



FactSheet

Extension

Ohio State University Extension Fact Sheet

Department

Entomology, 1991 Kenny Road, Columbus, OH 43210-1000

Mosquitoes

HYG-2058-98

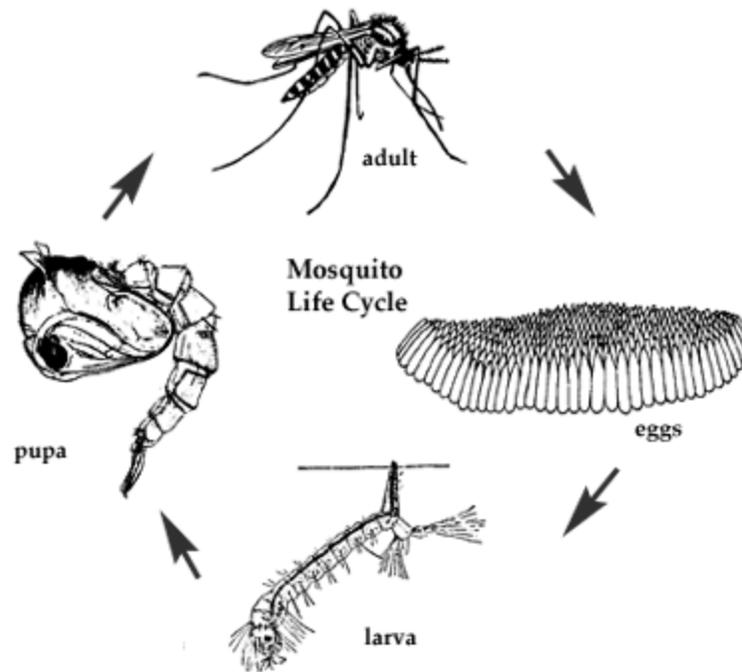
William F. Lyon
Richard L. Berry
Michael F. Collart

There are about 60 different species of mosquito in Ohio. Several of them are capable of transmitting serious, possibly even fatal diseases, such as mosquito-borne encephalitis and malaria to humans. Even in the absence of disease transmission, mosquito bites can result in allergic reactions producing significant discomfort and itching. In some cases excessive scratching can lead to bleeding, scabbing, and possibly even secondary infection. Children are very susceptible to this because they find it difficult to stop scratching. Frequently, they are outside playing and do not realize the extent of their exposure until it is too late.

Female mosquitoes can produce a painful bite during feeding, and, in excessive numbers, can inhibit outdoor activities and lower property values. Mosquitoes can be a significant burden on animals, lowering productivity and efficiency of farm animals.

Identification

Adult mosquitoes are small, fragile insects with slender bodies; one pair of narrow wings (tiny scales are attached to wing veins); and three pairs of long, slender legs. They vary in length from 3/16 to 1/2 inch. Mosquitoes have an elongate "beak" or piercing proboscis. Eggs are elongate, usually about 1/40 inch long, and dark brown to black near hatching. Larvae or "wigglers" are filter feeders that move with an S-shaped motion. Larvae undergo four growth stages called instars before they molt into the pupa or "tumbler" stage. Pupae are comma-shaped and nonfeeding and appear to tumble through the water when disturbed.



Life Cycle, Habits and Diseases Carried

Mosquitoes may overwinter as eggs, fertilized adult females or larvae. Eggs, larvae, and pupae must have water to develop. Some female mosquitoes lay their eggs directly on the water surface. Others lay their eggs on substrates above the water line (flood pool mosquitoes); the eggs hatch upon flooding. In some cases, the eggs will remain viable for several years until further flooding occurs. Mosquitoes belonging to the genus *Culex* lay their eggs in bunches or "rafts." Each raft may contain up to 400 individual eggs. Larvae feed on bits of organic matter dispersed in the water, becoming full grown in about one week. The pupal stage lasts two to three days. Female mosquitoes are ready to bite one to two days after adult emergence. Male mosquitoes do not bite but feed on flower nectar or plant juices. Some mosquitoes have only one generation per year, whereas others may have four or more. Adults may fly 5 to 10 miles, but usually rest in grass, shrubbery or other foliage close to the water breeding area.

Mosquitoes may transmit diseases such as dengue, yellow fever, and malaria to humans. Mosquito-borne encephalitis is a viral inflammation of the brain. Encephalitis can infect humans, horses, and a variety of other mammals and birds. Eastern equine encephalomyelitis (EEE), although very rare is frequently fatal. A small rural outbreak in late 1991 resulted in more than 20 farm animal fatalities, most of which were horses. Transmission of the disease occurs when an infected mosquito takes a blood meal. Birds serve as natural hosts for EEE and St. Louis encephalitis (SLE). St. Louis encephalitis, like EEE is an epidemic disease, meaning that it is usually rare. It can be absent from an area for several years and then reoccur suddenly without warning. LaCrosse encephalitis (LAC) is the third type found in Ohio. It is considered endemic to Ohio and occurs year after year at low levels. Ohio has more recorded cases of this disease than any other state. LaCrosse encephalitis is the least severe of the three types of mosquito-borne encephalitis that are found in Ohio, and occurs most often in children. Small woodland mammals, such as chipmunks and squirrels serve as the natural host for the virus, however LAC virus can also be passed, transovarially, from mother mosquito to her offspring.

Mosquitoes can also transmit filariasis (heartworm) to animals. Dog heartworm is the most significant of these, however in some areas, veterinarians are beginning to see more heartworm in cats.

| Common Name | Scientific Name | Importance |
|--|----------------------------------|---------------------|
| Asian Tiger Mosquito | <i>Aedes albopictus</i> | LAC, EEE, SLE, Pest |
| (banded spring mosquito) | <i>Aedes canadensis</i> | LAC, Pest |
| Eastern Treehole Mosquito | <i>Aedes triseriatus</i> | LAC |
| (flood-water mosquito) | <i>Aedes tivittatus</i> | Pest |
| Vexans Mosquito | <i>Aedes vexans</i> | Pest |
| Common Malaria Mosquito | <i>Anopheles quadrimaculatus</i> | Malaria, Pest |
| Cattail Mosquito | <i>Coquillettidia perturbans</i> | EEE, Pest |
| Northern House Mosquito | <i>Culex pipiens</i> | SLE |
| Key: LAC = LaCrosse Encephalitis EEE = Eastern Equine Encephalomyelitis SLE = St. Louis Encephalitis | | |

Control Measures

What Doesn't Work

There have been a number of natural and man-made mosquito repellents, attractants, and predators touted as effective against mosquitoes. In truth, they don't do much good and cannot be used to effectively control mosquitoes.

A company has been marketing a "mosquito repellent plant" that produces citronella and consequently repels mosquitoes. Citronella oil is produced by a number of different plants. At relatively high concentration, Citronella oil is repellent to mosquitoes. Thus far, there does not appear to be adequate scientific literature to substantiate the claim that enough Citronella is released by a stationary plant to repel mosquitoes. Most likely the plant would have to be physically damaged in order to release enough citronella to repel mosquitoes and the effect would be very short lived.

Dietary studies indicate that mosquitoes are insignificant in the purple martin diet. Studies of bat stomach contents show beetles as the dominant food. Ultraviolet or black lights and sonic devices indicate ineffective control.

Prevention

Since most of the mosquitoes that transmit encephalitis will not travel very far, the risk of contracting encephalitis can be minimized by controlling the mosquito breeding sites which are in close proximity to your home. Water management, to prevent mosquito breeding, is essential for control. Eggs do not hatch unless they are in water. Remove old tires, buckets, tin cans, glass jars, broken toys and other water-catching devices. Change water in bird baths and wading pools once or twice a week; clean out roof gutters holding stagnant water; and place tight covers over cisterns, cesspools, septic tanks, barrels, and tubs where water is stored. Never over-apply lawn and garden irrigation; fill, drain or treat tree holes; and drain or fill stagnant water pools, puddles, ditches, or swampy areas. Inspect water in plant containers, water-holding stumps, keep grass mowed around bodies of water, stock ponds and reservoirs with fish. Ohio Department of Natural Resources is discouraging the release of fish such as *Gambusia* since they are not indigenous to Ohio.

Use adequate screens with 16 x 16 or 14 x 18 mesh on windows and doors. Screen doors should open outward and close automatically.

Repellents

Repellents applied to the skin and clothing will prevent mosquito bites for one to five hours depending on the person, type, and number of mosquitoes and the type and percent of active ingredient in the repellent. Repellents are available as aerosol sprays, pump sprays, creamsticks, lotions, or foams.

N, N-Diethyl-m-toluamide (Deet) is very effective and widely used as a repellent but it should not be used indiscriminately as severe allergies can develop. Formulations containing high concentrations of Deet, 50% or more, should not be used on children. Formulations containing 5 to 10% Deet will work just as well as those containing 90% or more, however, they will not last as long.

Avon Skin-So-Soft has been widely used as a mosquito "repellent" for a number of years without being labeled. Avon Products, Inc. has recently obtained EPA approval and is now marketing some of its Skin-So-Soft products for use as a mosquito repellent.

Indoor Control

Space sprays or aerosol "bombs," containing synergized pyrethrins 0.1%, are effective against adult mosquitoes. Frequent treatments may be needed during problem periods.

Outdoor control

Adulticides

Space sprays or aerosol foggers, containing pyrethrins, will give rapid knockdown of adult mosquitoes. However, it is a temporary treatment with little residual effect. Residual sprays applied to tall grasses, weeds, trees, shrubs, and outbuildings, one to two days before use of the area, is effective. Use water solution or emulsions instead of oil-based formulations to prevent plant injury. Some insecticides registered for residual mosquito control include: carbaryl (Sevin), chlorpyrifos (Dursban) and malathion. There are a number of different formulations available. Follow specific label directions when applying.

Note: Malathion and carbaryl (Sevin) are extremely toxic to honey bees. Do not spray plants when in bloom. Mow weedy areas before treatment. Bee losses are minimized by spraying late in the afternoon when bees are gone or when temperatures are below 45 deg F. Malathion and methoxychlor are highly toxic to fish.

Larvicides

Homeowners may apply Mosquito Dunks (made with *Bacillus thuringiensis* Berliner var. israelensis or B.t.i.) to kill mosquito larvae in the water. This natural ingredient is harmless to other living things and is biodegradable. (Summit Chemical Co. 800-227-8664).

Methoprene (Altosid XR) is another safe material for control of mosquito larvae. It is an insect hormone which retards the development of larvae (disrupts molting) and prevents mosquitoes from developing into adults (Clarke Mosquito Control Products, Inc. 800-323 -5727).

Altosid XR Briquets can be placed even on ice for season-long control. Treat swamps, ponds, and marsh areas in early spring before thawing. These extended-release briquets will provide up to 150 days of uninterrupted mosquito control once they hit the water. It can be applied by hand and the product is labeled for use in known fish habitats.

NOTE: Disclaimer - This publication may contain pesticide recommendations that are subject to change at any time. These recommendations are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. Due to constantly changing labels and product registrations, some of the recommendations given in this writing may no longer be legal by the time you read them. If any information in these recommendations disagrees with the label, the recommendation must be disregarded. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. The author and Ohio State University Extension assume no liability resulting from the use of these recommendations.



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Chiggers

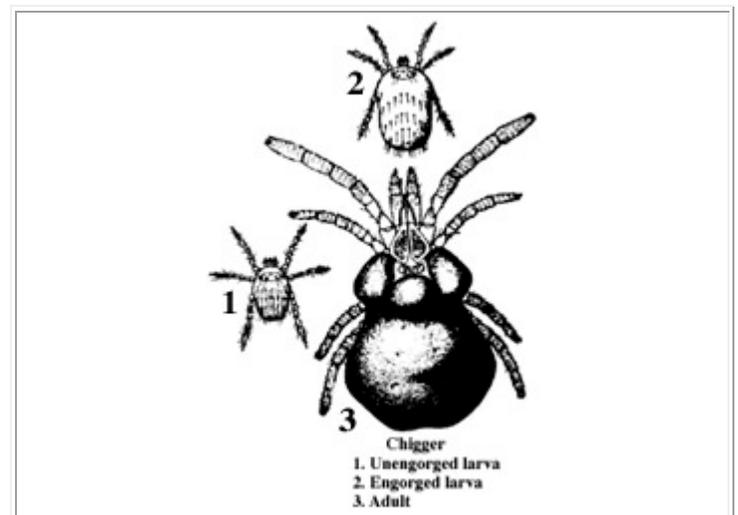
HYG-2100-98

William F. Lyon

Probably no creature on earth can cause as much torment for its size than the tiny chigger. Tiny six-legged chigger larvae attack campers, picnickers, hikers, bird watchers, berry pickers, fishermen, soldiers, and homeowners in low, damp areas where vegetation is rank such as woodlands, berry patches, orchards, along lakes and streams, and even in drier places where vegetation is low such as lawns, golf courses, and parks. They are most numerous in early summer when grass, weeds and other vegetation are heaviest. Chiggers do not burrow into the skin, but insert their mouthparts in a skin pore or hair follicle. Their bites produce small, reddish welts on the skin accompanied by intense itching as irritating as acute cases of poison ivy or poison sumac. These symptoms often are the only way of learning that an outdoor area is infested since chiggers are so small that most cannot be seen without a magnifying glass. Chiggers feed on a wide variety of snakes, turtles, birds, and small mammals as well as humans.

Identification

Chigger mites are about 1/20 inch long, usually bright red, have hairy bodies, and travel rapidly. The larval stage has three pairs of legs whereas the nymph and adult stage have four pairs of legs. There is a marked constriction in the front part of the body in the nymph and adult stage. Larvae are orange, yellow or light red and about 1/150 to 1/120 inch in diameter. Eggs are globular-shaped.



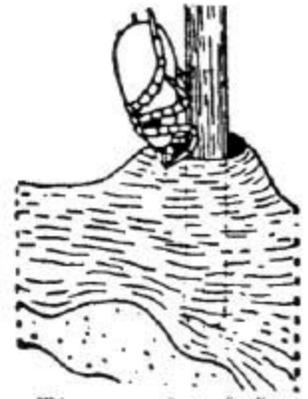
| Common Name | Scientific Name |
|-------------|---|
| Chigger | <i>Trombicula alfreddugesi</i> (Oudemans) |
| Jigger | |
| Red Bug | |

Life Cycle and Habits

Adult chiggers overwinter near or slightly below the soil and in other protected places. Females become active in the spring and lay up to 15 eggs per day in vegetation when soil temperatures are 60°F. Eggs hatch into six-legged larvae, the only stage that attacks humans and animals (parasitic stage). After hatching, chigger larvae climb up onto vegetation from which they can more readily snag a passing host. After engorgement, often requiring one to several days, larvae drop off the host and transform into eight-legged nymphs which mature to the adult stage. Nymphs and adults feed on eggs of springtails, isopods, and mosquitoes. The life cycle is about 50 to 70 days, with adult females living up to one year and producing offspring during this time. Multiple generations occur in warmer climates, whereas only two to three develop each season in some northern states. Chiggers are usually encountered in late spring and summer in areas where weeds and briars have overgrown. They lurk on grass stems, leaves, shrubbery, etc., usually in damp, shaded spots near the top of different objects close to the soil. Young chiggers attach themselves to the skin of people, domestic animals, wild animals (including reptiles), poultry and birds. The preferred feeding locations on people are parts of the body where clothing fits tightly over the skin such as around the belt line, waistline, under girdles and under socks, or where the flesh is thin, tender or wrinkled such as the ankles, in the armpits, back of the knees, in front of the elbow, or in the groin.

Bites

Chigger larvae do not burrow into the skin, nor suck blood. They pierce the skin and inject into the host a salivary secretion containing powerful, digestive enzymes that break down skin cells that are ingested (tissues become liquefied and sucked up). Also, this digestive fluid causes surrounding tissues to harden, forming a straw-like feeding tube of hardened flesh (stylostome) from which further, partially-digested skin cells may be sucked out. After a larva is fully fed in four days, it drops from the host, leaving a red welt with a white, hard central area on the skin that itches severely and may later develop into dermatitis. Any welts, swelling, itching, or fever will usually develop three to six hours after exposure and may continue a week or longer. If nothing is done to relieve itching, symptoms may continue a week or more. Scratching a bite may break the skin, resulting in secondary infections. However, chiggers are not known to transmit any disease in this country.



Control Measures

Skin Care

After returning from a chigger-infested area, launder the field clothes in soapy, hot water (125°F.) for about half an hour. Infested clothes should not be worn again until they are properly laundered and/or exposed to hot sunshine. Unlaundered clothes or those laundered in cool water will contain the biting chiggers to again reinfest your skin. As soon as possible, take a good hot bath or shower and soap repeatedly. The chiggers may be dislodged, but you will still have the stylostomes, causing the severe itch. Scratching deep to remove stylostomes can cause secondary infections. For temporary relief of itching, apply ointments of benzocaine, hydrocortisone, calamine lotion, New Skin, After Bite, or others recommended by your pharmacist or medical doctor. Some use Vaseline, cold cream, baby oil, or fingernail polish. (The sooner the treatment, the better the results.)

Prevention

Mowing of briars, weeds, and thick vegetation and close clipping of lawns, to eliminate shade and moisture, will reduce chigger populations, and permit sunlight and air to circulate freely. Chigger larvae can penetrate

many types of clothing, but high boots and trousers of tightly woven fabric tucked into stockings or boots help deter them.

Before going into an area where chiggers may be present, protect yourself by using a repellent such as deet (Off MGK, Muskol, Detamide, Metadelphene, Repel, Diethy-toluamide) or permethrin available at many drugstores or hardware stores. Deet-based repellents are effective for only a few hours, whereas permethrin-based repellents are for use only on clothing and effective for several days. Apply the repellent to both the skin and clothing, especially on hands, arms, or legs, if uncovered, and to clothing openings at cuffs, neck, waistband, and upper edges of socks. Follow label directions since repellents may damage plastics, nail polish, and painted or varnished surfaces. Do not use indiscriminately as severe human allergies can develop. Keep moving since the worst chigger infestations occur when sitting or laying down in a sunny spot at midday with temperatures above 60°F. If possible, stick to roads and trails.

Insecticides

Treating known chigger trouble spots is quicker and less expensive than treating an entire area. Place six-inch squares of black cardboard on edge in the grass and observe for a few minutes. Any small, yellowish or pinkish chiggers present will climb rapidly to the top of the square and congregate there. Make tests in 10 to 12 different spots such as grass, dead leaves, briars, weeds, etc. Unless the entire area is infested, treat only the spots where control is desired such as grass around picnic tables, lawn chairs, or recreational equipment. Chiggers tend to concentrate in "mite islands" while nearby spots are free of them. They become rather inactive at temperatures below 60°F.

Outdoor sprays of chlorpyrifos (Dursban), carbaryl (Sevin) or diazinon will give control. Only the licensed pest control operator or applicator can use certain formulations of propoxur (Baygon), cyfluthrin (Tempo), or fluvalinate (Marvik, Yardex). Treat the grass, shrubs, and trees in lawns, parks, campgrounds and golf courses, if needed, keeping humans and pets off treated areas until dry. Retreatment may be needed after two to three weeks in heavy chigger infestations. Before using any pesticide, always read the label and follow directions and safety precautions.

Do not wear dog or cat flea collars on your ankles or cattle ear tags on your shoes to ward off chiggers. It is very dangerous resulting in chemical skin burns and toxic effect to the wearers.

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TDD No. 800-589-8292 (Ohio only) or 614-292-1868

Ticks

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Twelve species of ticks are known to occur in Ohio. The brown dog tick, *Rhipicephalus sanguineus*, is the only species that can become established as a pest in homes and kennels. Three tick species are medically important because they are disease vectors: the American dog tick, *Dermacentor variabilis*; the lone star tick, *Amblyomma americanum*; and the blacklegged tick (also commonly called the 'deer tick'), *Ixodes scapularis*. The remaining tick species are rarely encountered. All ticks are parasites that feed on the blood of animals.

Identification

Not all ticks cause human disease, so it is important to properly identify the tick species when determining disease risk. Many of the species in Ohio, including the three of medical importance, are hard ticks. They are called hard ticks because they possess a scutum (hard plate) on their upper surface just behind the mouthparts. The scutum covers almost the entire upper surface of the adult male whereas it covers only the front portion of the female. Soft ticks lack a scutum. In Ohio, soft ticks are not pests of humans.

Tick adults and nymphs have eight legs whereas the larvae (first stage) have six. Adult ticks often have distinct characteristics and markings, but immature stages are completely tan or brown and difficult to identify to species. All stages are round to oval shaped; they are flattened prior to obtaining a blood meal. The adult female greatly increases in size after feeding but adult males do not. Nymphs become engorged, but they are much smaller than the adults.

Important Tick Species in Ohio

Brown Dog Tick *(Rhipicephalus sanguineus)*

The adult brown dog tick is reddish brown. Unfed adults are about 1/8 inch long. After feeding, the female is much larger (~1/2 inch long), bluish gray, and oval shaped. All stages of the brown dog tick have a pair of small eyes.

Unlike other tick species, the brown dog tick can complete its entire life cycle indoors. The brown dog tick is well adapted to survive in the warm, dry conditions inside and outside home environments. These ticks do not thrive in wooded areas. Nonetheless, they may occur in grassy and bushy areas adjacent to homes and kennels, roadsides, and footpaths.

Brown dog ticks rarely attack humans. Rather, dogs are their preferred host. All stages of the brown dog tick feed on dogs and they may attach anywhere on its body.



Brown dog tick adult male (left) and female (right).
(Photo by J. F. Butler, courtesy of University of Florida)

However, adult ticks typically attach on the dog's ears and between its toes, whereas larvae (seed ticks) and nymphs typically attach on the dog's back. After feeding, they drop off the host but do not travel far. Brown dog ticks can complete a generation in approximately 60 days with optimal temperatures and readily available dog hosts.

Brown dog ticks can transmit Rocky Mountain spotted fever and several other disease organisms to dogs.

**American Dog Tick
(*Dermacentor variabilis*)**

The adult American dog tick is brown with light grey mottling on the upper surface. The unfed adult female is about 3/16 inches long. After feeding, she is much larger (~5/8 inches long), mostly gray, and oval shaped. The male, whether fed or unfed, is ~1/8 inch long. All stages of the American dog tick have a pair of very small eyes.

American dog ticks occur primarily in overgrown vacant lots, fallow farm fields, weedy roadsides, and edges of paths and hiking trails. The immature stages of this species feed on rodents and other small mammals. Unfed larvae and nymphs crawl about actively seeking a host. After feeding, larvae and nymphs drop to the ground where they seek shelter and digest the blood meal before molting (shedding the skin).

Adults of the American dog tick are most abundant from mid-April to mid-July. Adult ticks feed on a wide variety of medium to large size mammals, such as raccoons, ground hogs, opossum, dogs, and humans. The adult tick waits on grass and weeds for a suitable host to brush against the vegetation. It then clings to the fur or clothing and crawls upward seeking a place to attach and feed.

The adult male obtains a brief blood meal then mates with the female on the host. The adult female feeds for 7 to 10 days then she drops to the ground and remains there for several days before laying several thousand eggs. The female dies shortly thereafter. The male remains on the host and continues to feed and mate for the rest of the season until his death.

American dog ticks are the primary transmitter of Rocky Mountain spotted fever. They also may transmit tularemia. The bite of the American dog tick also may cause tick paralysis in dogs and humans.

**Lone Star Tick
(*Amblyomma americanum*)**

The unfed adult female is about 1/8 inch long, brown, with a distinctive silvery spot on the upper surface (hence the name 'lone star'). Once fed, the female is almost circular in shape and ~7/16 inch long. The male tick is about 1/8 inch long, brown, with whitish marking along the rear edge. All stages have a pair of small eyes.

Lone star ticks are common in the southern half of Ohio. All stages can be found throughout the warm months of the year. This species typically occurs in shady locations along roadsides and meadows and near the edges of wooded areas. All stages crawl to the tip of low growing vegetation and wait for a host to pass by. All stages feed on a variety of bird and mammal hosts, including humans.

Lone star ticks are the primary transmitter of human monocytic ehrlichiosis (anaplasmosis). They also may transmit tularemia and Q-fever. This species is a minor vector of Rocky Mountain spotted fever.



Various stages of the American dog tick: larva, nymph, adult female, adult male (counterclockwise from upper right; sesame seed shown for size comparison).
(Photo by Kent Loeffler, courtesy of Cornell University)



Various stages of the lone star tick: nymph, adult female, adult male (counterclockwise from upper right; sesame seed for size comparison).
(Photo by Kent Loeffler, courtesy of Cornell University)

Blacklegged Tick **(*Ixodes scapularis*)**

The larval stage of the blacklegged tick is about the size of a poppy seed and nearly translucent, which makes it extremely difficult to see. The nymphal stage is translucent to slightly gray or brown. Adult males are ~1/16 inch long; unfed females are larger (~1/8 inch long). Both sexes are a dark chocolate brown color, but the rear half of the adult female is red or orange. When fed, they may appear gray. All stages lack eyes.

Blacklegged ticks are found mostly in or near forested areas. The immature stages of this species feed on birds, rodents (mice, voles, chipmunks, squirrels, etc.) and other small to medium size mammals such as dogs, raccoons, opossum, etc. Adult blacklegged ticks feed on large mammals, most commonly white-tailed deer. Hence, some people call them 'deer ticks'. All stages may attach to humans.

The blacklegged tick (*Ixodes scapularis*), the principal vector of Lyme disease, is rare in Ohio. The most commonly encountered *Ixodes* tick in Ohio is the groundhog tick, *Ixodes cookei*, which does not transmit Lyme disease. There are many other *Ixodes* ticks in the United States and only an expert can identify them to species.

In addition to transmitting Lyme disease, blacklegged ticks are the principal vectors of babesiosis and human granulocytic ehrlichiosis. This tick species may be co-infected with several disease agents.



Various stages of the blacklegged tick: nymph, adult female, adult male (counterclockwise from upper right; sesame seed for size comparison).

(Photo by Kent Loeffler, courtesy of Cornell University)

Injury

Tick feeding often results in inflammation, swelling, irritation, and the potential for secondary bacterial infection at the feeding site. When dogs are heavily infested, excessive blood loss can result in death.

The risk of infection by tick-borne disease agents is of primary concern. Humans and dogs can become infected with causal agents of Rocky Mountain spotted fever, Lyme disease, ehrlichiosis, tularemia, and babesiosis among others. **If you experience fever or flu-like symptoms following a tick bite, immediately contact your physician.** It is important to receive the appropriate antibiotics as soon as possible.

Dogs that become infected with a tick-borne disease may become lethargic and anemic; they may quit eating and lose weight; in some cases, they may become lame. A dog with such symptoms should be examined by a veterinarian.

Rocky Mountain Spotted Fever

American dog ticks are the primary transmitter of Rocky Mountain spotted fever, which is one of the most common tick-transmitted diseases in Ohio. Symptoms of Rocky Mountain spotted fever appear 3 to 12 days after tick feeding and typically include sudden high fever, headache, and aching muscles. On the second or third day of the fever, a non-itchy rash may develop on the wrists and ankles. The rash soon spreads to other parts of the body including the torso, palms, and soles. This disease rapidly progresses and can cause death if not treated with the appropriate antibiotics. Most fatalities can be attributed to a delay in seeking medical attention. Early treatment of spotted fever typically results in rapid recovery.

Lyme Disease

Lyme disease is the most prevalent tick-borne disease of humans in the United States with approximately 10,000 cases reported annually. This bacterial disease is named after Lyme, Connecticut, where cases were first reported in 1975. The nymphal stage of the blacklegged tick is usually responsible for transmitting Lyme disease to humans.

Blacklegged ticks are very rare in Ohio, and the Lyme disease bacterium, *Borrelia burgdorferi*, has never been isolated or identified from any animals or ticks in the state. Nevertheless, 40 to 80 cases of Lyme disease occur annually in Ohio. Some of these cases can be tracked as being acquired out-of-state. However, it is possible that infected nymphs are transported on migratory birds, or blacklegged tick populations may be too low to be detected via current surveillance efforts, although many hundreds of animals have been tested in Ohio.

Be alert for a red, ring-like rash developing at the site of a tick bite within 2 to 32 days, because this ring-rash is diagnostic for Lyme disease. Note, however, that ~40% of infected humans do not develop a ring-rash. Fever, head-

ache, fatigue, or joint pain also may be symptoms of Lyme disease. Immediate antibiotic therapy for Lyme disease reduces the risk of neurological, arthritic, or cardiac complications developing days to years later.

Identification and Disease Testing of Ticks

A FREE service for identification and disease testing of ticks is provided by:

The Ohio Department of Health
Zoonotic Disease Program
8955 E. Main St.
Reynoldsburg, OH 43068
Telephone: 614-752-1029
Fax: 614-644-1057

- Ticks can be identified whether dead or alive, but only live ticks can be tested for disease.
- Place the live tick in a small, tightly sealed container (pill bottle, film container, etc.) or zippered plastic bag, along with a few blades of green grass to provide moisture.
- Store the tick in a cool place until it can be mailed to the above address.
- Prompt mailing of the tick is best. Include a note with the collection date and the county where the tick was found. Indicate whether it was attached to a human or companion animal.
- Contact the Ohio Department of Health's Zoonotic Disease Program (see above) if you have any questions about ticks and testing available.

Integrated Pest Management Strategies

Prevention and Personal Protection

- Avoid tall grass and weedy areas during tick season, April through August.
- If exposure to a tick-infested area is unavoidable, tuck pants into socks or boots. Or use masking tape to wrap the bottom of the pant leg around the top of boots or shoes. Such measures provide a physical barrier and crawling ticks can be more easily detected.
- Wear light-colored clothing to make it easier to find crawling ticks.
- Apply a tick repellent containing DEET or permethrin to the socks and pant legs when going into tick habitat. Do not apply permethrin directly to exposed skin.

- Keep dogs confined to your yard or home; do not allow them to roam freely.
- Keep dogs on a leash and inspect them for ticks after a walk. Dogs can become infected with tick-borne diseases.

—Tick Checks and Tick Removal

- Inspect for ticks periodically (every hour or so if in tick habitat and as soon as you leave their habitat) to remove them before they attach and begin feeding. Ticks can be found crawling on clothing and bare skin before attachment. Be sure to also inspect children and companion animals.
- Pay special attention to the head and back of the neck of humans to detect attached ticks.
- PROMPTLY REMOVE any ticks. Prompt removal of an attached tick reduces the chance of infection by Rocky Mountain spotted fever or Lyme disease. Tick attachment of several hours or more often is required for disease transmission.
- Take care not to crush or puncture the tick during removal. Rocky Mountain spotted fever may be acquired from infected tick body fluids that contact broken skin, the mouth, or eyes. Do NOT use a hot match or cigarette to remove a tick as this may cause the tick to burst.
- Do NOT apply solvents or other materials to the tick to “stimulate” the tick to detach. Such treatments can result in increased tick salivation and disease transmission.
- Avoid touching a tick with bare hands. Shield your fingers with a paper towel, wear rubber gloves, or use tweezers.
- Grasp an embedded tick as close to your skin as possible (the area where the tick's mouthparts enter the skin) and use steady pressure to pull it straight out. Do not twist or jerk the tick, as its mouthparts may be left in the skin.
- After tick removal, thoroughly disinfect the bite site and wash your hands with soap and water. The feeding lesion should be swabbed with a topical antiseptic to prevent secondary bacterial infection.
- As soon as possible, send the live tick for disease testing (see above for information regarding this free service provided by the Ohio Department of Health's Zoonotic Disease Program).

Habitat Modification

Habitat management is essential for controlling tick populations. Keep your yard mowed and do not allow brush or leaf litter to accumulate. Tall weeds or grass should be mowed and brush removed to eliminate the habitat of tick hosts, such as the white-footed mouse, meadow voles, and other small mammals.

Host Removal

It is helpful to remove rodents harboring inside or near one's house by using traps or rodenticides.

Pesticides

As mentioned above, products containing DEET or permethrin applied to the socks and pant legs are useful for repelling ticks if you are unable to avoid a tick-infested area.

Dogs may be treated for ticks, and products are available from your veterinarian. Before using any over-the-counter product, it is recommended that you consult your veterinarian.

In areas where it is necessary to control ticks in the rodent population, open tubes packed with insecticide-treated cotton and placed at an appropriate density in the landscape can be used. Ticks die after contacting treated cotton that has been incorporated into rodent nests.

Outdoor chemical control is largely ineffective because

of the wide distribution and movement of most tick species. The brown dog tick is an exception because of its close proximity to human habitation. Treatment of the premises outside the home should include grassy and brushy areas around outbuildings and kennels, sites where the dog rests, and underneath doghouses where ticks may reside during off-host periods.

Pesticide treatments should be preceded by sanitation efforts such as vacuuming and cleaning to remove debris and as many ticks as possible; this also allows increased penetration of an insecticide into cracks and crevices. Pesticide application indoors should target areas frequented by the dog, particularly its sleeping and resting sites where ticks are likely to have dropped off. Because ticks hide in secluded places to molt, it also is critical to treat cracks and crevices in the floor and walls, baseboards, window frames, and doorframes; around wall molding and hangings; and under carpet edges.

The dog should be treated for ticks, preferably by a veterinarian, at the same time as the premises, outdoors or indoors, are being treated. A variety of pesticide products are labeled for indoor and outdoor treatment of ticks. For a list of products available for use by homeowners or by commercial pesticide applicators, see <http://edis.ifas.ufl.edu/IG088> [P. G. Koehler and F. M. Oi (2003), Ticks, University of Florida Extension, ENY-206].

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