



# MOSQUITOES

## and Mosquito-Borne Diseases



- West Nile Virus
- Mosquitoes of Concern
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- Canine Heartworm and Treehole Mosquitoes
- Insects that Resemble Mosquitoes

*Protecting the Public from Vector-Borne Disease since 1989*



*Mosquitoes can transmit a variety of viruses and parasites to people and animals including West Nile, St. Louis encephalitis, and western equine encephalomyelitis viruses, canine heartworm, and malaria.*

### ***Out for Blood***

Mosquitoes are small biting flies.

Both male and female mosquitoes feed on plant juices for food.

Only females bite to get blood from mammals, birds, amphibians, and reptiles using specialized mouthparts (proboscis).

Proteins in blood are needed to produce eggs.

### **MOSQUITOES & DISEASE**

Mosquitoes can be annoying, but they are most important as vectors (transmitters) of disease. Nearly 70% of emerging threats to public health worldwide are diseases of animals transmitted to humans. Diseases once nearly eradicated are making a comeback in the United States and around the world.

Viruses that cause West Nile (WNV) and other encephalitides are normally found in birds, but also cause illness in people each year. Since introduced in 2003, more than 600 people have been sickened by WNV in Los Angeles County alone. Thankfully, most people bitten by an infected mosquito will not have symptoms. Approximately 20% will develop West Nile fever. Symptoms may include headache, fever, body aches, vomiting, nausea, swollen lymph glands and skin rash on the chest, stomach and back. Rarely, this virus will invade the brain and/or nervous system leading to a more severe form of illness typified by mental confusion, coma, paralysis, and in extreme cases, death.

There is no cure for WNV, but by following simple mosquito-proofing and bite prevention tips found in this brochure, you can reduce your risk and protect your family from mosquito-transmitted disease.

## Life Cycle of the Mosquito

The entire life cycle from egg to adult takes an average of five to seven (5-7) days for most species.

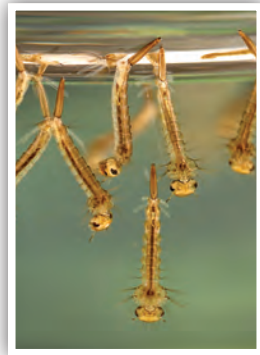
### EGG

Adult female mosquitoes lay approximately 100-250 eggs either in clusters called rafts which float on the surface of the water, or singly on or at the water's edge. Larvae hatch from eggs within days after contact with water.



### LARVA

Larvae are often found at the surface of the water where they breathe and feed. They live in a wide variety of water-filled sources including neglected swimming pools, ditches, storm drains, household containers, tree holes, ponds, horse troughs, and discarded tires. Larvae feed on algae and bacteria in the water and shed their skin four times as they grow over several days or weeks.



### PUPA

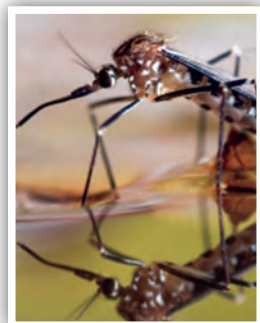
As pupae, mosquitoes transform in their cocoon-like shell. Pupae do not feed but must come to the water's surface to obtain oxygen. Once fully developed, the pupal skin splits and the adult mosquito emerges.



### ADULT

Newly emerged adult mosquitoes rest on the surface of the water until they are strong enough to fly. After mating, female mosquitoes fly off in search of a blood meal necessary for developing eggs.

Female mosquitoes are attracted to heat, odors, and carbon dioxide given off by hosts such as humans, mammals, reptiles, and birds. Adult mosquitoes live an average of 1-3 weeks.



## Species of Concern

There are approximately 3,500 species of mosquitoes worldwide. California is home to 53 different species, 15 of which are found in Los Angeles County. Those of greatest concern fall into one of four groups listed below.

### CULEX



*Culex are often brown or reddish and feed oriented horizontally*

The most prevalent mosquitoes in urban southern California, *Culex* thrive in natural and man-made sources of highly organic water including drainages, underground sumps, dirty swimming pools, and containers. Most can mature from egg to biting adult in 5-7 days.

Some species fly only short distances, but others may fly up to 10 miles in search of a blood meal and are active from dusk to dawn.

These mosquitoes feed primarily on birds, but also bite humans and are major vectors of West Nile, St. Louis encephalitis and Western equine encephalomyelitis viruses.

### ANOPHELES



*Anopheles feed head down at a characteristic 45-degree angle.*

The most common *Anopheles* in southern California transmitted malaria among early settlers. While malaria is no longer endemic in California, local outbreaks can occur when infected travelers are fed upon by local mosquitoes.

*Anopheles* larvae are often found in rivers and canyon streams in algae mats and cattail stands.

Females are strong fliers and aggressive biters at dawn and dusk. *Anopheles* mosquitoes prefer to feed on humans and large mammals.

## AEDES

Many *Aedes* inhabit coastal marshes and irrigated pastures or breed in containers and tree holes. *Aedes* feed aggressively during the day and are significant vectors of dengue and other viruses worldwide. In California, the treehole mosquito is responsible for transmitting canine heartworm and is often found in wooded areas where treehole cavities are common. Several species of *Aedes* have been introduced into California but have not become established. If you notice day-biting mosquitoes, please report them promptly.



*Many Aedes have striking black and white banding*

## CULISETA

These “cool-weather” mosquitoes are most common between fall and spring. Typically larger than *Culex* mosquitoes, *Culiseta* prefer to bite large mammals instead of humans. Larval habitats include both sunlit and shaded ponds, puddles, and artificial containers holding relatively clear water. These mosquitoes may be important in the maintenance cycle of canine heartworm.



photo by Sean McCann

*Culiseta are larger and darker than other common species*

### What can I do to avoid being bitten?

- Apply a repellent that contains DEET, Picaridin, IR3535®, or Oil of Lemon Eucalyptus. Make sure you follow label directions!
- Wear protective clothing, such as long-sleeved shirts and pants.
- Check and repair all screens and screen doors to keep mosquitoes out of your house.
- Minimize outdoor activities at dawn and dusk when mosquitoes are most active.

### Actual Size

Mosquitoes are generally about 1/2” at full adult size.



# Fight the Bite! Don't Breed Mosquitoes

## A BIT ABOUT THE BITE!

That itchy bump you get after a bite is a reaction to the saliva a mosquito injects when it feeds. Viruses and other pathogens can also be transmitted through mosquito saliva.

## FIND SOURCES!

Look for anything that can hold water for more than a few days. Buckets, dirty swimming pools, tires, trash cans, and other containers should be drained and/or cleaned weekly.

## AVOID THEM!

Try to limit outdoor activity at dusk and dawn during peak mosquito season (spring through fall).

## BLOCK 'EM OUT!

Make sure windows and doors have tight fitting, intact screens. This will help keep other unwanted critters out too!

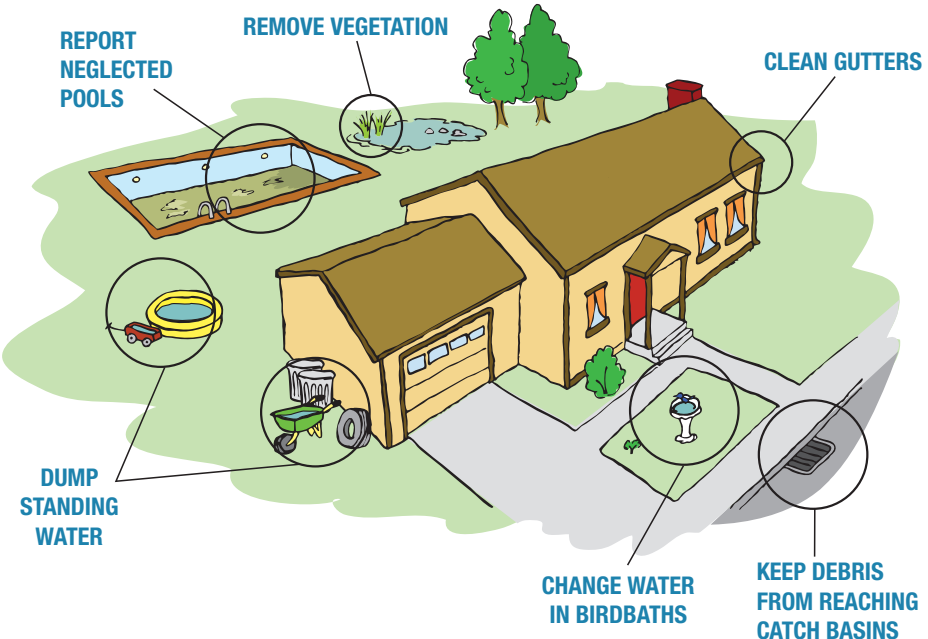
## USE MOSQUITOFISH!

These small, hardy fish can eat hundreds of mosquito larvae a day in a backyard pond or other man made source of water.

Call us, we provide them at no charge to our residents.

## WEAR REPELLENTS!

Wear long sleeves and pants and use repellents when outdoors. Remember to read the labels and carefully follow instructions on all insect repellents.





## Common Residential Mosquito Sources

Residential yards are often the #1 source of mosquito production in a community. Anything that can hold a half inch of water for more than five days can be a source of mosquitoes. This includes puddles in lawns and gardens, flower pot saucers, neglected swimming pools and spas, bird baths, clogged rain gutters, and more. Maintain, manage, or eliminate all types of standing water regularly.

*Use this home & garden checklist to help make your activities around your home safer & more enjoyable.*

- Trash bins:** Keep lids shut tightly and remove water that accumulates inside. Drill several drain holes in the bottoms.
- Boats:** Check and remove water weekly from boat covers.
- Fountains and bird baths:** Clean or hose out weekly.
- Rain gutters:** Keep clear of leaves and other debris.
- Potted plant saucers:** Don't over water. Flush out saucers with a hose or drill holes in the bottom to allow for better drainage.
- Tires:** Drill holes in tire swings. Recycle used tires or store in a covered area.
- Water bowls for pets:** Rinse and fill with fresh water 1 to 2 times a week.
- Water troughs:** Stock with free mosquitofish from the District.
- Leaky hoses:** Replace damaged hoses and fix leaky faucets and pipes.
- Low areas:** Do not over water lawns or gardens.
- Ponds:** Stock ornamental ponds with mosquitofish. Keep ponds clear and free of excess vegetation.
- Neglected swimming pools and spas:** Maintain even when not in use. Remove standing water on top of covers. Report neglected pools or spas by contacting the District.
- Containers:** Store containers upside down, cover or place in a sheltered area.
- Rain barrels:** Cover tightly with a fine mesh screen.
- Chain link fence:** Cover hollow chain link fence posts with caps.
- Drains:** Make sure that drains are not clogged by debris and flow freely.
- Flat roofs:** Water may puddle on flat roofs during the rainy season. Inspect weekly and remove any standing water.
- Lighting:** Check garden lights and eliminate water from tops of fixtures and from inside floodlights.
- Sculptures:** Check for water that may collect in lawn ornaments. Drain or flush out weekly.
- Screens:** Install and maintain tight fitting window and door screens.
- Rot hole in trees:** Be aware that water can collect in treeholes, crotches and dead tree stumps. Check with an arborist for best way to manage water or fill cavities.
- Water under home:** Use a sump pump to remove water.
- Septic tanks:** Screen vent pipes with a fine mesh screen. Cover exposed tanks or manhole lids with plastic or a similar material and secure in place. Place several inches or more of dirt or sand over the top of the area.
- Wheelbarrows:** Remove water that collects inside or store upside down.

## Environmental Mosquito Control

Once mosquitoes reach adulthood, controlling their populations becomes difficult. Removing sources of standing water and targeting immature mosquitoes are by far the most environmentally sensitive and effective approaches.

### IMMATURE MOSQUITOES

Eliminating sources of standing water removes habitat where mosquitoes lay their eggs. Immature stages must have water to survive. Overturning buckets and other containers will prevent mosquitoes from maturing into biting adults. In areas where water cannot be removed, mosquitoes can be managed using biological or chemical control.



To help mosquitofish adjust to a new home, place the container of fish directly into the pond for 10-15 minutes before release. In established ponds, extra food is not needed. If necessary, fish food or crushed dry pet food can be provided.

### Biological Control

Mosquitofish (*Gambusia affinis*) are small, surface feeding fish used throughout the world to control mosquito larvae. They are well adapted to artificial ponds and are available for delivery or pickup, free of charge to residents of our District. They are only used in artificial containers (backyard ponds, fountains) and should not be released into natural areas or swimming pools.

Goldfish and koi may incidentally control larvae but are not efficient predators of mosquitoes. Ponds that are inhabited by predatory insects such as dragonflies, damselflies, and aquatic beetles often have fewer mosquito problems.

### BioChemical/Chemical Control

The safest and most commonly used products for larval mosquito control are formulations derived from natural sources.

***Bacillus thuringiensis (Bti)*** and ***Bacillus sphaericus (Bs)*** are natural soil bacteria that are toxic to feeding mosquito larvae.

**Methoprene** is an insect juvenile growth hormone that prevents mosquitoes from successfully maturing to adulthood.

Both products selectively control mosquitoes, midges, and black flies and are safe to use in ponds with fish, in horse troughs, and in natural areas. These are the products of choice for most treatments.



**Surface films** are used to control mosquito pupae by preventing immature stages from obtaining oxygen from the water's surface.

These products disrupt the water's surface tension causing mosquitoes to drown and are ideal solutions for swimming pools and man-made containers.



Adult *Aedes* mosquitoes are aggressive daytime-biters and significant vectors of disease like dengue virus, yellow fever, and chikungunya worldwide.

### ADULT MOSQUITOES

Controlling adult mosquitoes is more difficult and requires the use of non-specific products that may impact other insects. Adult control may become necessary if mosquito populations are high and disease transmission is occurring in an area. Vector control districts select products shown to be safer for the environment and require use of the least amount of pesticide.

**Pyrethrums** or their analogs are applied as an ultra-low volume fog into the air in the evenings or early morning hours when mosquitoes are most active.

Because droplet size is so small and it is applied when most other insects are inactive, fewer non-target species are impacted.

## BACKYARD REMEDIES FACT OR FICTION?

- Many electronic devices claim to repel mosquitoes with high frequency sounds that mimic their natural predators; however there is no scientific support for these claims.
- Bug 'zappers', even those using mosquito attractants, are not effective against mosquitoes.
- Citronella candles/oil lamps may provide benefit over a limited area but should not be relied upon to protect users from bites.
- Mosquito traps will attract and capture a percentage of the mosquitoes however they are expensive to purchase and maintain. They work best when placed at the periphery of large properties in areas where mosquito numbers are high.
- Mosquito-repelling plants are not effective at keeping mosquitoes from your yard.

## About Repellents

Choose and use a repellent containing one of the following active ingredients so you can spend time enjoying the outdoors knowing you are protected from biting insects and the diseases they may transmit.

### DEET

DEET-based repellents have provided effective, dependable protection since the 1950s.

Repellents containing DEET are available in various concentrations that repel insects equally well for the length of time they are needed.

DEET-based products are available in a wide variety of forms, including aerosol and pump sprays as well as wipes.

***DEET is the most effective and best-studied repellent available.***

Repels Mosquitoes	Yes
Repels Ticks	Yes
Ages for Children	Over 2 months

Hours of Protection	Against Mosquitoes	Against Ticks
Less than 10% formula	1–2 hours*†	1–2 hours* for <b>some</b> products
15–20% formula	2–6 hours*†	X
20–25% formula	5–8 hours*†	X
25–95% formula	6–10 hours* for <b>most</b> products	2–4 hours* for <b>some</b> products
95% or more formula	8–10 hours*	5–10 hours* for <b>most</b> products

### IR3535®

IR3535®, also called Merck 3535, is registered with the EPA as a biopesticide, but has been used as a synthetic repellent in Europe for over 20 years with no significant harmful effects.

IR3535® was approved for use in the United States in 1999, and is currently available in aerosol, pump sprays and wipes.

While EPA recognizes the use of IR3535® as safe for adults and children, ***be advised that it is an eye irritant.***

Repels Mosquitoes	Yes
Repels Ticks	Yes
Ages for Children	Over 6 months

Hours of Protection	Against Mosquitoes	Against Ticks
Less than 10% formula	2–4 hours*	2–4 hours*
15–20% formula	4–6 hours*	X
20% or more formula	6–8 hours*	8–12 hours* for <b>some</b> products

\* These protection times have been approved for product labels. These times are based on the technical information provided to the EPA by the companies on the effectiveness of the product against mosquitoes and/or ticks. Time frames were consolidated for all brands with the same percentage formulas.

X An "X" indicates that the majority of repellent product in this category has not been registered for protection from ticks.

† Information provided by the Centers for Disease Control and Prevention.

## Oil of Lemon Eucalyptus/PMD

Oil of Lemon Eucalyptus is a natural plant-based repellent that is derived from the oil of the leaves of the *Eucalyptus citidora* tree.

Repellents containing oil of lemon eucalyptus provide protection similar to that of products containing low concentrations of DEET.

These products tend to have a strong botanical smell and are available in a wide variety of formulations, including pump sprays and lotions.

Repels Mosquitoes	Yes
Repels Ticks	Yes
Ages for Children	Over 3 years

Hours of Protection	Against Mosquitoes	Against Ticks
20% or more formula	2-6 hours*†	6 hours* for <i>some</i> products

## Picaridin/KBR 3023

Picaridin is a synthetic repellent developed in the 1990s that has been commercially available in the United States since 2005. Picaridin is colorless, nearly odorless, and is available in multiple formulations. It provides long-lasting, effective protection similar to that of products containing identical concentrations of DEET.

Be advised that no specific recommendations regarding the use of Picaridin on children have been issued by the manufacturers or the CDC.

Repels Mosquitoes	Yes
Repels Ticks	Maybe
Ages for Children	n/a

Hours of Protection	Against Mosquitoes	Against Ticks
Less than 10% formula	1-2 hours†	X
15% formula	2-4 hours*	X

### Choose the right repellent for your activity

#### DEET, IR3535®

- Extended Hikes
- Overnight Camping

#### Oil of Lemon Eucalyptus

- Sitting at the Park
- Light Yard Work
- Stroll Around the Neighborhood

#### PICARIDIN, DEET, IR3535®

- Heavy Yard Work
- Barbecues
- Late Night Outdoor Activity
- Outdoor Festival

#### Some formulations of DEET

- Waterplay

## Reduce, Reuse & Recycle Water RESPONSIBLY

Capturing and storing water has become increasingly important as communities face the threat of water shortages caused by drought and waste. Mosquitoes will readily reproduce in water capture devices, increasing the risk of disease transmission to humans and animals in the area. We must consider all factors as we strive to maintain a sustainable and healthy environment.

Private property owners and home owner associations (HOAs) must maintain water storage/infiltration devices installed on their property. To ensure regular inspections, please report their location and any mosquito problems promptly to the District.

### RAIN BARRELS

- Tightly screen all openings on rain barrels with 1/16th inch mesh to prohibit mosquito entry. Check regularly and replace torn or degraded screens.
- Remove water that pools on the lid at least once weekly
- Keep gutters and downspouts clean and free of debris

### WATER TANKS (CISTERNS)

- Cisterns (above and below ground) must be tightly sealed to keep mosquitoes out.
- Cover all inlets, outlets, and vents with tight-fitting 1/16th inch mesh screening. Inspect regularly to ensure there are no cracks and seals remain intact.
- The cistern must be accessible for periodic maintenance and inspection for mosquito breeding.

### BEST MANAGEMENT PRACTICES (BMPs) FOR MOSQUITO CONTROL

Stormwater retention/treatment devices must be designed and properly maintained to minimize mosquito production, use of mosquito larvicides, mosquito-borne disease transmission, and other public health issues.

- Select and maintain proper slope for all water conveyances
- Ensure swales, ditches, and rain gardens are maintained properly and drain completely within 3-4 days
- Thin emergent vegetation and remove silt annually from stormwater detention basins.
- Select native, low-growing vegetation. Avoid cattails or other invasive species such as creeping water primrose, water hyacinth, and parrot feather which grow rapidly, can be difficult to maintain, and prohibit effective mosquito control and inspection.
- Underground vaults/sumps must be cleaned out regularly. Select devices designed to drain completely.

## Mosquitoes Can Make Your Pets Sick Too!

Canine (Dog) Heartworm Disease is a serious and sometimes fatal condition in dogs caused by the roundworm *Dirofilaria immitis* that lives within the dog's heart and lungs. Heartworm affects coyotes, foxes, dogs, and rarely cats, and is transmitted by mosquitoes, particularly the Western treehole mosquito (*Aedes sierrensis*).



Dog heart with heavy worm infestation.

### BIOLOGY

Adult heartworms are 6 -12 inches long and can reduce blood flow to the point that the heart, lungs, liver, and kidneys of canines are damaged. Symptoms are usually not apparent until after damage has been done. Advanced symptoms of heartworm include: rapid tiring, panting, chronic soft dry cough, listlessness, and weight loss.

Mosquitoes become infected and can transmit heartworm after feeding on an infected dog, fox, or coyote. Humans cannot develop heartworm even if bitten by an infected mosquito.

### PREVENTION

It is usually impossible for mosquito control agencies to eliminate treehole mosquitoes from a problem area because of the difficulty in locating and accessing breeding sources. Immature treehole mosquitoes develop in the water that collects in rot holes of mature trees, old tires, cans, buckets, and other containers. Treehole mosquitoes are most common in heavily wooded areas.

Homeowners should examine trees and tree stumps on their property for rot holes, cavities, and crotches that can hold water. If holes are found, consult an arborist to determine the best way to correct the problem. Holes may be filled with sand or water absorbing gel polymers (polyacrylamide). Eliminate other breeding sources by emptying, turning upside down, or throwing away containers that hold water.

#### Pet Prevention

Pet owners should consult with their veterinarian about testing and preventative medications for dogs, especially those that frequently spend time outdoors.

Canine heartworm is curable if diagnosed in the early stages.

## Insects That Resemble Mosquitoes

The San Gabriel Valley is home to numerous insects that closely resemble mosquitoes. Many of these insects emerge in large numbers during the early spring, alarming the public. The following are insects that are often mistaken for mosquitoes.

### MIDGES



Midge

#### *Actual Size*

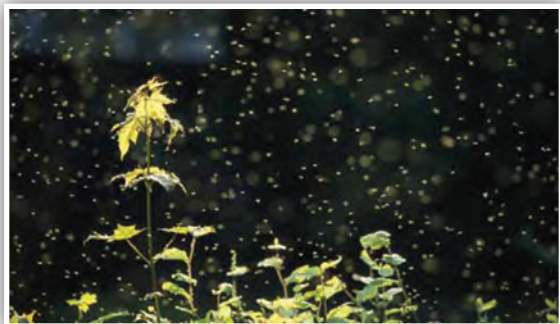
Midges are generally about 3/8" at full adult size.



Midges are small, grayish colored flies similar in size to mosquitoes. Most species do not bite or pose a health risk, but can be a serious nuisance, particularly in communities adjacent to large aquatic habitats. Tiny “no-see-ums,” however, are well known for their painful burning bites. Some people may be sensitive to midges and experience allergic reactions.

Immature midges live in damp or submerged soils and are often an important source of food for aquatic predators. Adult midges are short-lived and weak flyers. During peak emergence, massive swarms may appear like clouds of smoke from afar, and when at rest, can cover houses, cars, and other structures.

Personal protection is the best defense against biting midges; wear protective clothing such as long sleeves and pants, and apply repellent to exposed skin when these insects are present. To discourage congregations of adults, move lights away from doorways, windows, and patios, and replace mercury vapor lights with yellow or sodium vapor lights.



Swarming Midges



## CRANE FLIES



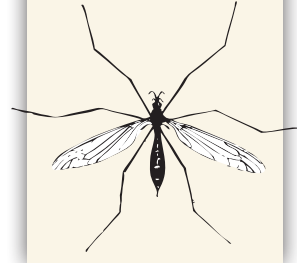
Crane Fly

Often called “mosquito hawks,” harmless crane flies are much larger than mosquitoes and cannot bite or transmit any diseases to people. Crane flies are tan, brown or reddish in color with long legs and slender bodies reaching 1 to 3 inches in length. The larvae live in moist soil, muddy water, or decomposing material.

These non-biting insects are short-lived and do not constitute a health problem but can be annoying when found inside homes or in large numbers. If they get indoors, they should be released back outside since crane flies are an important seasonal food source for birds.

### Actual Size

Crane Flies can be from 1” to 3” depending on species.



## BLACK FLY



Black Fly

One of the most irritating pests, these small biting flies often appear in our foothills in great numbers during the spring and summer months, and have moved into urban areas with the proliferation of backyard ponds and water features.

Like mosquitoes, these insects bite humans and other mammals to obtain blood proteins necessary for egg development. Locally, black flies do not transmit disease, but can cause extreme discomfort, allergic reaction, and irritation due to their biting habits and/or great numbers.

### Actual Size

Black flies are generally about 1/4” at full adult size.



### CONTROL AND PROTECTION

Black flies breed in flowing rivers and streams, irrigation ditches, and backyard water features. Control efforts are directed at the black fly larvae by interrupting water flow or using Bti/Bs products when necessary. In ponds and fountains, turn off pumps once a week for a 24 hour period to help control populations.

Avoid bites by wearing protective clothing and using DEET-based repellents, especially along the hairline and around ears.

# About the San Gabriel Valley Mosquito & Vector Control District

The District was founded in 1989 to protect residents from mosquito-borne disease through public education, surveillance, and control of mosquitoes.

As the District evolved, additional programs were added. In 1997, the Board of Trustees approved a full vector surveillance and control program.

Surveillance for vector-borne diseases include St. Louis encephalitis, western equine encephalomyelitis, West Nile virus, plague, murine typhus, hantavirus, arenavirus, and Lyme disease.

District services are provided through an Integrated Vector Management (IVM) approach which incorporates significant measures aimed at protecting the environment. The District promotes cooperation and communication with property owners, residents, social and political groups, and other governmental agencies to aid in those efforts. A strong commitment to public education is critical to achieving these goals.



The San Gabriel Valley Mosquito & Vector Control District is concerned about protecting and preserving the environment. We strive to cut down on waste and use eco-friendly materials wherever possible.

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