

A GUIDE TO VECTORS AND VECTOR-BORNE DISEASES OF ANIMALS



The Center for
Food Security
& Public Health

IOWA STATE UNIVERSITY®
College of Veterinary Medicine

A practical guide for U.S. animal health professionals to detect, identify, control vectors and prevent vector-borne diseases



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For more resources, visit CFSPH's Vectors and Vector-Borne Diseases of Animals at cfsph.iastate.edu/vectors or by scanning the above QR code.



HOW VECTORS AFFECT ANIMALS

Is your animal getting bug bites?

Do you need help identifying a tick or mite?

Are you curious what diseases an insect will spread?

While many insects and other arthropods, like ticks and mites, are harmless or helpful, some are harmful to people and animals. Vectors can be parasites, which are organisms that live on or in a person or animal, causing harm directly to their host. Vectors can also transmit pathogens (e.g., bacteria, viruses, or parasites) from one person or animal to another.

These resources will explain:

- Important vectors and parasites affecting animals and signs of infestation
- How to submit unfamiliar vectors and parasites for identification
- Pest management practices for controlling vectors and parasites

The information provided has been developed for veterinary personnel, animal health professionals, producers, and anyone who interacts with animals on a regular basis. For simplicity purposes with terminology, parasites are not differentiated from vectors throughout these resources. However, please appreciate their distinction when seeking additional information.

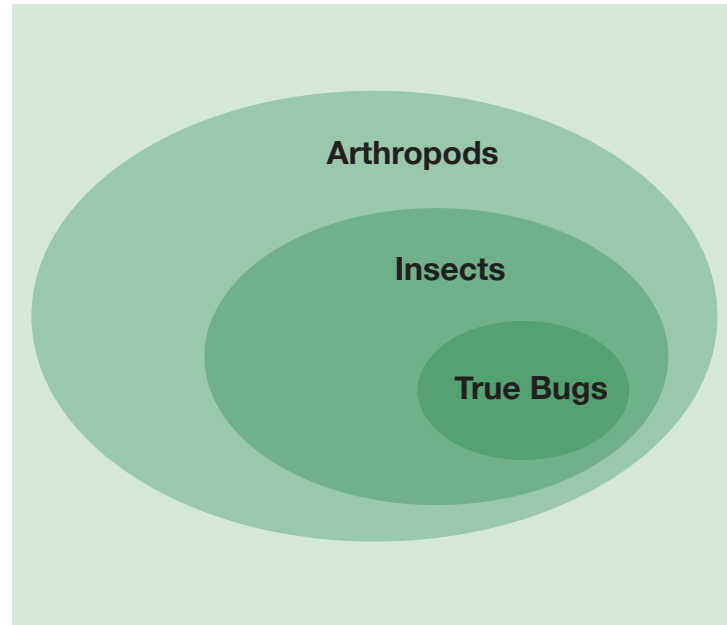
What are vectors?

In disease terms, a vector is an organism that transmits a pathogen from one person or animal to another. It includes insects and other arthropods, like arachnids. All insects are arthropods. However, not all arthropods are insects. And not all insects are true bugs.

- **Arthropods** (ticks and mites) have exoskeletons, segmented bodies, and at least three pairs of legs.
- **Insects** (mosquitoes, fleas, and flies) are arthropods that have six legs, three body segments, one pair of antennae, and possibly wings.
- **True bugs** (kissing bugs) are insects that have mouthparts for piercing and sucking and their first pair of wings are tough and hard.

Are all arthropods vectors?

Arthropods are all around us. As E.O. Wilson once said, “they are the little things that run the world.” Thankfully, not all arthropods transmit pathogens. Most arthropods are harmless or beneficial, like honey bees and dung beetles. Only a small number are harmful to the health of people and animals.



How do vectors cause illness?

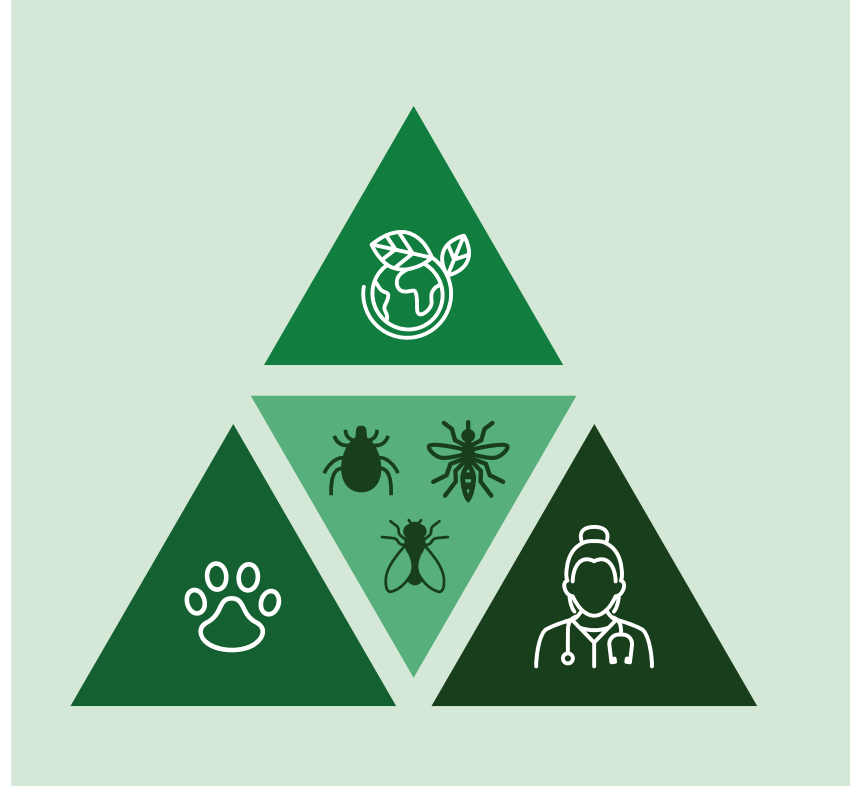
Vectors may directly harm people and animals as parasites or they may transmit pathogens that cause disease (vector-borne diseases). For example, flies may damage hides and lower productivity, ticks may cause anemia in severe cases, and mosquitoes may transmit pathogens like viruses and parasites.

- **Biological vectors** carry pathogens that can multiply within their bodies and be delivered to new hosts.
- **Mechanical vectors** carry pathogens on contaminated mouth parts or other body parts and distribute these pathogens through direct contact with hosts or indirectly through the environment.

Why should you be concerned about vector-borne diseases?

Vector-borne diseases are a One Health issue, highlighting how human, animal, and environmental health are connected. Many vector-borne diseases can infect both animals and humans. The risk of vector-borne disease is increasing worldwide and can be unpredictable as conditions change over time and place. From year to year, risk can go up or down depending on what vectors, animals, and people are doing as well as due to changes in temperature or other weather conditions in a specific area.

- People, vehicles, animals, and weather events can quickly move vectors to new areas.
- Pathogens may change in new environments or hosts.
- Interactions that people and animals have with vectors change as temperatures become warmer, precipitation patterns change, and we use the land differently (like urbanization and reforestation).



What is a foreign animal disease?

A foreign animal disease (FAD) is a disease that does not occur in the United States. Similar terms include emerging, exotic, and transboundary diseases of animals. These diseases can spread rapidly and pose a significant threat to animal agriculture, human health, and the economy. Foreign vectors and vector-borne diseases can be introduced into the United States. However, they may not thrive in their new area and become a health threat if the right animal hosts and environmental conditions are not present. If the introduced vector or vector-borne disease becomes widespread or common, it could become established in the United States.

Have foreign vectors or vector-borne diseases been introduced into the U.S.?

Some vectors and vector-borne diseases have never been found in the United States while others have been introduced and are now considered in disease terms to be endemic (established and regularly occurring).

- Varroa mites were first detected in 1987 and are now the most serious health threat of U.S. honey bees today.
- West Nile virus was a foreign pathogen introduced to the United States in 1999. It is now considered an endemic disease across the continental United States.
- The Asian longhorned tick is native to East Asia and was discovered in New Jersey in 2017. It has now been found in over 20 states and linked to bovine theileriosis, a serious disease affecting cattle.

Why is identification of vectors important?

It is important to know which vectors are commonly found in your area so you can quickly detect unusual vectors. Identifying a vector is important for many reasons:

- Understanding which vectors are and are not found in an area
- Preventing vector-borne disease transmission to people and animals
- Prescribing targeted treatments that are safe and effective

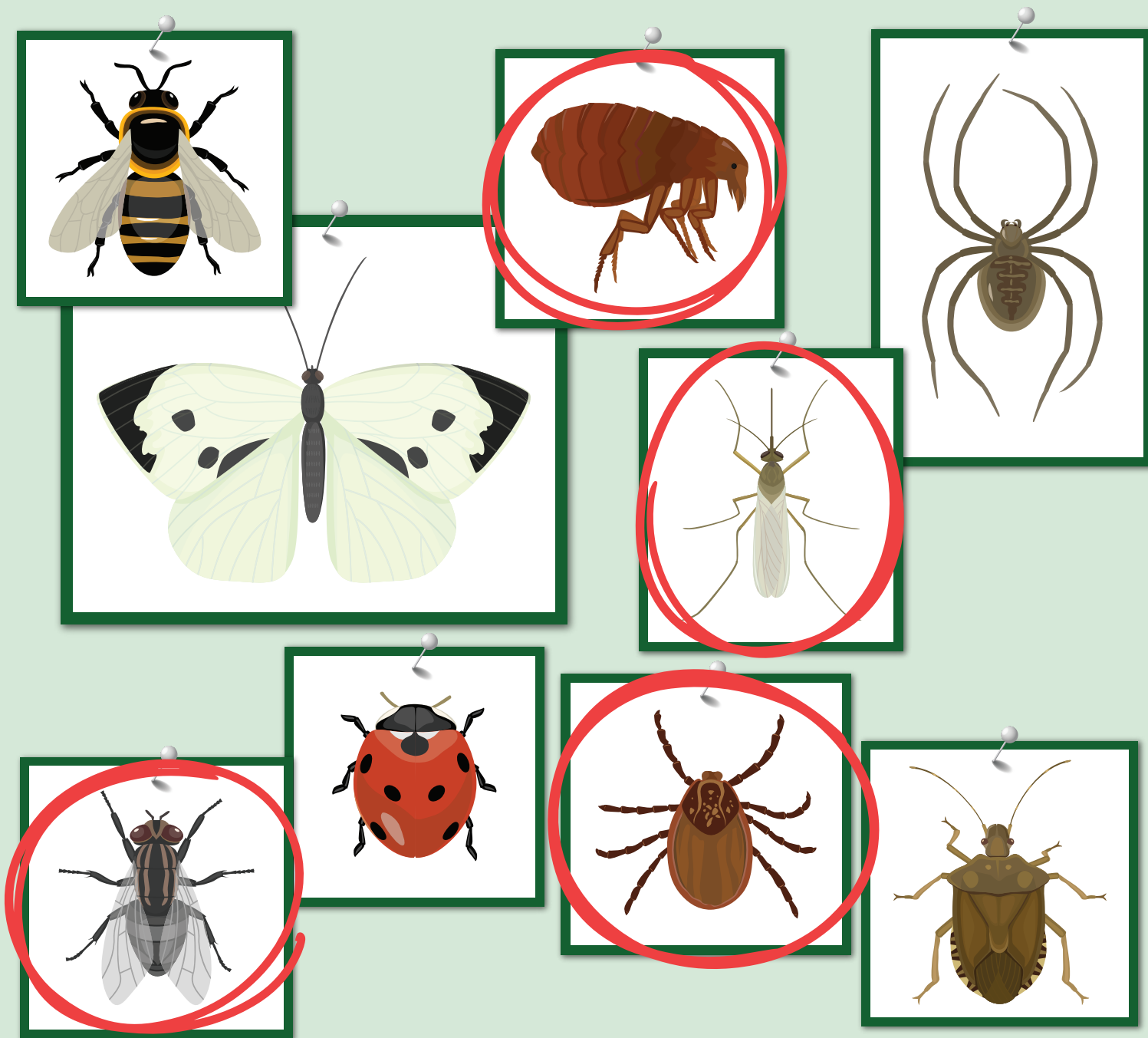


What can you do?

All of us have a role in detecting and responding to potential threats. For vectors that impact human and animal health, veterinary personnel and animal owners are the first line of defense. Our ability to quickly detect and respond to disease threats can make a world of difference. Rapidly reporting an emerging or exotic vector or vector-borne disease to the proper agencies can help eliminate the threat before it becomes established. Entomologists, animal and public health officials, and other experts are available and happy to help stop a threat early on.



Note: This guide shows some of the most significant vectors of concern to domestic animals in the United States. It is not meant to be a complete resource of all arthropods, their associated diseases and conditions, or used as a diagnostic tool. Veterinary consultation is advised for clinical cases.

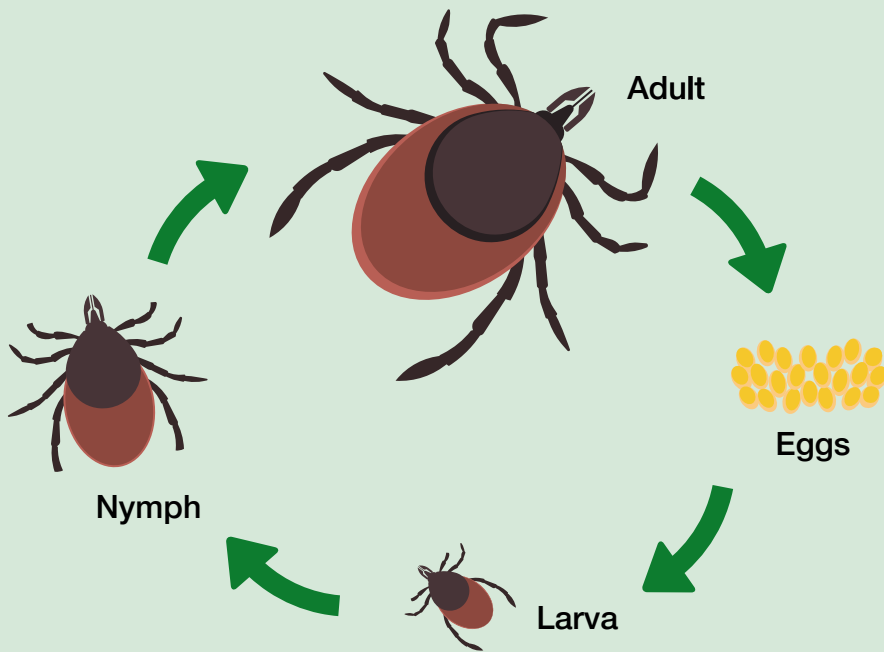


KNOW WHAT TO WATCH FOR

Not all arthropods are vectors. Learn more about where each vector lives, how to detect them, and how to control vectors and prevent the pathogens they may transmit. A reference table of vector-borne diseases of animals, including those that are zoonotic, can be found in the Appendix: Vector-Borne Diseases by Animal.



Ticks Affecting Animal Health



IMPORTANCE

- There are over 1,000 species of ticks worldwide. Only about 25 species are of concern to people or domestic animals.
- Ticks cause most vector-borne diseases reported each year in people and animals in the United States. Signs of tick-borne disease commonly include fever, lethargy, swollen or painful joints, and anemia.
- Foreign vectors and foreign animal diseases (FADs) are not found in the United States and can threaten human and animal health. FADs can be introduced to the United States, so animal owners and veterinary personnel have a key role in recognizing and reporting FADs to animal and public health officials. Early signs of tick-related FADs may include:
 - Unfamiliar tick appearance, or ticks present in unusually high numbers on an animal
 - Large number of sick or dead animals
 - Unusual signs of illness (like blisters or neurologic disease)

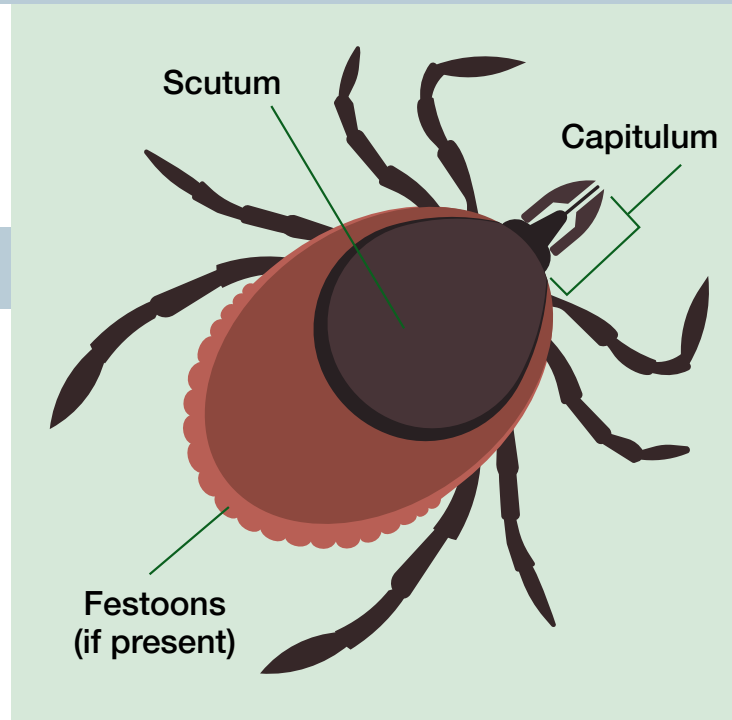
ABOUT TICKS

- Ticks are arachnids, relatives of spiders and mites.
- Hard ticks are the most common ticks affecting people and domestic animals. They have a four-stage life cycle (egg, larva, nymph, and adult) and usually live two to three years.
- Larvae, nymphs, and adult females of most tick species need a blood meal from a person or animal to continue their development. Some ticks are generalists with a wide host range, while others are specialists with a limited host range.
- Many tick species spend most of their life in wooded or grassy areas. Others live almost their entire life on one animal host.

- Ticks cannot jump or fly since they do not have wings. They do not travel far on their own without a host. Movement of ticks to new areas typically occurs through transporting animals infested with ticks.

IDENTIFICATION

- Many tick species can be identified by a unique set of characteristics visible to the naked eye or with the help of a dissecting microscope.
 - Some ticks, including engorged ticks, may be difficult or impossible to identify without the help of a trained entomologist or molecular testing.
- Ticks take on a different appearance at each life stage.
 - Larvae are tiny (about the size of a speck of dirt) and have six legs.
 - Nymphs are small (about the size of a freckle or poppy seed) and have eight legs.
 - Adults are about the size of a sesame seed or larger and have eight legs. Males may look different from females.
- Unique characteristics can help differentiate tick species.
 - The tick’s “head” (capitulum) is shaped differently from one tick genus to another.
 - Mouthparts of nymphs and adult females are longer than adult males.
 - The scutum (shield) often has distinctive colorings and markings (ornamentation). Adult females have a short scutum, which allows for large blood meals to be taken. Males have a scutum that reaches completely to the end of their body.
 - Bumpy grooves or ridges (festoons) are present along the back edge of some species.
- Identification keys and tick experts can be consulted for further details.



ENDEMIC TICKS OF ANIMAL HEALTH CONCERN

The ticks listed below are commonly found in the United States. In certain areas, these ticks may transmit pathogens. Endemic diseases in animals may or may not be reportable, depending on the jurisdiction.



Amblyomma americanum (Lone Star Tick)

Characteristics: Dark brown scutum with white spot centrally located (females) or white streaks along the body edge (males), long mouthparts, and festoons

Distribution: Widely distributed in the southeastern and eastern U.S. (grassy and wooded areas)

Endemic Diseases: Cytauxzoonosis, Ehrlichiosis, Rocky Mountain spotted fever, Tick paralysis, Tularemia



***Amblyomma mixtum* (formerly *A. cajennense*) (Northern Cayenne Tick)**

Characteristics: Similar to lone star ticks but without a white spot on the scutum, tan to gold scutum with dark brown ornamentation, long mouthparts, and festoons

Distribution: Mostly southern Texas as well as the coastal region bordering the Gulf of Mexico (grassy and brushy areas)

Endemic Diseases: Rocky Mountain spotted fever



***Amblyomma maculatum* (Gulf Coast Tick)**

Characteristics: Dark brown scutum with white linear lines, long mouthparts, and festoons

Distribution: Coastal areas along the Atlantic coast and the Gulf of Mexico (grassy, drier uplands)

Endemic Diseases: American canine hepatozoonosis, Tick paralysis



***Dermacentor albipictus* (Winter Tick)**

Characteristics: Reddish-brown in color with creamy white scutum, short mouthparts, and festoons

Distribution: Widely distributed throughout the U.S. (one-host tick that prefers moose and other ungulates)

Endemic Diseases: Anaplasmosis, Tick paralysis



***Dermacentor andersoni* (Rocky Mountain Wood Tick)**

Characteristics: Dark brown scutum with whitish ornamentation, short mouthparts, and festoons (similar to *D. variabilis*)

Distribution: Higher elevations in western states, including the Rocky Mountains (grassy and lightly wooded, shrubby areas)

Endemic Diseases: Anaplasmosis, Colorado tick fever, Rocky Mountain spotted fever, Tick paralysis, Tularemia



***Dermacentor* (formerly *Anocentor*) *nitens* (Tropical Horse Tick)**

Characteristics: Yellowish-brown without ornamentation, short mouthparts, and festoons (similar to *D. albipictus*)

Distribution: Southern Texas and Florida (one-host tick that prefers the ears of equids)

Endemic Diseases: Anaplasmosis



Dermacentor similis (Western American Dog Tick)

Characteristics: Dark brown scutum with whitish ornamentation, short mouthparts, and festoons (similar to *D. variabilis*)

Distribution: West of the Rocky Mountains (forest edges and open, grassy areas)

Endemic Diseases: Ehrlichiosis, Rocky Mountain spotted fever, Tularemia



Dermacentor variabilis (American Dog Tick)

Characteristics: Dark brown scutum with whitish ornamentation, short mouthparts, and festoons (similar to *D. similis*)

Distribution: Widely distributed east of the Rocky Mountains (grassy and lightly wooded, brushy areas)

Endemic Diseases: Anaplasmosis, Rocky Mountain spotted fever, Tick paralysis, Tularemia



Haemaphysalis longicornis (Asian Longhorned Tick)

Characteristics: Reddish-brown tick lacking ornamentation, small mouthparts, festoons, and lacking eyes

Distribution: Recently introduced, continuing to expand its distribution, and currently found in the Eastern states and central U.S. (grassy and wooded areas)

Endemic Diseases: Bovine theileriosis



Ixodes pacificus (Western Blacklegged Tick)

Characteristics: Red tick with black scutum lacking ornamentation, long and narrow mouthparts, and no festoons (similar to *I. scapularis*)

Distribution: West coast of the U.S. (wooded and brushy areas)

Endemic Diseases: Anaplasmosis, Lyme disease



Ixodes scapularis (Blacklegged or Deer Tick)

Characteristics: Red tick with black scutum lacking ornamentation, long and narrow mouthparts, and no festoons (similar to *I. pacificus*)

Distribution: Eastern and upper midwestern states (wooded and brushy areas)

Endemic Diseases: Anaplasmosis, Bovine babesiosis, Cervid babesiosis, Ehrlichiosis, Lyme disease, Tick paralysis



Ornithodoros coriaceus (Pajahuello Tick)

Characteristics: Soft tick that lacks a hard scutum and has mouthparts on the underside of its body

Distribution: Present in western U.S. at elevations of 600-8,000 feet (chaparral and oak tree habitat)

Endemic Diseases: Foothill abortion (epizootic bovine abortion)



Otobius megnini (Spinose Ear Tick)

Characteristics: Soft tick that lacks a scutum, has mouthparts on the underside of its body, and is covered in sharp spines; adult ticks do not feed

Distribution: Throughout the U.S., especially arid regions of western states (one-host tick that lives in the ear canal of livestock and companion animals)

Endemic Diseases: Otitis, Secondary infections



Rhipicephalus sanguineus group, including *R. sanguineus sensu stricto* (Brown Dog Tick)

Characteristics: Reddish-brown tick with elongated body lacking ornamentation, short mouthparts, hexagonal basis capitulum, and festoons

Distribution: Throughout the U.S., with higher populations in southern states (grassy and wooded areas, cracks and crevices in homes and dog kennels); common in urban settings where dogs or other domestic pets are abundant

Endemic Diseases: Anaplasmosis, Ehrlichiosis, Rocky Mountain spotted fever, Tick paralysis

FOREIGN TICKS OF ANIMAL HEALTH CONCERN

The ticks listed below are selected vectors of highly contagious, reportable, or foreign diseases of animals.



Amblyomma variegatum (Tropical Bont Tick)

Characteristics: Brown with bright yellow-orange ornamentation on scutum (males), large mouthparts, and festoons

Distribution: Tropics and subtropics (esp. Africa and Caribbean)

Foreign Diseases: Dermatophilosis, Heartwater, Nairobi sheep disease



Ixodes ricinus (Castor Bean or Sheep Tick)

Characteristics: Red tick with black scutum lacking ornamentation, long and narrow mouthparts, and no festoons (similar to *I. scapularis*)

Distribution: Temperate zones (esp. Europe and northern Iran/Africa)

Foreign Diseases: Louping ill



Ornithodoros moubata (African Hut or Eyeless Tampan)

Characteristics: Soft tick with brown, leathery dorsum (no scutum), ventrally located head with no eyes and no suture line between the dorsal and ventral surfaces

Distribution: Tropics (esp. Africa)

Foreign Diseases: African swine fever



Rhipicephalus (Boophilus) annulatus and microplus (Cattle Fever Ticks)

Characteristics: Brown, elongated tick lacking ornamentation with hexagonal basis capitulum, short mouthparts, and no festoons

Distribution: Permanent quarantine zone in southern Texas along Mexican border (as part of USDA's Cattle Fever Tick Eradication Program); tropics and subtropics (esp. Mexico), large parts of Asia

Foreign Diseases: Piroplasmiasis

COLLECTION AND SUBMISSION

- Prompt tick removal is critical since many pathogens require at least 12-24 hours of attachment to a person or animal to transmit disease.
- Inspect animals closely for ticks after being outdoors, paying close attention to areas in and around the ears, on the eyelids, behind the elbows, under the armpits, and under the base of the tail.
- To remove an attached tick, grasp it near skin (attachment point) with tweezers and gently pull straight up to keep the head and mouthparts (capitulum) intact.
- Ticks of concern should be collected for identification to ensure effective control measures are used. Testing may be available to determine if pathogens are present.
 - Laboratories and shipping companies may have specific instructions for you to follow.
 - Organisms should be dead before shipping. Ticks can be killed by freezing overnight or placing them in 70-90% ethanol.
 - It is best to place ticks in a labeled, sealed, water-proof container. Alternatively, ticks may be double bagged inside sealable baggies (e.g., Ziploc® bags).



- Ticks can be preserved by submerging them in 70-90% ethanol. For shipping purposes, liquids may be avoided by placing a cotton ball soaked in ethanol, rubbing alcohol, or clear cocktail alcohol (80 proof or higher) alongside the tick in a container.
- Always label specimens with host (if applicable), location collected from the body or environment, and date of collection.

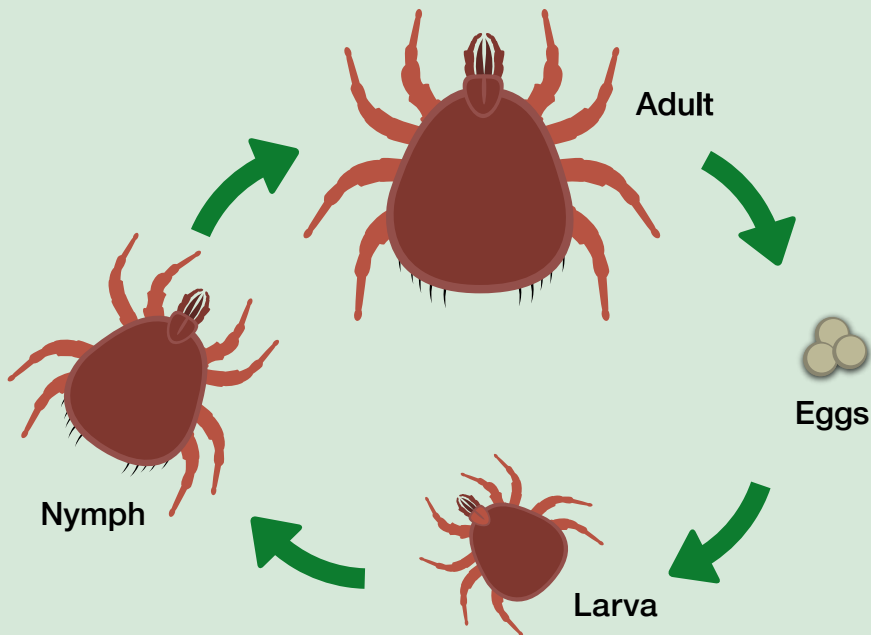
CONTROL AND PREVENTION

- While eliminating ticks is not likely, tick populations can be managed by disrupting the tick life cycle and habitat.
 - For prompt detection and control, continuously monitor animals for tick infestations and frequently inspect animal housing areas (particularly areas near woods, shrubs, and tall grasses).
 - Manage tick habitat to discourage tick migration and reduce tick encounters. Preventive measures may include frequent mowing and tree or brush removal within three feet of animal areas and trails.
- A variety of tick control products are available for treatment of animals, including oral chews, injectables, or topical pour-ons, sprays, and dips.
 - Be sure to choose a product with an EPA registration number (topicals) or FDA (A)NADA number (orals and injectables).
 - Read the product label carefully to make sure it is effective against the tick species and safe for the species and age of animal to be treated.
- Environmental tick control products should be used only after consultation with experts to prevent unintended harm to wild animals and invertebrates, like frogs and honey bees. These products can also contaminate water sources.
- Researchers are currently exploring and assessing community-based tick control practices such as trail maintenance and insecticide treatment of wild animals.
- Avoid moving ticks from one site to another.
 - Check animals and people closely for ticks after being in or near tick habitat and before movement.
 - Remove ticks from affected clothing, equipment, and vehicles.
- Canine Lyme disease vaccines are commercially available and should be considered for preventing disease in dogs with tick exposure.





Mites Affecting Animal Health



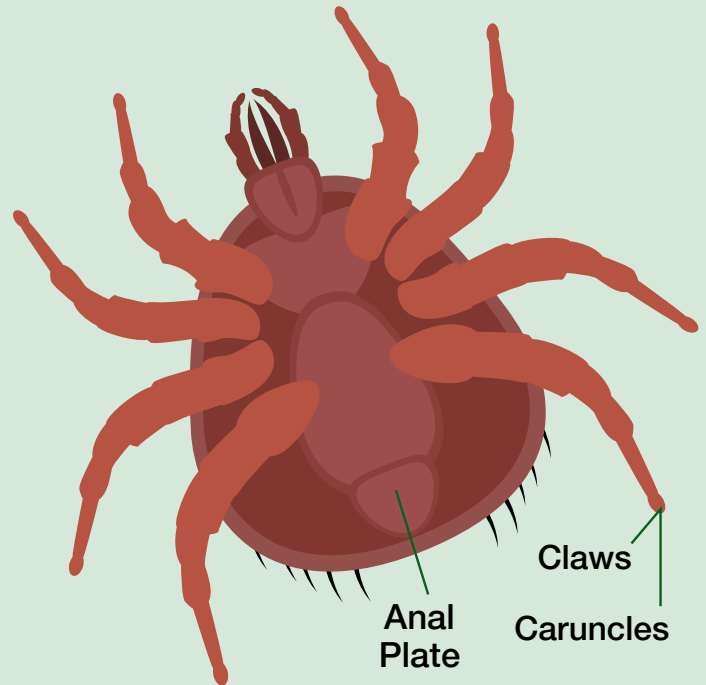
IMPORTANCE

- There are over 55,000 species of mites worldwide. Many species are harmless or even beneficial as they break down organic matter. However, several species can affect the health of people and animals, including honey bees.
- Animals with mite infestations may be intensely itchy. Mites can transmit pathogens or cause hair loss, papules or nodules, thickened skin, or secondary skin infections.
 - Clinical signs depend on whether the species burrows into the skin, remains on the skin surface, or inhabits hair follicles or sebaceous glands.
- Foreign vectors and foreign animal diseases (FADs) are not found in the United States and can threaten human and animal health. FADs can be introduced into the United States, so animal owners and veterinary personnel have a key role in recognizing and reporting FADs to animal and public health officials. Early signs of mite-related FADs may include:
 - Unusual mite appearance
 - Large number of sick or dead animals
 - Unusual signs of illness (like severe skin lesions or neurological disease)

ABOUT MITES

- Mites are arachnids, relatives of spiders and ticks. They may be free-living or parasitic.
- Mites live most of their life on an animal but can live days to weeks off a host.
 - Some species are restricted to one type of animal host (high host specificity). Others infect various types of hosts (low host specificity).

- Depending on the species, mites may live for several weeks to months or even decades.
 - Eggs are usually laid on the host and develop into six-legged larvae.
 - Larvae molt into eight-legged nymphs.
 - Nymphs molt into eight-legged adults, which live on or off the animal host.
- Mites cannot jump or fly since they do not have wings.
 - Mites can be transmitted from one host to another through direct contact (particularly at birth or dense animal housing) and fomites (such as fences and grooming equipment).



IDENTIFICATION

- Most mites are too small to be seen with the naked eye. However, many can be identified by a unique set of characteristics with the help of a dissecting microscope.
 - The body shape varies from oval to round to elongated.
 - Legs may be short or long and distinct. Claws and caruncles (suckers) may be present in some species.
 - The location of the anus on the anal plate (a chitinous plate on the ventral surface) differs between species.
 - Some mites, especially closely-related species, may be difficult or impossible to identify without the help of a trained entomologist or molecular testing.
- Identification keys and mite experts can be consulted for further details.

ENDEMIC MITES OF ANIMAL HEALTH CONCERN

The mites listed below are commonly found in the United States. In certain areas, these mites may transmit pathogens. Endemic diseases in animals may or may not be reportable, depending on the jurisdiction.



***Cheyletiella* spp.** (*C. parasitivorax*, *C. blakei*, *C. yasguri*)

Characteristics: Microscopic, non-burrowing mite with large curved palpal hooks by its mouthparts, and feeds on skin debris

Domestic Animal Hosts: Rabbits, cats, dogs (low host specificity), highly contagious to humans

Health Impacts: Dermatitis (“walking dandruff”), itching, possible crusts, vector of myxoma virus (rabbits)



***Chorioptes* spp. (*C. bovis*)**

Characteristics: Microscopic, non-burrowing mite with long legs and suckers that feeds on skin debris

Domestic Animal Hosts: Cattle, horses, sheep, goats, rabbits (low host specificity)

Health Impacts: Range of subclinical to mild itching to mange (particularly affecting the tail and lower legs)



***Demodex* spp. (*D. bovis*, *D. canis*, *D. equi*)**

Characteristics: Microscopic burrowing mite that is a normal inhabitant of hair follicles in many animals (causing disease when populations overgrow); elongated with short, stumpy legs

Domestic Animal Hosts: Multiple host-specific species (not zoonotic)

Health Impacts: Large pustules or nodules may occur in heavy infestations (cattle) or secondary infections



***Dermanyssus* spp. (*D. gallinae*)**

Characteristics: Non-burrowing mite with claw-like mouthparts, feeds at night and hides in crevices close to the roost/nest during the day

Domestic Animal Hosts: Poultry

Health Impacts: Decreased egg production, anemia, low weight gains, sometimes fatal if secondary infections, vector of fowl pox virus and several encephalitis-causing viruses



***Notoedres* spp. (*N. cati*)**

Characteristics: Microscopic, round burrowing mite

Domestic Animal Hosts: Cats, rabbits, sometimes humans

Health Impacts: Severe itchiness with crusts, hair loss (particularly on the face and neck)

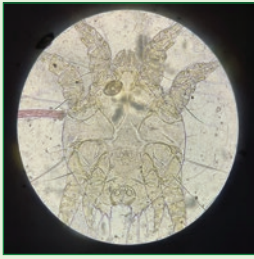


***Ornithonyssus* spp. (*O. sylviarum*)**

Characteristics: Non-burrowing, oval mite with whip-like mouthparts

Domestic Animal Hosts: Poultry (may also feed on mammalian hosts, including humans)

Health Impacts: Reduced egg production, anemia, irritation



Otodectes spp. (O. cynotis)

Characteristics: Non-burrowing, oval mite commonly found in the ear canal but can be found in other parts of the body

Domestic Animal Hosts: Cats, dogs, and other animals

Health Impacts: Intense irritation in and around the ears



Psoroptes spp. (P. cuniculi)

Characteristics: Non-burrowing, large, oval mite commonly found in the ears of affected animals

Domestic Animal Hosts: Rabbits, horses, goats, other animals

Health Impacts: Otitis externa with crusting, intense itchiness, head shaking, head tilt, secondary infections



Sarcoptes spp. (S. scabiei var bovis, ovis)

Characteristics: Microscopic, round, burrowing mite of the skin

Domestic Animal Hosts: Host-specific varieties affecting a wide range of mammalian hosts (humans can be infested with animal varieties but short-lived and self-limiting)

Health Impacts: Intense itchiness, thickened skin with large folds, zoonotic infections



Varroa spp. (V. destructor, V. jacobsoni)

Characteristics: Round, reddish, non-burrowing mite of honey bees; larger and slower than *Tropilaelaps*

Domestic Animal Hosts: Honey bees

Health Impacts: Parasitic mite syndrome, deformed wing virus, slow bee paralysis virus, colony collapse

FOREIGN MITES OF ANIMAL HEALTH CONCERN

The mites listed below are selected vectors of highly contagious, reportable, or foreign diseases of animals.



Psoroptes ovis

Characteristics: Tiny, non-burrowing mite commonly found on the backs and flanks of hosts

Distribution: Global distribution, although has been eradicated from the U.S., Canada, Australia, Scandinavia, and New Zealand

Health Impacts: Affects cattle, sheep, and goats by causing exudative dermatitis with thick crusts and scabs, hair/wool loss, lichenification (thick and leathery skin), secondary infections, and possibly death



Tropilaelaps spp. (*T. clareae*, *T. mercedesae*)

Characteristics: Fast-running reddish-brown, non-burrowing mite of honey bees; about 1/3 the size of a *Varroa* mite and oval in shape rather than round

Distribution: Asia, Indonesia, and Papua New Guinea

Health Impacts: Affects honey bees by transmitting parasitic mite syndrome, deformed wing virus, and possibly colony collapse

COLLECTION AND SUBMISSION

- History and clinical signs can be helpful for presumptive diagnosis. However, mites of concern should be collected for identification to ensure effective control measures are used. Testing may be available to determine if pathogens are present.
 - If visible, mites can be placed in a labeled, sealed, leak-proof container with 70-90% ethanol. Rubbing alcohol, hand sanitizer, or clear cocktail alcohol (80 proof or higher) will also work, if needed.
 - If mites are suspected, specimens may be collected from affected areas through skin scrapes, hair plucks, and/or skin biopsies. Due to grooming behaviors of some animals, mites can sometimes be detected in fecal examinations.
 - Take care to not crush mites before submission.
 - Always label specimens with host, location collected from the body (or environment), and date of collection.



For honey bee colonies, mites can usually be identified by collecting and submitting a sample of affected adults and brood comb. Detailed instructions can be found at USDA: Bee Research Laboratory.

- Laboratories and shipping companies may have specific instructions for you to follow.

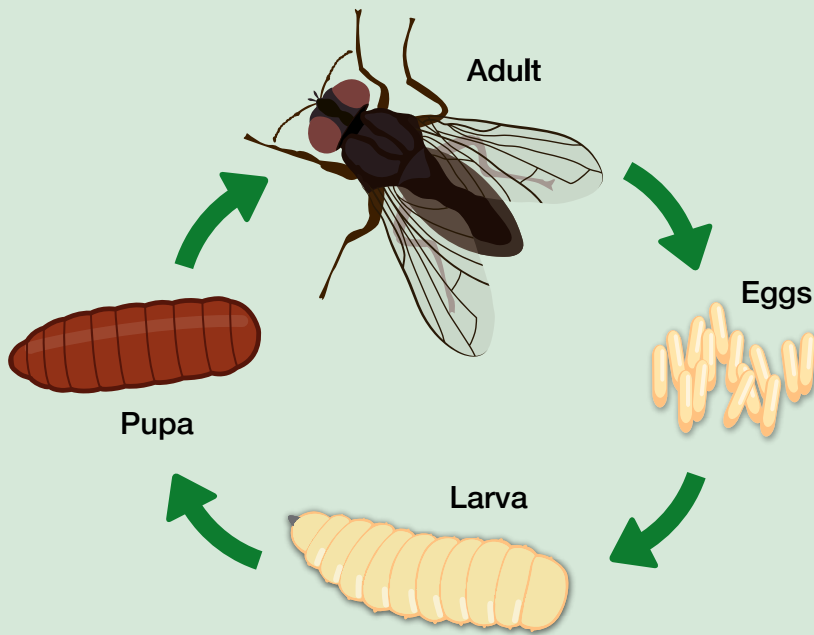
CONTROL AND PREVENTION

- Depending on the species, eliminating mite infestations may not be possible. However, mite populations can be managed by disrupting their life cycle. Specific methods of treatment and control vary depending on the type of mite and animal involved.
 - For prompt detection and control, continuously monitor animals for mite infestations and frequently inspect animal housing areas for signs of mites.
- A variety of mite control products are available for animals, including injectable, pour-on, and sprays.
 - Be sure to choose a product with an EPA registration number (topicals) or FDA (A)NADA number (orals and injectables).
 - Read the product label carefully to make sure it is effective for the mite species and safe for the species and age of animal to be treated.
 - Over-the-counter products may not always be effective. Some mite species are developing resistance to common chemicals. Veterinary guidance is recommended.
 - Multiple consecutive treatments may be needed to prevent reinfestation of animals from the environment.
- Additional treatments, such as antibiotics, may be needed for secondary infections.
- Avoid moving mites from one site to another.
 - Check animals closely for mites before movement.
 - Quarantine, inspect, and monitor new and returning animals in a separate area.
 - Clean and disinfect contaminated vehicles and other equipment before movement.
- Some pathogens that are transmitted by mites can be prevented through the use of vaccines, such as fowl pox and avian encephalomyelitis in poultry.





Flies Affecting Animal Health



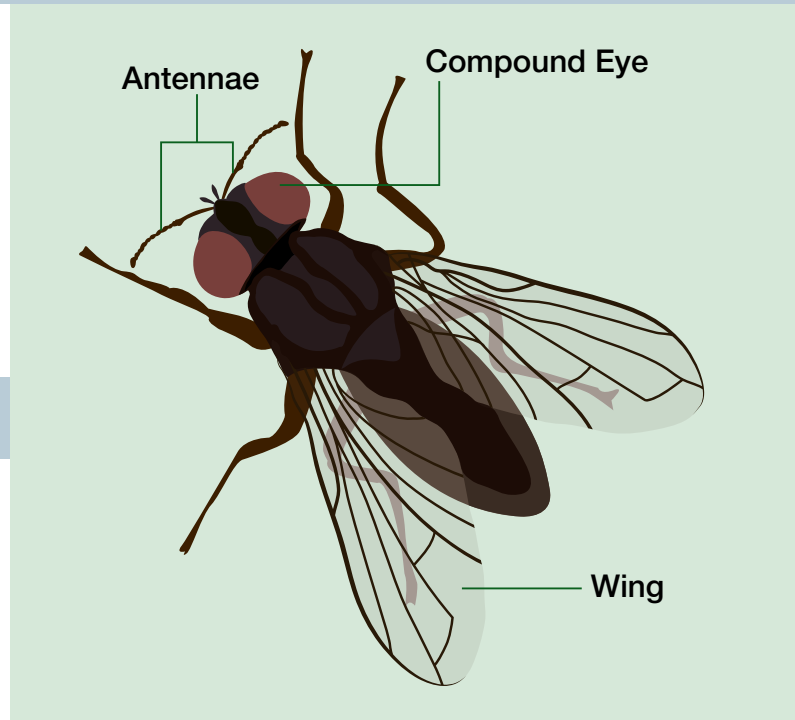
IMPORTANCE

- There are over 150,000 species of flies worldwide. Many species are beneficial as they pollinate plants and break down organic matter. However, several flies can transmit pathogens to people and animals.
- Flies can negatively impact animals by causing irritation, stress, reduced production (lower weight gain and milk production), and disease. Flies can transmit pathogens through biting and blood feeding (biological vector) or by carrying pathogens on their bodies (mechanical vector). Signs of illness associated with flies may include fever, lethargy, skin sores, hair loss, and anemia.
- Foreign vectors and foreign animal diseases (FADs) are not found in the United States and can threaten human and animal health. FADs can be introduced to the United States, so animal owners and veterinary personnel have a key role in recognizing and reporting FADs to animal and public health officials. Early signs of fly-related FADs may include:
 - Unusual appearance or activity of flies or larvae (maggots)
 - Large number of sick or dead animals
 - Unusual signs of illness (like painful and enlarging wounds that smell of decay)

ABOUT FLIES

- The fly life cycle includes the egg, larva (maggot), pupa, and adult. In warm weather, some flies can complete all stages within one to two weeks.
- Immature flies need moisture to develop. Adult females lay their eggs in water or wet organic matter, such as manure or decaying material like dead animals.
- Biting flies have either scissor-like or piercing-sucking mouthparts used to feed on the blood of animals and sometimes people. Blood meals are needed for female biting flies to develop their eggs.

- Non-biting flies have specialized mouthparts designed for sponging up liquids.
- Screwworm flies require living animal tissue for development. Eggs are laid in or near wounds or mucous membranes. Larvae feed on the living tissue of their host, causing large, painful wounds that enlarge over time and attract more flies to lay eggs until the host is either treated or dies.



IDENTIFICATION

- Many fly species can be identified by appearance, behavior, and habitat. Some flies, especially immature stages, may be difficult or impossible to identify without the help of a dissecting microscope or trained entomologist.
- Adult flies vary in color, shape, and size from tiny (1-3 mm) to large (15-20 mm).
 - All flies have six legs and one pair of functional wings. The hind wings are small, vestigial structures called halteres.
 - Mouthparts may be short or long and used for sucking, piercing, or biting.
 - Antennae may be short or long with varying segments.
- Fly larvae (maggots) are usually worm-like, with no distinct head or legs. Size, color, and shape may be used to identify species.
- Identification keys and fly experts can be consulted for further details.

ENDEMIC FLIES OF ANIMAL HEALTH CONCERN

The flies listed below (arranged by size from largest to smallest) are commonly found in the United States. In certain areas, these flies may transmit pathogens. Endemic diseases in animals may or may not be reportable, depending on the jurisdiction.



Tabanus, Haematopota spp. (Horse Fly)

Characteristics: Large (6-20 mm) biting fly; stout bodies, large metallic or iridescent eyes; only females blood feed

Habitat: Streams, marshes, and wooded areas throughout most of the U.S., except Hawaii

Endemic Diseases: Anaplasmosis (*A. marginale*), Anthrax, Equine infectious anemia, Tularemia



Lucilia, Phormia, Cochliomyia spp. (Blow Fly)

Characteristics: Medium (8-16 mm) non-biting fly; robust, shiny metallic blue, green, or black bodies and large, reddish eyes

Habitat: Found in urban, rural, and forested areas; eggs laid on dead animals, open wounds, or decaying organic matter; widely distributed in the U.S.

Endemic Diseases: Myiasis (larva grow inside host and feed on tissue, resulting in tissue damage and secondary infections), Anthrax, Colibacillosis (*E. coli*), Salmonellosis, Campylobacteriosis



Oestrus ovis, Gasterophilus spp. (Bot/Warble/Heel/Gad Fly)

Characteristics: Medium (6-20 mm) non-biting fly; chunky, bee-like appearance with hairy bodies and rounded heads; larvae feed on tissues of host

Habitat: Eggs laid on or near a host; thrive in tropical and subtropical climates, but also found in temperate regions; throughout the U.S.

Endemic Diseases: Myiasis (larva grow inside host and feed on tissue, resulting in tissue damage and secondary infections)



Chrysops spp. (Deer Fly)

Characteristics: Medium (6-13 mm) biting fly; large, brightly colored eyes which can be iridescent, wings are clear with dark bands or patterns, only females blood feed

Habitat: Wooded, wetland and damp areas, eggs laid on vegetation near water, larvae require aquatic to semi-aquatic habitat; broad geographic distribution

Endemic Diseases: Tularemia, Equine infectious anemia, Anaplasmosis (*A. marginale*)



Musca autumnalis (Face Fly)

Characteristics: Medium (6-8 mm) non-biting fly; similar in appearance to house flies, grayish-black color with four dark stripes on body

Habitat: Prefer pastured cattle and horses, feeding on secretions from eyes, nose, and mouth; eggs laid in fresh cow manure; found throughout the U.S., particularly temperate regions

Endemic Diseases: Dermatophilosis, Pinkeye in cattle (*Moraxella*), Eye worm (*Thelazia lacrymalis*)



Stomoxys calcitrans (Barn Fly)

Characteristics: Medium (6-8 mm) biting fly; resemble house flies but lighter color and spotted abdomen, both males and females blood feed

Habitat: In and around livestock areas; breed in decaying organic matter or decaying vegetation; broad geographic distribution

Endemic Diseases: Anthrax, Colibacillosis (*E. coli*), Contagious mastitis, Dermatophilosis, Salmonellosis, Ulcerative lymphangitis



Melophagus ovinus (Sheep Ked)

Characteristics: Medium (7 mm) biting fly; reddish brown, wingless, covered in short, bristly hairs, eggs hatch internally so female lays mature larvae that are glued to animal's fleece, numbers are highest in winter

Habitat: Lives less than one week off host (sheep); widely distributed

Endemic Diseases: Anemia, Damaged wool and hide (cockles)



Musca domestica (House Fly)

Characteristics: Medium (6-7 mm) non-biting fly; grayish black in color with four stripes on thorax (upper body)

Habitat: Commonly found in confined animal production as well as urban habitats, primarily areas with human or animal waste and food waste; eggs laid in moist, decaying organic matter; widely distributed

Endemic Diseases: Campylobacteriosis, Colibacillosis (*E. coli*), Cryptosporidiosis, Pinkeye in cattle (*Moraxella*), Porcine reproductive and respiratory syndrome (PRRS), Salmonellosis, Streptococcosis, Swine dysentery, Transmissible gastroenteritis, Turkey coronavirus, Many others!



Haematobia irritans (Horn Fly)

Characteristics: Small (3.5-5 mm); brownish-gray or black bodies. They have two parallel stripes on their bodies; both males and females blood feed and remain on their animal hosts between feedings

Habitat: Primarily blood feed on cattle and often cluster on back, sides, or belly; eggs are laid in fresh cow manure; found throughout the U.S.

Endemic Diseases: Ulcerative lymphangitis, Dermatophilosis, Granulomatous dermatitis (due to nematode *Stephanofilaria stilesi*)



Simulium spp. (Black Fly/Buffalo Gnat)

Characteristics: Small (1-5 mm) biting fly; shiny black to gray or yellow with a humpbacked appearance; only females blood feed; most active during the day

Habitat: Prefer running rivers and streams; eggs are laid on vegetation just below the water surface; widely distributed in the U.S.

Endemic Diseases: Vesicular stomatitis, Leucocytozoonosis, Severe anemia, Toxic shock, Exsanguination (associated with mass attack)



Lutzomyia spp. (Sand Fly)

Characteristics: Small (1.5-3.5 mm) biting fly; hairy bodies and wings, wings are held in a distinctive V-shape at rest and tips of wings are pointed, not rounded as in other flies; nocturnal; only females blood feed

Habitat: Prefer damp, dark places, such as cracks in walls, animal burrows and leaf litter; found in warm areas in southern U.S.

Endemic Diseases: Leishmaniasis (biological vector), Vesicular stomatitis



Culicoides spp. (Biting Midge/No-See-Um)

Characteristics: Tiny (1-3 mm) biting fly; grayish in color (reddish when filled with blood); most active at dusk and dawn; only females blood feed

Habitat: Moist environments (swamps, marshes, edges of ponds and lakes, piled animal manure, moist leaf litter); more than 150 species throughout the U.S.

Endemic Diseases: Bluetongue, Epizootic hemorrhagic disease, Vesicular stomatitis, Burning, itching, red welts from bites

FOREIGN FLIES OF ANIMAL HEALTH CONCERN

The flies listed below are selected vectors of highly contagious, reportable, or foreign diseases of animals.



Cochliomyia hominivorax (New World Screwworm)

Characteristics: Large (8-10 mm) non-biting fly, about the size of a house fly or slightly larger; distinctive metallic blue or green coloration, three dark stripes along its back, and large orange eyes

Larvae Characteristics: Larvae are creamy white, cylindrical with encircling bands of spines and taper at both ends; larvae eat tissues of living animals (non-necrotic tissue)

Habitat: Tropical and subtropical regions of Western Hemisphere; recent cases in Caribbean, Central America, and Mexico; eggs are laid near open wounds, navel, or mucous membranes of living animals or people

Foreign Diseases: New World screwworm myiasis (larvae eat tissues of living animals, causing tissue damage and secondary infections)





Chrysomya bezziana (Old World Screwworm)

Characteristics: Large (8-12 mm) non-biting fly; metallic green or blue with a yellow face

Larvae Characteristics: Larvae are creamy white but lack obvious body processes, except the last segment; larvae eat tissues of living animals (non-necrotic tissue)

Habitat: Tropical and subtropical regions of Asia, Africa, the Middle East, India and Papua New Guinea; eggs are often laid near open wounds, navel, or mucous membranes of living animals or people

Foreign Diseases: Old World screwworm myiasis (larvae eat tissues of living animals, causing tissue damage and secondary infections)



***Glossina* spp.** (Tsetse Fly)

Characteristics: Large (6-16 mm) biting fly; brown with long proboscis (mouthpart) and folded wings that lay on top of each other when at rest. Both males and females blood feed

Habitat: Sub-Saharan Africa; typically inhabit woodlands but can be found in open grasslands

Foreign Diseases: Trypanosomiasis



Hippobosca longipennis (Dog Louse Fly)

Characteristics: Medium (5-7 mm) biting fly; flattened, reddish-brown body and yellowish underside; wings often held flat over the body; males and females blood feed

Habitat: Africa, Middle East, Asia, southern Europe; distribution is limited by low temperatures and high humidity; primarily infest dogs but can be found on other animals; females give birth to larvae rather than laying eggs

Foreign Diseases: Canine filarial parasite (*Dipetalonema dracunculoides*), Significant irritation and extensive blood loss possible



Musca vitripennis (Muscoid Fly)

Characteristics: Medium (6-7 mm) non-biting fly similar in appearance to the house fly (gray body with dark stripes)

Habitat: Europe, Asia, Africa; decaying organic matter.

Foreign Diseases: Intermediate host for *Parafilaria bovicola*, Significant irritation

COLLECTION AND SUBMISSION

- Flies of concern should be collected for identification to ensure effective control measures are used.
- Testing may be available to determine if pathogens are present or insecticide resistance is developing.
 - Adult flies can be collected with insect nets or fly traps. Different types of attractants and traps may be needed depending on the species.
 - Care should be taken not to crush or damage the insect.
 - Fly eggs, larvae, and pupae can be collected from the animal or the environment.
 - If collecting larvae from a wound, get a representative sample by using forceps to gently remove larvae from several sites and depths.
- Laboratories and shipping companies may have specific instructions for you to follow.
 - Place adult flies in a labeled, sealed, hard-sided container and keep dry and cool in a refrigerator or freezer.
 - Place larvae and pupae in a labeled, sealed, leak-proof container submerged in 70-90% ethanol. Rubbing alcohol, hand sanitizer, or clear cocktail alcohol (80 proof or higher) will also work, if needed. Place the container inside a sealable bag (e.g., Ziploc®).
- Always label specimens with host (if applicable), location collected from the body or environment, and date of collection.



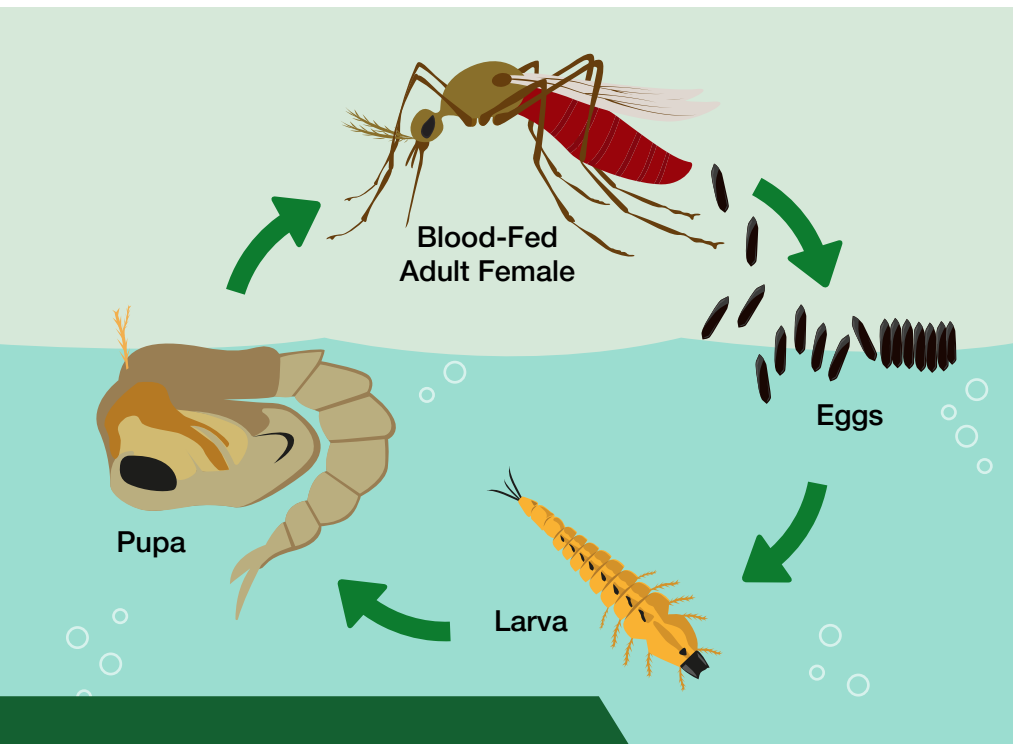
CONTROL AND PREVENTION

- Fly populations can be managed by disrupting their life cycle and habitat.
 - For prompt detection and control, continuously monitor flies in animal housing areas. Appropriate monitoring methods differ by species; consult a veterinary entomologist for best methods for species of concern in your region. Frequently inspect animals for fly larvae (maggots).
 - Reduce moisture in and around animal areas (such as breaking up manure and other organic debris weekly or spreading it into thin layers to dry) to reduce immature fly development. Composting animal and feed waste can limit suitable habitat for fly development.
 - Consider ways to encourage natural predators like birds, bats, and invertebrates.
- Keep flies away from animals and animal housing areas.
 - Keep animals indoors during high fly activity, use fans to create air movement, install screens on windows, and set up fly traps near animal areas.
 - A variety of fly repellents and insecticides are available for animals, including topical pour-ons, sprays, and ear tags. Be sure to choose a product with an EPA registration number (topicals) or FDA (A)NADA number (orals and injectables). Read the product label carefully to make sure it is effective against flies and safe for the species and age of animal to be treated.
- Promptly treat animals with any wounds, diseases, or secondary infections. Isolation of the animal and supportive care may be needed.
- Fly control products should only be used after consulting with experts to prevent unintended harm to wild animals and invertebrates, like frogs and honey bees. These products can also contaminate water sources.
- Avoid moving flies from one site to another. Check animals closely for fly larvae (maggots) in wounds before movement. Quarantine, inspect, and monitor new and returning animals in a separate area.
- Some pathogens can be prevented through vaccines, such as *Moraxella bovis* (pinkeye in cattle).





Mosquitoes Affecting Animal Health



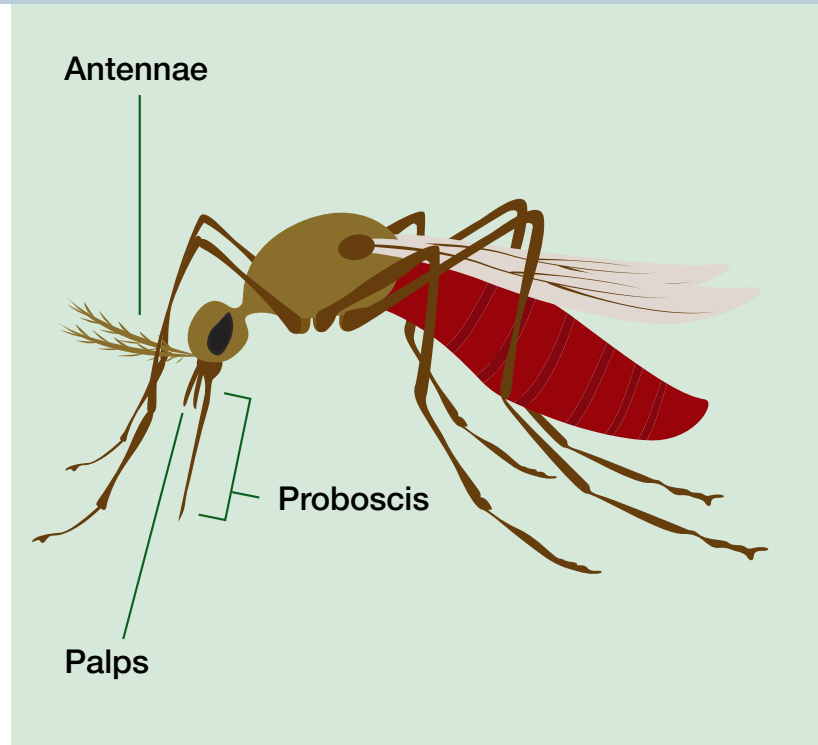
IMPORTANCE

- There are over 3,000 species of mosquitoes worldwide. Mosquitoes are an important food source for many animals. Some mosquitoes can also be beneficial as pollinators. However, some mosquitoes can transmit pathogens to people or animals.
- Mosquito-borne diseases affect millions of people and animals each year throughout the world. Signs of mosquito-borne disease commonly include fever, lethargy, muscle aches, and headache. Severe illness can lead to neurological damage, including encephalitis and death.
- Foreign animal diseases (FADs) are not found in the United States and can threaten human and animal health. FADs can be introduced to the United States, so animal owners and veterinary personnel have a key role in recognizing and reporting FADs to animal and public health officials. Early signs of mosquito-related FADs may include:
 - Unusual mosquito appearance, abundance, or distribution
 - Large number of sick or dead animals
 - Unusual signs of illness (like abortion storms or neurologic disease)

ABOUT MOSQUITOES

Mosquito species differ by where they lay eggs, what animals they feed upon, when they are active, and how far they can fly. Some mosquitoes don't fly far, while others can fly several miles.

- The mosquito life cycle has four stages: egg, larva, pupa, and adult.
 - Eggs are laid in or near water.
 - Larvae (wigglers) and pupae (tumblers) live in the water and feed on organic matter.
 - Adults live on land and feed on nectar from plants or blood from animal hosts (typically birds and mammals).
- All mosquitoes require standing water to complete their development.
 - Some species lay single eggs on damp soil (that is later flooded by water) while others lay an egg raft (containing up to hundreds of eggs) on the water's surface.
 - Some species lay eggs in larger water sources, like ponds and swamps. Other species may use small containers that collect water, such as a discarded tire or bottle cap.



- Most eggs hatch within 48 hours, but some can remain dormant for years.
- Mosquitoes typically live for two to three weeks. Some species in cold climates survive winter in the egg, larval, or adult stage.

IDENTIFICATION

- Many mosquito species can be identified by a unique set of characteristics visible to the naked eye or with the help of a dissecting microscope.
 - Some mosquitoes, especially closely-related species, may be difficult or impossible to identify without the help of a trained entomologist or molecular testing.
- Adult mosquitoes are slender, long-legged insects with one pair of wings, scales on wings, and long mouthparts (proboscis) used for sucking blood or nectar.
 - Antennae in males are bushier than in females.
 - Palps (sensory organs near the proboscis) may be long or short, depending on the species.
 - Coloration of hairs on the body, wings, and legs varies by species.
- Identification of mosquito larvae and pupae uses different characteristics, but is more challenging than the identification of adult mosquitoes.
- Identification keys and mosquito experts can be consulted for further details.

MOSQUITOES OF ANIMAL HEALTH CONCERN

The mosquitoes listed below are commonly found in the United States. In certain areas, these mosquitoes may transmit pathogens. Endemic diseases in animals may or may not be reportable, depending on the jurisdiction. Foreign diseases listed below are Notifiable Diseases and Conditions by the United States Department of Agriculture (USDA).



***Aedes* spp.** (*A. aegypti*, *A. albopictus*, *A. japonicus*, *A. vexans*)

Characteristics: Distinctive black and white striping on legs and body, most active during dawn and dusk. Eggs laid individually near water, which hatch when they come into contact with flood water.

Habitat: Prefer small containers (tires, flowerpots, bird baths) or natural sources of standing water. Most abundant in southern U.S. but can live in temperate areas.

Endemic Diseases: Eastern equine encephalitis, Fowl pox, Tularemia, West Nile virus disease, Western equine encephalitis

Foreign Diseases: Akabane, Japanese encephalitis, Lumpy skin disease, Rift Valley fever, Venezuelan equine encephalitis



***Anopheles* spp.** (*A. freeborni*, *A. quadrimaculatus*)

Characteristics: Smaller than other mosquitoes, dark brown with spotted wings, hold body at angle (head down, abdomen up) when at rest. Individual eggs laid on water surface.

Habitat: Prefer clean, unpolluted water like ponds or slow-moving streams. Found in many parts of the U.S.

Endemic Diseases: Dirofilariasis (heartworm disease), West Nile virus disease

Foreign Diseases: Akabane, Venezuelan equine encephalitis



***Coquillettidia* spp.** (*C. perturbans*)

Characteristics: Medium-sized mosquito with a “salt and pepper” appearance of brown and white, wings have tear-drop shaped scales, most active early in the evening, persistent and painful biters, strong fliers. Eggs laid in rafts on surface of freshwater near aquatic plants.

Habitat: Prefer areas of low elevation and dense aquatic vegetation like wetlands or areas with cattails, widely distributed across eastern half of the U.S. and several areas of western states.

Endemic Diseases: Eastern equine encephalitis, West Nile virus disease



***Culex* spp.** (*C. tarsalis*, *C. pipiens*, *C. quinquefasciatus*)

Characteristics: Uniform brown color, no distinctive markings, hold body parallel to surface when at rest. Eggs laid in rafts on water surface.

Habitat: Prefer stagnant, polluted water like water in drainage ditches. Different species found in all parts of U.S.

Endemic Diseases: Eastern equine encephalitis, Fowl pox, St. Louis encephalitis, West Nile virus disease, Western equine encephalitis

Foreign Diseases: Akabane, Bovine ephemeral fever, Japanese encephalitis, Rift Valley fever, Venezuelan equine encephalitis



***Culiseta* spp. (*C. inornata*, *C. melanura*)**

Characteristics: Chocolate brown, medium-sized mosquito. Eggs laid in rafts on water.

Habitat: Prefer cool, acidic water like lowland swamps or flood plains. Different species found in all parts of U.S.

Endemic Diseases: Eastern/Western equine encephalitis, West Nile virus disease



***Mansonia* spp. (*M. dyari*, *M. titillans*)**

Characteristics: Medium-sized, brown mosquito, most active at dusk and dawn, strong fliers. Eggs laid on underside of leaves of aquatic vegetation where larvae attach to plant roots to obtain oxygen.

Habitat: Prefer large, permanent bodies of water, like retention ponds, with dense floating vegetation. Found in Southeastern states.

Endemic Diseases: West Nile virus disease

Foreign Diseases: Rift Valley fever, Venezuelan equine encephalitis



***Psorophora* spp. (*P. ciliata*)**

Characteristics: Larger mosquito, aggressive biters, active day and night, and strong fliers. Eggs remain dormant until water pools formed after rain.

Habitat: Prefer floodwaters. Found in tropical, warmer climates, southern U.S.

Endemic Diseases: Leucocytozoonosis, West Nile virus disease

Foreign Diseases: Venezuelan equine encephalitis

COLLECTION AND SUBMISSION

- Mosquitoes of concern should be collected for identification to ensure effective control measures are used to target the correct mosquito species in the intended way. Testing may be available to determine if pathogens are present or insecticide resistance is developing.
 - Adult mosquitoes are fragile, so care should be taken not to crush or damage the insect. They should remain dry so as not to mold.
 - Mosquito eggs, larvae, and pupae can be collected from water with a dipper, net, pipette, or turkey baster. Immature mosquitoes can degrade in water if not shipped quickly and kept in the refrigerator.
- Laboratories and shipping companies may have specific instructions for you to follow.
 - Place adult mosquitoes in a labeled, sealed, hard-sided container and keep dry and cool in a refrigerator or freezer.
 - Place larvae and pupae in a labeled, sealed, leak-proof container submerged in 70-90% ethanol. Rubbing alcohol, hand sanitizer, or clear cocktail alcohol (80 proof or higher) will also work, if needed.
 - Always label specimens with host (if applicable), location collected from the body or environment, and date of collection.



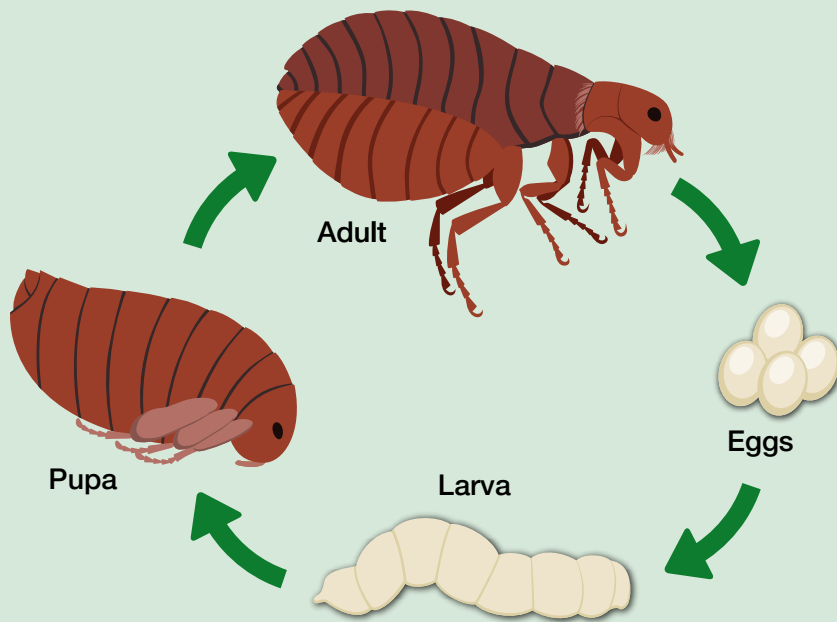
CONTROL AND PREVENTION

- Mosquito populations can be managed by disrupting their life cycle and habitat.
 - For prompt detection and control, continuously monitor areas in and around animal housing for adult mosquitoes and mosquito larvae habitats.
 - Reduce mosquito larvae habitats in and around animal areas by draining, agitating, or replacing water-holding containers at least weekly.
 - Consider ways to encourage natural predators like birds, bats, and fish to help reduce mosquito populations.
- Prevent mosquito bites to avoid pathogen transmission.
 - A variety of mosquito bite preventatives are available for animals, including topical pour-ons, sprays, and collars. Be sure to choose a product with an EPA registration number. Read the product label carefully to make sure it is effective against mosquitoes and safe for the species and age of animal to be treated.
 - Install and maintain screens on doors and windows to keep mosquitoes out of homes, barns, and other animal areas.
 - Plan outdoor activities during a time of day or time of year when mosquitoes are less active in the area.
- Avoid moving mosquitoes from one site to another.
 - Drain and remove eggs, larvae, and pupae from water-holding containers prior to movement.
 - Inspect vehicles and other equipment that may harbor adult mosquitoes before movement, and clean and disinfect as needed.
- Prevent mosquito-borne diseases in livestock and pets.
 - Vaccines are recommended for horses to protect against West Nile, eastern equine encephalitis (EEE), and western equine encephalitis (WEE) viruses.
 - Heartworm preventatives are recommended for dogs and cats at risk of mosquito bites.
- Mosquito control products should only be used after consulting with experts to prevent unintended harm to wild animals and invertebrates, like frogs and honey bees. These products can also contaminate water sources.
 - Larvicides (e.g., dunks) are used in rain barrels, small bodies of water, and other water sources that cannot be drained or frequently replaced.
 - Adulticides are used to quickly reduce adult mosquito numbers in an area.





Fleas Affecting Animal Health



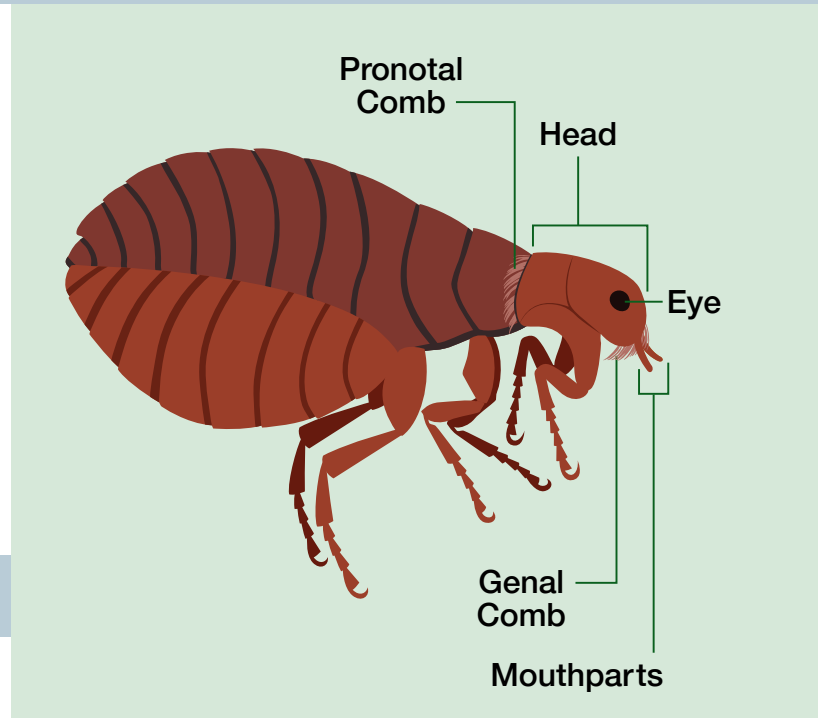
IMPORTANCE

- There are over 2,000 species of fleas found worldwide. Only about 20 species affect people or domestic animals.
- Animals with flea infestations may be intensely itchy. Fleas can also cause hair loss, flea allergy dermatitis, anemia, and death in severe cases (particularly in young animals). Fleas may be vectors of highly contagious, foreign, or reportable diseases.
- Foreign vectors and foreign animal diseases (FADs) are not found in the United States and can threaten human and animal health. FADs can be introduced to the United States, so animal owners and veterinary personnel have a key role in recognizing and reporting FADs to animal and public health officials. Early signs of flea-related FADs may include:
 - Unusual flea appearance or large infestations
 - Large number of sick or dead animals
 - Unusual signs of illness (like fever, enlarged lymph nodes, and sudden death)

ABOUT FLEAS

- Fleas are tiny, wingless insects that live their entire life parasitizing animals.
- Fleas have four life stages.
 - Adults feed on blood, mate, and lay eggs on a host
 - Eggs may fall off the host and into the environment.
 - Larvae and pupae develop indoors or in protected outdoor sites away from direct sunlight.

- Fleas usually live for about two or three months.
 - Adults live most of their lives on a host.
 - Immature stages contaminate the surrounding environment and can survive for months.
- Some fleas are host-specific and prefer to feed on one type of animal. Other fleas will feed on a wide range of hosts, including people.
- Flea activity is highest in summer months, but can be year-round in warmer climates.
- Fleas are transmitted from one animal to another through direct contact or fomites (such as bedding and grooming tools).



IDENTIFICATION

- Fleas are tiny but may be seen with the naked eye. Many can be identified by their appearance and animal host.
 - Determining the species may be difficult or impossible without the help of a dissecting microscope or trained entomologist.
- Adult fleas have hard, narrow bodies with large hind legs for jumping large distances.
 - The shape of the head varies by species.
 - The number and appearance of combs (dark, comb-like bristles) also varies by species. The genal comb is located below the eye, like a moustache. The pronotal comb is located behind the head, like a collar.
- Pupae are sticky, like cocoons, and may be white or brown depending on their stage of development.
- Larvae are slender, worm-like, and pale in color.
- Eggs are white and oval, similar to grains of salt, and may be sticky after they are laid.
- Identification keys and flea experts can be consulted for further details.

FLEAS OF ANIMAL HEALTH CONCERN

The fleas listed below are common species in the United States. In certain areas, these fleas may transmit pathogens. Some examples of diseases are listed as well. Endemic diseases in animals may or may not be reportable, depending on the jurisdiction.



Ctenocephalides felis (Cat Flea)

Characteristics: Genal and pronotal combs present, head length twice its height.

Hosts and Distribution: Primarily cats, but other animals (including humans) may be hosts; worldwide distribution.

Endemic Diseases: Bartonellosis, Flea-borne spotted fever, Murine typhus, Mycoplasmosis, Tapeworm (*Dipylidium caninum*)



Pulex irritans (Human Flea)

Characteristics: Genal and pronotal combs absent, rounded head, ocular bristle below eye.

Hosts and Distribution: Primarily humans, but other animals may be hosts; worldwide distribution.

Endemic Diseases: Flea-borne spotted fever, Murine typhus, Plague



Xenopsylla cheopis (Oriental Rat Flea)

Characteristics: Genal and pronotal combs absent, rounded head, ocular bristle behind eye.

Hosts and Distribution: Primarily rodents but other animals (including humans) may be hosts; worldwide distribution.

Endemic Diseases: Murine typhus, Plague

COLLECTION AND SUBMISSION

- To check an animal for fleas, restrain the animal and part its hair to look for eggs or adults near the skin. Preferred sites vary by animal species and type of flea.
 - Flea dirt (excreted blood) may be visible on an animal’s haircoat or skin.
 - A fine-toothed comb and damp towel may be useful to reveal fleas and “flea dirt” as water will turn black debris into reddish-brown specks.
- History and clinical signs can be helpful for presumptive diagnosis. However, fleas of concern should be collected for identification to ensure effective control measures are used.
 - Fleas can be placed in a labeled, sealed, leak-proof container with 70-90% ethanol. Rubbing alcohol, hand sanitizer, or clear cocktail alcohol (80 proof or higher) will also work, if needed.
- Laboratories and shipping companies may have specific instructions for you to follow.
- Always label specimens with host (if applicable), location collected from the body or environment, and date of collection.



CONTROL AND PREVENTION

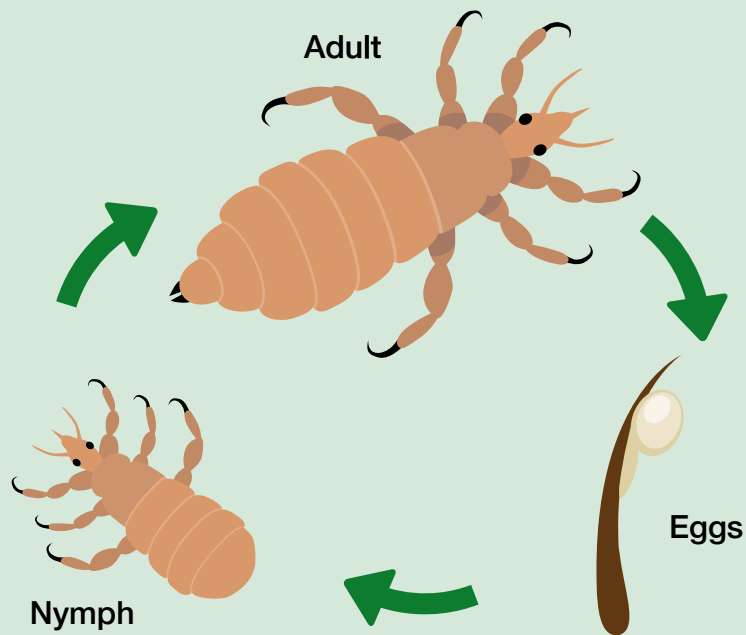
- Flea populations can be managed by disrupting their life cycle and habitat.
 - For prompt detection and control, continuously monitor animals for flea infestations and frequently inspect animal bedding and grooming tools for fleas and flea dirt.
- A variety of flea control products are available for animals, including oral medications, topical pour-ons, and sprays/dips. Be sure to choose a product with an EPA registration number (topicals) or FDA (A)NADA number (orals).
 - Read the product label carefully to make sure it is effective against fleas and safe for the species and age of animal to be treated.
 - Treat all affected animals for at least two to three consecutive months to kill newly hatched fleas.



- Environmental measures are an important step in controlling flea infestations.
 - Vacuum affected areas daily and dispose of any vacuum cleaner bag promptly.
 - Wash and dry affected animal bedding, rugs, and washable items.
 - Consider using diatomaceous earth to dehydrate immature fleas. Be sure to follow the product label closely to avoid harm to people and animals.
- Promptly treat animals with any diseases or secondary infections. Isolation of the animal may be needed.
- Avoid moving fleas from one site to another.
 - Check animals closely for fleas and flea dirt before movement.
 - Quarantine, inspect, and monitor new and returning animals in a separate area.
 - Clean and disinfect contaminated bedding, grooming tools, vehicles, and other equipment before movement.



Lice Affecting Animal Health



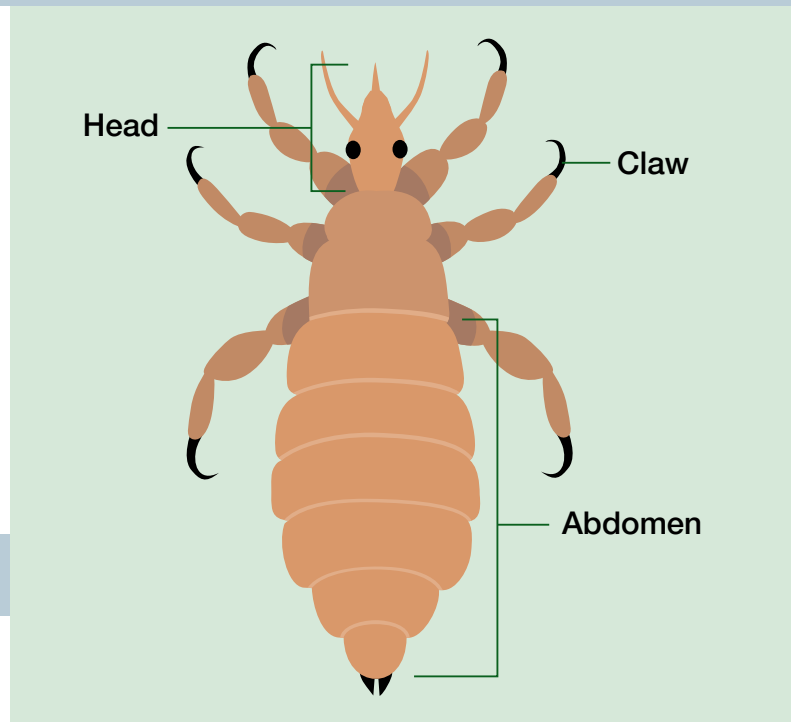
IMPORTANCE

- There are over 3,000 species of lice worldwide. A small number of species can affect people and domestic animals.
- Animals with lice infestations may be intensely itchy. Affected animals may rub against fences or other objects and rub off hair or fur. Lice can also cause anemia and reduced productivity in severe infestations. Some pathogens may be transmitted by lice.
- Foreign vectors and foreign animal diseases (FADs) are not found in the United States and can threaten human and animal health. FADs can be introduced to the United States, so animal owners and veterinary personnel have a key role in recognizing and reporting FADs to animal and public health officials. Early signs of lice-related FADs may include:
 - Unusual louse appearance or large infestations
 - Large number of sick or dead animals
 - Unusual signs of illness (like fever, anemia, and severe skin lesions)

ABOUT LICE

- Lice are tiny, wingless insects that live their entire life parasitizing animals.
- There are two main groups of lice.
 - Sucking lice feed on the blood of animals. These types of lice are generally better vectors of pathogens.
 - Chewing or biting lice feed on skin cells, exudates, fur, feathers, and sometimes blood.
- Lice complete all life stages on an animal host and usually live for about four weeks.

- Most lice are host-specific, only feeding on one animal species (or a few closely related species).
 - Lice usually do not live longer than a few days off an animal host.
- The adult female lays eggs (nits). Once the egg hatches, the louse undergoes a series of nymph stages before becoming an adult.
 - Lice burdens on animals usually increase during winter and spring months.
 - Lice are transmitted from one animal to another through direct contact or fomites (such as bedding and grooming tools).



IDENTIFICATION

- Lice are tiny but may be seen with the naked eye. Many can be identified by their appearance and animal host, including their location on the host.
 - Determining the species may be difficult or impossible without the help of a dissecting microscope or trained entomologist.
- Adult lice have flattened bodies, an elongated abdomen, and six clawed legs used for grasping hair shafts or feathers of hosts.
 - Sucking lice usually have broad heads and move quickly through the hair.
 - Chewing or biting lice usually have narrow, pointed heads and move slowly.
- Nymphs resemble small adults.
- Louse eggs (nits) are glued to hairs near the skin surface and appear oval in shape and pale in color.
- Identification keys and lice experts can be consulted for further details.

LICE OF ANIMAL HEALTH CONCERN

The lice listed below are examples of common species in the United States. In certain areas, these lice may transmit pathogens. Some examples of diseases are listed as well. Endemic diseases in animals may or may not be reportable, depending on the jurisdiction. Foreign diseases listed are highly contagious and reportable diseases in animals.



Haematopinus suis (Hog Louse)

Characteristics: Sucking louse affecting swine worldwide; large (up to 6 mm long) and brown; eggs are 1-2 mm long and light cream to gray in color.

Endemic Diseases: Swinepox, Swine eperythrozoonosis (*Mycoplasma suis*)

Foreign Diseases: African swine fever



Linognathus vituli (Long-Nosed Cattle Louse)

Characteristics: Sucking louse affecting cattle worldwide; small (2-3 mm) with bluish-black coloring and slender “nose”; eggs are 1 mm long and cream-colored.

Endemic Diseases: Bovine anaplasmosis, Dermatomycosis (ringworm), Theileriosis (*Theileria orientalis* Ikeda)

Foreign Diseases: Theileriosis (other types than *Theileria orientalis* Ikeda)



Trichodectes canis (Canine Chewing Louse)

Characteristics: Chewing louse affecting dogs worldwide; prefers the head, neck, and tail of its host; small (1-2 mm long) and tan in color.

Endemic Diseases: Tapeworm (*Dipylidium caninum*)

COLLECTION AND SUBMISSION

- To check an animal for lice, restrain the animal and part its hair to look for eggs or adults near the skin. Preferred sites vary by animal species and type of louse.
- History and clinical signs can be helpful for presumptive diagnosis. However, lice of concern should be collected for identification to ensure effective control measures are used.
 - Lice may be collected from affected areas with forceps, superficial skin scrapes, or hair samples collected with a fine-toothed comb or brush.
 - Lice can be placed in a labeled, sealed, leak-proof container with 70-90% ethanol. Rubbing alcohol, hand sanitizer, or clear cocktail alcohol (80 proof or higher) will also work, if needed.
 - Always label specimens with host, location collected from the body (or environment,) and date of collection.
- Laboratories and shipping companies may have specific instructions for you to follow.



CONTROL AND PREVENTION

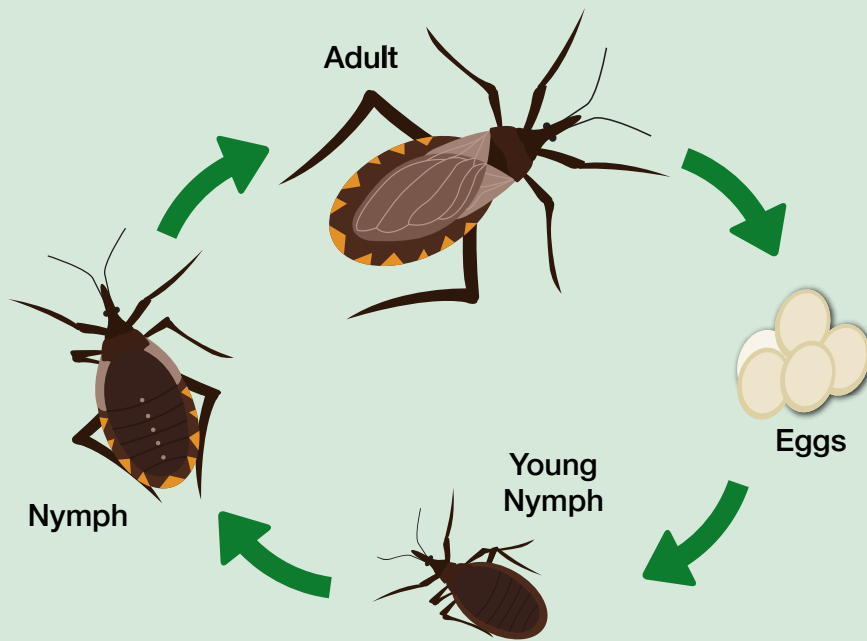
- Lice populations can be managed by disrupting their life cycle on the host(s).
 - For prompt detection and control, continuously monitor animals for lice infestations and frequently inspect animal bedding and grooming tools for lice.
 - Promote good animal husbandry (including proper nutrition and low stress environments) and avoid crowded living conditions to maintain animal health and resist severe lice infestations.



- A variety of lice control products are available for animals, including injectables and topical pour-ons and sprays. Be sure to choose a product with an EPA registration number (topicals) or FDA (A)NADA number (injectables).
 - Read the product label carefully to make sure it is effective for the species of lice and safe for the species and age of animal to be treated.
 - Systemic treatments generally work better for sucking lice than chewing lice.
 - Louse eggs are not susceptible to insecticides, so repeat treatments are often needed for complete control.
 - Common flea and tick preventatives and parasite control medications may also control lice.
- Promptly treat animals with any diseases or secondary infections. Isolation of the animal may be needed.
- Avoid moving lice from one site to another.
 - Check animals closely for lice before movement.
 - Quarantine, inspect, and monitor new and returning animals in a separate area.
 - Clean and disinfect contaminated bedding, grooming tools, vehicles, and other equipment before movement.



Kissing Bugs Affecting Animal Health



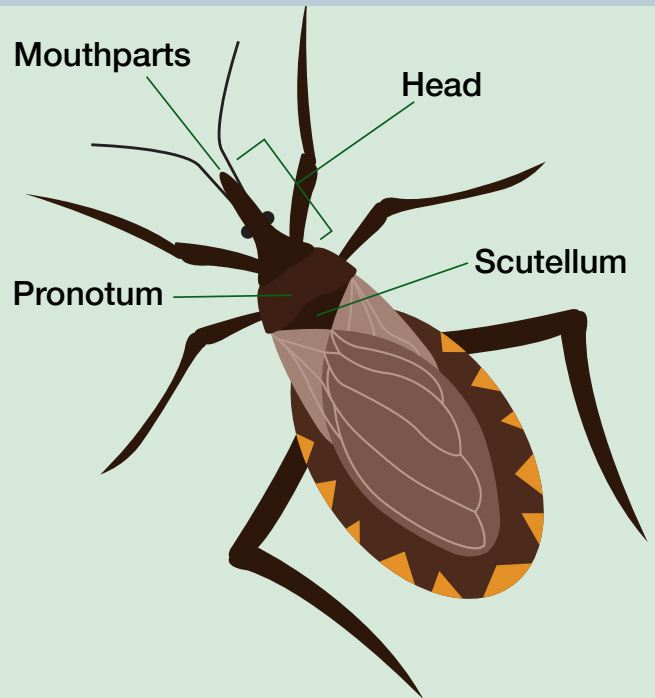
IMPORTANCE

- Kissing bugs are triatomine insects, members of the large Reduviidae family. Most species in this family are harmless or even beneficial as predators of pests in gardens and fields. Over 130 species of kissing bugs are found worldwide.
- Kissing bugs can cause itchiness, red welts, severe allergic reactions, or serious disease in people and animals.
- Animal owners and veterinary personnel have a key role in recognizing and reporting highly contagious, reportable, and foreign diseases to animal and public health officials. Early signs of such diseases may include:
 - Unusual bug appearance or large infestations
 - Large number of sick or dead animals
 - Unusual signs of illness (like fever and lethargy)

ABOUT KISSING BUGS

- Kissing bugs are large (about 0.5-1 inch long) blood-feeding insects commonly found in North America, Central America, and South America.
- Kissing bugs have three life stages: egg, a series of nymph stages, and adult.
 - They usually live months to years, depending on the species.
- Kissing bugs feed on a variety of hosts, including people, dogs, and wild animals.
 - Kissing bugs feed many times over their lives, taking several minutes to complete a blood meal.

- Bites generally occur near the mouth of a host, which contributes to their name.
 - Bites are usually not painful or noticeable to the host. During the bite, droppings (feces) get into the host’s skin or mucous membranes. These feces may then transmit pathogens from the kissing bug to the host.
 - Kissing bugs are nocturnal and hide in animal burrows, rodent nests, rock and brush piles, and cracks of buildings during the day.



IDENTIFICATION

- Many kissing bugs can be identified by their appearance and location. However, many common insects look like kissing bugs. Some species may be difficult or impossible to identify without the help of a dissecting microscope or trained entomologist.
 - Adult kissing bugs have a distinctive cone-shaped head, wings, and thin legs. Nymphs look like small, wingless adults.
 - Their body color varies from light brown to black with yellow, red, or tan markings.
 - Unique characteristics that vary between species include the shape of the head, mouthparts, pronotum, and scutellum.
- Identification keys and kissing bug experts can be consulted for further details.

KISSING BUGS OF ANIMAL HEALTH CONCERN



Triatoma spp. (Kissing Bug)

Eleven species of kissing bugs (e.g., *Triatoma sanguisuga*) have been found in the southern United States. In certain areas of the world, kissing bugs can transmit *Trypanosoma cruzi*. This protozoan parasite causes Chagas disease (American trypanosomiasis) in people and animals.

- Chagas disease is a serious health issue that can lead to heart disease and digestive problems in people.
- Dogs are particularly susceptible to Chagas disease and can develop a range of clinical signs, including heart failure in severe cases. Clinical illness has been reported in other domestic animals, including cats, a horse, and a llama.
- While kissing bugs are common in southern states, most reported cases of Chagas disease occur in people who have traveled to other countries.
- Chagas disease may be reportable in some U.S. states and jurisdictions.

COLLECTION AND SUBMISSION

- Kissing bugs of concern can be collected for identification to ensure effective control measures are used. Testing may be available to determine if pathogens are present.
 - Use gloves to avoid directly touching the kissing bug and any potentially infected feces.
 - Kissing bugs can be placed in a labeled, sealed, leak-proof container submerged in 70-90% ethanol. Rubbing alcohol, hand sanitizer, or clear cocktail alcohol (80 proof or higher) will also work, if needed.
 - For shipping purposes, liquids may be avoided by placing a cotton ball soaked in ethanol, rubbing alcohol, or clear cocktail alcohol (80 proof or higher) alongside the kissing bug.
 - Alternatively, kissing bugs may be double bagged inside sealable baggies (e.g., Ziploc® bags) and killed by freezing overnight.
- Laboratories and shipping companies may have specific instructions for you to follow.
- Always label specimens with host (if applicable), location collected from the body or environment, and date of collection.



CONTROL AND PREVENTION

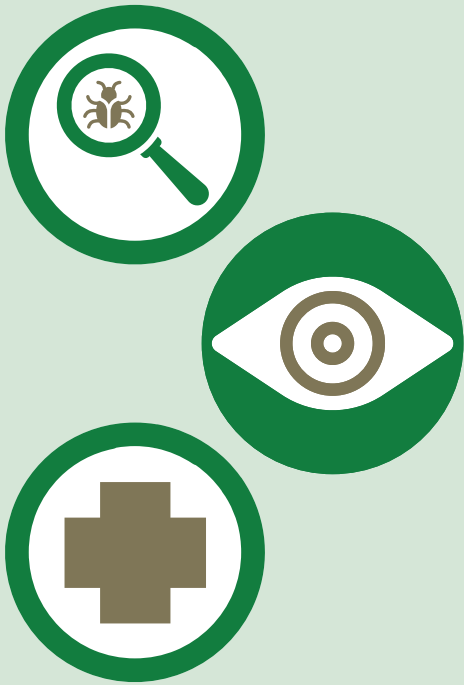
- Kissing bug populations can be managed by disrupting their life cycle.
 - For prompt detection and control, closely monitor animals for signs of disease and frequently inspect animal housing for kissing bugs.
 - Consult with a pest control expert before using insecticides.
- Keep kissing bugs away from animals and out of animal housing areas.
 - Keep kennels and other animal housing clean and dry.
 - Move animals indoors at night or seal cracks and gaps in animal housing.
 - Install and maintain screens on doors and windows.
 - Turn off lights near homes and animal housing at night.
- Provide supportive care for affected animals. There is no vaccine or specific treatment for animals infected with *T. cruzi*. Research is ongoing to determine effective treatments.
- Avoid moving kissing bugs from one site to another.
 - Inspect vehicles and equipment for kissing bugs before movement.
 - Clean and disinfect contaminated bedding and equipment as needed.



SEND IN UNUSUAL VECTORS

See an unusual bug? Submitting vectors to a diagnostic laboratory for identification helps experts know where vectors are living, what diseases may occur in an area, and which treatment and control measures will be most effective. In addition, prompt detection and response of foreign vectors may help limit or slow their spread.





How to Submit Vectors for Identification

Insects and other arthropods (like ticks and mites) can threaten the health, productivity, and welfare of pets, livestock, and honey bees. If an unusual vector is detected, submitting it to an expert for identification is vital for determining the best plan of action.

WHY SUBMISSION IS IMPORTANT

Accurate Identification: Insects and other arthropods are small and hard to distinguish. Knowing the exact species is essential to understand its life cycle and habitat.

Disease Surveillance: People, animals, and vectors are expanding into new areas. Different vectors carry different pathogens. Monitoring these vectors helps to know where diseases may occur.

Treatment Decisions: Properly identifying a vector helps determine the quickest and most effective methods for treatment, prevention, and control.

WHERE TO SUBMIT VECTORS FOR IDENTIFICATION

Common locations for identification include:

- Local university entomology or extension departments
- Local veterinary diagnostic laboratories
- County or state public health departments
- National Animal Health Laboratory Network (NAHLN)
- U.S. Department of Agriculture (USDA) National Veterinary Services Laboratories (NVSL)

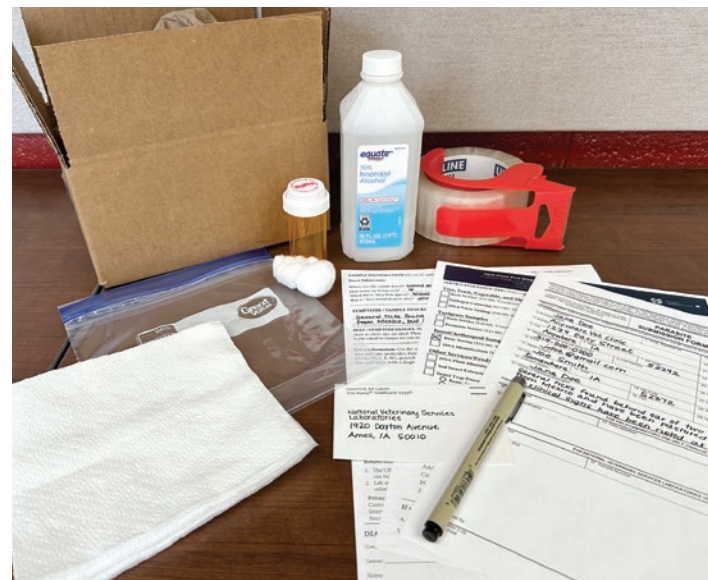
Some laboratories require submissions from a veterinarian or medical provider, while others accept submissions from the public.

Always check with the chosen laboratory and shipping company for packaging and shipping instructions.

HOW TO PREPARE SUBMISSIONS

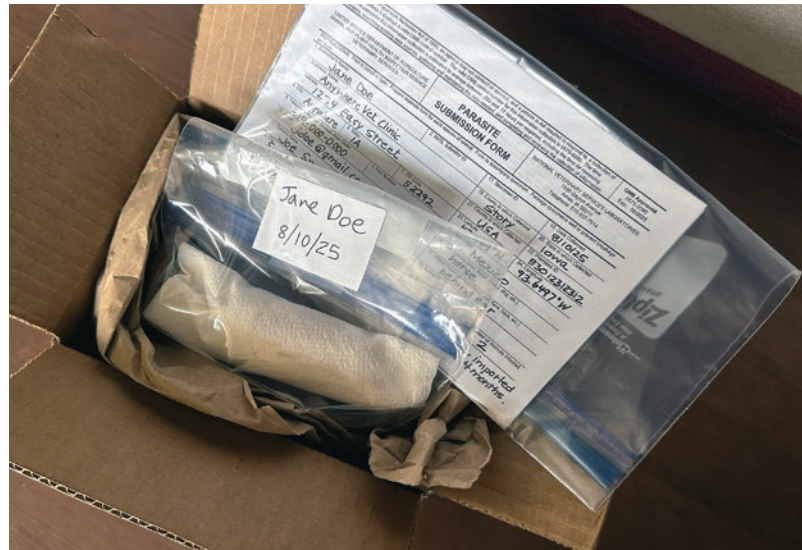
GATHER SUPPLIES

- Tight sealing container (screw topped vial), clean and dry
- 70-90% ethanol. Rubbing alcohol, hand sanitizer, or clear cocktail alcohol (80 proof or higher) will also work, if needed
- Waterproof and alcohol-proof pen (e.g., Pigma micro pen) or pencil
- Adhesive label or masking tape
- Paper towels and a resealable plastic bag (e.g., Ziploc®)
- Crush-proof box and bubble wrap or other packaging materials
- Any forms required by the laboratory
 - Note: if you are submitting to USDA NVSL, VS-Form 5-38 is needed



COLLECT THE ORGANISMS

- Use tweezers, gloves, or other tools as needed to collect several (6-12) organisms.
- Handle organisms gently to avoid damaging identifiable traits.
- Place organisms in the tightly sealed container.
- Kill and preserve the organisms prior to shipping.
- For hardy organisms (ticks), fully submerge in an alcohol solution overnight.
- For fragile organisms (mosquitoes), place in a freezer for 24-48 hours.



PREPARE FOR SHIPMENT

Prepare the organisms

- Drain any alcohol from the container.
- Place a small amount of facial tissue or a cotton ball in the vial to absorb residual alcohol.
- Write your name, date, and location where the organism was found on a small piece of cardstock or other durable paper and place it inside a sealed container.
- Label the container with your name, date, and location where the organism was found.
- Wrap the container with plastic film (Press and Seal) and a paper towel or tissue.
- Place the wrapped container in a sealable plastic baggie (e.g., Ziploc®).

AVOID:

- Using formalin or formaldehyde
- Using ink jet printed labels or water-based pens
- Using tape to secure organisms
- Sending live or unpreserved organisms

Provide detailed information

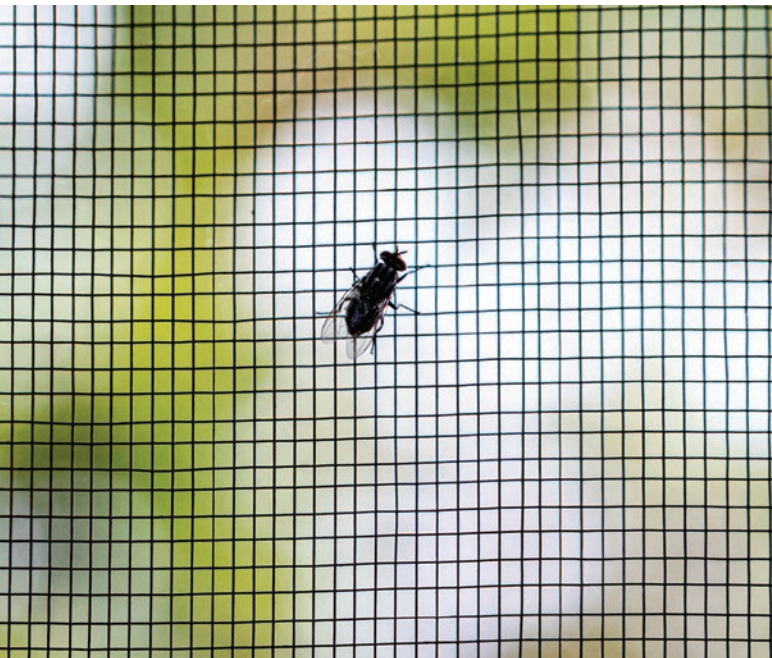
- Complete any forms required and keep copies for your records.
- Include your name, contact information (phone number and email address), date and location of collection, and animal or environment upon which the organism was found.
- Provide details about the organisms or situation (e.g., clinical signs, travel history).

Prepare the shipping container

- Place the sample into a sturdy, crush-proof box and surround it with packing material.
- Include any required paperwork by placing it in a resealable plastic baggie.
- Seal the box well with packing tape and label it with alcohol-proof ink.

CONTROL AND PREVENT VECTOR-BORNE DISEASES

Elimination of vectors is not always possible, but various control measures can lower disease risks for people and animals. Vector control requires a combination of methods to protect animals, humans, and the environment.



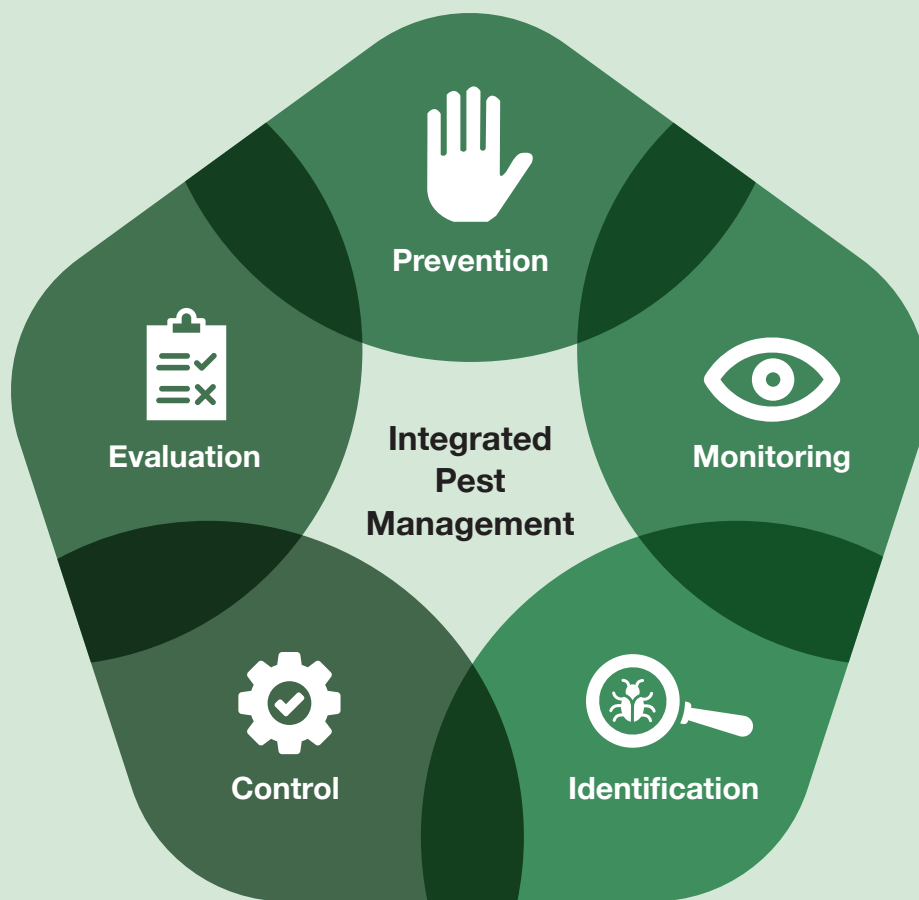
Considerations When Managing Vectors

Managing disease-causing vectors protects animal and human health. But it is also important to protect beneficial insects and other arthropods. When managing vectors, use of a multi-layered and holistic approach – referred to as integrated pest management (IPM) – is essential.

IPM is an approach to pest control that combines non-chemical and chemical practices. It is an effective and environmentally-friendly approach that aims to reduce the use of pesticides. In turn, negative effects from pesticides are minimized and risk of pesticide resistance is lowered.

Long-term, sustainable solutions require a team to accurately identify the problem and implement effective actions. Veterinary personnel, animal and public health officials, extension agents, laboratorians, and animal owners should all work together to keep animals and people healthy.

Listed below are key steps to consider when implementing IPM in animal settings.



PREVENTION

- Preventing the introduction and spread of vectors is the best way to avoid vector-borne diseases.
- New and returning animals can bring pests and parasites with them. Be sure to check (and treat as needed) for vectors before purchase and movement as well as upon arrival.
- Fomites, such as buckets of water and vehicles, can move vectors from one site to another. Clean and disinfect equipment as needed.

MONITORING

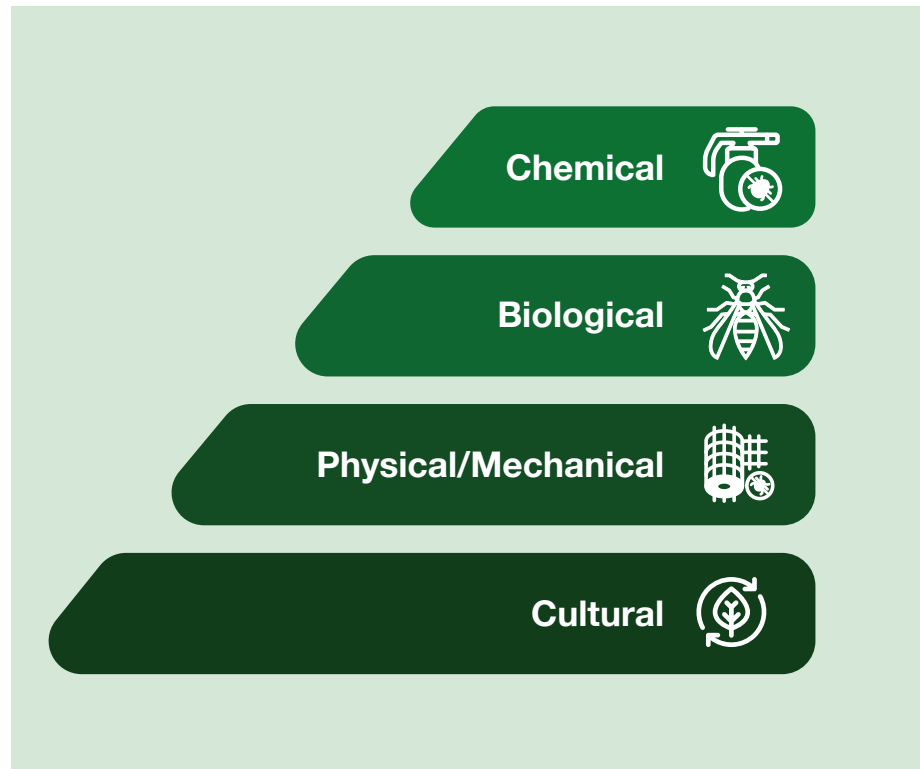
- Not all pests require control efforts. Monitor pest populations and prepare to act before illness or damage occurs.
- Regularly check animals, animal areas, and people for vectors or signs of illness.
- Prompt detection of disease vectors can minimize illness in animals and people.

IDENTIFICATION

- When harmful vectors are found, they must be accurately identified to ensure appropriate control measures are used.
- Having a correct identification helps to determine targeted methods to disrupt the vector's life cycle and habitat.

CONTROL

- **Cultural controls** are actions that minimize exposure to the vector. This includes efforts such as rotating pastures and avoiding outdoor activities during peak insect activity.
- **Physical or mechanical controls** are actions that directly eliminate the vector (e.g., removing water-holding containers and manure). They may also include devices to block or capture vectors (e.g., screens, fans, or traps).
- **Biological controls** involve the use of natural enemies – predators, parasites, pathogens, or competitors – to control vectors. Examples include mosquitofish, certain birds, bats, or parasitic wasps. Certain plants can also repel vectors or attract beneficial insects to help manage vector populations.
- **Chemical controls** involve the use of pesticides. Look for EPA or FDA-registered products and use them judiciously. Products selected should target the identified vector and be applied in a way that minimizes harm to people, animals, nontarget organisms, such as honeybees or aquatic animals, and the environment. When used responsibly, pesticides can be an important tool for controlling vectors, especially those that transmit highly contagious and foreign diseases.



EVALUATION

- Once control efforts are started, it is crucial to continually monitor any impacts on the vector as well as the animal(s) and surrounding people and environment.
- Keeping detailed records about the identified vector, control methods used, and results obtained will help measure success and guide future efforts.

Be sure to use a combination of targeted measures and work together to continuously improve IPM practices. Doing so will promote healthy people, animals, plants, and our shared environment.

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APPENDIX: VECTOR-BORNE DISEASES BY ANIMAL REFERENCE TABLE

This table shows some of the most significant vector-borne diseases of concern to domestic animals in the United States, including cattle, sheep and goats, cervids, horses, swine, poultry, dogs, cats, rabbits, and honey bees. It is not meant to be a complete resource of all vector-borne diseases and conditions or used as a diagnostic tool for clinical cases. In certain situations, pathogens may cause illness in animal species and be transmitted by disease vectors not listed here. Further details can be found in other resources.

CATTLE				
Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Akabane Orthobunyavirus	Biting midges	Foreign	Yes (Reportable)	No
Anaplasmosis <i>Anaplasma marginale</i> , <i>A. centrale</i>	Ticks	Endemic	Yes (Reportable)	No
Anthrax <i>Bacillus anthracis</i>	Flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Bluetongue Orbivirus	Biting midges	Endemic (Serotypes other than 8) Foreign (Serotype 8)	Yes (Reportable)	No
Bovine babesiosis <i>Babesia bovis</i> , <i>B. bigemina</i> , <i>B. divergens</i> , <i>B. microti</i>	Ticks	Endemic	Yes (Reportable)	No
Bovine ephemeral fever Ephemerovirus	Mosquitoes, biting midges	Foreign	No	No
Contagious mastitis Multiple bacterial species: <i>Staphylococcus aureus</i> , <i>Streptococcus agalactiae</i> , <i>Mycoplasma</i> spp., <i>Corynebacterium bovis</i>	Biting flies	Endemic	No	No
Crimean Congo hemorrhagic fever Nairovirus	Ticks	Foreign	Yes (Reportable)	Yes (Zoonotic)

CATTLE

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Dermatophilosis <i>Dermatophilus congolensis</i>	Ticks, flies	Endemic	No	Yes (Zoonotic)
East Coast fever <i>Theileria parva</i>	Ticks	Foreign	Yes (Reportable)	No
Epizootic bovine abortion (foothill abortion) <i>Pajaroellobacter abortibovis</i>	Ticks	Endemic	No	No
Epizootic hemorrhagic disease Orbivirus	Biting midges	Endemic	Yes (Reportable)	No
Heartwater <i>Ehrlichia ruminantium</i>	Ticks	Foreign	Yes (Reportable)	No
Lumpy skin disease Capripoxvirus	Ticks, mosquitoes, biting flies, biting midges	Foreign	Yes (Reportable)	No
Mange <i>Chorioptes bovis</i> , <i>Sarcoptes scabiei var ovis</i> , <i>Psoroptes ovis</i>	Mites	Endemic (some) Foreign (some)	Yes (Reportable)	Yes (Zoonotic – Some)
Parafilaria <i>Parafilaria bovicola</i>	Flies	Foreign	No	No
Pinkeye <i>Moraxella bovis</i> and other species	Flies	Endemic	No	No
Rift Valley fever Phlebovirus	Mosquitoes	Foreign	Yes (Reportable)	Yes (Zoonotic)
Schmallenberg disease Orthobunyavirus	Biting midges	Foreign	Yes (Reportable)	No
Screwworm myiasis <i>Chrysomya bezziana</i> , <i>Cochliomyia hominivorax</i>	Flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Stephanofilaria (granulomatous dermatitis) <i>Stephanofilaria stilesis</i>	Flies	Endemic	Yes (Reportable)	No
Surra <i>Trypanosoma evansi</i>	Biting flies	Foreign	Yes (Reportable)	Yes (Zoonotic)

CATTLE

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Theileriosis <i>Theileria annulata</i> , <i>T. orientalis</i> , <i>T. parva</i>	Ticks	Endemic (<i>T. orientalis</i> Ikeda) Foreign (<i>T. annulata</i> , <i>T. parva</i>)	Yes (Reportable)	No
Trypanosomiasis (tsetse-transmitted) <i>Trypanosoma congolense</i> and other species	Tsetse flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Ulcerative lymphangitis <i>Corynebacterium pseudotuberculosis</i>	Biting flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Vesicular stomatitis Vesiculovirus	Flies, biting midges	Endemic	Yes (Reportable)	No

SHEEP AND GOATS

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Akabane Orthobunyavirus	Biting midges	Foreign	Yes (Reportable)	No
Anaplasmosis <i>Anaplasma marginale</i> , <i>A. centrale</i>	Ticks	Endemic	Yes (Reportable)	No
Anthrax <i>Bacillus anthracis</i>	Flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Bluetongue Orbivirus	Biting midges	Endemic (Serotypes other than 8) Foreign (Serotype 8)	Yes (Reportable)	No
Crimean Congo hemorrhagic fever Nairovirus	Ticks	Foreign	Yes (Reportable)	Yes (Zoonotic)
Dermatophilosis <i>Dermatophilus congolensis</i>	Ticks, flies	Endemic	No	Yes (Zoonotic)

SHEEP AND GOATS

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Heartwater <i>Ehrlichia ruminantium</i>	Ticks	Foreign	Yes (Reportable)	No
Louping ill Flavivirus	Ticks	Foreign	No	Yes (Zoonotic)
Mange <i>Psoroptes ovis</i> , <i>Sarcoptes scabiei</i> <i>var ovis</i> , <i>Chorioptes bovis</i>	Mites	Endemic (some) Foreign (some)	Yes (Reportable)	Yes (Zoonotic - Some)
Nairobi sheep disease Orthonairovirus	Ticks	Foreign	Yes (Reportable)	Yes (Zoonotic)
Pinkeye <i>Moraxella bovis</i> and other species	Flies	Endemic	No	No
Rift Valley fever Phlebovirus	Mosquitoes	Foreign	Yes (Reportable)	Yes (Zoonotic)
Schmallenberg disease Orthobunyavirus	Biting midges	Foreign	Yes (Reportable)	No
Screwworm myiasis <i>Chrysomya bezziana</i> , <i>Cochliomyia hominivorax</i>	Flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Sheep and goat pox Capripoxvirus	Biting flies	Foreign	Yes (Reportable)	No
Theileriosis <i>Theileria lestoquardi</i> , <i>T. luwenshuni</i> , <i>T. uilenbergi</i>	Ticks	Foreign	Yes (Reportable)	No
Trypanosomiasis (tsetse-transmitted) <i>Trypanosoma congolense</i> and other species	Tsetse flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Tularemia <i>Francisella tularensis</i>	Ticks, mosquitoes, biting flies, biting midges	Endemic	Yes (Reportable)	Yes (Zoonotic)
Ulcerative lymphangitis <i>Corynebacterium pseudotuberculosis</i>	Biting flies	Endemic	Yes (Reportable)	Yes (Zoonotic)

CERVIDS

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Anaplasmosis <i>Anaplasma marginale, A. centrale</i>	Ticks	Endemic	Yes (Reportable)	No
Anthrax <i>Bacillus anthracis</i>	Flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Bluetongue Orbivirus	Biting midges	Endemic (Serotypes other than 8) Foreign (Serotype 8)	Yes (Reportable)	No
Epizootic hemorrhagic disease Orbivirus	Biting midges	Endemic	Yes (Reportable)	No
Screwworm myiasis <i>Chrysomya bezziana, Cochliomyia hominivorax</i>	Flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Trypanosomiasis (tsetse-transmitted) <i>Trypanosoma congolense</i> and other species	Tsetse flies	Foreign	Yes (Reportable)	Yes (Zoonotic)

HORSES

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
African horse sickness Orbivirus	Biting midges	Foreign	Yes (Reportable)	No
Anaplasmosis (Equine granulocytic anaplasmosis) <i>A. phagocytophilum</i>	Ticks	Endemic	Yes (Reportable)	Yes (Zoonotic)
Anthrax <i>Bacillus anthracis</i>	Flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Dermatophilosis <i>Dermatophilus congolensis</i>	Ticks, flies	Endemic	No	Yes (Zoonotic)
Eastern equine encephalomyelitis Alphavirus	Mosquitoes	Endemic	Yes (Reportable)	Yes (Zoonotic)

HORSES

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Equine infectious anemia Lentivirus	Biting flies	Endemic	Yes (Reportable)	No
Eye worm <i>Thelazia lacrymalis</i>	Flies	Endemic	No	Yes (Zoonotic)
Japanese encephalitis Flavivirus	Mosquitoes	Foreign	Yes (Reportable)	Yes (Zoonotic)
Lyme disease <i>Borrelia burgdorferi</i>	Ticks	Endemic	No	Yes (Zoonotic)
Parafilaria <i>Parafilaria multipapillosa</i>	Flies	Foreign	No	No
Piroplasmosis <i>Theileria equi, Babesia caballi</i>	Ticks	Foreign	Yes (Reportable)	No
Screwworm myiasis <i>Chrysomya bezziana, Cochliomyia hominivorax</i>	Flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
St. Louis encephalitis Flavivirus	Mosquitoes	Endemic	No	Yes (Zoonotic)
Surra <i>Trypanosoma evansi</i>	Biting flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Trypanosomiasis (tsetse-transmitted) <i>Trypanosoma congolense</i> and other species	Tsetse flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Ulcerative lymphangitis <i>Corynebacterium pseudotuberculosis</i>	Biting flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Venezuelan equine encephalomyelitis Alphavirus	Mosquitoes	Foreign	Yes (Reportable)	Yes (Zoonotic)
Vesicular stomatitis Vesiculovirus	Flies, biting midges	Endemic	Yes (Reportable)	No

HORSES

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Western equine encephalomyelitis Alphavirus	Mosquitoes	Endemic	Yes (Reportable)	Yes (Zoonotic)
West Nile virus disease Orthoflavivirus	Mosquitoes	Endemic	Yes (Reportable)	Yes (Zoonotic)

SWINE

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
African swine fever Asfivirus	Ticks (soft)	Foreign	Yes (Reportable)	No
Anthrax <i>Bacillus anthracis</i>	Flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Japanese encephalitis Flavivirus	Mosquitoes	Foreign	Yes (Reportable)	Yes (Zoonotic)
Porcine reproductive and respiratory syndrome (PRRS) Arteriviridae	Flies	Endemic	No	No
Screwworm myiasis <i>Chrysomya bezziana</i> , <i>Cochliomyia hominivorax</i>	Flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Swine dysentery <i>Brachyspira hyodysenteriae</i>	Flies	Endemic	No	No
Swinepox Suipoxvirus	Lice, flies, mosquitoes	Endemic	No	No
Trypanosomiasis (tsetse-transmitted) <i>Trypanosoma congolense</i> and other species	Tsetse flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Vesicular stomatitis Vesiculovirus	Flies, biting midges	Endemic	Yes (Reportable)	No

POULTRY

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Eastern equine encephalomyelitis Alphavirus	Mosquitoes	Endemic	Yes (Reportable)	Yes (Zoonotic)
Fowl pox Avipoxvirus	Mosquitoes	Endemic	No	No
Leucocytozoonosis <i>Leucocytozoon</i> spp.	Biting flies, biting midges	Endemic	No	No
Louping ill Flavivirus	Ticks	Foreign	No	Yes (Zoonotic)
Screwworm myiasis <i>Chrysomya bezziana</i> , <i>Cochliomyia hominivorax</i>	Flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Turkey coronavirus Coronavirus	Flies	Endemic	No	No
West Nile virus disease Orthoflavivirus	Mosquitoes	Endemic	Yes (Reportable)	Yes (Zoonotic)

DOGS

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
American canine hepatozoonosis <i>Hepatozoon americanum</i>	Ticks	Endemic	No	No
Anaplasmosis <i>Anaplasma marginale</i> , <i>A. centrale</i> , <i>A. phagocytophilum</i>	Ticks	Endemic	Yes (Reportable)	Yes (Zoonotic)
Anthrax <i>Bacillus anthracis</i>	Flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Bartonellosis <i>Bartonella henselae</i> and other species	Fleas	Endemic	No	Yes (Zoonotic)

DOGS

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Chagas disease <i>Trypanosoma cruzi</i>	Kissing bugs	Endemic	No	Yes (Zoonotic)
<i>Dipetalonema dracunculoides</i> (roundworm)	Dog louse fly <i>(Hippobosca longipennis)</i>	Foreign	No	No
Dirofilariasis (heartworm disease) <i>Dirofilaria immitis</i>	Mosquitoes	Endemic	No	Yes (Zoonotic)
Ehrlichiosis <i>Ehrlichia canis</i> and other species	Ticks	Endemic	No	Yes (Zoonotic)
Eye worm <i>Thelazia californiensis</i>	Flies	Endemic	No	Yes (Zoonotic)
Flea-borne spotted fever <i>Rickettsia felis</i>	Fleas	Endemic	No	Yes (Zoonotic)
Leishmaniasis <i>Leishmania</i> spp.	Sand flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Lyme disease <i>Borrelia burgdorferi</i>	Ticks	Endemic	No	Yes (Zoonotic)
Plague <i>Yersinia pestis</i>	Fleas	Endemic	No	Yes (Zoonotic)
Rocky Mountain spotted fever <i>Rickettsia rickettsii</i>	Ticks	Endemic	No	Yes (Zoonotic)
Screwworm myiasis <i>Chrysomya bezziana</i> , <i>Cochliomyia hominivorax</i>	Flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Tapeworm <i>Dipylidium caninum</i>	Fleas, lice	Endemic	No	Yes (Zoonotic)
Trypanosomiasis (tsetse-transmitted) <i>Trypanosoma congolense</i> and other species	Tsetse flies	Foreign	Yes (Reportable)	Yes (Zoonotic)

CATS

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Anaplasmosis <i>Anaplasma phagocytophilum</i>	Ticks	Endemic	Yes (Reportable)	Yes (Zoonotic)
Anthrax <i>Bacillus anthracis</i>	Flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Bartonellosis <i>Bartonella henselae</i> and other species	Fleas	Endemic	No	Yes (Zoonotic)
Chagas disease <i>Trypanosoma cruzi</i>	Kissing bugs	Endemic	No	Yes (Zoonotic)
Cytauxzoonosis <i>Cytauxzoon felis</i>	Ticks	Endemic	No	No
Dirofilariasis (heartworm disease) <i>Dirofilaria immitis</i>	Mosquitoes	Endemic	No	Yes (Zoonotic)
Eye worm <i>Thelazia californiensis</i>	Flies	Endemic	No	Yes (Zoonotic)
Feline hemotropic mycoplasmosis (formerly known as feline infectious anemia) <i>Mycoplasma haemofelis</i>	Fleas	Endemic	No	No
Flea-borne spotted fever <i>Rickettsia felis</i>	Fleas	Endemic	No	Yes (Zoonotic)
Plague <i>Yersinia pestis</i>	Fleas	Endemic	No	Yes (Zoonotic)
Screwworm myiasis <i>Chrysomya bezziana</i> , <i>Cochliomyia hominivorax</i>	Flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Tapeworm <i>Dipylidium caninum</i>	Fleas, lice	Endemic	No	Yes (Zoonotic)
Trypanosomiasis (tsetse-transmitted) <i>Trypanosoma congolense</i> and other species	Tsetse flies	Foreign	Yes (Reportable)	Yes (Zoonotic)

CATS

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Tularemia <i>Francisella tularensis</i>	Ticks, mosquitoes, biting flies, biting midges	Endemic	Yes (Reportable)	Yes (Zoonotic)

RABBITS

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Anthrax <i>Bacillus anthracis</i>	Flies	Endemic	Yes (Reportable)	Yes (Zoonotic)
Myxomatosis Myxoma virus	Ticks, mosquitoes, mites, fleas	Endemic	Yes (Reportable)	No
Screwworm myiasis <i>Chrysomya bezziana</i> , <i>Cochliomyia hominivorax</i>	Flies	Foreign	Yes (Reportable)	Yes (Zoonotic)
Tularemia <i>Francisella tularensis</i>	Ticks, mosquitoes, biting flies, biting midges	Endemic	Yes (Reportable)	Yes (Zoonotic)

HONEY BEES

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
Acarapisosis <i>Acarapis woodi</i>	Mites	Endemic	Yes (Reportable)	No
Deformed wing virus, variant C <i>Picornavirales</i>	Mites	Endemic	Yes (Reportable)	No
Slow bee paralysis virus Flavivirus	Mites	Foreign	Yes (Reportable)	No
Small hive beetle infestation	Beetles	Endemic	Yes (Reportable)	No

HONEY BEES

Disease and Pathogen	Primary Disease Vector(s)	Endemic/Foreign	USDA Reportable?	Affects People?
<i>Tropilaelaps</i> infestation	Mites	Foreign	Yes (Reportable)	No
Varroosis	Mites	Endemic	Yes (Reportable)	No