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Companion Animal Ectoparasites

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Companion Animal Ectoparasites

**Understanding the Pests and
the Prevention**

By Jennifer Furchak

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Fleas

The cat flea, *Ctenocephalides felis*, is one of the most important ectoparasites of companion animals. Cat fleas infest both dogs and cats and are not always easy to identify. Initial signs of a flea infestation include excessive scratching and chewing or biting at the skin or fur.⁸ Depending on the degree of infestation, when examining the dog or cat more closely fleas may be found crawling quickly through the animal's fur (Figure 1).



Figure 1. Cat Flea Infestation on animal.

Photo Credit: Michael Dryden DVM, PhD, Kansas State University



Figure 2. Cat Flea Biting Adults

Photo Credit: A to Z Pest Control, 2018.

Adult fleas make up only 5% of the population with the immature stages accounting for the other 95% (Figure 3).¹⁰ While an infestation may seem small at first it is important to recognize that unless the problem is addressed as soon as possible the immature stages will eventually develop into more biting, adult fleas.¹⁰

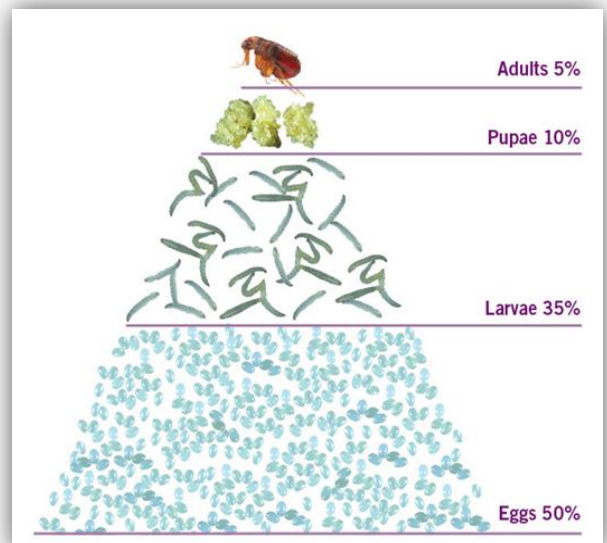


Figure 3. Flea Life Stage Pyramid

Photo Credit: The Hartz Mountain Corporation, Secaucus, NJ

Fleas

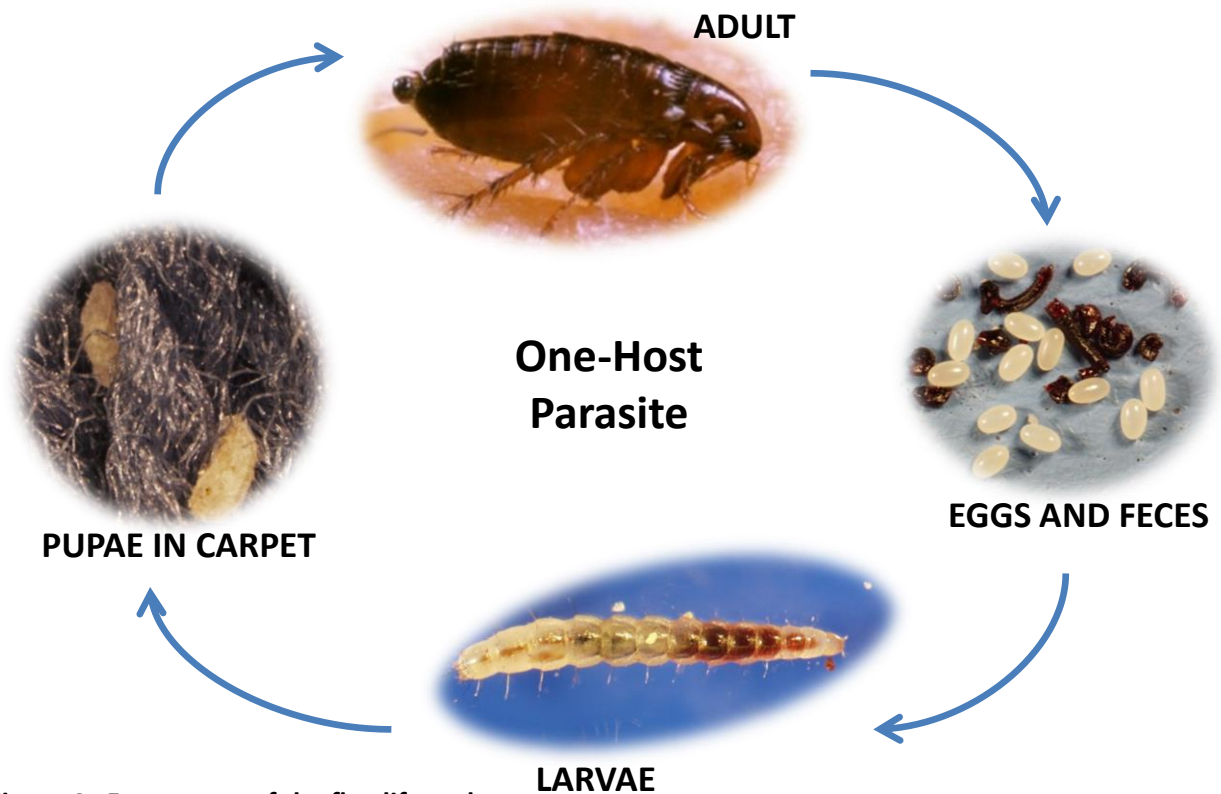


Figure 4. Four stages of the flea life cycle

Photo Credit: Adult: James Dill, Pest Management Specialist, UMaine Extension. Eggs, Larvae, Pupae: Michael Dryden, DVM, PhD, Kansas State University.

Adults: Adult fleas seek out a host for a blood meal in order to reproduce. Adults will remain on a host and continue to feed, mate, and lay eggs for up to two months. As females lay eggs, the eggs fall off the host into the environment such as carpet, pet bedding or outside in the yard.^{7,10,13,16}

Eggs: Eggs fall off the host along with dried blood feces excreted by the adults. Eggs typically hatch in two to three days.^{7,13}

Larvae: Newly emerged larvae will begin feeding on organic matter including the dried blood feces. Larvae will feed and continue to grow for five to ten days before pupating.¹³

Pupae: Larvae will pupate by forming a silk-like cocoon of debris where the adult flea will develop. The pupal stage can last up to 6 months, however when a host is present the adult fleas are stimulated to emerge by vibrations, heat, and carbon dioxide.^{7,16}

Fleas

Diseases and Conditions Associated with Fleas^{7,8,10,13}

Anemia	Having a less than normal amount of red blood cells and iron deficiency. A heavy infestation of feeding fleas can lead to substantial blood loss. Symptoms include lethargy, rapid and shallow breathing. In severe cases a transfusion may be necessary.
Bartonellosis	Cats and dogs can contract this bacterial infection through flea feces. As fleas feed they also excrete feces which can come in contact with open bites on the skin and infect the animal. While dogs and cats don't usually show symptoms the infection can be linked to other medical conditions with the heart and liver. Bartonella can cause several diseases in humans as well, the most common being cat scratch fever.
Tapeworms	Cats and dogs that groom off and ingest fleas infected with tapeworms can also become infected. Tapeworms live in the intestines and attach using sharp hook-like mouthparts. These worms steal nutrients and can cause abdominal pain and diarrhea.
Flea Allergy Dermatitis (FAD)	Typically flea bites cause minor skin irritation. FAD is an allergic reaction to flea saliva which causes inflammation and bumps at the site of each bite. Cats and dogs that are allergic to flea bites experience severe itching that can lead to hair loss, open sores, hot spots and skin infections.

Dog with FAD

Photo Credit: Michael Dryden DVM,
PhD, Kansas State University



Cat with FAD

Photo Credit: Rosanna Marsella DVM,
University of Florida College of Medicine

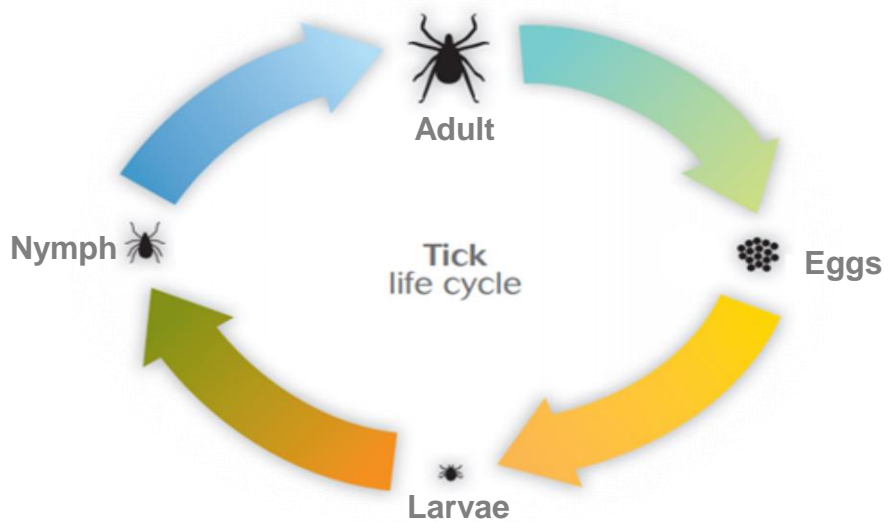
Ticks

There are approximately 80 species of ticks found in the United States with only a handful of them routinely infesting companion animals. These tick species include the brown dog tick, *Rhipicephalus sanguineus*, the American dog tick, *Dermacentor variabilis*, the lone star tick, *Amblyomma americanum*, the Gulf Coast tick, *Amblyomma maculatum*, and the black-legged tick, *Ixodes scapularis*.⁹

All of these species are considered three host ticks, meaning they will feed on three different hosts throughout the course of their life.⁵ The consequences of ticks on companion animal hosts can range from inflammation and infection at the site of tick bites, to tick paralysis, anemia, and disease transmission.¹⁸ The primary concern however, is their ability to serve as disease vectors.

Figure 5. Three host tick life cycle.
Depending on the species the life cycle can take two months to two years to complete.

Credit: Companion Animal Parasite Council



Eggs: A fully engorged female can lay several thousand eggs in the environment, usually outside in a sheltered area in the Spring. On occasion, brown dog ticks have been known to lay eggs indoors.^{4,6}

Larvae: Once the eggs hatch the tiny, six-legged larval stage emerges and begins to look for a host. Larvae remain on the ground or climb low vegetation and wait for a small host, usually a small mammal. Depending on the species, larvae will feed anywhere from three to 14 days.^{5,18}

Nymph: Engorged larvae drop off their host back into the environment where they molt into eight-legged nymphs. Nymphs are larger than the larvae, but are still very tiny. Nymphs seek out a host and feed for three to 14 days, usually during late summer months.^{5,10,18}

Adults: Engorged nymphs drop off their host back into the environment where they molt into either male or female, eight-legged adults. Adults will find a larger host, usually deer, dogs, cats, or humans and take their final blood meal. Once a female has fully engorged and mated she drops off the host and finds a spot to layer her eggs. Once she lays her eggs she will die.^{5,10}

Brown Dog Tick

The brown dog tick, *Rhipicephalus sanguineus*, is found throughout the United States (Figure 7) but are more prevalent in the south.⁹ These ticks primarily feed on dogs but occasionally feed on other mammals such as deer and humans.⁴

 TickEncounter Resource Center

Rhipicephalus sanguineus (Brown Dog Tick)

Figure 6. Life stages of *R. sanguineus*

Photo Credit: Tick Encounter Resource Center, University of Rhode Island



Figure 7. Brown Dog Tick Distribution Map

Source: Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of Vector Borne Disease.

American Dog Tick

The American dog tick, *Dermacentor variabilis*, is widely distributed in the United States east of Montana and Texas (Figure 9). The species is most abundant from Massachusetts down to Florida.⁹ They are found in areas with little tree cover such as grassy areas and along hiking trails. Dogs are the preferred host but they feed readily on other mammals such as deer and humans.¹⁸

 TickEncounter Resource Center

Dermacentor variabilis (American Dog ticks)

Figure 8. Life stages of *D. variabilis*

Photo Credit: Tick Encounter Resource Center, University of Rhode Island



Figure 9. American Dog Tick Distribution Map

Source: Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of Vector Borne Disease.

Black-legged Tick

The black-legged tick or deer tick, *Ixodes scapularis*, occurs throughout the eastern United States but is much more abundant in the northeast and the Great Lakes region (Figure 11).⁹ This species has a very wide host range. They have been found feeding on birds, rodents, dogs, cats, and humans.¹⁵ The life cycle of the black-legged tick can take up to two years to complete depending on environmental conditions.¹⁵

 Tick Encounter Resource Center ***Ixodes scapularis* (Blacklegged ticks or Deer ticks)**

Figure 10. Life stages of *I. scapularis*

Photo Credit: Tick Encounter Resource Center, University of Rhode Island

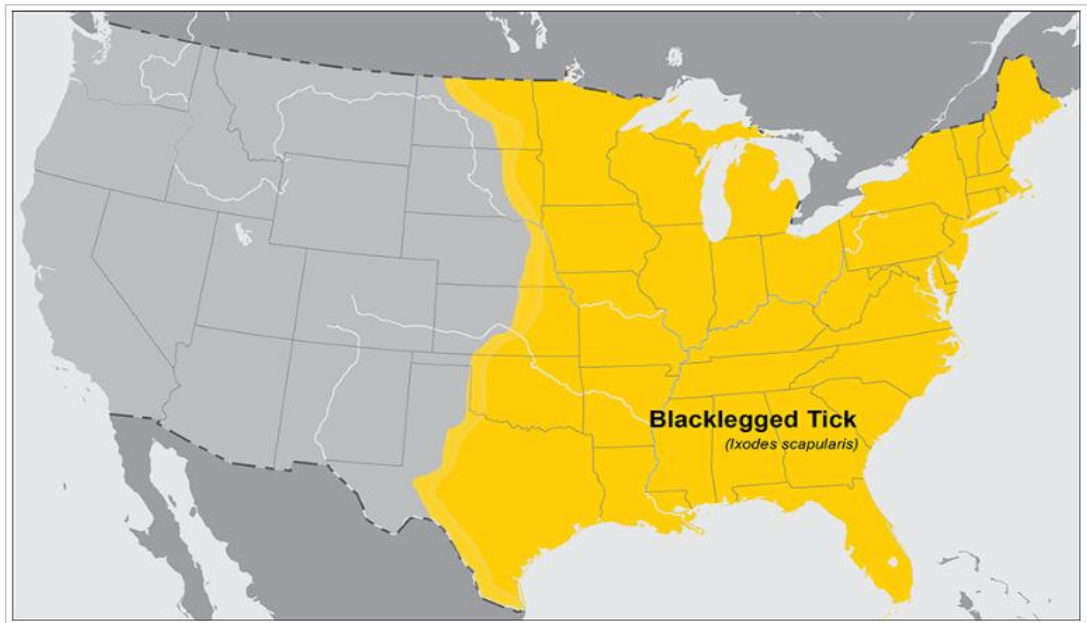


Figure 11. Black-legged Tick Distribution Map

Source: Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of Vector Borne Disease.

Lone Star Tick

The lone star tick, *Amblyomma americanum*, is widely distributed throughout the southeastern United States (Figure 13).⁹ Lone star ticks will feed on a wide range of hosts from birds and small mammals to deer, dogs, cats, livestock, and humans.¹⁸ This species is the second most common tick found on humans. They are known for being active hunters and aggressive feeders.

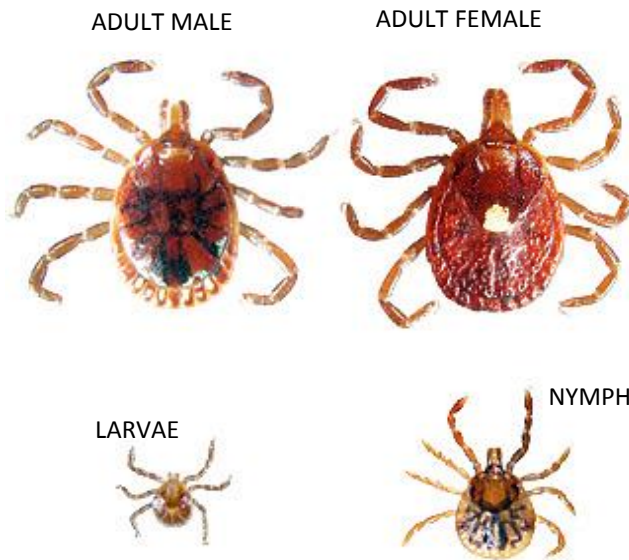


Figure 12. Life stages of *A. americanum*

Photo Credit: Tick Encounter Resource Center, University of Rhode Island

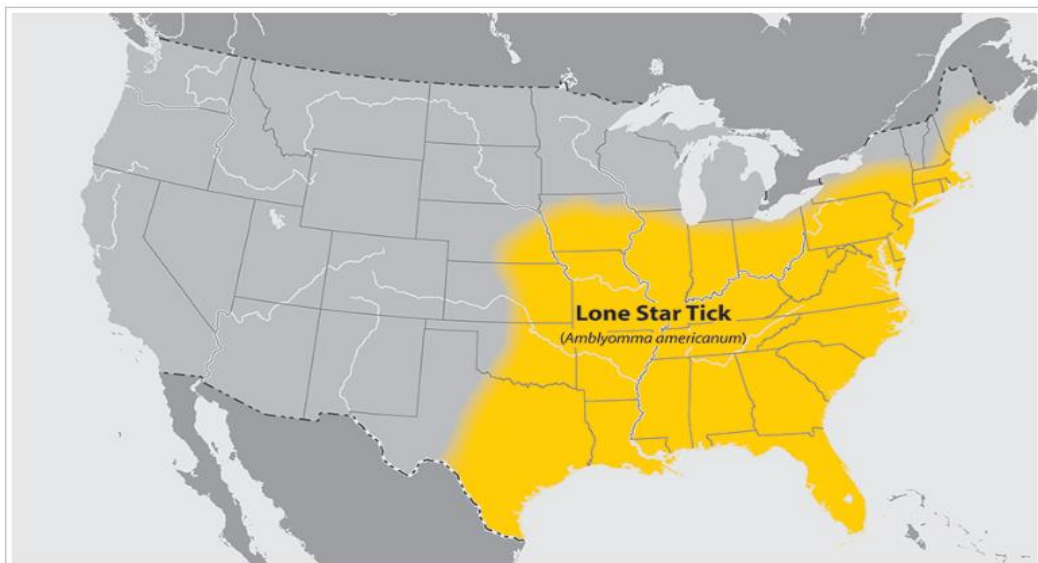


Figure 13. Lone Star Tick Distribution Map

Source: Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of Vector Borne Disease.

Gulf Coast Tick

The Gulf Coast tick, *Amblyomma maculatum*, is found along the Gulf and South Atlantic coastline (Figure 15).⁹ Common hosts include birds, livestock, horses, deer, dogs, and humans. Immature stages will feed on smaller mammals.¹¹

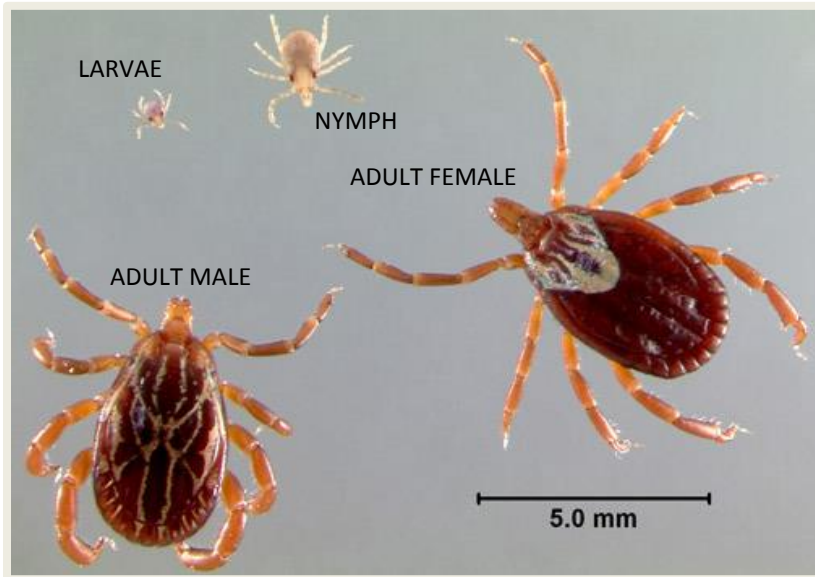


Figure 14. Life stages of *A. maculatum*

Photo Credit: Jeffrey C. Hertz, University of Florida

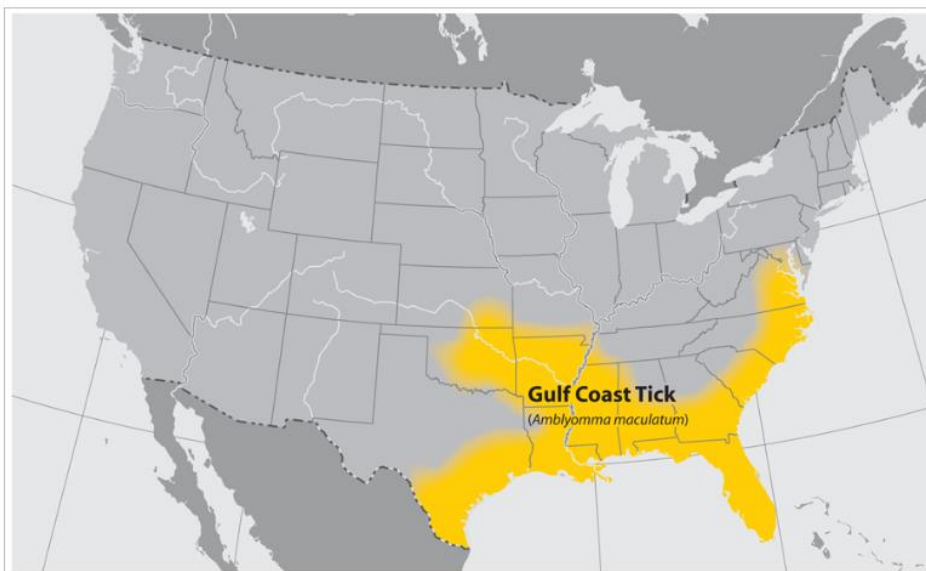


Figure 15. Gulf Coast Tick Distribution Map

Source: Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of Vector Borne Disease.

Ticks

Tick-Borne Diseases in Companion Animals^{10,13,18}

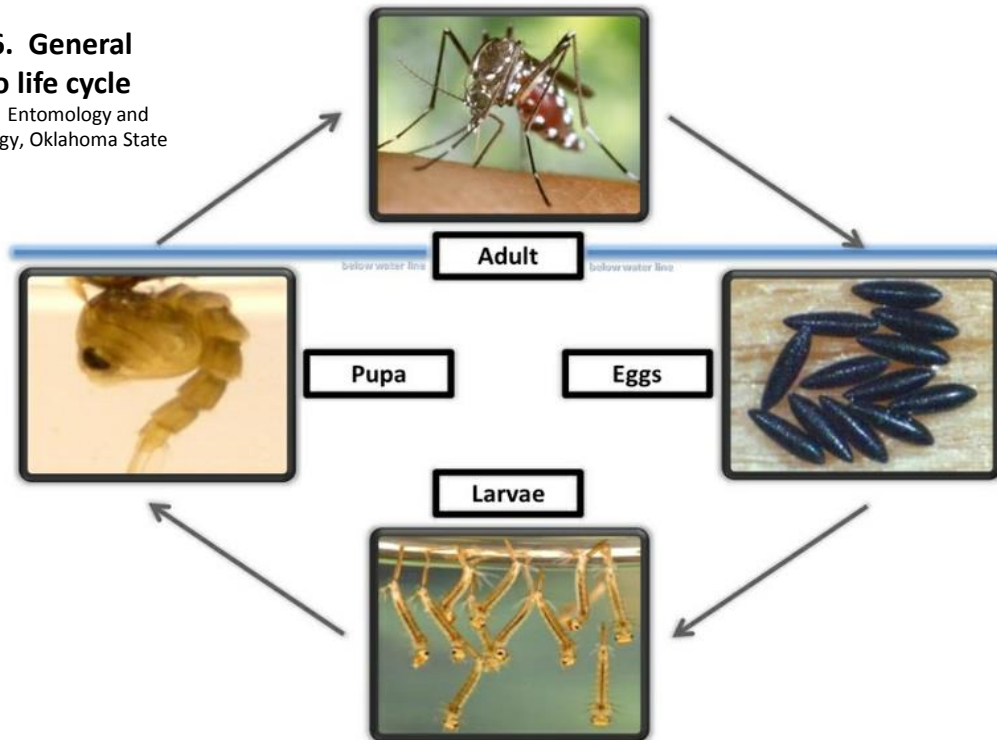
Disease	Tick Vector	Symptoms
Lyme Disease (bacterial infection)	Black-legged Tick Western Black-legged Tick	Joint pain, lethargy, lameness, decreased appetite, and fever. Common bulls-eye rash that appears on humans does not appear on dogs.
Anaplasmosis (bacterial infection)	Black-legged Tick Western Black-legged Tick Brown Dog Tick	Muscle aches, fever, decreased appetite, vomiting, diarrhea, lethargy. Severe cases seizures have occurred.
Ehrlichiosis (bacterial infection)	Brown Dog Tick Lone Star Tick Black-legged Tick	Fever, lethargy, poor appetite, abnormal bruising and bleeding, eye inflammation, lameness, neurological issues.
Rocky Mountain Spotted Fever (bacterial infection)	American Dog Tick Lone Star Tick Brown Dog Tick	Fever, joint and muscle pain, anemia, neurological abnormalities, vomiting, skin lesions, loss of appetite.
Hepatozoonosis (protozoan infection)	Brown Dog Tick Gulf Coast Tick	Fever, runny nose, watery eyes, bloody diarrhea, muscle pain, weight loss, reluctance to move.
Babesiosis (microscopic parasite infection in red blood cells)	American Dog Tick Brown Dog Tick	Anemia, dark urine, fever, swollen lymph nodes, weakness, can be life threatening if severe.
Bartonellosis (bacterial infection)	Brown Dog Tick Cat flea	Lameness, fever, painful lymph nodes, nausea, shivering, restlessness. If untreated, can cause heart and liver disease.
Tick Paralysis (medical condition)	American Dog Tick Black-legged Tick Lone Star Tick Brown Dog Tick Gulf Coast Tick	Potentially fatal. Caused by tick toxins during feeding that affect the host's motor neurons. Symptoms include fatigue, paralysis and respiratory failure. Recovery is seen within 24 hours after removing the tick.

Mosquitoes

There are around 200 species of Mosquitoes in the United States. Mosquitoes are a diverse group of semi-aquatic, flying insects with unique feeding habits in that only the females bite and require a blood meal for egg production.¹³ Male mosquitoes feed on nectar and plant juices. Mosquito species of concern include the yellow fever mosquito, *Aedes aegypti*, the Asian tiger mosquito, *Aedes albopictus*, and the common house mosquito, *Culex pipiens*.

Figure 16. General mosquito life cycle

Photo Credit: Entomology and Plant Pathology, Oklahoma State University



Eggs: Female mosquitoes lay their eggs on the surface of water. Depending on the species, eggs are laid singly or stuck together in rafts that float. Some *Aedes* species will lay eggs in damp soil, tires, or containers where water will flood or collect.^{13,17,20}

Larvae: Eggs typically hatch into larvae within 48 hours. The larvae are aquatic and swim around in the water coming to the surface to breathe. Most species have a siphon tube they use to breathe and hang at the water surface. Larvae feed on organic matter and micro-organisms such as algae and plankton for seven to 14 days.^{13,17,20}

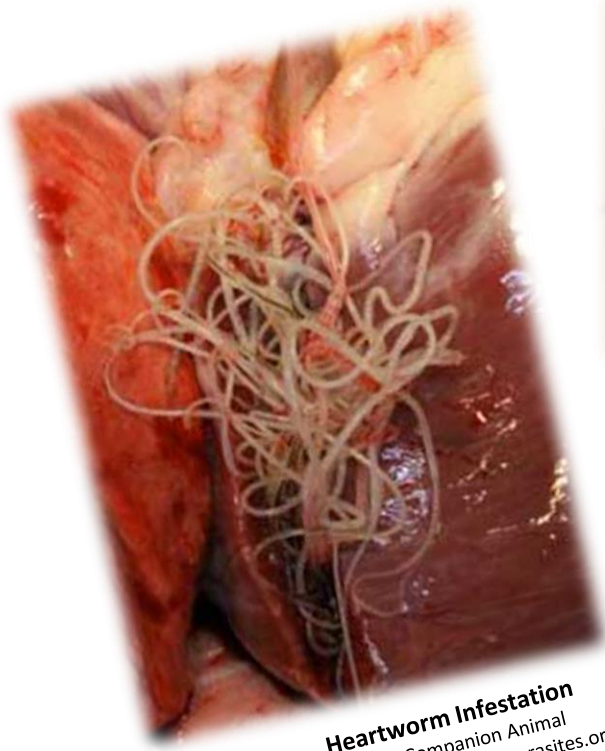
Pupae: Once the larvae has consumed enough food and molted for the last time the mosquito develops into the resting, pupal stage. Inside the pupal casing the adult mosquito develops, usually emerging within a few days.^{13,17,20}

Adult: The pupal casing will split open and the adult emerges. Adults will rest on the surface of the water for a short time until their wings dry and their body hardens. Eventually they fly off in search of a blood meal and a mate.^{13,17,20}

Mosquitoes

Diseases and Conditions Associated with Mosquitoes^{1,13,14}

Heartworm	Parasitic worm that infests the heart of its host. Immature heartworms are transferred to the host by the mosquito. Once mature they live in the heart and blood vessels in the lungs. They are more prevalent in dogs than cats. They can grow to over 12 inches in length.
Insect Bite Hypersensitivity	An allergic reaction to the bite of the mosquito. Allergy can range from mild to severe and is a response to the saliva being secreted during feeding.



Heartworm Infestation
Photo Credit: Companion Animal
Parasite Council, petsandparasites.org



Yellow Fever Mosquito and Asian Tiger Mosquito

Photo Credit: Florida Medical Entomology Lab, University of Florida

Parasite Comparison

Key Differences Among These Ectoparasites^{5,7,13,17,18,20}

	Fleas	Ticks	Mosquitoes
Type of Ectoparasite	Wingless insect with powerful legs for jumping	Arachnids, similar to spiders. Wingless with eight legs.	Winged adult insects with aquatic immature stages.
Biting Life Stage(s)	Adults	Larvae, nymphs, and adults	Adult females only
Type of Mouthparts	Piercing, suck mouthparts	Piercing, cutting mouthparts. Saw-like	Piercing, sucking mouthparts
Feeding Behavior	Adult fleas live on their host where they continuously feed, biting up to several hundred times per day. Can live on a host for up to two months.	Locate an optimal place to attach and feed on their host for several days. Secrete a cement-like substance to secure themselves in place.	Will feed on one host for 1-2 minutes at a time and move on to another host until she has consumed enough blood for egg production.
Climate Tolerances (species dependent)	Prefer warm temperatures and high humidity. Can overwinter.	Can survive near freezing temperatures and overwinter. Hardier than fleas and harder to kill.	Prefer warm temperatures and high humidity.

Control and Prevention

Ectoparasite control products for companion animals come in many forms including topical drops, collars, shampoos, sprays, and tablets or chewables. ALL of these products are approved and regulated by either the EPA or FDA.¹⁰ The FDA regulates products that are injected, ingested, or are applied topically and are absorbed through the body for effectiveness.^{3,10} The EPA regulates products that are applied to the animal such as topicals, collars, sprays, and shampoos where the active ingredients remain within the layers of skin.¹⁰

FDA products are considered drug products and are only available through licensed veterinarians or online pharmacies. EPA products are available at both veterinarians and retail outlets.¹⁰ Both FDA and EPA regulated products are subjected to rigorous safety and efficacy testing before gaining approval and registration.¹⁰

FDA Regulated Products:



The product will say it is FDA approved and give the NADA (new animal drug application) number.



Control and Prevention

EPA Regulated Products:



The EPA registration number will be on the label along with the active ingredients and the percentage of each in the product.



Control and Prevention

Precautionary Statements: What do they mean?^{10,12}

The EPA determines what precautionary statement is listed on the product label based on acute safety data of the product. The acute data includes oral toxicity, dermal toxicity, inhalation (if applicable), eye irritation, skin irritation, and dermal sensitization. Every product receives a score for each safety evaluation. The overall safety profile is determined by the safety evaluation that has the worst category score. Categories are indicated by a Roman numeral with Category I being the worst and Category IV being the safest.

Precautionary Statements are based on overall Category.
Majority of EPA registered products fall in Category II or III.



Category I	Danger
Category II	Warning
Category III	Caution
Category IV	No signal word required

The FDA precautionary statements are determined after the conclusion of an animal safety review of a NADA (New Animal Drug Application).³ The animal safety review includes confirming all safety studies were done properly, reviewing data related to drug safety and effectiveness, dosage levels and routes of administration proposed.³

Majority of FDA Flea and Tick products for companion animals have a CAUTION statement.

CAUTION: Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

September 2018 – FDA released a warning for flea and tick medication that may cause neurological issues. New labeling was required for Isoxazoline class of products.²

Precautions: For topical use only. Avoid oral ingestion. Use with caution in cats with a history of neurologic abnormalities. Neurologic abnormalities have been reported in cats receiving Bravecto, even in cats without a history of neurologic abnormalities. Bravecto has not been

Active Ingredients

Parasiticides in Companion Animal Products^{2,10,12,21}

Active Ingredients	Chemical Class	Acute Oral LD50 (Rat) (mg/kg)*	Active Ingredient Safety Profile Designation (EPA)	Products Containing Active Ingredient
Permethrin	Type I Pyrethroid	430-4,000	Category II	Vectra 3D for Dogs K9 Advantix II for Dogs
Fipronil	Phenylpyrazole	97	Category II	Frontline Plus for Dogs and Cats Pet Armor Plus for Dogs and Cats Catego for Cats
Etofenprox	Non-ester pyrethroid	>42,880	Category III	Hartz UltraGuard Pro for Dogs and Cats
Dinotefuran	Neonicotinoid	>2,000	Category II	Vectra 3D for Dogs Catego for Cats
Imidacloprid	Neonicotinoid	450	Category II	K9 Advantix II for Dogs Advantage II for Cats
Afoxolaner	Isoxazoline	>1,000	N/A	NexGard Chewables for Dogs (FDA Regulated)
Fluralaner	Isoxazoline	>2,000	N/A	Bravecto Chewables for Dogs (FDA Regulated) Bravecto Topical For Cats (FDA)
Flumethrin	Type II Pyrethroid	41-3,849	Category II	Seresto Collars for Dogs and Cats

*The higher the score the less toxic the active is.

Integrated Pest Management^{5,16,19}

To achieve complete infestation control, sometimes it is necessary to treat more than just our pets. Infestations can vary in severity and longevity so it is important to explore a variety of control options. Some products are better for immediate control and other are better for long term prevention. Treating areas within the home and yard, as well as animal treatments will provide the best protection for pets and pet parents.

A Strong Integrated Approach

Animal Treatments



Topical Drops
Shampoos
Collars

Home Treatments



Home Spray
Carpet Powder

Yard Treatments



Yard Spray
Granules

Resources

There are resources available to pet parents for further information.

The Pet Owner's Parasite Resource: petsandparasites.org

Tick Encounter Resource Center: tickencounter.org

Pet MD: www.petmd.com

American Heartworm Society: www.heartwormsociety.org/pet-owner-resources

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