. Each species of tapeworm attaches to a different section of the digestive tract. A tapeworm attaches itself by using four pairs of suckers located on its head. Most tapeworms are host specific, with chicken tapeworms affecting only chickens, and so on. Tapeworms require an intermediate host to complete their life cycle. These intermediate hosts include ants, beetles, houseflies, slugs, snails, earthworms, and termites. For birds kept in cages, the most likely host is the housefly. For those raised on litter, intermediate hosts include termites and beetles. For free-range birds, snails and earthworms can serve as intermediate hosts. There are no approved medications for use against tapeworms, so controlling the intermediate hosts of tapeworms is vital in preventing initial infections and reducing the risk of reinfection. If you get a laboratory diagnosis of tapeworm infection, always ask which tapeworm species is causing the infection and which intermediate host is involved in the parasite's life cycle. Because the intermediate hosts for tapeworms vary greatly, it is important to identify the tapeworm species to target prevention efforts toward the correct intermediate host.

PROTOZA

Protozoa are single-celled organisms found in most habitats, and they include some parasitic pathogens of humans and domestic animals. Protozoan parasites that are important to backyard poultry growers are coccidia (species of the Eimeria genus), cryptosporidia (Cryptosporidium baileyi), and histomonads (H. melegridis).

By far, the most common protozoan parasites of chickens and turkeys are **Coccidia**. Nine species of coccidia affect chickens, and seven affect turkeys. Coccidia are species-specific, meaning that coccidia that affect chickens, for example, do not affect turkeys or other livestock. Coccidia live and reproduce in the digestive tract, where they cause tissue damage. This damage reduces nutrient and fluid absorption and causes diarrhea and blood loss. Coccidiosis (infection with or disease caused by coccidia) can increase a bird's susceptibility to other important poultry diseases, such as necrotic enteritis. Coccidia are in nearly all poultry. Chicks develop immunity to coccidiosis over time, with most severe cases occurring when chicks are three to six weeks old. Signs of coccidiosis include bloody diarrhea, watery diarrhea, abnormal feces, weight loss, lethargy, ruffled feathers, and other signs of poor health. Most store-bought feeds contain medication that controls but does not eliminate coccidia. Eating such feed allows young birds to develop resistance to the coccidia prevalent in their environment. However, if the birds are exposed to a different species of coccidia, they will not have immunity, and disease symptoms may result. A common medication for controlling coccidiosis in

birds not fed medicated feed is amprolium. As mentioned above, following the instructions for administration is important for proper drug delivery and bird recovery. Vaccines are currently available that give newly hatched birds a small amount of exposure to coccidia, allowing them to develop immunity without developing the disease. With proper vaccination and management, routine anticoccidial medications are not necessary.

Cryptosporidiosis is infection with, or disease caused by cryptosporidia. Cryptosporidia are not specific to chickens and can infect other birds and even mammals. Cryptosporidia frequently spread from flock to flock on the feet of animals and people and can be carried by wild birds. Intestinal cryptosporidiosis is common, and symptoms are usually mild. Frequently, the only symptom is pale skin in yellow-skinned breeds. Cryptosporidiosis also can be contracted by inhalation, resulting in a respiratory infection that is more severe than the intestinal form. There is no treatment for this form of cryptosporidiosis. Providing supportive therapy and guarding against secondary infection are the only courses of action. Once recovered, birds are immune to future infection.

As mentioned previously, histomoniasis is a disease of turkeys caused by histomonads, protozoan parasites carried by cecal worms. Histomoniasis is a serious, even deadly, disease and is most common in range-raised birds. Turkeys raised with access to chicken fecal material or earthworms that have ingested cecal worm eggs pick up histomonads and develop the disease. There is no effective treatment for histomoniasis. The only effective control is to control cecal worms, thereby reducing the spread of histomonads. Also, you should not house or range turkeys with chickens or in areas where chickens recently have been.

The oral Ivomec product for cattle is now being used fairly widely with chickens. However, it must be the oral and not the pour-on form of the product because the pour-on is not soluble in water. To use, add 11/2 cc’s of the product per gallon of drinking water and offer as the only source of drinking water to the birds for a twenty-four hour period.

Some do use the pour-on form of this product in a different manner, placing one or two drops of it to the back of the adult bird’s head or to another spot on the body, inaccessible to the bird. These products will control all parasites that feed upon bodily fluids. Do consult with your veterinarian before using any of these newer generation wormer products and administer them only to otherwise healthy birds. Consult your organic certifier to get a list of certified products before beginning treatment.

There are other worming products that can be used with poultry, but you must follow all label directions carefully. Any off-label use of a product should be done only under the direction of a veterinarian. It is also best to regularly rotate worming products to prevent the chance of any product immunity developing.

External Parasites of Poultry[1]

P. E. Kaufman[2]

Arthropods are important pests of poultry in Florida, especially where proper management practices are not implemented. Lice and mites are the most common pests of poultry in Florida, although the fowl tick and the sticktight flea may also cause serious problems. Though not a parasite of poultry, the house fly is a major concern to poultry producers, especially in caged-layer operations.

Chewing Lice

Chewing lice (or biting lice) are small, wingless, flattened insects with broad heads. All the chewing lice have similar life cycles. These lice usually spend their entire lives on a single host with occasional exceptions, such as when they cling to flies and are transported to new hosts or move from a nesting hen to a chick. For the most part, biting lice remain on the same host from generation to generation. Lice are highly host specific and are usually not transmitted from wild to domestic birds. Sucking lice do not occur on birds.

Lice tend to be more of a problem in backyard flocks than commercial flocks because commercial breeders do not permit parent-offspring contact. In backyard flocks, the hen incubates the egg and cares for the chick. Thus, louse populations are easily transmitted from one generation of chickens to the next.

The development of the common pigeon louse exemplifies the typical life cycle of poultry lice. As many as 60 eggs are glued to the host's feathers by the adult female louse. The eggs have an incubation period of from 3 to 5 days if the temperature is optimal. Nymphs hatch from the egg and pass through three nymphal instars, each lasting approximately 7 days. The third-stage nymph then molts to the adult stage. It usually takes 30 days to develop from egg to adult.

Biting lice do not suck blood from their host bird; however, they may ingest blood from irritated skin. Normally, bird lice feed on the protective sheaths of growing feathers, feather fibers, down, skin, scabs, blood, mucous, and even their own eggs and cast-off skins. Infested birds exhibit skin irritation, damaged plumage, and generally poor condition. Young birds often die from the presence of secondary infections. The most serious effect on older birds is the reduction in egg production.

In Florida, the major lice that attack poultry are the shaft louse, the fluff louse, the wing louse, and the chicken head louse.

Shaft, Fluff, and Wing Lice

The shaft louse (Figure 1) is the most serious louse pest of chickens. It feeds on the barbs and scales of the birds' feathers, causing little host irritation. It is usually not found on young chickens because their wings are less well developed. The adults, nymphs, and eggs are found on the feathers and generally damage the plumage. The shaft louse also will infest ducks, turkeys, and guinea hens if they are housed close to infested chickens.

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2. P. E. Kaufman, associate professor, Entomology and Nematology Department; UF/IFAS Extension, Gainesville, 32611.

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Figure 1. Shaft louse.
Credits: J. F. Butler, UF/IFAS

The fluff louse is a small louse species approximately 1 mm long. It lives in and feeds on the fluff under the vent.

The wing louse (Figure 2) is found among the barbules of the wing feathers of young and old birds. When heavy infestations occur, areas of the host's skin are made bare. Infested birds commonly scratch themselves with their claws, causing intense irritation.

Figure 2. Wing louse.
Credits: J. F. Butler, UF/IFAS

Chicken Head Louse

The chicken head louse constantly nibbles at the skin scales (Figure 3) and is a serious pest of young chickens and turkeys. It is frequently found on the head and neck of poultry.

Figure 3. Chicken head louse.
Credits: J. F. Butler, UF/IFAS

Lice become a problem when proper maintenance practices are not routinely followed. In all cases, good louse control can be attained with the application of sprays or dusts to the birds. Because lice rarely leave birds, premise treatment (treatment of the chickens' living area) is of little value in louse control operations.

Mites

The mites that attack poultry have similar life cycles, with four stages: egg, larva, two nymphal instars, and adult. The nymphs and adults have piercing-sucking mouthparts and take blood meals from birds.

Several mite species can be found on poultry in Florida; however, the most important mite is the northern fowl mite. Other mites such as the red chicken mite and the tropical fowl mite occasionally cause severe problems.

Northern Fowl Mite

The northern fowl mite (Figure 4) is a common external parasite of domestic fowl and wild birds throughout the temperate regions of the world. It has been shown to produce economic damage by causing anemia, lowering

egg production, reducing weight gain, and causing bird death. The mites also will bite people, causing itching and irritation to the skin.

Figure 4. Northern fowl mite.
Credits: J. F. Butler, UF/IFAS

The adult female mite lays eggs on the host bird. Depending on the temperature and humidity, the eggs will hatch in 1 to 2 days. The larvae that hatch from the egg do not feed, and molt to the nymphal stage in about eight hours. The nymph has biting mouthparts and pierces the host bird's skin for a blood meal. The nymphs mature to adults in 4 to 7 days.

Adult female mites take a blood meal and complete egg laying in two days. Each female lays an average of 2 to 5 eggs. The complete life cycle from egg to egg-laying adult can take place in 5 to 7 days or longer, depending on temperature and humidity. Adult mites spend most of their lives on the host but will also wander from the birds. The preferred site on the host is the vicinity of the vent, although the back is also favored.

Although female mites do not lay large numbers of eggs, mite populations can rise rapidly after a bird has been initially infested. When conditions are optimal, populations can grow from zero to more than 20,000 mites per bird in 9 to 10 weeks. Mite populations of approximately 200,000 per bird may cause so much blood loss, called exsanguination, that it kills the birds. Mite populations vary seasonally, with the largest populations in mid-winter.

Insecticides should be re-applied every 4 to 7 days to control northern fowl mites.

Common Red Chicken Mite

The common red mite (Figure 5) is found on domestic fowl throughout the world, parasitizing chickens, turkeys, pigeons, wild birds, and occasionally people. Older fowl with common red mite infestations exhibit symptoms similar to those of chickens parasitized by the northern fowl mite. Young chickens will usually die when attacked by this mite. The common red mite also serves as the vector for avian spirochetes.

Figure 5. Red chicken mite.
Credits: J. F. Butler, UF/IFAS

The red mite hides in cracks and crevices during the day and crawls onto the host at night for a blood meal. The life cycle is similar to that of the northern fowl mite and also can be completed in as little as 7 days. Premise treatments and bird treatments will both aid in the control of this mite, because much of its life is spent off the host.

Tropical Fowl Mite

The tropical fowl mite (Figure 6) is widely distributed in South America, the Caribbean, and southern United States. It is a mobile species and will feed during the day or night. Besides domestic fowl, the tropical fowl mite prefers English sparrows and transmissions from wild birds to domestic fowl are quite common.

Fowl Tick

The fowl tick (Figure 7), also called the blue bug, injures poultry by blood feeding, causing weight loss, blemishes, and lowered egg production. The tick is especially difficult

to control because it hides near the roosts of birds during the day. At night, however, the nymphs and adults climb onto the birds and engorge themselves with blood.

Figure 6. Tropical fowl mite.
Credits: J. F. Butler, UF/IFAS

Figure 7. Fowl tick.
Credits: J. F. Butler, UF/IFAS

The female tick lays 25 to 100 eggs at one time in clumps, and one female may produce as many as 700 eggs in her lifetime. The eggs hatch in 1 to 4 weeks into larvae that climb onto the birds for a blood meal. The larvae remain on the host up to five days, until fully engorged. The feeding sites become severely irritated after extended feeding. The larvae drop off the host and molt into the nymphal stage about 7 days after hatching. The nymphs blood-feed and molt 3 to 4 times before maturing to the adult stage. After each feeding the tick returns to its hiding place. At night there is often movement of large numbers of ticks from hiding places to hosts and back.

The fowl tick can live for extended periods of time without a blood meal. Therefore, leaving facilities vacant for a long period of time usually will not eliminate a population.

Sanitation is the best control of the fowl tick and is accomplished by removing ticks from their hiding places, eliminating cracks and crevices near roosting sites and improving the cleanliness of the facility to reduce litter where ticks may hide. Thorough spray applications of pesticides will help control ticks, but are not completely effective. Reducing a fowl tick problem requires persistent effort.

Sticktight Flea

The sticktight flea (Figure 8) can be a severe poultry pest in Florida. Symptoms of infestations are dark brown spots on the face, comb, and wattles where the fleas are embedded in the skin (Figure 9). Young fowl can be killed, and other fowl may reduce egg production as a result of the irritation and blood loss. Infestations can begin through contact with wild birds.

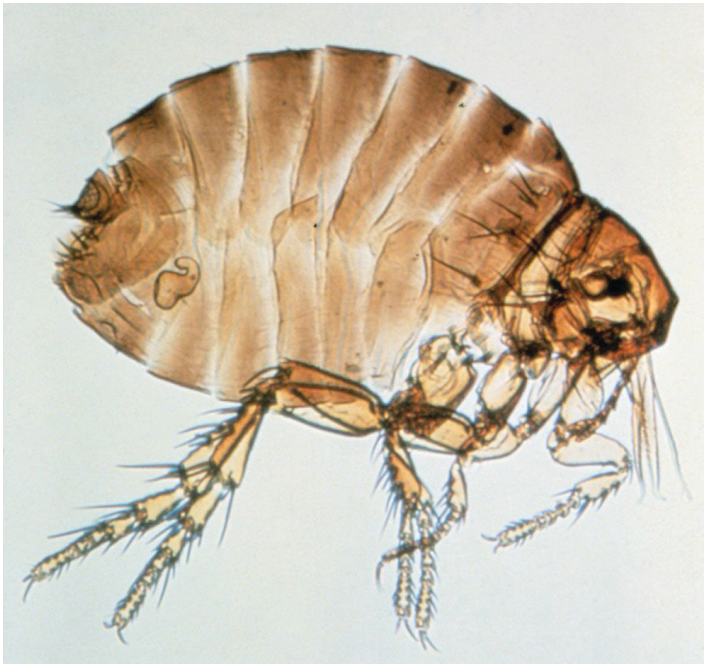


Figure 8. Sticktight flea.
Credits: J. F. Butler, UF/IFAS

The adult males and females of the sticktight flea are usually found on the heads of fowl. The females remain attached for 2 to 3 weeks. The female lays eggs that fall to the ground and hatch into larvae that feed on organic matter. Within 2

to 4 weeks, the larvae pupate. The life cycle is completed in 1 to 2 months. Usually these fleas are more prevalent in the cooler months of the year.

Figure 9. Sticktight fleas.
Credits: P. E. Kaufman, UF/IFAS

House Fly

A poultry farm cannot be kept entirely free of house flies. In caged-layer poultry operations, where conditions for house fly (Figure 10) development are ideal, it is extremely difficult to prevent breeding. However, by practicing good management and using the proper selective insecticides, poultry producers can keep the flies at a lower level than is found in many poultry operations.

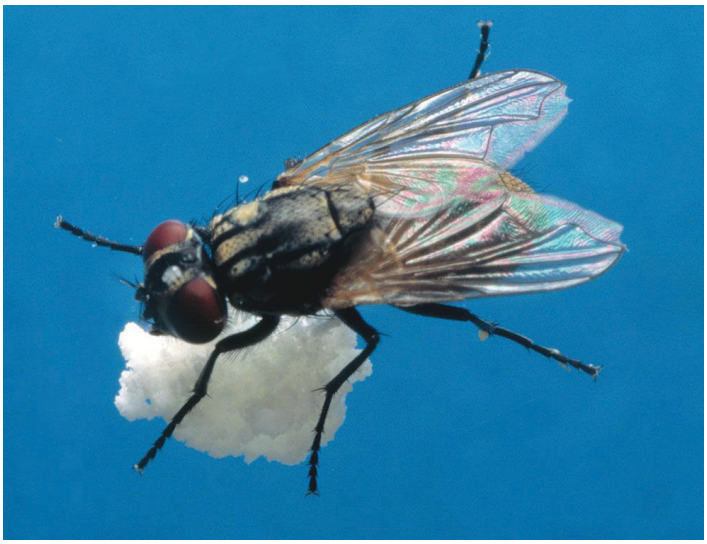


Figure 10. House fly.
Credits: J. F. Butler, UF/IFAS

House fly eggs are laid in almost any type of warm organic material; however, poultry manure is an excellent breeding medium. Fermenting vegetation such as grass clippings and garbage also provide a medium for fly breeding. The white eggs, which are laid in clusters of 75 to 100, hatch within 24 hours into minute larvae or maggots. In 4 to 6 days the larvae migrate to drier portions of the breeding medium and pupate. The pupal stage may vary in duration considerably, but in warm weather can be about three days.

When the adult emerges from the puparium, the wings are folded in tight pads. The house fly crawls about rapidly while the wings unfold and the body dries and hardens. Under normal conditions, this may take as little as an hour. A house fly may go through an entire life—egg, larva, pupa to winged adult—in 6 to 10 days under Florida conditions. An adult house fly may live an average of 30 days. During warm weather 2 or more generations may be produced per month. Because of this rapid rate of development and the large number of eggs produced by the female, large populations develop.

House flies are strong fliers and can become widely distributed by flying. Generally, however, flies are abundant in the immediate vicinity of their breeding site. Under certain conditions, they may migrate 1 to 4 miles, but they are more usually limited to one-half to 1 mile.

Insecticide Resistance

Insecticide resistance is a complex problem associated with chemical use in the control of insect populations. Recognized some 60+ years ago, it is not a new problem. Resistance is the ability of an insect population to withstand exposure to insecticides that had previously successfully controlled those populations. Insecticide resistance is acquired by successful breeding by those insects that survived previous exposures to the insecticide. The surviving insects developed resistance in one or more of several different ways. Some insects develop biochemical mechanisms (enzymes) that enable them to quickly break down the insecticide. Other insects experience physiological changes in internal structures that prevent the insecticide from binding to the correct site. Still others develop behavioral adaptations that enable them to avoid insecticide exposure (such as resting outdoors, rather than indoors). Once a population of insects achieves insecticide resistance, that population is unlikely to return to susceptibility. It is illegal—and most likely ineffective—to increase the insecticide dose applied to livestock or livestock facilities beyond what is prescribed on the label.

Control of Poultry Ectoparasites

Insecticides should be considered the last resort after sanitation and management methods have been tried. Sole reliance on insecticides often results in insecticide

resistance, control failures, and higher pest populations due to a lack of biological control organisms.

Keys to Pesticide Safety

1. Before using any pesticide, stop and read the precautions.
2. Read the label on each pesticide container before each use. Heed all warnings and precautions.
3. Store all pesticides in their original containers away from food or feed.
4. Keep pesticides out of the reach of children, pets, and livestock.
5. Apply pesticides only as directed.
6. Dispose of empty containers promptly and safely.

Recommendations in this document are guidelines only. The user must insure that the pesticide is applied in strict compliance with label directions.

The Food and Drug Administration has established residue tolerances for certain insecticides in the meat of certain animals. When these and other approved insecticides are applied according to recommendations, the pests should be effectively controlled and the animals' products will be safe for consumption.

The improper use of insecticides may result in residue in milk or meat. Such products must not be delivered to processing plants. To avoid excessive residues, use the insecticides recommended at the time recommended and in the amounts recommended.

See ENY-272 *Pesticide Safety around Animals* for information on how to correctly and safely treat livestock with insecticides.

Residues

Poultry producers are strongly cautioned against the use of anything but recommended materials for insect control. The use of any insecticide not clearly labeled "For Use On Poultry" can lead to illegal residues in meat or eggs, resulting in seizure, economic loss, financial penalties and a tarnished image of the industry.

To avoid excessive residues, use the insecticides recommended, at the time recommended, and in the amounts recommended.

Locating an Approved Pesticide

In 2014, a group of livestock entomologists, as a part of Multistate Hatch Project S-1060, developed an online system for obtaining the names of registered pesticides appropriate for use with livestock and pets. This is a state-specific database (only certain states are represented, and Florida is one of these); if you are in another state, you must be certain that your state is represented in the dropdown list.

This database is easily searchable by the type of animal or site that you want to treat (such as a barn), as well as the targeted pest. From these two selections, you can then choose the "Method of Application" and the "Formulation Type." To use this system, please visit the following website https://www.veterinaryentomology.org/vetpestx.

Although the group continuously strives to keep this database current, it is ultimately your responsibility to ensure that the product that you choose is registered in in the state that you plan to make the application and that you use the product in accordance with the label requirements and local laws and ordinances. Remember, "the label is the law" for pesticide use, and the uses indicated on the label, including the site of application and targeted pest(s), must be on the label.

If you have any challenges with this system, please contact your local UF/IFAS Extension office (https://sfyl.ifas.ufl.edu/find-your-local-office/) or for additional assistance contact Dr. Phillip Kaufman, pkaufman@ufl.edu.

Formulations

Many of the active ingredients in insecticides are manufactured and sold in several types of formulations, each registered for a given targeted commodity. Remember to ensure that the formulation you choose is labeled for poultry. The formulation is the end-user product that contains both the insecticidal active ingredient (the killing agent) and "carrier," or inactive/inert materials. Inactive ingredients may include emulsifiers, which allow for the suspension of the active ingredient in water when one mixes it, or substances that increase the likelihood that insects will consume the active ingredient (sugar in fly bait, for instance). Insecticide can be produced for many types of applications and each of these has unique formulations. These include the general groups: residual sprays, space sprays or fogs, animal-directed applications, baits, feed-through larvicides, and spray-on larvicides.

BAITS

Dry baits should be applied twice weekly from late spring to fall. Bait applications attract and kill adult flies around the poultry house. Baits consist of an insecticide applied to sugar with other fly attractants, such as pheromones, added to increase effectiveness.

Baits will not effectively reduce large fly outbreaks but will eliminate a few flies that would otherwise be a nuisance. Where allowed, baits should be scattered on walkways, at the ends of buildings, and under feed bins where adult flies congregate. Place baits in dry areas to prolong their effectiveness.

FEED-THROUGH LARVICIDE

Insect growth regulators have been approved for use in Florida. The product is mixed into the feed at the feed mill and may be an effective method of controlling house flies. A few days after initiating birds on treated feed, house fly pupae become so deformed that adult flies cannot develop. Populations of house flies then decline in 10 to 20 days. Control is maintained as long as IGR is fed to birds and the maggots fail to develop into adult flies. If when using a larvicide one notices normally shaped pupae (shortened with rounded ends, as compared to elongate fly larvae), the larvicide is no longer working, possibly because the house fly population has become resistant.

SPRAY-ON LARVICIDES

Larvicides are pesticides that are applied to waste to kill immature insects. Spray larvicide carefully, treating only those areas of waste that are breeding flies. Routine applications of larvicides to the entire manure pad will kill beneficial insects and add moisture to the waste. Apply larvicides as spot treatments to kill larvae in wet spots. Spot treatment saves money and is effective in a total management program.

RESIDUAL SPRAYS

Residual sprays may be effective in controlling heavy populations of insects. These sprays should be applied to surfaces where flies rest. Look for fly specking on ceilings, trusses, wires supporting cages, electric light cords, and other areas and spray where you see evidence of flies. To target lesser mealworms, direct applications at the sides of the facility and near the food and water provisioning areas (waterers and feeders must be raised or covered). Because lesser mealworms stay out of sight, targeting them is easiest after removal of a flock and will be most effective when litter is removed. Residual sprays should be applied with a power sprayer and low pressure. To avoid contamination of feed, water, and eggs while applying residual sprays, these must be covered or raised. Flies have developed resistance to many of the pesticides found in residual sprays. Lesser mealworm resistance may be emerging in some areas.

SPACE SPRAYS OR FOGS

Space spraying or fogging is the application of pesticides to air in fine droplets to kill flies. This system generally does not work with lesser mealworms, mites or lice. Several types of sprayers are available for space spraying. These include thermal foggers, cold foggers, ULV (Ultra Low Volume) generators, and automatic spray systems.

Space sprays or fogs have no residual effect and therefore must be applied when flies are in the poultry house. Space sprays should be applied in the evening or early morning when the air is calm and the flies are in the poultry house. Careful application can provide rapid knockdown of adult flies.

If the waste is breeding large numbers of adult flies, no reduction of adult populations may be noticed for several days.

ANIMAL APPLICATIONS

To control mites and lice, direct animal applications may be needed. These applications often are restricted to a very few insecticides with specific formulations because many formulations are not safe for direct application to animals. When applying these products, follow manufacturer product labels and avoid over applications. Please see recommendations for calibration and product recommendations below before conducting on-animal applications. Direct animal application often requires a retreatment of the flock because the products targeting lice and mites that are labeled for use on animals generally do not kill the arthropod egg stage.

Spray System Recommendations

1. Distance of nozzles from vent of bird—8 inches
2. Nozzle type—50 flat fan
3. Distance between nozzles—8 inches (2 nozzles will cover a cage 18” deep)
4. Pressure—80 psi
5. Size of orifice—08

Calibration

The job of a pesticide applicator is to coordinate the gallons or lbs/minute and the birds/minute. The requirements of a good application are:

1. A good operator.

2. A delivery system of the proper type, correctly adjusted.

3. Speed coordinated with the output.

Calibration is the calculation of the time to travel a distance so the correct amount of insecticide is delivered per bird. It is important to do this calculation before spraying to ensure proper application.

STEPS IN CALIBRATION

1. Measure ounces of spray solution from one nozzle per minute (2 x output per one-half min).

2. Multiply ounces from one nozzle by total number of nozzles.

3. Divide total number of ounces from all nozzles by 128 ounces (128 ounces = 1 gallon). This figure equals the gallons per minute delivered by the spray system.

4. Determine from label the number of birds one gallon of diluted spray should cover (usually 100-125 birds per gallon).

5. Multiply the number of gallons per minute by the number of birds per gallon to determine the number of birds to be treated per minute.

6. Determine the number of birds per linear feet of cage.

7. Divide the number of birds treated per minute by the number of birds per linear feet.

This is the distance that must be traversed in one minute to apply the recommended rate of insecticide.

Example: An applicator is using 2 nozzles to cover cages 10" wide and 18" deep. There are 3 birds per cage. He wants to spray carbaryl (Sevin) at the recommended 6 oz of 50% WP in 5 gal of water per 500 birds.

Step 1—The applicator collects 154 fl oz of spray from one nozzle in one minute.

Step 2—154 fl oz x 2 nozzles = 308 fl oz/min

Step 3—308 fl oz/min = 2.4 gal/min

128 fl oz/gal

Step 4—500 birds per 5 gal = 100 birds/gal

Step 5—2.4 gal/min x 100 birds/gal = 240 birds/min

Step 6—3 birds/cage x 12 in/ft = 3.6 birds/ft.

10 inch/cage

Step 7—240 birds/min = 66.7 ft/min

3.6 birds/ft

Therefore, if the house is 300 feet in length, it should take the operator 4.5 minutes to spray one row of cages at the proper rate.

Problems with Spray Systems

Control of external parasites on poultry requires that an effective pesticide be properly applied. Besides problems with calibration and application of proper rates, lack of control can also be traced to poor application techniques.

Problems of poor application techniques usually are of two types:

1. Lack of adequate coverage.

2. Lack of penetrating ability.

It is difficult to get both good coverage and good penetration. For instance, a wide-angle nozzle (80°–120°) gives good coverage but poor penetration. A narrow-angle spray (50°–65°) provides less coverage but greater penetration. To overcome more limited coverage, two 50° nozzles could be used to cover the same distance as one 80° nozzle.

Penetration—The ability of a spray to penetrate the vent area is dependent upon the size of the droplet and the distance it must travel. The optimum distance a nozzle should be from the vent is 8 inches. If the nozzle is 14 inches from the vent, penetration of the spray is reduced. At 8 inches from the target, a 50° nozzle will cover 8 inches horizontally and an 80 nozzle will cover 14 inches.

Wetting Agents

The feathers of chickens are often oily, making it difficult for sprays to stick and penetrate to the skin. Surfactants or

wetting agents may be added to the formulated spray to aid in breaking the surface tension of the feather.

Animal Toxicity Recognition

The initial sign of pesticide poisoning is a quieting of the bird's attitude and loss of interest in its surroundings. It will lie quietly and move very little. Toxicity symptoms usually occur within 48 hours of treatment.

The initial lethargy usually will be accompanied by diarrhea. More advanced poisoning usually causes the bird to have difficulty breathing. If made to move, the animal will move stiffly and stumble.

Many animals will recover without treatment if the dosage of toxicant has not been too high.

RABITS AND GUNIEA PIGS

EXTERNAL PARASITES

Parasite preventatives are a big region of discussion in our cats and dogs; however many rabbit and guinea pig owners are unsure if their animals require regular worming and flea preventatives.

As a general rule, regular parasite products should not be required in these little critters. It is important to recognize that rabbits and guinea pigs are very different and cannot be treated the same!

We do occasionally see parasites in bunnies, which are generally external parasites. Fur mites, ear mites and fleas are the most common bugs we see in our rabbits and are all very easily treated with Revolution (selamectin). Revolution is available from most vet clinics and pet stores, however the dose used in cats and dogs is not always applicable to our bunnies. It is always best to double check with your vet if you are not seeing improvement, as there may be something other than parasites causing issues.

Fur mites are also sometimes called ‘walking dandruff’ and can cause flaky white itchy skin in bunnies. They can be an indicator of underlying disease. Ear mites cause crusty woody material to proliferate down the ear canal, and this can cause secondary bacterial infections to occur. They are usually very irritating and itchy and cause a lot of discomfort in our rabbits. Fleas are the same as what we see in dogs and cats. Rabbits whom live in households with dogs and cats are more likely to experience problems with fleas. They are dark, black bugs that leave black flea feces throughout the coat.

In guinea pigs we can see ear mites, fur mites and less commonly fleas. Fur mites are by far the most problematic and can result in significant hair loss, itchy skin, secondary infections and even seizures occurring due to the marked irritation!

Treatment for guinea pigs is often best with injectable medications administered by your veterinarian.

As parasites are so uncommon in these little guys, we certainly recommend a checkup if you are having issues!

TOPICAL PARASITES

These mites are very painful causing skin lesions, itching and hair loss. They are microscopic meaning they cannot be seen with the naked eye. It is vital that treatment is offered as soon as possible, as these burrowing mites can cause severe illness and in some cases death.

SYMPTOMS	WHAT YOUR VET MAY DO	COMMON MEDICATIONS	HOME CARE
Hair loss generally starting at the rear	Skin scraping - although not always a good diagnostic tool	Ivermectin (Oral or Topical) over 4 weeks	Cut nails so they are short to prevent injury when scratching
Itchiness	Vet should prescribe Ivermectin	Revolution for Puppies & Kittens	Do not use prays, shampoos or washes it can result in the mites burrowing more
Patchy Fur	May also treat for fungal infections		All guinea pigs will need treatment even if no symptoms are showing
Open sores and scabs on the skin	Topical creams for open sores		Clean and disinfect all housing
Skin residue similar to dandruff	Diazepam to control itching		An old sock with the ends cut off can be used as a cover to prevent scratching
Seizures in severe cases			

BITING LICE

These parasites can be seen with the naked eye. Often residing near the guinea pigs ears, head, rear and neck. Skin can appear dry and scaly with the presence of scabs…

SYMPTOMS	WHAT YOUR VET MAY DO	COMMON MEDICATIONS	HOME CARE
Hair Loss	Applying sticky tape to the hair follicle can trap the parasite so it can be seen under the microscope	Ivermectin (Oral or Topical) over 4 weeks	Cut nails so they are short to prevent injury when scratching
Crusty Skin and Scabs	Vets should prescribe Ivermectin	Revolution for Puppies & Kittens	Do not use prays, shampoos or washes it can result in the mites burrowing more
Excessive Shedding	May also treat for bacterial infections	Antibiotics for secondary skin bacterial infection	All guinea pigs will need treatment even if no symptoms are showing
			Clean and disinfect all housing

FUR MITES

There are two distinct fur mites that can guinea pigs can contract. One is called Static lice (Chirodiscoides caviae*).* This mite is relatively harmless and can be seen moving in the guinea pigs fur.

SYMPTOMS	WHAT YOUR VET MAY DO	COMMON MEDICATIONS	HOME CARE
Itchiness	Applying sticky tape to the hair follicle can trap the parasite so it can be seen under the microscope	Ivermectin (Oral or Topical) over 4 weeks	Cut nails so they are short to prevent injury when scratching
Hair Loss	Vets should prescribe Ivermectin	Revolution for Puppies & Kittens	Do not use prays, shampoos or washes it can result in the mites burrowing more
Scabs	May also treat for bacterial infections	Antibiotics for secondary skin bacterial infection	All guinea pigs will need treatment even if no symptoms are showing
Reddened Skin			Clean and disinfect all housing
Mites resemble dandruff			

EAR MITES

Also known as Psoroptes cuniculi can cause scratching and shaking of the head. The ears can also have a dark excretion.

SYMPTOMS	WHAT YOUR VET MAY DO	COMMON MEDICATIONS	HOME CARE
Shaking of the head	Examination of the ear with a Otoscope	Ivermectin injectible or oral twice (once per 18 days)	Cut nails so they are short to prevent injury when scratching
Scratching at the ears	Vets should prescribe Ivermectin	Revolution for Puppies & Kittens	Clean the ears with a dry cotton ball and a gentle ear cleanser approved for small animal use
Scabs	May also treat for secondary bacterial infections	Antibiotics for secondary skin bacterial infection i.e. Baytril	All guinea pigs will need treatment even if no symptoms are showing
Reddened Skin	Using residue from the ear may be applied to a glass slide	Ivermectin can also be applied directly to the ear	Clean and disinfect all housing
	Examination of slides under a microscope to diagnose Ear Mites	Genoctin ear drops/octomite	

RINGWORM

This condition is caused by fungal spores which can weaken hair follicles causing hair loss. The skin underneath is then exposed appearing crusty.

SYMPTOMS	WHAT YOUR VET MAY DO	COMMON MEDICATIONS	HOME CARE
Bald Patches of Skin	Skin scrape and culture	Malaseb Shampoo	Cut nails so they are short to prevent injury when scratching
Crusty flaky skin	Prescription of anti-fungal cream and shampoo	Anti-fungal cream such as Miconazole	Soak all accessories in a diluted bleach solution for a minimum of 15 minutes
Facial Scabs	Cleanse the area with Chlorhexadine solution	Chlorhexadine Solution	Wash hands regularly and wear gloves
			Clean and disinfect all housing
			Quarantine infected pets

Daily Health Chart

Nose	Eyes	Ears	Mouth	Fur	Fecal/Urine	Behaviour
						
Normal	Normal	Normal	Normal	Normal	Normal	Normal
Clear No Discharge Skin Clean Ease of Breathing	Clear Symmetrical Open	Clean Inside of ear clear	Teeth Straight Clear of debris Closes easily	Clean Clear skin	Oval Shape Brown/Black Urine Clear	Alert Active
Abnormal	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal
Discharge Runny Sneezing Crusty Wheezing	Cloudy Discharge Crusty Squinting Redness Bulging Eyes	Crusty Skin Peeling Inflamed	Difficulty Eating Slightly Ajar Salivating	Hair Loss Scratching Balding	Diarrhoea Blood in Urine Incontinence	Lethargic Loss of appetite

Behaviour: When Your Rabbit is Unwell

By Tamsin Stone

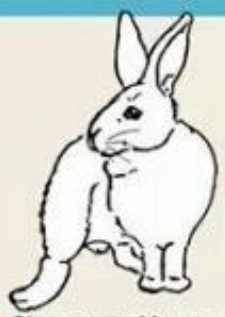
www.theRabbitHouse.com

Changes to Grooming

Soiled or dirty fur, dirty ears, excessive scratching, chewing fur, wet fur around eyes, chin or bottom.

Changes to Activity

Less active than normal, slower to greet you, aggressive, spending less time playing, exploring or interacting.



Changes to Movement

Limping, stumbling, dragging back legs, uncoordinated, tilting to one side or reluctant to move.

Changes to Eating Habits

A change in food preferences, only eating favourite foods, eating less, dropping food or chewing oddly.

Not eating at all is an emergency.

Rabbit's instincts are to hide signs of illness; they often show little outward sign of being unwell until they are very sick. The first hint of potential illness are subtle changes in your rabbit's behaviour and routine that make you feel "something's not quite right". If you notice a change you are worried about, call your vet to set up an appointment.

Changes to Toilet Habits

Losing litter training, increased wee-ing, small or odd shaped droppings.

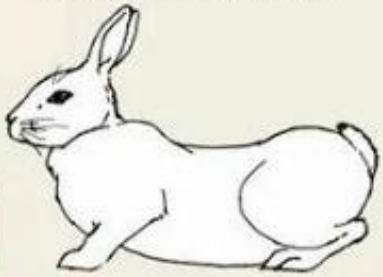
Diarrhoea or producing no droppings are emergencies.

Signs of Pain

Sitting huddled/hunched up, eyes tense or semi closed, reluctant to move, and may grind their teeth.

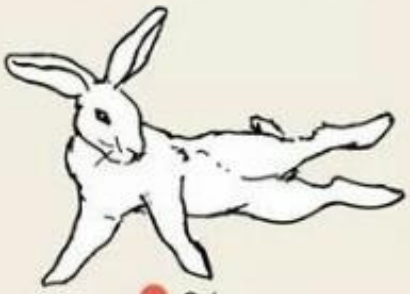
Some health issues should be treated as an emergency and you'll need to call your vet (day or night!) and go straight there:

Unresponsive
Difficulty Breathing
Not eating/pooping
Diarrhoea (Liquid/watery poop)
Flystrike
Trauma
Bleeding
Seizure



Stomach Pressing (Pain)

Pressing the stomach to the floor, being restless and unable to find a comfortable position to sit or lie in.



Seizure

Rapid twitching, kicking or shaking. May stagger or appear disorientated, but not necessarily fall over.

Unresponsive

Laying on side limp, floppy, cold. Some rabbits sleep in this position but will act normally when disturbed.

Difficulty Breathing

Mouth breathing (rabbits usually breath through their nose), laboured breathing, wheezing or blue lips.

LABOKLIN aktuell

Info 01/2018

Intestinal parasites in rabbits and guinea pigs

Dental disease and inappropriate feeding are common causes of diarrhoea. Parasites, in contrast, play a smaller role in pets. However, some parasites may occur more commonly depending on the type of husbandry and age of the animals (larger collections, breeders, outdoor enclosures, juvenile animals). While young animals often develop clinical signs when they are infested, adults may only develop notable changes in cases of severe parasitism. Parasite infestation can, however, lead to changes and disruptions in the intestinal environment. Increased growth of yeasts (Fig. 1) or bacterial secondary infections (e.g. with Clostridia, E. coli) can be a result and can cause intestinal disease.

Fig. 1: Cyniclomyces guttulatus

Parasites of rabbits

Protozoa

Coccidia

Various *Eimeria* species can infest the intestine or bile ducts of rabbits. Young rabbits are particularly susceptible to intestinal coccidiosis, and infestation in these animals can be associated with high mortality. Infestations can spread epidemically within collections. Adult animals can be clinically inapparent shedders. In addition to diarrhoea, animals can develop bloat and appear dull and lose their appetite. In bile duct coccidiosis, severe infestation leads to a reduction in liver function. Affected animals are apathetic, lose weight, and are constipated. Some animals may also develop fever and become icteric.

Treatment

Treatment of coccidiosis is carried out with toltrazuril (10 mg/kg once daily per os for 3 days, repeat after 3 days). Sulfonamides such as sulfadimethoxine can also be used, but are often less effective than toltrazuril.

Giardia

Giardia infections are rare in rabbits. The occasional diarrhoea is usually slimy and has a light colouration. Detection via SAF is preferable to the flotation method. Coproantigen ELISAs are even more sensitive.

Treatment

Fenbendazole (20 mg/kg once daily per os) or metronidazole (10-20 mg/kg twice daily per os) can be used in infected rabbits for at least 5 days.

Nematodes

Of the nematodes, *Passalurus ambiguus* (pinworm) is most common (Fig. 2). Animals often only develop clinical signs (diarrhoea, bloat, colicky abdominal pain, anal itching) if they are severely parasitized. Normal faecal exams can be false negative. In suspected cases it is therefore prudent to prepare a cellophane

tape impression of the anus, since eggs are laid on the rectal and anal mucosa and on the surface of faecal pellets.

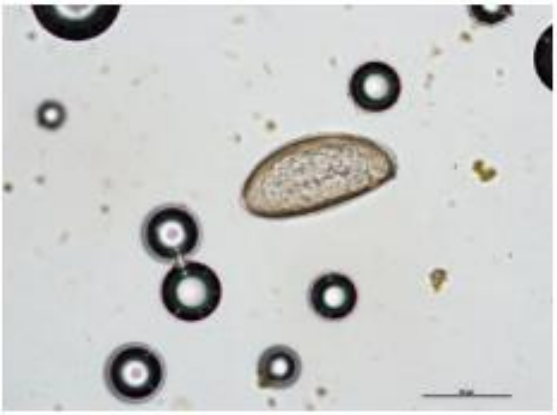


Fig. 2: Passalurus ambiguus

Stronglyus-type eggs can also be found in the faeces, and can be from *Graphidium strigosum* or *Trichostrongylus retortaeformis*. Like *Strongyloides* spp. and *Trichuris leporis*, these parasites play a subordinate role in pets. Animals can be infected by feeding greens that have been contaminated by wild rabbits or field hares, or by the use of outdoor enclosures. Young animals are mostly affected with diarrhoea, dullness, and inappentence.

Treatment
Animals with nematode infestations can be treated with (pro-) benzimidazoles like fenbendazole (20 mg/kg once daily per os for 5 days, repeat after 14 days), mebendazole (20 mg/kg once daily per os for 3-5 days, repeat after 14 days), or febantel (10 mg/kg once daily per os for 3 days, repeat after 14 days). Subcutaneous administration of ivermectin (0.3-0.5 mg/kg) or doramectin (0.5 mg/kg) repeating after 7-14 days is also possible.

Cestodes

Tapeworm infestations are rare in wild rabbits, and even rarer in pet rabbits. Tapeworms in the family Anoplocephalidae (Fig. 3) are transmitted by oribatida (moss or beetle mites), which are intermediate hosts. Clinical signs are found mostly in juveniles or in cases of mass infestations.

Fig. 3: Tapeworm egg from the family Anoplocephalidae

Treatment
Praziquantel (one treatment with 10 mg/kg per os or subcutaneously, repeat after 10-14 days) can be used to treat tapeworm infestations.

Trematodes

Infestations with *Fasciola hepatica* or *Dicrocoelium dendriticum* are extremely rare. Transmission is via green fodder or swampy locations or sheep pastures, whereby the metacercariae of *Fasciola hepatica* adhere directly to the fodder, while the metacercariae of *Dicrocoelicum* dendriticum are ingested through infested ants. The common liver fluke can cause hepatitis and cholangitis, leading to inappetence, wasting, icterus, and oedema formation. Infestations with the lancet liver fluke generally remain undetected.

Treatment
Treatment with substances such as e.g. closantel (10 mg/kg per os, single dose) for Fasciola hepatica or fenbendazole (100 mg(kg per os) for *Dicrocoelium dendriticum* have been described.

Incidence of parasites in rabbits

An evaluation of routine submissions (n=3746) showed that parasites were detected in 27.5% of the rabbits, 72.5% of the rabbit samples were negative (Fig. 4).

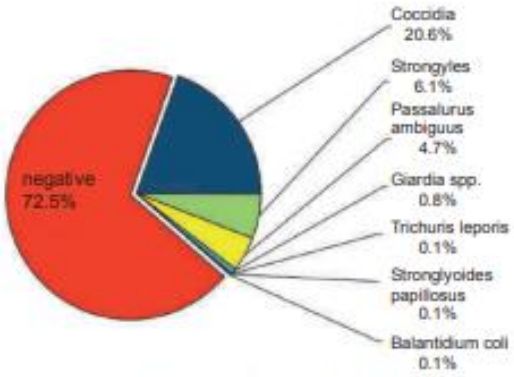


Fig. 4: Parasite detection in rabbits using flotation and SAF methods (n=3746).

Parasites of guinea pigs

Protozoa

Trichomonads

Trichomanads are physiological intestinal commensals in the caecum and colon of healthy guinea pigs. They can, however, strongly proliferate and cause disease if the intestinal environment changes or in immunosuppressed animals. Changes in the intestinal environment can be caused e.g. by other parasites, incorrect feeding or dental disease. The resulting chronic diarrhoea is soft and the animals lose weight. Trichomonads can be detected in native smears of fresh faecal material. It is important to determine the cause of the proliferation of flagellates.

Treatment

Metronidazole and dimetridazole (20-50 mg/kg once or twice daily per os) can be used for 7 days to treat trichomonads.

Entamoeba caviae and Balantidium coli

These single celled organisms are also commensal in the caecum and colon. As for trichomonads, they can proliferate and cause disease under various circumstances. An increased detection of Balantidium coli, for example, is an indication of too little structure in the fodder.

Treatment

Metronidazole and dimetridazole can also be used to treat these flagellates.

Cryptosporidia

Cryptospoidium wrairi plays a minor role in pets. Increased rates of infestation have been described in large collections. In suspected cases, a coproantigen ELISA is better for diagnosis than flotation.

Treatment

There are no effective treatment.

Giardia

Giardia are rare in guinea pigs. Affected animals generally do not have diarrhoea. SAF is superior to flotation for detection. Coproantigen ELISAs are even more sensitive.

Treatment

Fenbendazole (20 mg/kg once daily per os) or metronidazole (20-40 mg/kg twice daily per os) for 5 days can be used to treat infected guinea pigs.

Coccidia

Infestation with *Eimeria cavia* is mostly relevant in groups, such as breeding groups or in the animal trade. Juveniles most commonly develop disease. Affected animals are apathetic, inappetent, lose weight, and have diarrhoea, with high mortality in some cases.

Treatment

The same treatment is used in guinea pigs as in rabbits.

Nematodes

Infestation with *Paraspidodera uncinata* (pinworm) is mostly found in large collections, outdoor enclosures or in animals with outdoor runs. Clinical signs manifest in cases with severe infestations (Fig. 5).

Fig. 5: Paraspidodera uncinata

Trichuris gracilis is found mostly in wild guinea pigs, but has also been described in pet animals in individual cases.

Treatment
Various substances are effective against nematodes. Of the (pro-)benzimidazoles, e.g. fenbendazole (20 mg/kg once daily per os for 5 days, repeat after 14 days), and febantel (10 mg/kg once daily per os for 3 days, repeat after 14 days) can be used. Subcutaneous injection of ivermectin (0.3-0.5 mg/kg) or doramectin (0.5 mg/kg) with a single repeat treatment after 7-14 days are also effective.

Cestodes

Hymenolepis nana or Hymenolepis diminuta can be found in guinea pigs, but are quite rare. Insects are the intermediate hosts. Transmission to guinea pigs is via oral ingestion of these insects (e.g. fleas, flour beetles, mealworms, cockroaches). *Hymenolepis* nana can also be transmitted by direct oral ingestion of eggs. Infestation is usually clinically inapparent.

Treatment
Infestation is treated with praziquantel (single administration of 5-10 mg/kg per os or subcutaneously, repeat after 10-14 days).

Incidence of parasites in guinea pigs

An evaluation of routine submissions (n=689) showed that parasites were detected in 12.0% of the guinea pigs, 88.0% of the samples were negative (Fig. 6).

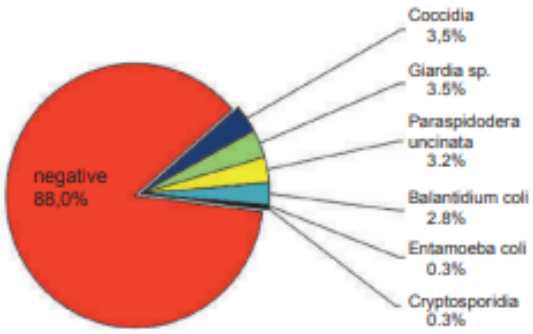


Fig. 6: Parasite detection in guinea pigs using flotation and SAF methods (n=689).