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HOUSE AND LANDSCAPE PESTS

Mosquitoes and the Diseases they Transmit

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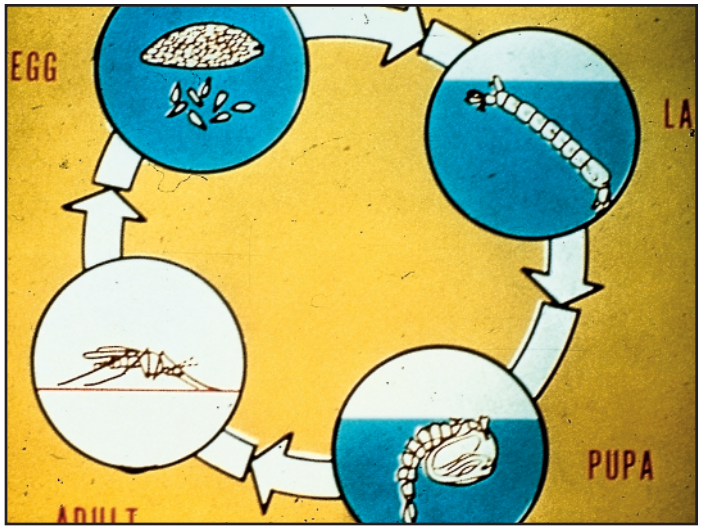
Mosquitoes are among the most important insect pests affecting the health of people and animals. Biting female mosquitoes not only irritate people and animals, but they can also transmit many disease-causing organisms.

Annoying populations of mosquitoes can occur anywhere in Texas because there are habitats favorable for mosquito species almost everywhere in the state.

To control mosquitoes effectively, it helps to understand their life cycle, to be able to identify the various kinds of mosquitoes, and to know what steps work best for the different species and specific locations.

Life history

Mosquitoes have four distinct stages during their life cycle: egg, larva, pupa and adult. The adult stage is free-flying; the other stages are aquatic.



Life cycle of a mosquito.

The length of time that a mosquito takes to complete its life cycle varies according to food availability, weather conditions and the species of mosquito. Under favorable conditions, some mosquitoes can complete their entire life cycle in only 8 to 10 days.

Egg

One way to identify the breeding sites of mosquitoes is to find the eggs. Mosquito eggs may be laid in clusters called rafts on the water surface. They may also be laid singly on the water surface or in dry areas that are flooded periodically.


Adult mosquito laying eggs.

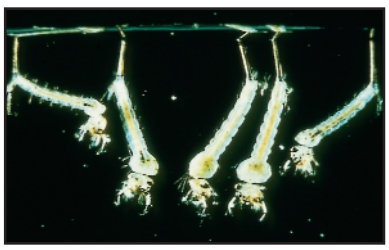
When first laid, mosquito eggs are white, but within a few hours they become dark brown to black. The shape and size of mosquito eggs vary, with most being football-shaped or boat-shaped and 0.02 to 0.04 inch long.

In warm water, the eggs may hatch in 2 to 3 days. Some mosquito eggs can remain dormant in dry conditions for many months.

Larva

Mosquito eggs hatch into long larvae called wigglers, which are seldom over 1/2 inch long. Wigglers have three body sections: a small head, an enlarged thorax (the middle section) and a long, cylinder-shaped abdomen.

Wigglers live only in water. Most of them feed on microscopic plants, animals and organic debris suspended in the water. They filter the food particles from the water with their brush-like mouth


Mosquito larvae.

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parts. The larvae of some mosquito species are predators that feed on other mosquito larvae.

Most mosquito larvae mature in 4 to 10 days, passing through four instars (growth stages) and then transforming into the pupal stage. The length of a mosquito's larval development period depends on food, temperature and species.

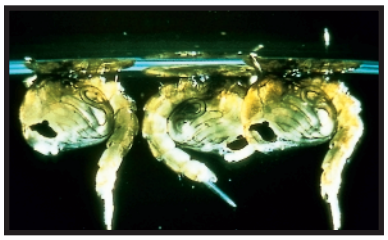
While feeding or breathing, mosquito larvae assume distinctive positions in the water. For most species, the larva breathes through an air tube located near the end of the abdomen. It projects the air tube through the water surface and hangs head down at an angle to the water surface, with only the tip of the breathing tube coming into contact with the surface of the water.

An exception is the larvae of *Anopheles* mosquitoes. They lack air tubes and tend to lie flat against the water surface.

One way to control mosquitoes in the larval stage is to apply a surface film of certain petroleum products in standing water. This film disrupts their breathing and kills the larvae.

Pupa

The pupal stage is the transitional stage between the mosquito larvae, which live in the water, and the adults, which live on land.



Mosquito pupae.

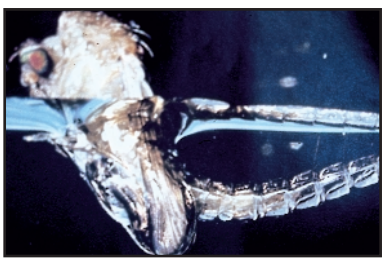
Mosquito pupae do not eat. They spend most of their time at the water surface and tend to move only when disturbed. Mosquito pupae are sometimes called tumblers because of their tumbling motion in water when they are disturbed

Mosquito pupae are comma-shaped and, like the larvae, breathe through air tubes at the surface of standing water. The front region of the pupa's body is greatly enlarged, consisting of a fused head and thorax. A pair of respiratory tubes, or trumpets, extends from the back of the thorax and are used at the water surface to breathe air. The pupal abdomen or tail consists of several segments that move freely.

The pupal stage may last from 1 to 10 days, or even more, depending on the temperature and the mosquito species involved. Pupae may also be killed with surface film treatments.

Adult

Adult mosquitoes have wings. Male mosquitoes feed only on nectar, plant juices and other sources of liquid carbohydrates. Male mosquitoes usually emerge a few hours up to a few days before the females emerge. The males rest in the vegetation surrounding the emergence site, waiting for females to emerge.



Emerging adult.

Adult laying eggs.

Female mosquitoes also feed periodically on nectar, plant sap and other sources of plant carbohydrates for energy. However, the females of most species must have a blood meal as a source of protein before they can produce eggs.

Mating usually occurs near the emergence site and coupling occurs quickly in the air. Female mosquitoes can fertilize all of their eggs after a single mating because they can store the sperm internally. Male mosquitoes usually die shortly after the mating period.

Adult female mosquitoes typically live for about a week to a month, but this can vary depending on several environmental factors. Some species overwinter (spend the winter) as engorged mated females that may live up to 6 months or more.

When female mosquitoes are inactive, they rest in protected areas that are typically dark or shaded, humid, and cool in the summer or warm in the winter.

The mouthparts of female mosquitoes are complex and form a prominent beak or proboscis. When a mosquito takes a blood meal, it uses its mouthparts to puncture the skin of the host and feed directly from the capillaries (small blood vessels).

As it feeds, the mosquito injects a small amount of saliva into the wound before drawing blood. The saliva makes penetration easier and prevents the blood from clotting during feeding. In most cases, the itching and swelling caused by the saliva subside within a few hours.

The adult mosquitoes around your home may have come from a breeding site near or far away, depending on the species, wind patterns and the flight habits of the females:

- *Aedes aegypti* breed primarily in and around human habitations and fly short distances, usually only about 200 yards.
- Most *Anopheles* mosquitoes have a flight range of about 1 mile. *Psorophora* species have flight ranges of at least 5 miles.
- Some salt-marsh mosquitoes in the genera *Aedes* and *Ochlerotatus* can disperse with the prevailing winds for 20 to 40 miles or more away from the larval development sites.

You need to recognize these flight distances in order to find the source of mosquito problems and choose the appropriate management strategies. If the source of the mosquitoes is not on your property, you may need to

cooperate with others to be able to control them. In some cases, you may be unable to control them at all.

Identifying mosquitoes

All mosquitoes are classified in the order Diptera (true flies) and in the family Culicidae, which has more than 2,500 recognized species in the world. Adult mosquitoes are small, long-legged flies that have two wings like most other true flies.

All adult mosquitoes have three characteristics in combination, which separates them from all other flies:

- Long, many-segmented antennae
- A piercing and sucking mouthpart system elongated into a distinctive beak or proboscis, at least in the females
- Scales on the wing veins and margins

To control the mosquitoes in your area, first you need to know what kinds are living there. At least 84 species of mosquitoes are known to occur in Texas. These species have considerable variation in their larval breeding sites, time of day when they bite, and flight distances of the adults. Table 1 provides a summary of this information for some common species in Texas.

Identification of larvae or adult mosquitoes to species is complicated and generally requires considerable expertise and training. If there is a question about the species involved, it is best to send samples to an identification lab. A mosquito control district, a university, or a pest control operator should be able to help.

Groups of mosquitoes

Mosquito species are often divided into groups based on where the females lay their eggs and where the larvae develop. There are different control strategies for each group. The Center for Disease Control and Prevention (CDC) has developed a convenient grouping of four mosquito types according to the habitats in which the larvae generally develop:

Table 1. Biological data on 20 common species of mosquitoes found in Texas

Mosquito Species	Larval Habitat(s)	Biting Time	Flight Range
Aedes aegypti	AC	C, D	under 100 yards
Aedes albopictus	AC, TH	C, D	100 - 300 yards
Aedes vexans	FW, GP, IP	C, N	10 - 25+ miles
Anopheles punctipennis	WP	C, N	0 - 0.25 mile
Anopheles quadrimaculatus	FW, GP, LM	C, N	0.5 - 1 mile
Culex erraticus	WP	N	0 - 0.25 mile
Culex nigripalpus	GP, FW, DD	C	0.5 - 1 mile
Culex quinquefasciatus	AC, SCB, GRP	C, N	0.25 - 0.5 mile
Culex restuans	WP, GRP, DD	C, N	1 - 2 miles
Culex salinarius	GP, LM, FS, SM	C, N	0.25 - 5 miles
Culiseta melanura	FS, WP	C, N	0.5 - 1 mile
Ochlerotatus (=Aedes) atlanticus	WP	C, D	0.25 - 0.5 mile
Ochlerotatus (=Aedes) canadensis	WP, DD, FS	C	0 - 0.25 mile
Ochlerotatus (=Aedes) sollicitans	SM	C, N, D	5 - 40 miles
Ochlerotatus (=Aedes) taeniorhynchus	SM	C, N, D	5 - 40 miles
Ochlerotatus (=Aedes) triseriatus	TH, AC	D	0.5 - 1 mile
Psorophora ciliata	IP, RF, GRP	C, N	5 - 10 miles
Psorophora columbiae	IP, RF, GRP	C, N	5 - 10 miles
Psorophora ferox	WP	C, N	1 - 2 miles
Psorophora howardii	WP, Coastal Pools	C, N	1 - 2 miles

AC: Artificial containers
DD: Drainage ditches
FS: Freshwater swamps
FW: Flood waters
GP: Grassland pools
GRP: Ground pools
IP: Irrigated pastures
LM: Lake margins
RE: Rooted emerged vegetation
RF: Rice fields
SCB: Sewage catch basins
SM: Salt marshes
TH: Tree holes
WP: Woodland pools
C: Crepuscular (dusk and dawn)
D: Day
N: Night

Modified from the original source: *http://www.deh.enr.state.nc.us/phpm/Pages/Biology.html*

- Permanent pool group
- Transient water group
- Floodwater group
- Artificial container and tree-hole group

Understanding these groups will help you determine the source of the mosquitoes and what control measures are likely to help. Table 2 provides a summary of these groups, the more problematic genera and/or species, larval breeding habitats and general management approaches.

Managing mosquitoes

To control mosquitoes effectively long-term, you need to use several complementary management techniques, including:

- **Sanitation** — removing food, water, and shelter
- **Habitat disruption** — draining the water where mosquitoes breed
- **Biological control** — using mosquito fish, nematodes, and *Bacillus thuringiensis israeliensis* toxin and *Bacillus sphaericus*
- **Mechanical control** — maintaining window screens and altering building designs
- **Personal protection** — wearing protective, light-colored, loose-fitting clothing; using repellents; and avoiding activities in areas when mosquitoes are active
- **Chemical suppression** — using insecticides against adults and/or larvae

Mosquito control is often complex and expensive, requiring the cooperation of individual homeowners as well as such groups as industry, agriculture, state agencies and local governments.

Some communities may have to take an areawide approach to mosquito control and hire permanent control personnel. These areawide programs are sometimes the only solution to a mosquito problem. Areawide mosquito control programs can provide manpower and expertise that are usually unavailable to homeowners.

In these programs, trained personnel conduct mosquito surveys to identify the species, track the population levels and determine appropriate management alternatives. Areawide management can provide relief from

Table 2. Mosquito groups, their breeding sites and management suggestions for each group.

Mosquito Group	Genera and/or species	Breeding Sites	General Management Approaches
Permanent pool	*Anopheles*, some *Culex, Culiseta, Coquillettidia, Mansonia*	Standing water that seldom dries, edges of ponds, lakes and smaller impoundments	Biological control—using mosquito fish, nematodes, and *Bacillus thuringiensis* israeliensis toxin and *Bacillus sphaericus* Habitat disruption—draining the water or removing plants
Transient water	*Culiseta*, some *Culex*, occasionally *Anopheles*, especially *Anopheles punctipennis*	Roadside ditches, excavations, canals, ground pools, catch basins, storm sewers, clogged streams, irrigated land	Biological control—using nematodes, and Bacillus thuringiensis israeliensis toxin and Bacillus sphaericus Sanitation—removing food, water and vegetation
Floodwater	*Aedes, Ochlerotatus, Psorophora*	flood plains, salt marshes, smaller sites, even animal footprints	Habitat disruption—draining the water where mosquitoes breed Chemical suppression—using insecticides against adults and/or larvae
Artificial container` and tree-hole	Most *Aedes*—especially *Aedes aegypti, Aedes albopictus* and *Ochlerotatus (=Aedes) triseriatus*	Artificial containers, discarded tires, tin cans, flower pots, cemetery vases, roof gutters, tree-holes, water caught in bromeliads and orchids and other plants	Sanitation—removing food, water, and shelter Habitat disruption—draining the water in small containers

mosquito problems that develop miles away from the affected area.

Laws have been enacted in Texas enabling various groups to form mosquito control districts. The Texas Department of Health in Austin can provide information on how to establish a control district. The Texas Animal Health Commission monitors the mosquito-borne animal diseases in the state.

Homeowners can reduce their local program in many cases. More specific management actions are provided by location in Table 3. Evaluate your area to recognize the likely larval breeding sites for mosquito larvae then take appropriate action.

How mosquitoes affect people and animals

Mosquitoes can affect people and animals directly or indirectly.

Direct effects: Mosquito species that feed on blood can annoy people, birds, mammals and other vertebrates. They disrupt outdoor work and recreational activities. If there are enough mosquitoes in an area, they can cause severe blood loss and slow the growth of livestock.

When they feed, mosquitoes inject salivary fluids into their hosts. These fluids contain chemicals that can prevent blood from clotting and break down red blood cells.

The bites often cause mild allergic reactions such as swelling and itching. These reactions may continue to affect the hosts long after the female mosquitoes have taken their blood meals. Although some people may react more strongly to the bites, severe reactions are uncommon.

Indirect effects: Mosquitoes indirectly affect people and animals when they transmit disease organisms to them. Each year worldwide, mosquitoes affect millions of people by transmitting the disease-causing agent (pathogen) of several serious diseases, including encephalitis, dengue, yellow fever, malaria and filariasis.

Although most of these diseases were once common in the United States, none causes serious human problems in the United States today. The most common of these diseases now in Texas is encephalitis, which affects a few people each year.

Table 3. Possible mosquito sources around the home and other property.

Mosquito Sources	How to Reduce Mosquitoes
Ponds	Stock the pond with fish. Use *Bacillus thuringiensis israelensis* (such as Mosquito Dunks®). Remove excess vegetation.
Swimming pools	Keep water off the cover. Maintain water quality at all times.
Tree holes	Fill the holes with sand, or drill a drain hole.
Plastic pools	Drain the water when not in use or cover the pool to prevent mosquitoes from laying eggs in the water.
Containers	Empty the water. Store the containers in an inverted position. Dispose of the containers. Cover the containers so mosquitoes cannot lay eggs in them.
Bird baths	Change the water at least once a week.
Standing water	Eliminate it by draining it. Fill in low areas.
Watering troughs	Stock the trough with fish. Change the water weekly.
Cooler drains	Prevent water from standing in the drain.
Street gutter or catch basins	Keep litter and garden debris out of the gutter. Do not overwater the yard.
Cesspool or septic tanks	Seal and cover it so mosquitoes cannot lay eggs in it.
Roof gutters	Clean them once a year to remove debris.
Irrigated lawns or fields	Avoid overirrigation. Drain standing water.

Modified from the original source: UC Pest Management Guidelines. *http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7451.html*

Another common mosquito-borne disease in Texas is heartworm in dogs, particularly in the humid areas of East Texas and the Coastal Plain.

Mosquitoes rarely cause death directly, but they can do so by a combination of effects, including exhaustion, suffocation, toxemia and blood loss.

Mosquito-borne diseases

Mosquito-borne diseases can become a problem when these four living elements are present:

- **Pathogen** — the organism that causes the disease
- **Reservoir** — the animals in which the pathogen lives and which serve as the source of the pathogen for the mosquitoes that transmit it
- **Susceptible hosts** — the people and/or other animals that can be infected by the pathogen
- **Vectors** — the mosquito species that can transmit the pathogen, either mechanically or biologically, from it reservoirs to the susceptible hosts

All four of these living elements **must** be present for a mosquito-borne disease to continue to occur and cycle in a geographic location.

Encephalitis

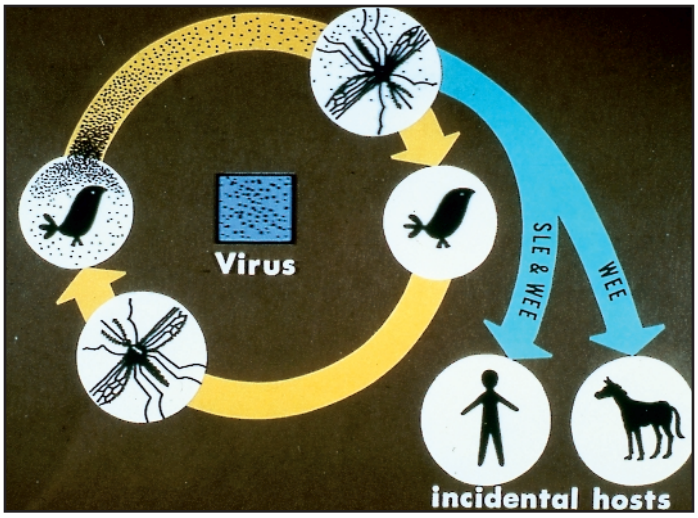
Encephalitis is an inflammation of the brain caused by certain viruses transmitted by mosquitoes. Human cases of encephalitis range from unapparent or mild cases to very severe illnesses that can permanently damage the central nervous system or, in some instances, cause death. Symptoms include high fever, convulsions, delirium and other central nervous system problems. If these symptoms occur, seek medical assistance quickly.

Birds serve as the primary reservoirs for the viruses that most often cause the disease. Encephalitis occasionally becomes a problem when it is transmitted to humans, horses or other equines such as donkeys or mules.

Public health officials often check local and migrating bird populations to see if they have the virus and whether there is a potential for its transmission to humans and animals.

Several types of encephalitis cause concern in Texas: eastern equine encephalitis (EEE), western equine encephalitis (WEE) and St. Louis encephalitis (SLE). The viruses causing EEE, WEE or SLE are normally transmitted from bird to mosquito to bird and sometimes from bird to mosquito to human. EEE and WEE can also be transmitted from bird to mosquito to horse. When the incidence of any encephalitis virus increases in bird populations, it becomes more likely that humans and equines can become involved.

In most cases, the human or equine host is a "dead-end host" for the virus, meaning that the disease probably will not be transmitted from these hosts because they cannot infect mosquitoes.



Typical transmission cycle for encephalitis.

Similarly, horses may have mild to severe or even fatal infections with EEE or WEE viruses. Horses with the SLE virus show no outward sign of infection.

Birds may die of infection caused by some encephalitis viruses but not by others. For example, deaths from the EEE virus have been reported in red-winged blackbirds, house sparrows, pheasants and emus. SLE virus, however, produces no outward sign of infection in birds.

The various types of viruses are transmitted by different mosquito species:

EEE virus: *Culiseta melanura*, a mosquito that breeds in freshwater swamps, is typically involved in the bird to mosquito to bird cycle of the eastern equine encephalitis virus.

Because this mosquito rarely bites humans or horses, other mosquitoes, such as the eastern salt marsh mosquito, *Ochlerotatus (=Aedes) sollicitans*, probably transmit EEE virus to humans and horses.

WEE virus: *Culex tarsalis* and *Ochlerotatus (=Aedes) dorsalis* are the main mosquito vectors for western equine encephalitis virus, particularly west of the Mississippi River. Other insects, such as the swallow bug (Cimicidae), may also serve as overwintering hosts of the WEE virus.

SLE virus: Members of the *Culex pipien*s complex, *Cx. p. pipiens* (the northern house mosquito) and *Cx. p. quinquefasciatus* (the southern house mosquito), are the main urban vectors of the St. Louis encephalitis virus, with the latter species causing concern in Texas.

Culex tarsalis is the chief vector of SLE virus in rural areas of the western United States. *Culex nigripalpus* has been identified as the primary vector of SLE virus in Florida and is a potential vector in Texas.

VEE and CE viruses: The Venezuelan equine encephalitis (VEE) virus complex and the California encephalitis (CE) virus complex also have been recorded in Texas. These virus complexes can cause encephalitis in humans and sometimes in horses. They differ from

the other mosquito-borne encephalitis viruses in that their reservoirs are small mammals such as rodents rather than birds, and in the case of VEE sometimes horses serve as reservoirs.

The dark rice field mosquito, *Psorophora columbiae*, is the only mosquito that has been confirmed to transmit VEE from horse-to-mosquito-to-horse in the epidemic cycle in Texas. The tree-hole mosquito, *Ochlerotatus [= Aedes] triseriatus*, is the primary vector of CE, and tree squirrels serve as the primary reservoirs. The La Crosse type of California encephalitis is the strain that occurs most often in humans, but only a few cases have been confirmed in Texas.

WNV virus: West Nile virus (WNV) is a relatively recent concern in the eastern United States and continues to spread toward Texas. It threatens birds (both wild and domestic), horses and people. Wild birds are the primary reservoirs of this disease, and the pathogen can move with migratory birds.

WNV can also be spread by mosquitoes to horses and humans, causing encephalitis that may result in death. Although about 40 percent of horses that contract encephalitis die, the disease is much less severe in humans. There is no evidence that it can be spread from human to mosquito to human or from animals to humans through direct contact with infected individuals.

Since 1999, WNV has been detected in 12 states and the District of Columbia — from as far north as Vermont down to Florida along the east coast and as far west as Wisconsin in the upper midwestern states and Louisiana in the south central states.

During the summer of 2000, the Texas Department of Health (TDH) cooperated with several agencies and research groups in an intense national monitoring survey for WNV. The department monitored the possible reservoirs, incidental hosts and mosquito species likely to feed on birds migrating from the northeastern United States through Texas to the Gulf Coast.

As of 2001, the mosquito vectors of WNV had been reported in Texas, but no human, veterinary or wild bird cases of WNV had yet been reported here.

Dengue

Another virus-caused disease transmitted by mosquitoes is dengue, or breakbone fever. The more serious manifestations of this disease are called dengue hemorrhagic fever and dengue shock syndrome. It is transmitted from infected humans to susceptible humans by mosquitoes.

A dengue outbreak occurred in Texas in 1999, with 62 cases reported to the TDH, including one death. Dengue is usually a severe but nonfatal disease. Symptoms include the sudden onset of high fever, severe headache, backache, joint pains and a rash that appears on the third or fourth day of illness.

In Texas, the mosquito primarily responsible for transmitting dengue to people is *Aedes aegypti*. Mosquitoes obtain dengue virus from the blood of infected humans during the period from the day before the initial fever occurs in the person through the third or fourth day of illness.

The virus then multiplies in the mosquito and invades the mosquito's salivary glands, making the mosquito infective to humans from 8 to 14 days after taking the infective blood meal. The mosquito then may remain infective for the rest of its life and able to transmit the disease during any subsequent blood feedings it takes on susceptible people.

Yellow fever

Historically, yellow fever is one of the most feared epidemic diseases in the United States because the mortality rate in humans can reach 85 percent. Although the last case originating in the United States occurred in 1911, it is still regarded as so dangerous that U.S. law requires that cases of yellow fever be reported immediately.

The symptoms are high fever, internal bleeding and jaundice. Illness from yellow fever may be acute and fatal, or so mild that it is unapparent.

In the classical "urban type" of yellow fever, epidemics are the result of human to mosquito to human transmission of the virus by *Aedes aegypti*, the yellow fever mosquito. The virus is introduced into the blood stream via the saliva of the mosquito as it bites.

An extremely slight infection risk exists for tourists who visit countries where yellow fever exists. To enter many of those countries, visitors must take a highly effective and well-tolerated vaccine. Occasionally people who have contracted the yellow fever in other countries return to the United States infected with the virus.

Malaria

Although by the early 1950s, malaria had disappeared as a significant problem in the United States, it is still one of the most important communicable diseases affecting people worldwide.

Malaria in humans is an acute or chronic disease caused by any one of four species of microscopic protozoan parasites belonging to the genus *Plasmodium*. Malaria infections in people vary from a moderately severe to a highly fatal illness, depending on the species of *Plasmodium* involved and the condition of the human at the time of infection.

Malaria causes fever and flu-like symptoms that may include chills, headache, muscle aches and fatigue. Nausea, vomiting, and diarrhea may also occur.

The parasites are transmitted from human to mosquito to human by the bite of *Anopheles* mosquitoes. Although at least 16 species of Anopheles occur in the United States, only two species are known to be signifi-

cant vectors of malaria: *Anopheles freeborni* and *Anopheles quadrimaculatus*.

In the blood in humans, these parasites invade individual red blood cells eventually destroying these cells and reproducing asexually. The parasites leave these cells and invade new red blood cells as the blood-cycling phase progresses. If insufficiently treated, a malaria infection may persist in a human for many months or even years. During that time it can be continuously or or periodically able to infect mosquitoes.

People in areas where malaria is common may be infected repeatedly, which can result in them developing a "tolerance" for the parasite. Although this "tolerance" may prevent severe acute consequences, it does not prevent a chronic, often debilitating infection.

Dog heartworm

Dog heartworm is caused by a mosquito-borne filarial worm (a threadlike parasite) called *Dirofilaria immitis*. Adult stages of this worm amass in the heart cavities of dogs and cats, causing heart damage, blockages and eventually death if the infestation grows too large.

Heartworm can cause severe circulatory problems in dogs and produce symptoms such as coughing, labored breathing and general loss of vitality in advanced stages.

D. immitis is normally transmitted from dog to mosquito to dog. We do not know definitely what the mosquito vectors of dog heartworm are in Texas, but several mosquito species are suspected from the genera *Culex, Aedes, Ochlerotatus,* and *Anopheles*.

Mosquitoes can also transmit *D. immitis* to people, where the parasite usually migrates to the lungs and less often to the heart. It causes a condition known as *eosinophilia*. Some people also have allergic reactions to the filarial worms. Fortunately, human cases of *D. immitis* are rare.

Dog heartworm is fairly widespread in the United States, with the greatest prevalence being along the Atlantic and Gulf Coasts from Massachusetts to Texas and up the Mississippi River Valley inland to as far north as Minnesota.

Mosquito control is important for pet owners. Because it is very difficult to protect dogs from mosquitoes, the most effective way to control heartworm is to prevent the worms from reaching the adult stage. Veterinarians can prescribe drug treatment to protect pets during the mosquito season.

If you are concerned about symptoms that you have be sure to contact your physician. The current information on human diseases is tracked by the Center for Disease Control. Your veterinarian is the local contact to recommend management of pet and animal related diseases.

For more information on insect management,
visit the Web site at: http://insects.tamu.edu

Acknowledgments

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