

CHAPTER 5

Common Diseases and Ailments of Turkeys and Their Management

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Standard turkey varieties are hardy and robust birds that are easily managed, provided basic precautionary measures are taken to ensure their health and welfare. Good flock health begins with obtaining eggs or stock from reputable suppliers with disease-free flocks. At the very least, the flock of origin should be certified through the National Poultry Improvement Program (NPIP) of USDA. This is a certification given to flocks that are regularly tested and pronounced clean of several poultry diseases once common in the United States. Flocks may also participate in the Avian Influenza Surveillance program as an added measure of biosecurity.

Any new stock that is obtained should be identified with bands or toe punches, maintained together in their source groups, and quarantined for at least 30 days prior to introduction to the main flock. Source identification (wing or leg bands, tattoos, etc.) enables the producer to know where each bird comes from if problems of any kind develop after the 30-day quarantine.

The practice of vigilant observation enables a producer to detect illness early on in the flock and take measures to correct the problem before it spreads or becomes serious. Observe all birds several times a day to become familiar with their normal behavior. Birds may not show obvious signs of illness until a disease is in an advanced state. Some individual birds remain healthy even though they are carriers of disease. When stressed, these carriers shed disease organisms. Stress is an underlying factor in a bird's ability to naturally combat pathogens. Keep stress to a minimum. Provide a comfortable and relaxed farm environment at all times. Consistent schedule and handling procedures will minimize stress.

Following basic sanitary and biosecurity measures is often the most important preventative of the vast majority of diseases and ailments that can occur with turkeys. (These precautionary measures are covered in detail in Chapter 7, *Health Promotion and Biosecurity*.) Good

biosecurity practices begin in the brooder and should continue throughout the birds' lives. Young poults are at the most vulnerable age in a turkey's life and will need time to build up their immune systems before being exposed to the outdoors or potential vectors for disease. Once the birds are out on pasture, rotational management of the birds on the land will protect against overgrazing and the buildup of any pathogens they shed into the soil. (See Chapter 3, *Pasturing Turkeys*, for more information on rotational pasture management.) Keep food and water inaccessible to pest species by placing them in receptacles that are not easy for these species to gain entry. Move food and water sites often to avoid the accumulation of feces, moisture, and dropped food around feed areas.

Vaccination may be a good option for protecting flocks against some diseases. The vaccines available for turkeys are: Fowl Cholera, Turkey Pox, Avian Encephalomyelitis, and Newcastle Disease. However, vaccination should be used only when birds are at risk for a certain or specific disease. Check with your state's agricultural extension service or the state veterinarian's office to learn which diseases may be prevalent in your area, and if restrictions apply.

Building and maintaining the health of the flock is the strongest defense in the fight against any disease. Birds should get plenty of exercise and are healthiest when fed more than just the basic necessities. Vitamin and mineral supplements and probiotics can be used to increase vigor and ability to remain healthy. Fresh, clean water is an absolute necessity at all times.

On the following pages is a list of ailments and diseases that can be associated with turkeys. Much of the information in the table has been adapted from *Turkey Management* by Marsden and Martin (1), along with numerous other sources that are listed in the Resources section at the end of the chapter.

Deformities, Injuries, and Behavioral or Situational Problems

Problem	Symptoms	Likely Causes	Prevention and Treatment
Feather Picking and Cannibalism	Birds may pluck their own feathers or the plumage of other birds. This can escalate to attack and/or injury of birds within the flock. Other signs include blood and swelling at the vent.	One or more stressors including crowding, bright light, dietary deficiencies (esp. salt), insufficient feeding or watering, lack of space, or boredom can cause feather picking and cannibalism. For turkeys the sight and smell of blood induces increased pecking. Movement of the vent during defecation, especially when swollen and bloody, attracts pecking.	Calculate available space on your farm before ordering poults. Provide proper nutrition and water sources. Provide high fiber feeds such as whole oats (free choice) during periods of feather picking or cannibalism to reduce these behaviors. Separate injured birds until their wounds are healed and will no longer attract the pecking of others in the flock.
Insect Attack	Bite welts are found around the head and occasionally under feathers.	Lack of shelter is the most common cause.	An open-sided range shelter seems to protect turkeys somewhat against insects.
Bumblefoot	This condition manifests as a hard swelling of the center of the foot pad and/or bottom of toes, cracking and infection of the underside of the feet, and may also involve Staphylococcus infecting the foot.	Stress, overcrowding, poor sanitation, poor diet, roosts that are placed too high, and flooring that is too hard or rough lead to Bumblefoot. Rocks, glass, and sharp objects in the birds' area can also cause this condition.	Avoid overcrowding and provide appropriate nutrition, and roosting area. Cover flooring with bedding to soften area. Remove animals from muddy or heavily soiled areas.
Dehydration	Indicators include listlessness, sunken appearance in the crop region, whitish crystals around the vent, and the crop found to be empty or containing dry feed.	Causes include the wrong type of watering equipment or lighting, poults incorrectly introduced to water source, unpalatable water from additive or contaminants, and insufficient watering space or supply.	Closely monitor water consumption in poults until they are drinking well. Monitor birds if something new has been added to the water source. Provide sufficient water for the flock at all times.
Enlarged Hock Disease (see also Perosis or Mycoplasma)	This begins with a slight enlargement of the hock at 2 weeks of age. The hock then returns to normal size at about 4 weeks, but the swelling returns in severe form at 14-16 weeks of age. The disease results in severe leg weakness, breast blisters and abscesses, sore feet, and/or sore legs.	Poor nutrition is the leading cause. Most likely deficiency of vitamin D3 and/or calcium coupled with Staphylococcus and/or Mycoplasma organisms.	Start with disease-free poults and feed them a nutritionally balanced diet throughout their lives. Avoid molds in feed. Note that tetracycline medications will interfere with calcium absorption and lead to enlarged hock disease.
Milkweed Poisoning	Poisoning is caused by whorled milkweed, <i>Asclepias galioides</i> . Symptoms are drowsiness, lack of coordination, convulsions, exhaustion, coma, and death. The weed is found in the southwestern to the south-central U.S.	Poisoning occurs through the ingestion of the plant material, both fresh and dried.	Eradicate the weed where turkeys are foraging or exclude birds from areas where the weed is present.
Perosis	This condition includes a number of problems including the softening of leg bones, enlarged hocks, slipped tendons, twisted shanks, bowlegs, misshapen hock, spraddle-leg, and lameness.	Poor nutrition, lack of sunshine, genetic predisposition (inherited condition), and being raised on slippery floor surfaces will cause birds to be prone to this condition.	Start poults off with nutritionally balanced diet and continue it throughout the birds' lives. Allow the birds access to natural sunlight as soon as possible. Avoid housing birds on slippery flooring. Birds that are permanently crippled should be culled.

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Problem	Symptoms	Likely Causes	Prevention and Treatment
Spraddle-leg	This is Perosis in young poults. With this condition they lose control of one or both legs so that the limb or limbs are held out sideways.	Inbreeding, poor nutrition of parents, poor incubation practices, and poor quality or slick smooth flooring will cause Spraddle-leg.	Supply an adequate nutritious diet to parents and use proper incubation and brooding practices. Prognosis is generally poor. It may be best to cull poults with this condition to prevent their possible use as breeders.
Stampeding	Turkeys are suddenly frightened at night and fly violently against walls and the roof of the shelter causing damage to legs, wings, etc. They can often pile up in the corners of houses and smother each other.	Birds can be startled by prowling animals, strange noises, or sudden bright lights, all of which could cause a stampede.	Night lights near the nighttime roosting area can reduce incidences of this behavior. Take protective measures to keep predators away from birds.

Diseases and Parasites of Turkeys

Disease or Parasite	Description and Symptoms	Transmission	Prevention and Treatment
Aspergillosis (Brooder Pneumonia)	This is a fungal infection usually caused by <i>Aspergillus fumigatus</i> . It most commonly affects poults 5 days to 8 weeks of age, although it can affect older birds. Indicators of infection include heavy or rapid breathing and yellow or grey nodular lesions in the respiratory tract especially lungs and air sacs, occasionally in the mouth or trachea. Lesions are common in the eyes and can sometimes occur in the brain.	Inhalation of large numbers of <i>Aspergillus</i> spores from infected hatchers, brooder houses, litter, or feed. Spores are present in almost all litter materials and grow at room temperature (~70° F) or warmer.	There is no practical cure for infected birds. Cull them. <i>Aspergillus</i> spores are very difficult to eliminate and can infect other avian species and humans. Raising the humidity and eliminating the source of the infection will limit the spread of the disease. Spraying the litter lightly with an oil-based germicide will help. Control dust and movement of spores. Replace litter if highly contaminated. Do not use litters high in bark content or ones that have previously been wet.
Avian Influenza (AI)	AI is caused by a virus. There are 256 different types of AI virus. It is found worldwide. Almost all birds are susceptible, especially turkeys. One type, HPH5N1, can be especially severe and under certain circumstances can infect humans. Mild forms produce listlessness, respiratory involvement, diarrhea and low mortality in birds. Some infected birds show no symptoms. Acute forms produce facial swelling, cyanosis, dehydration and respiratory distress, lesions and small hemorrhages throughout the body, and high mortality rates.	Poor sanitation or farm biosecurity, and close contact with wild birds (especially migratory waterfowl) will increase the chances of exposure to AI. Great amounts of virus are excreted from gastrointestinal (GI) and respiratory tracts and remain viable for variable lengths of time depending on environmental conditions. Recovered birds can excrete virus for several weeks. Transmission is by any means which carries respiratory or GI tract discharges. Infection occurs through both oral and respiratory routes.	Keep wild birds, especially migratory waterfowl, away from the flock. Implement basic biosecurity measures on the farm to reduce chances of transmission from other sources (such as other poultry farms or feed stores). A vaccine from USDA may be available for use (prior to flock exposure to AI) during times of pandemic. Notify state disease regulatory officials if AI is suspected. Flocks confirmed with AI should be depopulated.

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Avian Leucosis/ Sarcom Group of Diseases	A variety of transmissible benign and malignant tumors of chickens caused by viruses of the <i>Retroviridae</i> family. A number of tumors are produced, some in lymphoid tissues throughout the body, others in blood vessels or bone. These cause progressive weakness, loss of weight, dehydration, at times enlarged abdomen or eye tumors. Greenish diarrhea is present in terminal stages. Death occurs within weeks. Note that no symptoms or lesions appear in some birds.	The lymphoid form can infect turkeys. It is transmitted in two ways: (1) hen to progeny through the egg (small percentage), (2) bird to bird by direct or indirect contact especially at hatch time. Viruses in the droppings of newly hatched birds are highly infectious. Virus is present in both saliva and dropping of older birds. Field cases usually occur after 14 weeks of age with highest incidence around sexual maturity.	No effective prevention or treatment is available. Eradicate infected breeder flocks. Use proper cleanup, sanitation, and biosecurity practices. The causative agents are relatively resistant to sunlight but susceptible to heat, drying, and certain disinfectants.
Blackhead or Histomoniasis	This disease, caused by a protozoan (<i>Histomonas meleagridis</i>), is characterized by increased thirst, decreased appetite, watery sulfur-colored droppings, drowsiness, weakness, dry-ruffled feathers, dark cyanotic head, and lesions in the liver and ceca. Mortality is high, especially in poults less than 12 weeks of age. <i>Histomonads</i> are very stable inside cecal worm eggs that are ingested by earthworms. Earthworms can carry over the protozoans to successive broods year after year.	Birds are infected with the protozoan by directly ingesting cecal worm eggs in the soil or indirectly ingesting the eggs through earthworms infected with the protozoans. When eaten, the birds release the protozoans by excreting them in feces. The protozoans together with <i>E.coli</i> and other intestinal bacteria produce the disease. Turkeys, chickens, peafowl, and several game bird species are susceptible to the disease.	Ideally, separate turkey flocks from chicken flocks and separate young birds from older birds. Use good sanitation practices in the brooding area. Rotate range areas frequently. Feed containing a medication specific to Blackhead can be used as a preventative or to treat infected birds.
Blue Comb or Turkey Coronavirus	This infection of the gastrointestinal tract is caused by a highly contagious Coronavirus specific to turkeys. It infects turkeys of all ages. Mortality decreases with age. A disease of sudden onset, it will cause depression, low body temperature, diarrhea, loss of appetite and body weight, dehydration, prostration, and death. In poults mortality can be 50-90%. This disease will often stunt the growth of survivors.	The disease is caused by the ingestion of infected fecal material. Less than a pinhead amount will infect a bird. Within 72 hours this bird can in turn excrete a large amount of virus. Virus survival in environment is variable – days to indefinitely if frozen. Virus passage between birds or premises increase pathogenicity.	There is no effective treatment for this disease. To prevent the disease from occurring, keep young birds warm and dry. Eradication occurs only by depopulating all poultry from the farm and strict clean-up followed by decontamination with disinfectant, then a 30-day vacancy. Some birds, notably adults, may not show disease signs but almost every infected bird remains a lifelong carrier and shedder of the virus. The disease can be prevented only by strict biosecurity. Cull infected birds.

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Coccidiosis	A protozoan disease often seen in turkeys grown on range or on litter. It usually infects immature turkeys before their immune system develops. Usual symptoms include weakness, drooping wings, ruffled feathers, head drawn back into shoulders, listlessness, and light brown, mucoid, and often bloody diarrhea with a fetid odor.	This disease is caused by the protozoan parasites of the genus <i>Eimeria</i> . Turkeys are susceptible to 7 species, only 3 of which are pathogenic. Coccidia of chickens and other birds and animals do not infect turkeys and vice versa. Coccidial oocysts are shed in the feces of infected birds and must be ingested to produce disease. Oocysts are environmentally stable and are not killed by most disinfectants.	Prevent transmission of Coccidiosis by eliminating fecal material from infected birds. Feces from infected birds can be tracked in on crates, equipment, footwear, clothes, pets, wild animals, etc. Prevent build-up of oocytes in the environment by removing damp litter and preventing wet spots. A vaccine is available and other biological preventatives are under development to combat Coccidia. In severe cases, a dietary coccidiostat (preventative) should be considered, at least temporarily. Apple cider vinegar can be used as a prophylactic treatment (1-4 Tbsp/gallon of water). Limited immunity to coccidia is built up if birds are exposed to low doses of the organism over time.
Erysipelas	With this bacterial infection birds may exhibit listlessness, drooping posture, sulfur-colored droppings, cyanotic (dark blue) head, nasal discharge or stuffiness, swelling of the snood, slight fever, and/or lameness. This disease primarily infects toms through wounds caused by fighting. This disease can be passed to other species including swine, sheep, and humans.	This condition is caused by exposure of open wounds to the bacterium <i>Erysipelothrix insidiosa</i> . Erysipelas is soil-borne, persistent in the environment (esp. alkaline soils), and resistant to many germicides. The organism can become endemic on infected premises. The organism can enter through bites (esp. mosquitoes) or breaks in the skin or mouth of the bird.	Maintain appropriate social grouping within the flock to avoid fighting among toms. Vaccination is recommended in areas where the disease is common. The disease can be treated with penicillin or tetracycline. Use rubber gloves when treating infected birds. Infected, vaccinated birds can remain carriers and re-infect pens or new premises.
Flukes	Exposure to the fluke <i>Collyriclum faba</i> produces large, shiny cysts on the skin in the abdominal area of young turkeys. Other flukes (trematodes) affect the intestinal tract causing milky discharge from the cloaca or, in severe cases, enteritis. Infected hens may lay eggs with soft shells or no shells.	Birds kept near marshy areas can be exposed to intermediate hosts (snails, dragonfly nymphs, tadpoles, frogs) and drink from natural water sources that may be contaminated with flukes.	Avoid using natural water sources as the primary water supply for the flock. Remove birds from contact with intermediate hosts.

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Fowl Cholera	<p>Fowl of all species (esp. turkeys, chickens, pheasants, and ducks) are susceptible. The disease usually strikes birds older than 6 weeks. Symptoms range from sudden death to chronic localized infections of joints, nasal clefts, and/or brain. Recovered birds remain carriers. The disease may start with sudden deaths within the flock, followed within hours by birds with fever, lethargy, increased water intake, decreased feed consumption, cyanotic (dark blue) head and un-feathered parts, pronounced hemorrhage in various tissues, and increasing mortality within the flock. The infection is evident and consolidated in lungs upon diagnostic exam. Chronic forms usually follow acute outbreaks.</p>	<p>It is caused by the bacterium <i>Pasteurella multocida</i> which can survive in soil, litter, or decayed matter for several months. It is easily killed by disinfectants, drying, and direct sunlight. Wild birds, predators, and domestic cats are suspected of harboring and spreading the disease, especially to turkeys on range. Disease spreads through infected feces, body excretions, and contaminated materials (feed, water, equipment, etc.).</p>	<p>Control of the disease is achieved through eradication of infected birds, sanitation of infected areas, and good flock biosecurity. Control of rodents and predators is essential to prevent future outbreaks. In problem areas, vaccines can and should be used. Sick birds should be culled. Recovered birds are carriers of the organism and should therefore be culled.</p>
Fowl Pox	<p>There are two types of Fowl Pox. "Dry Pox" shows nodular prolific skin lesions on un-feathered body surfaces at the bite sites of infected insects. The lesions progress to thick scabs that are firmly attached. "Wet Pox" presents itself with yellow, canker-like lesions and swelling in mouth, throat, and respiratory tissues, which cause breathing difficulties in the birds.</p>	<p>Infection by Fowl Pox virus is through mosquitoes or other biting insects, possibly by ingestion of infected scabs, or through the dust in infected environments, which enters the eye, skin wounds or respiratory epithelium. Mosquitoes are infected when feeding on infected birds and possibly remain infective for life, even wintering over in poultry houses.</p>	<p>Vaccination should be used only on farms or in areas where fowl pox is a recurring problem although only a few methods of vaccination are effective for this disease. Consult knowledgeable sources. Antibiotics on the raw lesions and in drinking water will help to combat secondary infections.</p>
Gapeworm or "Redworms"	<p>These round red worms live in the trachea (windpipe) causing open mouth breathing (gaping), often accompanied by grunting sounds from the bird. Redworms grow rapidly and soon block the trachea causing air blockage and suffocation, especially in young birds. Birds may stretch out their necks, cough, or shake their heads trying to remove the worms. Birds will not eat and rapidly become weak.</p>	<p>Gapeworm problems occur mostly in young birds and those reared in range pens with gapeworm-infested soils. Gapeworm infestation occurs when redworms, their eggs, or earthworms which have eaten gapeworm eggs are ingested and shed in the turkey droppings. Gapeworm eggs on the ground or in the litter embryonate within 8-14 days and become infective when eaten by birds or earthworms. In earthworms, gapeworm larvae hatch and become encysted in muscle tissues, where they can remain infective for up to 4½ years (in snails and slugs up to 1 year.) After ingestion by turkeys, larvae hatch in the intestine, migrate to the lungs, and then move into the trachea.</p>	<p>Keep food and water off the ground to decrease chances of contamination from earthworms. Use of poultry anthelmintics in the food or water can reduce incidence of the worms in the flock. Tilling the soil in the pens after the growing season helps to destroy residual infection.</p>

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Hexamitiasis	Infected poults are chilled, nervous, chirp often, huddle, become listless with ruffled feathers, and finally become convulsive and comatose. Death typically follows coma. Watery, foamy, fetid diarrhea develops early with infection, probably causing electrolyte loss and hypoglycemia. Less affected poults consume some feed but lose weight, and many survivors become unthrifty and stunted. Recovered birds remain carriers. The greatest mortality occurs in poults 3-8 weeks of age. Resistance develops by 10-12 weeks. This disease is rare in adult turkeys. Hexamitiasis can be confused with Coronaviral enteritis.	Infection is caused by the flagellated protozoan <i>Hexamita meleagridis</i> which is found worldwide and is endemic in some areas. The parasite also infects ducks, quail, pheasants, and pigeons. Chickens can carry the organism but are not affected and can serve as carriers and sources of the parasite. The organism is passed from bird to bird and by ingestion of droppings contaminating feed or water.	Establish an all-in, all-out brooding and growing program. Avoid young poults coming into contact with older or free-flying birds that may be carriers of the organism. Put feeders and waterers on wire platforms. Clean and disinfect between flocks. Regularly clean and sanitize waterers. Medicating feed with histomonastats is especially important for turkeys on range. Depopulate infected flocks.
Leucocytozoon Infection	This is a blood protozoan disease that affects blood and tissue cells of internal organs. Domestic turkeys show loss of appetites, vigor, excessive thirst, depression, sleepiness, moist tracheal sounds, coughing, and sometimes uncoordination. Sudden death occurs in acute cases. Young turkeys less than a few months old during blackfly season are the most often infected victims of the protozoa. The disease is often rapid and fatal. Hens have decreased egg production, egg weight, poor hatchability, and high poult mortality. Wild turkeys, especially the mature birds, show few signs.	Blackflies and midges become infected with <i>Leucocytozoon smithi</i> which is host specific for turkeys. Within a few hours of taking blood from an infected turkey, the parasite within the blackfly or midge develops to a stage which allows transmission through the saliva of the biting insect. Once in the turkey, the parasite develops and matures in the blood and tissue cells and causes the disease signs and internal lesions. <i>L. smithi</i> remains infective within the biting insect for days after its last blood meal. Recovered birds may carry infective <i>L. Smithi</i> in their blood for more than a year and can infect biting insects in the next season.	Because the biting flies breed in running water, the disease is more common around streams. Blood screening of the flock can identify carriers of the parasite. Removal of carriers can break the cycle by eliminating the source of the parasite.
Lice (Fowl Lice)	Approximately 40 species of fowl lice exist. Many can cross-infect different species of fowl if the birds are in close contact. More than one species of lice can co-exist on the same birds. Treatment and control, however, are the same for all fowl lice. Lice are not highly pathogenic to mature birds but heavily infested poults may die. Infestations may contribute to infertility in mature turkeys. Lice feed on dry skin scales and feather products. Evidence indicates that lice irritate nerve endings and interfere with sleep, rest, and nutrition. Lice infestations frequently accompany symptoms of poor health, infectious disease, malnutrition, and poor sanitation.	Only chewing lice, not sucking lice, infect fowl. Turkeys, unless infected from other fowl, become infected with one of 3 species of fowl lice: a large louse, a slender louse, and chicken-type lice. The slender type is the most common in wild turkeys. Lousiness is diagnosed by finding the straw-colored lice on the skin or feathers. Eggs are attached as white clusters at the base of feathers and they hatch in 4-7 days. Lice spend entire life cycles (3 weeks) on the host producing as many as 120,000 offspring in their lifespan (several months). They remain alive for only 5-6 days away from the host. Turkeys in close confinement or in unsanitary conditions are susceptible to infestations.	Common methods of introducing lice to a premise are by infested birds, equipment, or materials such as hauling crates, trucks, feed bags, etc. Prevent contact with infested wild or domestic fowl, including those acquired for breeding or replacements. Inspect birds and housing at least twice per month. Lice can be killed by using an insecticide labeled for treatment of lice. Few treatments kills lice eggs. Several treatments on the birds and in their housing may be necessary to break the cycle of infestation.

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Marek's Disease	<p>Marek's Disease is a very prevalent worldwide herpes virus. It is an induced tumor disease of all types of chickens. The virus produces disease in turkeys, quail, and pheasants. Characteristics of Marek's Disease in turkeys are similar to but more subdued than in chickens and natural outbreaks are rare. Tumors in chickens are found in nerves, organs, muscles, and skin tissues. Tumors cause malfunctions wherever they occur. Symptoms include cloudy eyes, blindness, lameness, lack of coordination, unthriftiness, and weak, labored breathing. Paralysis, large feather follicles, and tumors in abdominal organs also occur.</p>	<p>Transmission of the virus between chickens and turkeys and from turkey to turkey has been proven. The virus is readily transmitted through epithelial cells (dander) shed from skin as feathers grow out. These cells contain infectious virus, which contaminates the environment and is carried by aerosol or tracked away to be taken in through feed and water. Dander remains infectious for at least several months and for years when frozen. Infected chickens shed the virus indefinitely.</p>	<p>Do not confuse Marek's disease with HVT (Herpes Virus Turkey), a non-disease producing avian herpes virus present in all domestic turkeys and found in wild turkeys. Currently it is present in practically all domestic chickens because of its earlier widespread use as a vaccine against Marek's Disease in chickens. Since no tumors or other disease is produced by HVT and virulent Marek's Disease in turkeys is rare, practical prevention and treatment measures have not been developed for either virus in turkeys.</p>
Mites	<p>The mites most important in turkeys are: (1) Chicken or Red mite, (2) Northern Fowl mite, (3) Chiggers, (4) Feather mite, (5) Scaly-leg mite, (6) Air Sac mite. Mites multiply very quickly into overwhelming numbers on the host and survive months in the environment. The Northern Fowl mite is often found in range turkeys and is the most common permanent parasite of poultry in the US. It is easily found on infested birds by day or night. Chicken mites are more easily found on birds at night. Both Chicken and Northern Fowl mites are blood feeders and heavy infestations cause anemia, pale comb and wattle, weakness, decreased feed consumption, poor resistance to disease, and sometimes poult deaths. Chicken mites, Northern Fowl mites, and Chiggers cause skin blemishes reducing health and marketability of the turkey carcass. The other mites cause problems as indicated by their names.</p>	<p>Wild birds (including their free feathers), un-sanitized equipment or materials, and infested replacement turkeys are the most common ways mites are carried to the un-infested hosts. Clothing of visitors from infested areas can carry mites. Some mites can survive away from the host for 3-4 weeks and remain dormant for 4-5 months. Thus re-infestation occurs unless thorough house cleaning and disinfection is done, especially in cracks and crevices.</p>	<p>Frequent inspection of the birds is key to mite control. Treatment of infected birds and their housing with approved insecticides for mites can control or eliminate mite infestation. The best control for mites is to treat their hiding places, such as cracks and crevices in turkey housing.</p>

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Mycosis Fungi	<p>In turkeys three different fungi cause three sporadically seen diseases. (1) Candidiasis or “Thrush”, is caused by <i>Candida</i>, which is part of the normal intestinal microflora of healthy humans, animals and birds. When certain microflora are reduced due to antibiotic use, dehydration, or poor hygiene, <i>Candida</i> increases. Young birds are most susceptible. Symptoms include poor growth, listlessness, and whitish lesions and ulcers of the lining of the mouth, esophagus and, especially, the crop. This lining peels easily. Endotoxins produced by the fungi may cause further damage. (2) <i>Mycrosporium</i> causes skin lesions called favus in birds and ringworm in humans and other animals. This disease is reported rarely in turkeys. Infected birds appear healthy other than the skin damage, which appears as white scaly or crusty lesions on the skin of the head and neck. There can also be some loss of feathers around the lesions. (3) <i>Dactylaria</i> is a fungi which migrates to the brain where it multiplies, causing imbalance, tremors, twisting of the neck, paralysis, and death. This is a rare disease which affects and kills a moderately large number of birds within infected flocks.</p>	<p>Prolonged or improper antibiotic treatment most often initiates and leads to Candidiasis. Immunosuppression increases susceptibility as do overcrowded, damp conditions, ingestion of moldy litter or feed (especially corn), malnutrition, and unsanitary water troughs. <i>Mycrosporium</i> can exist in contaminated soil and be transmitted by birds with skin infections. Contaminated wood chips and sawdust litter or egg incubators are the preferred environment for <i>Dactylaria</i>.</p>	<p>Prevent moldy feed and litter. It is possible to use mold inhibitors in feed and water. Propionic acid in feed and bleach in the water is are examples of treatments that work well. Remove wet or caked litter from housing. <i>Mycrosporium</i> and <i>Dactylaria</i> are transmissible to humans mainly through breaks in the skin. Use protective clothing (gloves, mask, etc.) and remove contaminated litter. Decontaminate housing and incubators with fungicides. Individual lesions may respond to Miconazol ointment treatment. A dietary fungicide is available for treating birds with crop mycosis.</p>
Newcastle Disease	<p>This is a very contagious respiratory virus affecting all bird species. Human eye infections associated with this avian disease can occur. Different strains of the virus cause varied disease response and there are variations within the strains causing either mild, moderate, or severe disease response. Age (younger birds are most susceptible), dose, route of infection, species of bird, and environmental conditions influence reactions. The disease occurs less often and is milder in turkeys than in chickens. Typically the virus infects the respiratory system (gasping, etc.), brain (central nervous system signs), or both. Sudden onset of the disease results in a drop in feed and water consumption, egg production, and facial swelling in the birds. There is high mortality in young birds.</p>	<p>Large amounts of Newcastle Disease virus are shed by infected birds in their droppings and in droplets from the respiratory tract, especially during the viremic (virus in blood) stage (5-7 days). Air-born virus (droplets or dust particles) can then be directly inhaled or ingested by other hosts and can contaminate litter or other surfaces including foot ware, clothing, equipment, wild birds, etc. The virus can then be transmitted to other sites. Susceptible birds can become infected with the strains of virus used in live virus vaccines if exposed to newly vaccinated birds.</p>	<p>Humans and their equipment most often mechanically transfer infective material. Very small amounts of manure carry large amounts of virus. Virus remains alive in litter for up to 2 months and in dead carcasses for up to 12 months. Virus is destroyed by heat, direct sunlight, disinfectants, and fumigants. Under certain circumstances birds without signs of Newcastle Disease can shed the virus. Vaccines are available for use in turkeys.</p>

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Disease or Parasite	Description and Symptoms	Transmission	Prevention and Treatment
Omphalitis (Navel Infection)	Omphalitis is a bacterial infection of the navel in newly hatched poults. The abdomen becomes enlarged on infected poults. The navel will remain unhealed, the poult will feel “flabby”. There will also be a putrid odor from the poult. Death can begin within 24 hours of hatching and mortality rates tend to be high.	Poor incubation and hatchery sanitation is the primary cause of this infection. Excessive incubation humidity or chilling at hatch time increases the problem. Poor egg shell quality allows fecal bacteria on the shell or from the environment to infect the eggs and poults before, during, and after hatching. Eggs which explode during incubation spread infective bacteria and viruses to other eggs and their environment.	There is no treatment for the condition. Most poults will die quickly and those that survive do not need treatment. Poor growing or stunted poults should be culled. Following proper sanitation and biosecurity methods is the most effective defense against this type of infection.
Ornithosis (Chlamydiosis, Psittacosis)	Infection with <i>Chlamydia psittaci</i> , a virus-like organism found worldwide, produces both acute and chronic respiratory and systemic reactions in almost all species of birds. Humans can be infected. Turkeys, especially males and young birds, are most often infected from wild birds. They will show depression, loss of appetite, respiratory discharges, loose yellow-green droppings, and have abdominal pain. Some infections, especially in older birds, show few signs until the birds are stressed. Severe cases exhibit fever, exudates in the respiratory system and throughout the abdominal cavity, swollen spleen and liver, and increased mortality. Infected humans show fever (104°F +), headache, and pneumonia-like symptoms.	Large amounts of organism are shed in the respiratory exudates and droppings of infected birds. Organisms are then ingested and inhaled as aerosols of respiratory exudate or manure dust. Infected material can contaminate other areas in many ways. Wild bird nests can become sources of the organism, especially in colony-nesting species. Turkeys can continue to shed the organism for more than 60 days. Stress may provoke a recurrence in carrier birds. The organism has been found in eggs from infected hens. Signs of disease from mild strains may not be noticeable until 2-8 weeks after exposure. Human infection occurs in turkey growers, haulers, and those handling the internal organs of diseased birds.	No vaccine is available. Good biosecurity practices are especially important, and in particular keeping wild birds from close contact with domestic birds. Recovered birds remain carriers and may re-infect replacement birds so culling infected birds is prudent. Obtain a laboratory diagnosis if Chlamydiosis is suspected.
Paratyphoid or Salmonellosis	The disease, caused by bacteria of the genus <i>Salmonella</i> , generally affects young birds but older birds may be affected. The vents of newborn poults may become pasted up with a sticky white diarrhea that hardens on the vent, prevents the bird from defecating, and causes death. Other symptoms in poults include loss of appetite, diarrhea, and unabsorbed or putrid yolk sacs. Mortality can be high in young poults. Older infected birds may have occasional enteritis and diarrhea, if there are any symptoms at all.	Transmission of the disease is through eggs, on eggs via fecal material, exposure to infected birds, and cross contamination due to poor biosecurity practices. Note that humans, turkeys, rodents, pets, wild birds, etc. can all contract and carry the disease.	Immediately isolate or cull infected birds. Antibiotics may be of some use to help with secondary infections. All salmonella infections must be reported to state regulatory agencies.
Pseudomonas Infection	The bacterium <i>Pseudomonas aeruginosa</i> creates this virulent infection. It can have a high mortality rate in young or immunosuppressed birds. Healthy adult birds are not as likely to contract infection. Symptoms include lameness; lack of coordination; swelling of head, wattles, sinuses, hock joints or foot pads; diarrhea; and cloudy, infected eyes.	<i>Pseudomonas</i> is a water-loving bacterium and may be passed through contaminated water sources or exposure to infected birds. It invades fertile eggs causing death of embryos and newly hatched poults.	Immediately isolate or cull infected birds. Medical treatment may have some effect, but this bacterium is highly resistant to most antibiotics. It is crucial to identify the source of contamination to prevent further infection. Running the tap before filling waterers may reduce the chances of infection.

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Pullorum Disease	This disease is caused by the Bacillus bacterium <i>Salmonella pullorum</i> . It can cause high mortality in young poults and can become a chronic infection in adult birds. Symptoms include droopiness, huddling in warm places, weakness, lack of appetite, white diarrhea, and pasted vents.	This organism can be spread via the down, shells, and excretions of infected birds. The organism is resistant to cold, sunlight, drying, and many disinfectants. It will live up to a year in unsanitized turkey houses. The disease is nearly eradicated but can be found in some isolated areas. It is required by law to report Pullorum to state or federal regulatory agencies.	It is important to obtain poults from NPIP-certified, Pullorum-free flocks and to disinfect incubators and brooders between hatches. Infected flocks should be culled.
Roundworms	Roundworms are intestinal parasites commonly found in many species. Symptoms of infestation include lack of vigor, loss of weight, sagging wings, paleness, occasional diarrhea, reduced feed efficiency, and retarded growth rate. Young birds are most susceptible.	The eggs of these parasites are picked up and ingested by the birds as they graze or eat on contaminated surfaces. Eggs then hatch in the proventriculus and migrate within the lining of the intestine. They cause damage in the intestines, which interferes with their function.	Roundworm eggs can remain viable for up to a year in the soil. Control of infestation is obtained through good pasture rotation and sanitary practices. One of the readily available anti-worm medications found at local feed stores can be used to treat infestation.
Infectious Sinusitis or M.g. (<i>Mycoplasma gallisepticum</i>)	The bacterium <i>Mycoplasma gallisepticum</i> causes a swelled sinus that is soft at first but may become hardened as the disease progresses. The eye may become closed or may even be destroyed during the infection process. Coughing, sneezing, and a thin nasal discharge usually occurs preceding the appearance of the swelled sinus. In the lower respiratory form, the disease may present itself through coughing, sneezing, and gasping.	The disease is spread through contact with contaminated birds or materials. The disease will pass into eggs from infected hens. The organism can survive for several days outside of the bird's body and within the eggs for longer periods of time. Recovered birds remain carriers. Diagnosis can be made by blood testing.	Obtaining poults from Mycoplasma free flocks is the best prevention for this disease. Antibiotics or vaccine can help control the disease in breeding flocks to some extent if necessary. Dispose of M.g.-positive flocks, as infected birds always remain carriers.
Spirochetosis	The spiral bacterium <i>Borrelia anserina</i> causes this disease. Infected birds are visibly sick with darkened heads, high temperature, fluid green droppings, dehydration, and weight loss. Late in the cycle of the disease the birds are more sleepy, anemic, and paralytic. Severe cases produce high mortality. Young poults are most susceptible. Free-range flocks are more likely to be infected.	The blood feeding fowl tick is the main reservoir and transmission agent. Adult ticks can remain alive without feeding and carry the spirochete for as long as three years. Spirochetes survive in carrier birds up to 31 days, but do not survive outside the host. Infected blood can transmit the agent through biting insects or through the cannibalism of infected birds. Recovered birds develop immunity and are not carriers. The disease has been reported in the southwestern U.S., but not recently. Tropical and subtropical areas provide wider distribution of fowl ticks that commonly harbor this disease.	Antibiotics may be used to control the disease. Preventing fowl tick infestation is the best control. Carefully examine any birds or materials that could be tick infested. Eliminate ticks from infested premises with products specific to tick control.

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Disease or Parasite	Description and Symptoms	Transmission	Prevention and Treatment
Synovitis	Synovitis is a worldwide disease of turkeys and chickens. The disease is caused by <i>Mycoplasma synoviae</i> and is frequently complicated by additional bacterial infections. There are two forms: (1) The respiratory form infects the trachea, sinuses, and air sacs and is more often found in broiler chickens. (2) The systemic form involves the synovial membranes of joints and tendons and is found in both turkeys and chickens. The systemic disease usually appears in turkeys at 10-12 weeks of age. Lameness is followed by lethargy, reluctance to move, swollen joints, loss of weight, breast blisters, poor growth, variable respiratory signs and lesions, and yellow, creamy fluid in swollen joints (hocks, wings, and feet). Chronically infected birds become dehydrated, emaciated, and have greenish diarrhea.	Synovitis is most often transmitted from the hen to the egg. It also spreads bird-to-bird at hatch and thereafter. Birds are infected for life and remain carriers. Mycoplasma are sensitive to sunlight and disinfectants. They are mechanically spread via equipment, clothing, etc.	Obtain stock from Mycoplasma-free flocks. No medication will eliminate the organism from the flock. There is no effective vaccine.
Tapeworm	Tapeworms absorb nutrients from the intestinal tract before these can be utilized by the bird. Symptoms include un-thriftiness, dry feathers, decreased feed efficiency, and weight loss. Tapeworm segments may be seen in the droppings of the birds.	Tapeworms are host-specific. Turkeys are hosts to 6 species of tapeworms. Each species has an intermediated host (IH) in which it must spend part of its life cycle. The brown ant frequently found on turkey ranges is the IH for one of the two most common turkey tapeworms. Several species of grasshoppers are the IH for the others. Tapeworms are readily transferred between domestic and wild turkeys, which can be reservoirs for tapeworms. Turkeys become infected by eating the IH.	Identification of the tapeworm species is needed before its specific IH can be identified and eliminated or managed. Control of the tapeworms is a two-part process. First eliminate the IH and its breeding habitat. Second, treat infected birds to rid them of tapeworms. Medications specifically formulated for tapeworms are readily available at local feed stores for successfully treating infected birds. Follow directions for the withdrawal period.
Ticks (Fowl Ticks)	Losses from ticks are fourfold: (1) Loss of host blood may cause death, especially in recently hatched poults. (2) Reduced production due to anemia. (3) Skin blemishes which reduce market value. (4) Transmission of disease (Spirochetosis, Tularemia, Fowl Cholera). Symptoms of tick infestation are emaciation, weakness, slow growth, lowered production, ruffled feathers, poor appetite, diarrhea, and of course, the presence of ticks.	High grassy areas provide ideal habitat for ticks. The fowl tick, <i>Argas persicus</i> , feeds on its host intermittently but mostly at night. It lays eggs in sheltered places within buildings and in the bark of trees. The life cycle for this tick is 7-8 weeks or longer and adults may live without a blood meal for more than 4 years; thus, temporary vacation of premises does not give control.	Keep pastures well-maintained and not overgrown. Seal cracks and crevices located around the bird's housing area. Prevent tree roosting. In the event of heavy infestation, use preventative medications, sprays, and/or powders to repel ticks on the birds and in the housing.

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Disease or Parasite	Description and Symptoms	Transmission	Prevention and Treatment
Trichomoniasis	Strains of the flagellated protozoan parasite <i>Trichomonas gallinae</i> cause the disease. Two forms of Trichomoniasis occur: (1) Infections of the upper digestive tract including mouth, sinus, esophagus, and crop. Caseous cankers in the mouth, esophagus, or crop similar to those of Candidiasis and Hypovitaminosis A, are seen. Upper digestive tract infections are rarely seen in turkeys. (2) Infection of the lower digestive tract including intestines, ceca, and liver. Lower digestive tract infections produce unthrifty, depressed turkeys with watery, yellow diarrhea and weight loss, intestinal caseous sores, cecal enlargement, and raised granular cream-colored liver lesions.	Infection may spread through stagnant pools, contaminated water, old straw stacks and generally moist, unsanitary conditions. Nearly all pigeons and doves carry this organism throughout their lives. Some have severe upper form and are blamed for transmission to turkeys through contamination of water and feed. The organism is shed in the droppings of recovered birds, who remain carriers throughout their lives.	Locate and eliminate possible sources of infection. In particular, prevent or minimize contact with pigeons and doves. Segregate young birds from adults and recovered carriers from susceptible stock. Mertonidazole (Flagyl) is an effective agent for treatment against Trichomoniasis in turkeys.
Tuberculosis (TB)	This disease is caused by <i>Mycobacterium avium</i> . In some cases, it causes the birds to become lame and emaciated, the heads become pale, and diarrhea frequently is present. With some turkeys, there will be no symptoms, and the disease will not be found until post mortem.	TB is not common in turkeys, especially when range-reared. The infection is usually contracted from infected chickens. Birds remain infectious through droppings and respiratory particulates throughout their life. Most other species of captive or wild birds can contract and serve as sources of TB. <i>M. avium</i> in soil persists for 4 years or more and there are no adequate procedures for cleaning and disinfecting contaminated premises.	There is no effective treatment for this disease. Use proper sanitation practices and biosecurity measures and purchase stock from healthy flocks. Practice good pasture rotation with the flock. If infection occurs, disinfect contaminated surfaces, tools and new equipment with agents approved for use against mycobacterium. Cull and dispose of the birds from infected flocks by incineration.
Fowl Typhoid	Fowl Typhoid is caused by the bacterium <i>Salmonella gallinarum</i> . It has many similarities to Pullorum, with symptoms such as poor hatch, poor quality of poults, increased thirst, listlessness, droopiness, huddling, pale heads, green-yellow diarrhea, pasty vent, fever, high mortality, early deaths without signs, and in later stages, swollen hock joints.	This organism can be spread via the down, shells, and excretions of infected birds.	It is important to obtain poults from NPIP certified Typhoid free flocks and to disinfect incubators and brooders between hatches. Infected flocks should be slaughtered. Fowl Typhoid must be reported to state or federal authorities.

Disease Resistance in Standard Turkey Varieties²

Research conducted in 2004 confirmed that several standard varieties of naturally mating turkeys are more disease resistant than industrial strains. These findings show that standard turkeys, popularly known as “heritage” turkeys, are better suited for range production than their industrial Broad Breasted White counterparts.

The American Livestock Breeds Conservancy (ALBC), Virginia Polytechnic Institute & State University (Virginia Tech), and eight breeders and producers of standard turkeys collaborated to compare standard turkey varieties and an industrial strain for immune function in range-based production systems. The hypothesis was that standard varieties of turkeys have superior immuno-competence and perform better in range-based production systems than industrial strains.

The project began with field trials conducted on eight farms situated across the country using Bourbon Reds and an industrial strain. The participants made behavioral observations and collected data on weather, health, feed consumption, morbidity, mortality, weekly weight-gain, harvest weight, dressed weight, and sales. The farm participants reported some expected results such as faster weight-gain and improved feed conversion in the industrial strain when compared with the Bourbon Red turkey variety. The commercial Broad Breasted White turkeys attained market weight in an average of 131 days, compared to an average of 185 days for the Bourbon Reds. The industrial strain, however, experienced greater mortalities from shipping stress, heat, and disease. Mortalities for the industrial strain ranged from 13 to 93%, averaging 46%. The Bourbon Red mortality rate ranged from 15 to 31%, averaging 21%. (Loss from predation is not included in these mortality calculations since it can be argued that such a death is not related to a bird’s immune response.)

Virginia Tech researchers Dr. Robert Gogal, Jr., Dr. William Pierson, Dr. Cal Larson, and Lisa Baker also conducted a series of laboratory tests to assess immune function on five varieties of standard turkeys (Black, Bourbon Red, Narragansett, Royal Palm, and Slate) and an industrial strain of Broad Breasted White turkeys. Results from laboratory tests confirmed what the farmers witnessed.

Two measures of hematologic function were taken.



Royal Palm tom held by Glen Drowns. Photo by David Cavagnaro

Packed cell volume measures red blood cells, which carry oxygen to the cells of the body. Total protein measures globulins and albumin, both of which are critical to immune response. In both tests the higher the measure, the healthier the bird. In all instances the standard varieties had higher packed cell volume and total protein, and the industrial strain had the lowest.

Two tests of immune response were conducted: non-specific T-cell stimulation and pan-lymphocyte stimulation. In each instance the standard turkeys’ immune response was superior to that of the industrial strain. Royal Palms performed best, followed by Bourbon Reds and Slates.

The standard varieties had significantly higher survivability when directly exposed to disease. Royal Palm, Narragansett, Bourbon Red, Slate, and Black turkeys, and the industrial strain were challenged with Hemorrhagic Enteritis Virus when they were six weeks old. They were then exposed to *E. coli* seven days later. All but two of the commercial birds died the first day after infection with *E. coli*. The remaining two died within three days. In contrast, a majority of the standard turkeys survived past three days of bacterial infection,

and lived to the study's termination. None of the Black, Slate or Bourbon Red turkeys died. The Narragansett and Royal Palm did not perform as well; most of them died during the course of the study.

Ascorbic acid production was also studied. Unlike humans, most mammals and birds are able to synthesize ascorbic acid, commonly known as vitamin C. Ascorbic acid has been shown to enhance immune function, modulate gene expression, act as a co-factor in enzymatic reactions, and protect organisms from free-radical damage during oxidative stress. An assay measuring endogenous ascorbic acid levels in tissue and plasma samples showed that the Black turkeys had the highest average plasma ascorbic acid concentration overall. Bourbon Reds were a close second, followed by Slates and Royal Palms. The Narragansett turkeys had the lowest average ascorbic acid concentration – approximately half that of the Black. Differences in endogenous ascorbic acid production in the varieties may point to an adaptive mechanism originally acquired to protect against environmental stresses. It was exciting to find that the same varieties that had the more robust immune responses also had the higher mean ascorbic acid levels. For more information contact ALBC or visit www.sare.org/reporting/report_viewer.asp.

Virginia Tech's physical evaluation confirmed weight change, with the industrial strain being three times heavier than the standard varieties at nine weeks of age. Hatchability of all of the standard varieties was excellent at 75 to 88%. The industrial strain was not evaluated since only males were available. However, hatchability in these lines in commercial hatcheries is within the same range.

Dr. Ed Smith of the Comparative Genomics Lab, Department of Animal and Poultry Sciences at Virginia Tech, found DNA evidence indicating that the Royal

Palm is genetically distinct from the other four varieties analyzed. It is most closely related to the Narragansett. The Bourbon Red, Slate, and Black are more closely related to one another.

Each of these studies is interesting and valuable on its own. As a group, they are stunning. They clearly indicate that the Slate, Black, and Bourbon Red turkeys, by virtue of their genetics, have more vigorous immune systems, making them obvious choices for free-range production. The only parameters on which the industrial strains excel are feed conversion and rate of gain.

Standard turkey varieties offer a robust immune system and with it a lower mortality rate, the ability to mate naturally, excellent hatchability, active foraging, increased levels of endogenous vitamin C, intelligence, and overall attractiveness. These exciting findings demonstrate the value and importance of the genetic resources embodied in standard varieties of turkeys, supporting claims long made by breeders.

From the results of the studies described, we can conclude that selection for increased rate of growth is negatively correlated with immune function. This has been reported in the scientific literature comparing randomly bred birds with lines selected for heavy body weight. Birds selected for heavy body weight may also have more incidences of poor locomotion compared to randomly bred birds. Birds reared in confinement have convenient access to feed and water while range birds must be able to forage further for feed and water. While feed conversion and rate of gain are important factors in flock profitability, for range-reared birds such as standard varieties, locomotion, i.e. the ability to walk and forage, is also extremely important. The improved immune response for randomly bred birds is a plus and fits birds that are destined to live at least part of their lives outside of confinement.

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