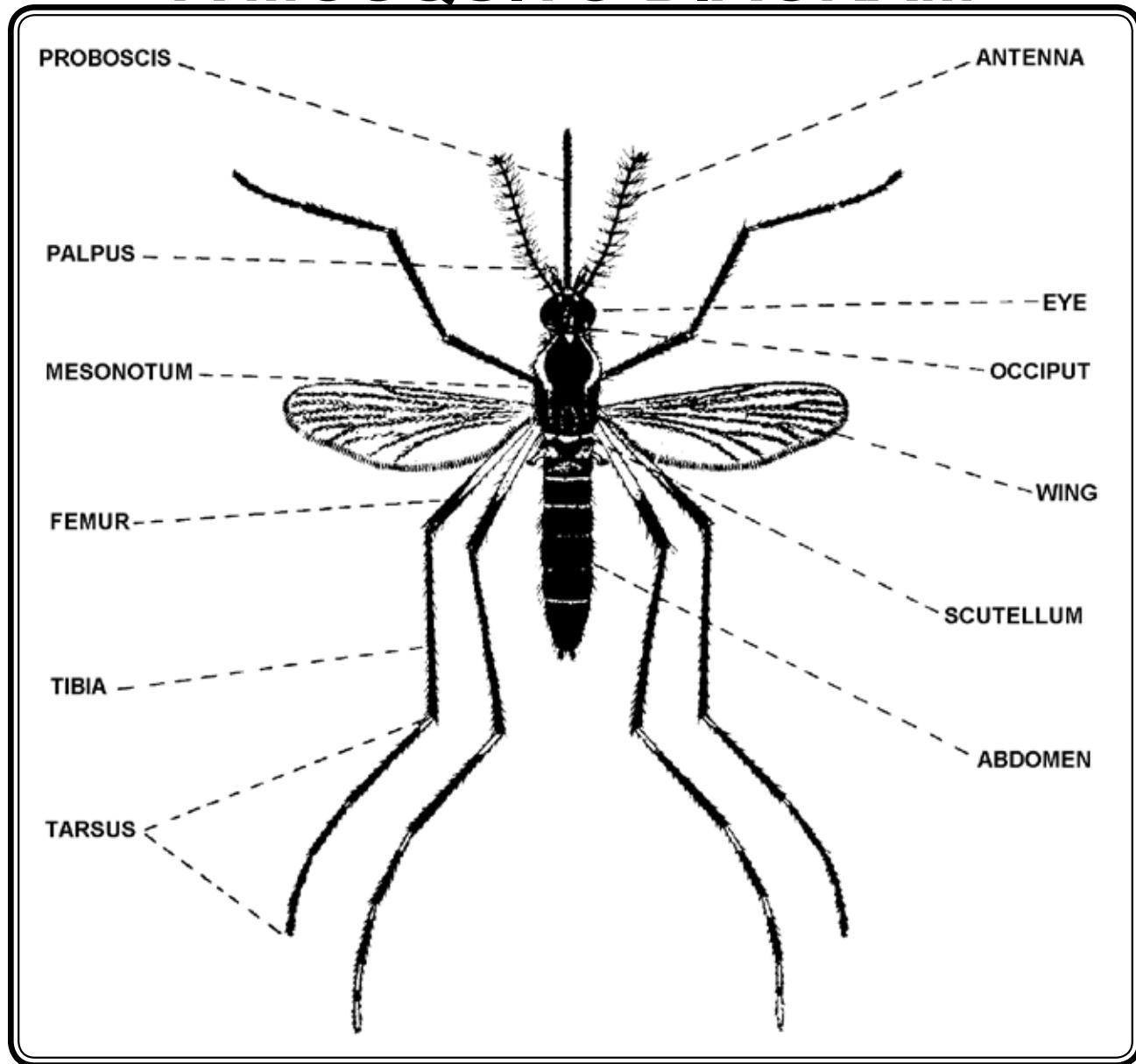


## CHAPTER 23

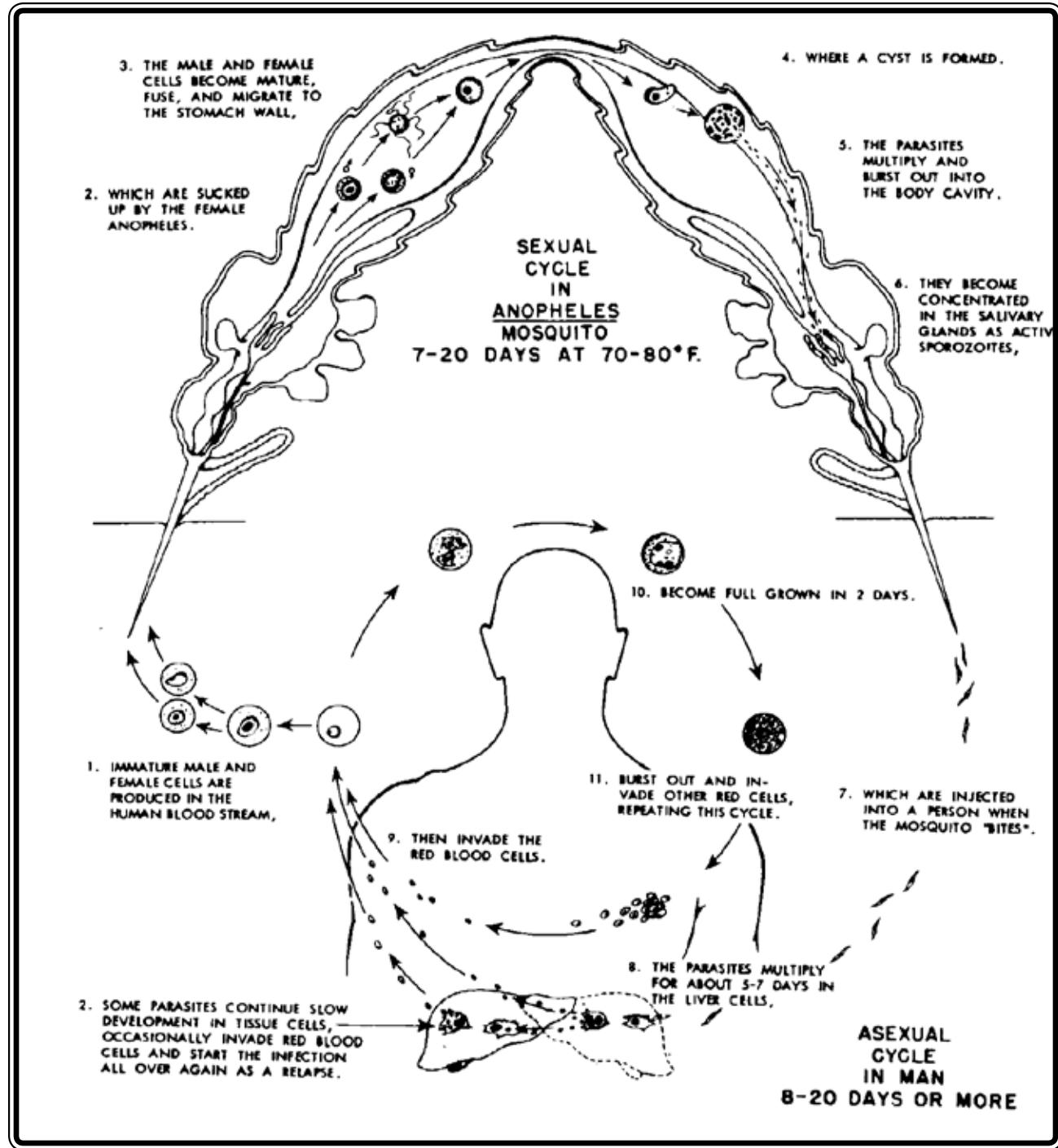
# THE BEST CONTROL FOR MOSQUITOES

Ollie and Sven are on a fishing trip in Minnesota and woke up to see shadows on the wall of their tent. Ollie looks out and sees two giant mosquitoes arguing. The first one says, "Should we eat them here or take them home?" The other mosquito thinks a minute and then says, "Let's eat them here. If we go home, the big mosquitoes will take them away from us!"

# A MOSQUITO DIAGRAM



Mosquitoes can be found all over the world from the Tropics to the Arctic. Some mosquitoes can be found 200 miles from their birthplace. There are far more mosquitoes in sewage-contaminated streams than in clean streams and these mosquitoes are also bigger and faster than those bred in cleaner waters. One species of Anopheles frequently becomes frozen but after gradual thawing revives and is capable of laying eggs. Of all the harmful creatures on earth, this little "vampire" probably poses the greatest threat to mankind. There are more than 3,450 species in the culicid, or mosquito family, worldwide and mosquito-borne diseases infect about 700 million people each year and kill 3 million according to the Centers for Disease Control. The U. S. and Canada spend more than \$150 million each year trying to control mosquitoes with poison. Residents spend more than that on repellents, insecticide poisons, screens and other products in the vain attempt to control mosquitoes. All stages can be easily destroyed with diluted Safe Solutions, Inc. enzyme cleaner, but the Author worries at the loss of non-target beneficials. Only the females bite and then only when they are actively reproducing.



## LIFE HISTORY OF THE MALARIA PARASITE (*Plasmodium vivax*) IN MAN AND THE ANOPHELES MOSQUITO

Note: By 1995 at least 1 of 4 species of the Plasmodium parasite that infect humans, e.g., *Plasmodium vivax*, *P. falciparum*, *P. malariae* and *P. ovale*, were found living in the blood of nearly 300 million people. Malaria is transferred to humans only via mosquitoes and now affects 300 - 500 million new people per year and kills 1.5 to 2.7 million people per year. Quinine no longer can control malaria - the disease has developed resistance to it. Malaria is found in at least 102 countries. In 395 A.D. 330,000 acres of farmland in Rome's Compania region were abandoned due to a malaria epidemic - Rome fell 81 years later.

In 1945, National Geographic ran an article entitled, "Your New World of Tomorrow." The photo showed two boys running after and into the almost opaque cloud of DDT being sprayed over a New York City playground to try to "control" mosquitoes. The sign on the side of the spray truck states, "Powerful Insecticide, Harmless to Humans." Somethings never change.... As the Author wrote to the New York City Health Department in April 2005, 60 years later.

## PEST OVERVIEW

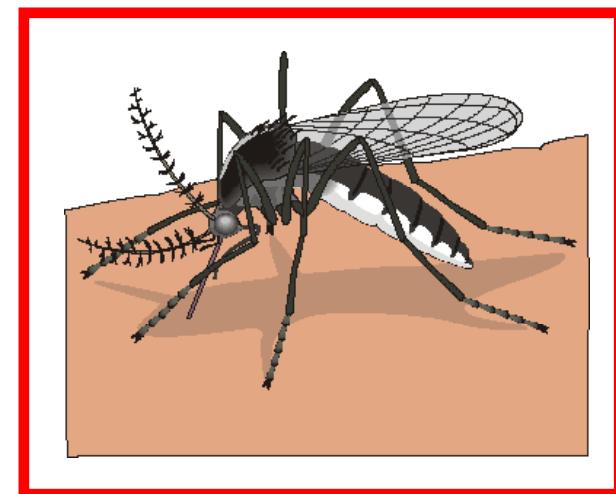
### General Description



**Mosquitoes are blood-feeding ectoparasites of people and animals.** The English call mosquitoes "gnats". There are about 100 trillion mosquitoes with at least 3,450 different species in the world. They are found from the tropics to the Arctic regions. All of the families belong to the order Diptera and are related to house flies, gnats and midges. What makes mosquitoes different from all other flies is the presence of a long, piercing mouthpart called a proboscis and the scales on the hind margins and veins of their wings. Morphologically, mosquito males differ from females in that they have feathery antennae, long feathery palps and smaller mouthparts. **Mosquitoes develop through complete metamorphosis and have four distinct states: egg, larva or "wiggler", pupa or "tumbler" and adult.** Mosquitoes need sites to lay their eggs that can hold water for 7 - 10 days.

**Mosquito eggs can be classified into three groups:** 1. eggs laid singly on the still or very slow-moving water surface (*Anopheles*), with each egg having a series of "floats" along its perimeter; 2. eggs laid in groups forming rafts made by the adult females that float on water surfaces (*Culex* and *Culiseta*); and 3. eggs laid singly out of the water in the mud (*Aedes* and *Psorophora*). Mosquito larvae are aquatic; they feed on water mites, water fleas, algae, protozoans and minute organic debris by sweeping the food into their mouths with a pair of feeding brushes. Mosquito pupae also live in the water. Adult mosquitoes are small, about 1/8" long, with a single pair of membranous wings and are free living. A typical mosquito weights about 2.5 milligrams, or about 20,000 mosquitoes per pound. Males feed on nectar as adults, but females of most species require a human and/or animal blood meal before oviposition, utilizing the protein in blood to produce their eggs and bring them to maturity. There are an estimated 10 trillion mosquitoes produced just in the U. S. each summer with about 170 species. To give you some idea how many 10 trillion is - that amounts to 41,000 mosquitoes for every man, woman and child or enough to fill the entire Grand Canyon! **A mosquito's brain is the size of the period at the end of this sentence, yet it has outwitted man since the dawn of recorded history!**

**Mosquitoes seriously harm vast numbers of people worldwide** by transmitting pathogenic organisms that cause disease and death, especially in tropical areas. Including Eastern (EEE), Western (WEE), California (CEE) and St. Louis (SLE) encephalitis, West Nile Virus (WNV), heartworm, malaria, yellow fever, dengue and filariasis. Malaria is a constant threat even in the United States where known vectors exist. Malaria, among all insect-borne diseases, has been the most deadly in modern history. During this century alone it has killed between 100-300 million people, mostly babies and small kids and it infects and debilitates hundreds of millions of others each year per WHO! CNN Trivia 2/4/98 noted that 700,000,000 people a year are infected by diseases carried by mosquitoes. In comparison, only 21 million people died in combat in World War I, World War II and the Korean War combined. Over 60 species of *Anopheles* mosquitoes are known to be capable of transmitting malaria. Travelers returning from abroad can constantly introduce the causal agents of malaria, which are microscopic protozoa in the genus *Plasmodium* spp. **On average, one person dies every 10 seconds as a result of a little mosquito "bite".** In Canada hordes of mosquitoes can actually darken the sky - researchers were bitten about 9,000 times per minute; at that rate they could lose 1/2 their blood in 2 hours and die from blood loss! But our primary reason for controlling mosquitoes usually is only to lessen the annoyance caused by their bites and then only secondarily to reduce the transmission of human and equine viral encephalitis and dog heartworm. The annoyance caused



by mosquito feeding can include the itching, restlessness, loss of sleep and nervous irritation in all people, pets and domestic animals that suffer from their attacks. Mosquitoes do not really "bite", but they penetrate their victim's hide or skin with their proboscis or hollow, flexible snout. The female has a pump in her head which she uses like a turkey baster to suck in your blood. The average meal takes about 1 millionth of a gallon per bite. Their saliva makes us itch. Usually this *minor* annoyance can not be documented in terms of economic loss, but, obviously, there may be some major economic losses, e.g., decreased recreation income and lower milk and beef production due to blood loss and irritation. Occasionally extremely large numbers of mosquitoes can actually cause the death of domestic animals through blood loss and anaphylactic shock from reactions to mass injections of mosquito saliva. **Mosquitoes are not strong fliers- so fans easily blow them away.** The reproductive success of mosquitoes depends in a large part on the ability of gravid females to locate and select oviposition sites that will support the growth development of their offspring. Enzymes diluted in water create an adverse environmental condition that renders the water repellent and/or lethal to all stages of growth and the protease enzymes destroy the malaria protozoa.

**Maintain tight screens and weather-stripping.** Use sodium vapor lamps or yellow non-attractive light bulbs at outside entrances. Remove or empty frequently any containers that may hold rainwater (flower pots, tires, cans). Clean out clogged roof gutters holding stagnant water. As a last resort, add light-weight oil or diluted enzyme cleaner to surfaces of ponds, ditches and even animal hoof prints in mud where mosquitoes may breed. Community effort is needed. Try the proper, professional use of entomopathogenic bacteria, e.g., *Bacillus thuringiensis* strains (Bt) or *Bacillus sphaericus* (Neide) (Bs), another important pathogen of mosquitoes, diluted Safe Solutions, Inc. enzyme cleaners, dehumidifiers and/or fans and other Intelligent Pest Management® controls before spraying any volatile, synthetic pesticide poisons.

**Mosquito control agencies in the United States and Canada together send over \$80 million annually using very dangerous synthetic pesticide poisons that kill or injure non-target species**, e.g., people, pets and the beneficial creatures that feed on mosquitoes, to reduce simple mosquito annoyance. They are wasting our money by attacking the adult populations which actually increase immediately after these toxins are sprayed. Flight and biting activity increases over 500% on nights with a full moon. (The Asian tiger mosquito, *Aedes albopictus*, is unusual in that it is active (biting) during the day- so bats, nighttime spraying and other nocturnal controls are not very effective. Treat tires and other stagnant water with diluted Safe Solutions, Inc. enzyme cleaner.) The mosquito's amazing whine is caused by the sound of their wings fluttering up to 600 times a second. A mosquito can sense a person 20 feet away. In studies done on Sanibel Island, Florida, we consistently found the adult population the day before the pesticide poison bombing was actually less than the day **after**. The reason is simple - the mosquitoes can replenish faster than the natural predators, e.g., dragonflies, fish, frogs, nematodes, giant water bugs, bats, spiders, birds, ants, backswimmers, snails, water scorpions and striders that feed on them can. In addition, there are increases in tree pests because the adult mosquito pesticide poisons are broad spectrum killers that kill the organisms that keep help forest pest population under natural control. Dehumidifiers, BT's, screens, fans, caulking and personal care can provide far better and, obviously, safer control. In addition we still allow entire wildlife food chains to survive. Proper Intelligent Pest Management® control includes the removal of all stagnant water, the wise use of repellents and proper clothing, the use of fans, and the development of natural predators. **Remove the cause rather than treat the symptom.** While mosquitoes remain a major killer in other parts of the world, in the United States, mosquitoes are simply not the scourge they once were. But they're still irritating, they still bite us and there are some species in the United States that may still spread disease. Mosquitoes also serve a vital ecological function. The larvae, pupae, and adults are important as food for fish, birds, bats, frogs and insects—an essential consideration when the subject of mosquito control arises. While there are more than 13 genera of mosquitoes in the United States, Most pest mosquitoes belong to one of three: *Aedes*, *Culex*, or *Anopheles*. *Aedes* mosquitoes are attracted to foot, sweat and skin odor more than CO<sub>2</sub>, transmit dengue, yellow fever, encephalitis and West Nile virus and are more active during the day. They can not survive very long during period of low humidity. *Anopheles* mosquitoes are more attracted to adult foot, sweat and skin odor than CO<sub>2</sub>; they also are attracted to Limburger cheese; they prefer to feed indoors and they can transmit filariasis, and are the primary transmitters of malaria. They are also more active at night. They are repelled by neem oils. *Culex* mosquitoes are more attracted to CO<sub>2</sub> than skin odor and can transmit St. Louis encephalitis, filariasis and West Nile virus. Mosquitoes that feed at night are more active during a full moon and are attracted to light traps. Carbon dioxide (from your expired breath) will attract most mosquitoes and other biting flies up to a range of about 50 feet. The one thing that all mosquitoes require to complete their life cycle is water. If people could manage all standing water, we would also manage all mosquitoes. While we can fill in a puddle, we don't want to fill in a salt marsh. We can empty a bucket, but it's not so easy to empty a tire dump.

Spray Safe Solutions, Inc. Enzyme Cleaner in stagnant water you can not empty or drain and you will control these pests, but remember you may also kill some beneficials. **Safe Solutions enzyme cleaners can remain active virtually as long as they are wet.**

**ORDER** - Diptera (The true flies.)

**FAMILIES** - Culicidae and Toxorhynchitinae

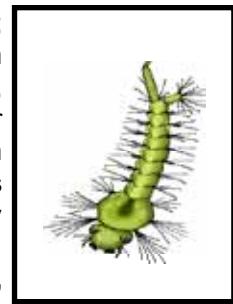
**GENERA** - *Aedes*, *Anopheles*, *Culex*, *Culiseta*, *Mansonia* and *Psorophora*

(Note: Toxorhynchitinae female mosquitoes do not feed on blood like culicine female mosquitoes which do, and contain the bulk of mosquito genera. There are about 3,500 species and subspecies and at least 34 genera worldwide. Canada has at least 74 species and the United States has over 169 species belonging to 13 genera the most important genera include *Aedes*, *Culex*, *Culiseta*, *Psorophora* and *Mansonia*. (Michigan has more than 60 species of mosquitoes; Texas has at least 83 species.)

**TYPE METAMORPHOSIS** - Complete

**Egg** - Slender, oval, usually dark and visible to the naked eye. Depending on the species, after each blood meal, females produce 50 - 500 eggs in the first brood and usually fewer number of eggs in the succeeding 8 - 10 broods. The protein in animal blood produces the yolk in the fertilized eggs. The egg-laying process can repeat itself every 3 days. *Anopheles* eggs are laid singly; in the case of *Culex* mosquitoes they are laid in clusters (rafts) in the mud or on the surface of water or wherever water is likely to accumulate. The mosquito eggs float until they are hatched in 2 - 6 days. If optimum conditions persist for only a 2-month period, an initial population of 1,000 female mosquitoes can grow into millions. For every mosquito adult biting people there may be at least 300 eggs waiting to hatch. **Mosquito eggs can lie dormant for up to 7 years!**

**Larva** - They have a large head and thorax; legless with slender abdomens and look "hairy"; up to 3/8" in length they are called "wrigglers, wiggle tails or wrigglers" and can be found in still, slow moving water feeding on small organic debris, algae and microscopic life, e.g., protozoans. Except for *Anopheles* larvae which rest horizontally on the surface of the water and breathe directly through a hole in their abdomen - the rest are in the water and a siphon tube on the abdomen is thrust into the air for oxygen. This stage usually takes 4 - 10 days and can include 4 larval instars. This is the most vulnerable stage to attack mosquitoes - they are concentrated in smaller areas. They sometimes go cannibalistic and eat the smaller, newly hatched stages. **Larvae do not normally develop in water sources with a current, e.g., rivers and streams.**



**Pupa** - Found in water, it has a large combined head and thorax and slender abdomen, giving it a comma shape. Swims actively. This stage usually takes 5 - 10 days.

**Adult** - Small and fragile, two winged with long, slender legs, capable of flying one to several miles. This genocidal insect flaps its wings 1000 times a second, creating a buzz that should warn you she is about to drip her saliva into your body and drink your blood. A mosquito can fly up to 300 miles in its lifetime. Some mosquitoes won't go more than 500 feet from the larval habitat - others can cover 6 - 8 miles a day with the help of the wind. Mature males are (as a rule) attracted to the flight sounds of the females and they "hear her" through their antennae. The female flies into a swarm of males and mating takes place almost immediately (belly to belly) in midair. Mating takes from 4 to 40 seconds and some stay together for over an hour. The Asian tiger mosquito was carried in a pile of scrap tires from either Nagasaki or Kobe, Japan to Houston, Texas and now has spread to over 21 states. Mosquitoes can only fly at 25 mph, but they can fly up, down, sideways and backwards. Wings, legs and other body parts are more less covered with tiny scales. Males have bushy feather-like antennae; females do not. They smell with their antennae. Can live from 10 - 60 days with females capable of living up to 5 months or more, depending on predator pressures. Note: They cannot fly into the wind, so simply sit in the breeze or install a fan outside. Throughout the mosquito's lifetime it can bite up to 6 times - even more if a blood meal is interrupted. Only female mosquitoes bite. They can sip up to 1-1/2 times their own weight in blood and still fly away. They can sense a person 20 feet away. They are attracted by carbon dioxide, odor, heat, moisture and wind; activity peaks at dawn or dusk. Male mosquitoes locate females by the sound of their wings in flight- the sounds range from 500 - 800 vibrations a second. Males will come to any source (e.g., a tuning fork) that produces these sounds.

## TYPICAL MOUTHPARTS

**Larva** - Chewing.

**Adult Female** - Piercing, cutting and sucking. Blood protein is needed to produce eggs. A female mosquito can consume 1½ times its weight in one feeding. If she gets too bloated with your blood to fly, she literally releases a little "piddle" from her bladder on you.

**Adult Male** - Tube not fitted for piercing the skin; feeds only on flower nectar and fruit juices. The male helps pollinate flowers.

**DISEASE ASPECTS** - Mosquito bites result in red swollen areas called wheals which itch severely. Some people are highly allergic to the proteins injected by mosquitoes and are ill for days. They are vectors of malaria, yellow fever, dengue, canine heartworm and several forms of filariasis and encephalitis. Canine heartworm disease is a serious, deadly disease wherever mosquitoes are present. Thousands of dogs each year just in Michigan become permanently debilitated or die from lung, heart or circulatory problems caused by heartworms. Heartworms, the diameter of a tooth pick, can grow from 5" to 14" long. In advanced cases, 100 or more worms have been found in a single heart.

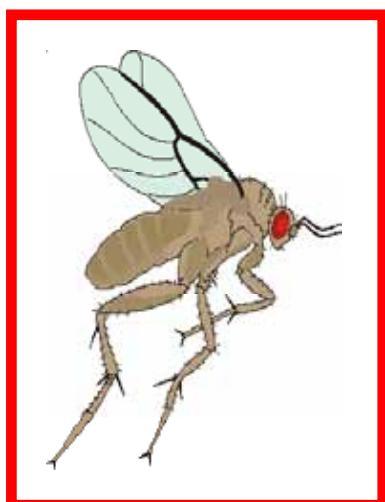
**LENGTH OF LIFE CYCLE** - Varies among species and climatic conditions; usually about 2 - 9 weeks.

**LIFE CYCLE** - Of the four life stages of the mosquito—egg, larva, pupa, and adult—the adult is the only stage that doesn't exist in standing water. Males live 1-2 weeks, but females can live up to 2 months.

The female mosquito lays her eggs on the water or, in the case of *Aedes* mosquitoes, above the water in areas that are sheltered from waves and with sufficient organic matter to feed the larvae. Eggs laid on the water's surface hatch in one to three days. Eggs laid by *Aedes* mosquitoes above the water line remain dormant until they are flooded.

The mosquito larvae or "wrigglers" that hatch must live in water to survive. They float at the surface breathing through an air tube and filtering food material through their mouth brushes. When disturbed, the mosquito larvae dive towards the bottom with a jerking motion. The larval stage lasts from five days to several weeks depending on the species and on environmental conditions such as water temperature.

The mosquito larvae transform into pupae or "tumblers". Although the mosquito pupae don't feed, they are quite active and may be seen breathing at the surface or bobbing through the water. Inside the pupal skin, the adult mosquito is developing and will emerge in two to three days. Mosquitoes pass the winter either in the egg stage or as adults.



**FEEDING HABITS** - Only the female mosquito sucks blood, which she needs to lay eggs, but she feeds on plant nectar for energy. Her mouthparts have 6 long hollow needles; through one of the needles she drips saliva into the wound to keep the blood from clotting as she sucks it up through the other hollow needles. Adult male mosquitoes feed only on plant nectar and are harmless to people.

Most female mosquitoes feed during the last 2 hours of sunlight until just after dark and begin just again before daylight. They spend the daylight hours hiding and resting in dark, damp, cool areas. Some mosquito species, however, feed during the day and others feed during both day and night.

The mosquito's blood-sucking habit is what causes certain species of mosquitoes to be disease vectors. If a female mosquito sucks blood from a person infected with malaria, for instance, the disease organisms can survive and reproduce in the mosquito, ending up in her salivary glands. When she next feeds on a host, she inoculates her new victim with the disease.

Larval mosquitoes feed on organic debris (with the exception of a few species that are predators). They use a pair of mouth brushes to strain out small aquatic organisms and particles of plant and animal material present in the water. **Note: Safe Solutions, Inc. enzyme cleaners will help "eat" the organic debris.**

**HABITAT** - Mosquito eggs, larvae and pupae are found in undisturbed, slow moving or stagnant water. Adults normally stay in protected, secluded places during the day. They become active and bite late in the afternoon and during the early evening and morning hours when the wind is calm. Mosquitoes are most prevalent in moist, wooded or lowland areas. **Eliminate water habitats and you control mosquitoes!**

**NATURE OF INJURY** - Mosquitoes are persistent biters of all warm blooded animals and some cold-blooded creatures, e.g., frogs and snakes. They individually consume about 2 - 8 milligrams of blood per meal. Aside from irritating bites, a number of species transmit diseases and have caused allergic reactions and even death. *Aedes aegypti* is worldwide in distribution; carries urban yellow fever and the only known vector of Dengue in the New World. The malarial parasite carried by mosquitoes probably kills a million people in Africa each year. Malaria claims 2-7 million lives throughout the world annually. Mosquitoes also carry yellow fever and at least 100 different viruses - these diseases adversely affect at least 800 million people every year. The *Anopheles* mosquito, for instance, carries malaria, and several species including *Culex*, the common house mosquito that stings **before** she bites, transport encephalitis-causing viruses. You can sample/collect with biting or landing counts.

**Seasonal Abundance.** Mosquitoes may breed and develop any time from the beginning of spring to the first hard frost of fall. In general, populations are highest in summer and early fall. There may be from one to several generations of mosquitoes during a season depending on the species, the temperature, and the amount of rainfall.

When rainfall is abundant, many mosquito species can lay eggs continuously. Under ideal conditions with high temperatures, development can be completed in less than a week, resulting in large populations of flying adults. We do not suggest you use DEET, not only do we believe this product is dangerous - the repellent only works after the mosquito lands on *treated* skin, it gets confused and forgets what they were going to do and fly away - if you forget a patch of skin they will find it right away.

**Medical Importance.** Worldwide, mosquitoes transmit many debilitating and fatal diseases, especially in tropical, developing countries. The most important of these is malaria, which has been on the increase in the last decade. The Centers for Disease Control and Prevention and the World Health Organization both report that currently available treatments for yellow fever and malaria are failing. In the United States, most mosquitoes are primarily an annoyance, causing itching bites and welts that can become secondarily infected. Human mosquito-transmitted diseases remain relatively rare, due largely to modern pest control methods and disease detection. Encephalitis, among humans, and dog heartworm, among dogs, are the main diseases transmitted by mosquitoes in the United States. Pregnant women attract mosquito attacks more than anyone.

**Malaria.** Worldwide infections of mosquito-borne malaria effect about 300 million people per year. As mosquitoes become more and more resistant to insecticides each year, new control strategies are sorely needed. Researchers at the Johns Hopkins School of Public Health have identified a protein in the salivary glands of the female *Anopheles gambiae* mosquito - the primary carrier in Africa - that appears to help Plasmodium recognize and gain entrance to that mosquito's salivary gland. The Author believes that his patented use of enzymes and surfactants will help destroy this protein.

**Encephalitis.** At least six types of mosquito-transmitted encephalitis occur in the United States. These are Eastern equine encephalitis, Western equine encephalitis, California encephalitis, St. Louis encephalitis, Venezuelan equine encephalitis, and La Crosse encephalitis. Each type is caused by a different virus or virus complex affecting the central nervous system. Symptoms of EEE in horses include fever, impaired vision, irregular gait, reduced reflexes, inability to swallow, convulsion and death. These viruses are normally transmitted by mosquitoes from birds or small mammals. EEE is normally carried by a species of mosquitoes that bite only infected birds but do not bite people. When there are other mosquito species that feed on birds and mammals present, these other mosquito species may pick up the EEE virus and transmit it. Occasionally horses or humans are infected. Despite the small number of people infected annually by eastern equine encephalitis, it is considered a serious disease because it is often fatal. EEE kills 30% - 70% of those who suffer central nervous system infection and it leaves most survivors with brain damage. It is twice as deadly as West Nile Virus. Vaccinating horses properly

will prevent them from contracting Eastern equine encephalitis, but I want to prove the garlic/food-grade DE will also prevent this disease as it did West Nile Virus.

**West Nile Virus.** Roy Hill of the University of Queensland and a team of Australian researchers were written up in USA Today 8/12/03 in an article entitled, "Virus experiment in mice could be a first step toward a vaccine." A relatively harmless virus called kunjin was injected into mice with various amounts of the modified kunjin DNA. The mouse blood then produced antibodies to both kunjin and West Nile viruses. This report was also in that week's on-line edition of "Proceedings of the National Academy of Sciences." Researchers suggested a possible kunjin vaccine for both horses and humans. West Nile Virus was first seen in the USA in 1999; in 2002 it killed at least 284 of us. The Author believes the birds become immune in about four years!

**Dog heartworm.** This is a filarial parasitic disease transmitted by a number of different mosquitoes to dogs and, rarely, man. Once a problem only in the U. S. coastal areas, dog heartworm is now found in every state in the United States. The nematodes, which lodge and grow in the heart tissue, can be fatal to dogs if left untreated.

**There has been some concern about whether mosquitoes are capable of transmitting AIDS** from an infected person to an uninfected person. Unlike encephalitis viruses and other mosquito-transmitted (viral) diseases, the HIV virus that causes AIDS is supposedly not able to survive inside the body of the mosquito. **However, the American cockroach and ticks in Africa have already been implicated in the spread of HIV.**

## **MONITORING AND THRESHOLDS**

### **Introduction**

Mosquito sampling and counting the mosquito population accomplishes a number of things. It helps determine whether mosquito control is necessary. It determines what growth stage the mosquitoes are in, providing information necessary to properly time control methods. It tells which mosquito species are present, especially important in areas of disease outbreaks. Finally, it helps to gauge how effective control efforts have been and when they need to be employed again.

Mosquito sampling should be done at least once a week, and more often during peak season. It is important to consistently sample the same sites each time. The numbers counted, the growth stage, and the species and sex should be needed when possible. All of this information gives an estimate of the population and must be compared with previous counts to determine whether the number of mosquitoes are increasing or decreasing. You can make an estimate of the number of mosquitoes in an area by counts of larvae or adults or both.

### **Larval Dipper Counts**

Mosquito larval dippers can be purchased through biological supply houses or you can make your own. It is basically a shallow, plastic, enamel, or aluminum cup attached to a long handle. To collect floating mosquito larvae, pupae, depress one end of the dipper under the surface and quickly but smoothly scoop up larvae. If you move too quickly or cast a shadow over the surface, they will dive to the bottom. The number of dips at each site will vary according to the size of the water body, but generally are in multiples of ten. Take five dips from open water and five from the water's edge, near vegetation if possible. Dipper instructions should be made weekly during breeding season. Larvae can also breed in rainwater that has collected in containers such as eavestroughs, toys, buckets, garbage cans, canoes, tires, and animal watering troughs. To sample larvae in less accessible areas such as tree holes, use a large basting syringe to collect them. Empty them into a white pan for counting to mosquito larvae. One advantage to sampling larvae is that the problem can be treated with Safe Solutions, Inc. Enzyme Cleaner with Peppermint at the same time it is identified. When counting adult mosquitoes, the mosquitoes can be flying in from some distance away.

### **Adult Trapping**

Trapping of adult mosquitoes gives information on the relative population size and the species composition. Light traps are very helpful for monitoring certain species of mosquitoes. Not all mosquito species are attracted to lights, e.g., Anopheles and Aedes. Different models of traps vary in the numbers, the species, and the proportion of males to females that they each attract and catch. New Jersey light traps with a frosted 25 watt bulb and CDC light traps (and their variations) are the traps most commonly used. Light traps are operated from dusk to

dawn, powered either by electric line or a battery. Some traps are available with a photoelectric cell that turns the light on at dusk and off at dawn. When mosquitoes approach the light, they are blown by a small fan down through a funnel into a killing bag or jar. The light mosquito trap should be hung about 6' off the ground in an open area near trees or shrubs but away from competing lights and buildings. Traps should be emptied each morning and the catch stored in a labeled box until it can be sorted and identified.

Since mosquitoes are attracted to carbon dioxide in the host's breath, some light traps are augmented with a one pound block of dry ice, wrapped in newspaper and hung next to the trap. The addition of dry ice also allows sampling on moonlit nights or in areas where bright lights may conflict with the light trap. And it allows daytime sampling of species that are active during the day or that are not attracted to lights. Other traps include sweep nets and large drop nets of various designs.

Because some mosquito species are not attracted to light traps they should be used in conjunction with other kinds of sampling methods. Monitoring for adult mosquitoes is an important part of the management of some mosquito-vector diseases such as eastern equine encephalitis. The decision to use pesticides for mosquito suppression should be made only after intensive monitoring of the mosquito population in an area to determine if the species that actually vectors the disease to humans or horses is present. The incidence of the disease in the wild animal population (or in caged chickens) is monitored as a way to estimate the possibility of transmission to humans or horses. Education is also emphasized to alert people to the presence of the disease and how to go about protecting themselves.

We are looking into a new trap that creates CO<sub>2</sub> electronically, not with propane.

### **Resting Stations**

Adults of many species are inactive during the day and rest quietly in cool, dark and damp places. Daytime collections made at these sites give a good indication of the species of mosquitoes present in the area.

### **Adult Landing/Biting Counts**

Collecting mosquitoes as they land on you or an animal to bite is a convenient method of sampling biting populations. It simply involves rolling up a sleeve or pants leg or exposing your back and sitting quietly for a designated period of time, usually 10 minutes. During that time, each mosquito that lands on the leg or arm or back is collected with a battery or mouth-operated aspirator. It is important that you collect each landing mosquito for counting and identification and to ensure that you don't count the same individual again. Mosquito biting counts are best conducted from 30 minutes before sunset to 30 minutes after sunset (unless sampling day-biting species) by the same person each time.

The advantage to using landing counts as a mosquito sampling device is that you are counting only the biting (female) mosquitoes. The method does not collect male mosquitoes or species that do not actively bite people. It can also be used to count and collect daytime biters.

When sampling adult mosquitoes, sample any and all areas where mosquitoes may be a nuisance. Obviously, you should sample areas from which you have received complaints and near areas with high larval or pupal counts. Sample the same sites regularly, from one to seven nights a week. Adult mosquito information is most useful in gauging the extent of your mosquito problem, since it is only the adults which transmit disease or create a nuisance.

### **Threshold/Action Population Level**

The data from mosquito sampling and monitoring will be used to help decide at which mosquito infestation level to initiate management tactics. This decision level may be based on larval and/or adult counts, mosquito complaints from visitors, residents, students, patients, etc. the potential for disease outbreaks, and the risk of the management tactics to other animals. For instance, in an area where there have been actual reported encephalitis cases, the risk is higher and the action level will, obviously, be lower than in other cases.

The number and location of mosquito complaints should be plotted on a graph against the counts of immatures

adults for the same date and site. The amount of unacceptable complaints is the injury level. The graph should show the number of mosquitoes that correspond to the complaint injury level. This is your action level. Action levels will, obviously, be different for each situation. In some areas, general annoyance does not occur until the number of female mosquitoes caught in light traps exceeds 25 per night. Other action levels that have been used are landing rates averaging more than 5 mosquitoes in 10 minutes and dipper counts averaging 5 larvae per dip or the outbreak of disease.

**HARBORAGE POINTS** - Here in the USA we are told we should drain our wetlands, but the government will not allow this to happen. Young mosquito stages breed in any available still water. Mosquitoes may be found in birdbaths, blocked rain gutters, rain barrels, buckets, old tires, bottles, dishes, tin cans, jars, cisterns, watering cans, toys, carts, hollow stumps or trees, plastic wading pools, septic tanks, air conditioner drain outlets, utility meters, wheelbarrows, ponds, over irrigated lawns, cesspools, watering troughs, drainage ditches, mud puddles, flower vases, potted plant saucers, unused toilets, hoof prints, water softening tanks, wells, on flat roofs and any other place where undisturbed or stagnant water can collect. At night, like vampires, the adults emerge from breeding sites and fly to areas of human and animal habitation to obtain blood. During the day most adults remain secluded in such places as trees, outbuildings, shrubbery, cars and homes. Eliminate cool, dark, damp areas. **Wash/fog/spray infested areas with diluted Safe Solutions, Inc. Enzyme Cleaner with Peppermint.**

**INTELLIGENT PEST MANAGEMENT® CONTROL** - First of all, identify the pest mosquito species then establish a quantity tolerance or acceptable injury levels. Remember to keep all screens in good repair. **Mosquitoes have become resistant to many “registered” insecticide poisons.** Cover all flues and chimneys, especially during the summer months. Eliminate resting places such as tall grass, weeds, shrubbery and vines from around the buildings. Eliminate rainwater-collecting items such as old tires, pans, cans, buckets, etc. Never kill any dragonflies or damselflies who both eat lots of mosquito larvae and adults. At least once a week, drain or treat plastic swimming pools and birdbaths. Provide for proper water drainage around the foundation of the building. When visiting mosquito-infested areas, wear protective clothing to prevent bites. If small garden ponds are present, use fish (*Gambusia* sp. or others), or treat ponds with *Bacillus thuringiensis israelensis* or diluted enzyme cleaner as a safe and effective alternative.

The key factor in a mosquito intelligent pest management® program is determining whether or not control is necessary. This decision requires a regular mosquito sampling program to determine what species are present and in what numbers, and a set of action thresholds to determine if management tactics are necessary. If control is needed, then decisions have to be made on the best combination of tactics to suppress the mosquito population while affecting the environment as little as possible. You can always swat them, but often you create a breeze with your intended blow that blows them away. If you lightly pinch your skin on either side, the pressure will trap her stinger inside and even when her sensors tell her to stop, she'll continue to take in blood until she literally explodes.

Normally, source reduction—eliminating or altering the water so that the mosquitoes cannot breed or complete their life cycle—is the first choice for control. If source reduction is impossible or incomplete, the next tactic to consider should be biological control of the larvae with numerous predators, bacterial insecticides, or growth regulators. Measures that increase water circulation like the Clean-Flo® system and vegetation removal or altering water circulation patterns may reduce mosquito breeding. Likewise, Natural Systems, 1-805-962-9953 , scale removing systems that electrically create negative ions, oxygen and hyrodgen peroxide show great promise. Enviro-Green™, 1-800-221-6188, using a system created by Ken Martin also can control mosquitoes at basically no cost. Ken's system of using aerobic bacteria and varius green algae and a small daily injection of nutrient provides an amazing answer to mosquito control while it also improves the soil or water. We are constantly looking at various combinations of bacteria and enzymes to restore water and/or to control pests. Interpretive displays (education) can be used to explain the role of mosquitoes as a food source for animals such as bats, birds, fish, and to help people understand that not all mosquitoes bite or carry disease and so all mosquitoes do not need to be killed. Personal protection through the use of proper clothing and mosquito repellents and fans can be explained, as well as the avoidance of areas with high mosquito populations.

### **Source Reduction**

**The simple fact that all mosquito species require water and aquatic vegetation to develop is the obvious key to their control.** No standing water means no mosquitoes. Aquatic vegetation offers mosquito larvae and

pupae protection from wave action and natural predators. Source reduction is the first step in an intelligent pest management® program for mosquitoes. It is simply the use of mechanical methods to eliminate standing water. Source reduction involves filling, deepening, draining, ditching, managing water levels, maintaining shorelines, managing aquatic and inundated vegetation, and others. While these methods may prove to be more extensive and more expensive than some other controls, in most cases they need be done only once. Unfortunately, these methods will most likely require permitting from several agencies before they can be implemented. They are also not feasible in natural zones. Look in the water to see the "wrigglers" (larvae) and "tumblers" (pupae) that indicate mosquitoes are breeding in the water then add Safe Solutions, Inc. enzyme cleaners and see your mosquito population in or out of the water disappear.

Source reduction controls the immature mosquito stages—eggs, larvae and pupae. Because these stages are concentrated in discreet bodies of water, they are much easier to control than are dispersed adult mosquitoes. Two water management tactics are ditching and ponding. That these would only be allowed in a developed zone. Ditching controls mosquitoes in two ways. In some cases water drains out of the potential breeding sites. In others, ditching allows fish access to the isolated pools where they prey upon the larvae and pupae. Ponding is another water management tactic that turns a temporary pool breeding mosquitoes into a permanent one capable of supporting fish and other mosquito predators. Ponding is accomplished by raising water level, digging new pools, or through impoundment.

If standing water can't be completely eliminated, control of mosquito larvae in the water is the next step. This is best done with natural controls such as mosquito fish or biorational insecticides. The latter do not affect pupae and should not be used if this is the predominant life stage. **You can use Safe Solutions, Inc. Enzyme Cleaners at any stage to gain immediate control.**

### **Tips On Eliminating Mosquito Breeding Sites On Your Property.**

The objective is to eliminates all water sites where mosquitoes can breed. Remember, some species of mosquitoes can breed in as little as one-half inch of standing water.

Some mosquitoes can hatch in as little as one week. Where drinking water must be made available-as for pets and other animals-it is necessary to change the water and flush out the container at least once a week to disrupt the breeding cycle of mosquitoes.

***Following is a list of things you can do to try to reduce mosquito breeding grounds on your property.***

- Increase water flow and decrease water surface area or tension and improve natural drainage.  
Routinely flush or drain water breeding areas. A fountain will force rippling, which will drown pupae.
- Clean out your eaves, troughs and gutters. Constantly monitor for new larval habitats.
- Keep grass cut short and shrubbery well trimmed to eliminate cool hiding places.
- Remove old tires or drill holes in those used for playground equipment to allow them to drain.
- Turn over or remove plastic pots, buckets and tin cans. Cover trash containers.
- Pick up broken, unused or discarded toys.
- Pick up all beverage containers and cups and/or plates.
- Check tarps on boats or other equipment that may collect water in pockets or indentations.
- Pump out bilges on boats or add enzyme cleaner or some food-grade DE or starch.
- Replace water in birdbaths at least once a week or add a drop or two of Safe Solutions, Inc. enzyme cleaner.
- Replace water in pet or other animal feeding dishes or troughs at least once a week.
- Dispose of broken or used kiddie pools.
- Pick up plastic wrappers used for food or other products; mosquitoes can breed even in a potato chip bag that has collected water.
- Don't leave garbage can lids lying around upside down check basins at road corners.
- Check plants, such as bromeliads, with large leaves that may collect water in axils, where the leaves join the stem. Eliminate the plant, keep it inside, or flush it out with a spray of water or tip the plant over at least once a week or add a drop or two of enzyme cleaner.
- Check holes in trees or stumps or low spots that may collect water; remove stumps, plug holes with sand or aerosol foam or cement, or flush out with spray of water or diluted Safe Solutions, Inc. enzyme

- cleaner at least once a week.
- Change water in bottom of plant containers, including hanging plants, at least once a week.
  - Remove vegetation or obstructions in drainage ditches that prevent the flow of water.
  - Fix dripping outdoor faucets or pipes that create pools of water and air conditioner drain outlets.
  - Check wheelbarrows, pet/livestock watering containers, sump pump pits, swampy areas, bromeliads, low spots in tarps, flower pots, vases, dry wells, rain barrels, ornamental pools, flat roofs and ditches.
  - **Add Safe Solutions Enzyme Cleaner or food-grade DE or starch to all standing water sources.**
  - Cultivate bat, dragonfly and damselfly populations to eat them.

Empedocles, a physician and philosopher in the mid-fifth century B.C., is credited with draining marshes and running two rivers together through the town of Selinunte; thus he prevented the water from becoming a breeding ground for mosquitoes. He also broke a gap in the rock wall behind his native town of Agrigentum so the “healthy north wind could blow the fever-bearing vapors (and mosquitoes) of the plain far our to sea.” In 1909 Brazilian rubber plantations paid workers to smoke Il Negro Mortes or “the black cigars of death” on the verandas of their mansions. These lethal cigars were made of tobacco, chemicals and petroleum tar; the fumes were effective, but it is estimated one smoker died for every 5 billion mosquitoes that were killed.

**Diet for Mosquitoes?** University of Florida scientist, Don Borovsky, is quite willing to share his recipe to control mosquito populations:

First, take 100,000 mosquito ovaries, dried and crushed into a powder that contains their digestive control hormone (**see Bug Juice**). From the nearest pool or pond, scrape off the green scum, also known as chlorella, an algae. Insert the hormone into the chlorella, make it into a pill, then place the pill into any water body where mosquitoes are known to breed. Then watch the larvae feast on the chlorella. Famine follows. Borovsky said when he first pulled out mosquito ovaries, homogenized them and inserted them back into mosquitoes, he found that the mosquitoes produced no more eggs.

“So at first we thought we had a birth control pill,” Borovsky said. “But then we found that the reason they were not producing eggs was because they were not digesting, so then we knew we had a diet pill, not a birth control pill.”

“Fortunately, now we can synthesize the hormone, so we don’t have to use 100,000 ovaries for each batch anymore,” Borovsky said. The synthesized hormone is inexpensive, as is chlorella, which is found and produced worldwide. Chlorella, in fact, turns out to be the perfect ride for the mosquito hormone, because it can be freeze-dried and stored for long periods and then brought back to life as the deadly diet pill.

“This is a natural bullet that we can use in the environment because the hormone doesn’t stay in the environment,” Borovsky said. “The chlorella stops producing the hormone within three weeks.”

That’s by design, Borovsky said. If the hormone were incorporated into the chlorella genome and chlorella continued to produce the hormone, making it omnipresent in the environment, mosquitoes could become resistant to it. But the hormone sits outside the genome and, after the third division of the chlorella, it no longer can be detected.

Of course, Borovsky points, if mosquitoes become resistant to their own reproductive hormone, that could have unknown adverse consequences for them as well. “We have to stay a step ahead of them or outsmart them all over again,” Borovsky said.

### Natural Enemies

Mosquito larvae are an important food for many aquatic organisms. Large numbers fall prey to phantom gnats, damselflies, dragonflies, fish, shrimp, other water insects, and spiders. Naturally occurring enzymes, bacteria, protozoa, snails, fungi, and nematodes also kill mosquito larvae. Both bacteria and predatory fish have been used as biocontrol agents to control mosquito larvae. Adult mosquitoes are also fed upon by birds, bats, frogs, lizards, spiders and insects out of the water environment. Dragonflies have eyes with as many as 28,000 facets and can spot a mosquito 25 feet away and fly at a speed of 60 mph.

## Mechanical Controls

Screening of doors, windows, and vents is a time-honored method of keeping mosquitoes out of structures. Ordinary window screen of 16x16 or 14x18 meshes to the inch will keep out most mosquitoes. There are new mosquito control devices, e.g., the Mosquito Magnet which attracts and kills mosquitoes. Campers can use fans and/or hang mosquito netting over cots, tent openings, picnic tables, etc. Long sleeves, long pants, hats and veils give additional protection from mosquitoes. **Water that is moving fast prevents mosquito breeding.**

**"Bug zappers" and ultrasonic devices have not been proven to be effective** in controlling mosquitoes and other noxious flying insects. Try to reduce the population by fogging with enzyme cleaners. Generally, mosquito control is best undertaken on an area wide basis by public health agencies or mosquito abatement districts. We only recommend they use the bacterium *Bacillus thuringiensis israelensis* because it is relatively safe and environmentally sound. Bti is highly selective, killing only mosquitoes and several other water inhabiting insects. First try spraying with Safe Solutions, Inc. Not Nice to Bugs® or their Enzyme Cleaner with Peppermint or simply dish soap and water and/or garlic oil or cedar oil and use Safe Solutions Insect Repellent.

## HOW Bti WORKS TO CONTROL MOSQUITOES

The bacterium *Bacillus thuringiensis israelensis* infects and kills mosquito larvae. It is relatively safe and environmentally sound because it is highly selective, killing only mosquitoes and certain related water-inhabiting insects. The larvae feed on Bti spores and crystals suspended in the water. Within 10 minutes the spores and crystals enter the gut of the larva and the crystals dissolve. Within 1 - 4 hours the gut wall of the larvae break down from the action of these toxic crystals. Then, within 2 - 12 hours after the crystals have done their work, the spores escape into the larvae's body cavity and the larvae die. Note: There have been increased reports of low-level resistances to both Bt strains and Bs.

## NON-TOXIC MOSQUITO CONTROL

**PREFORMED ENZYME CLEANERS** - Safe Solutions, Inc. enzyme cleaners are organic, enzymatic, bio-catalytic agents which have proven to be outstandingly effective for mosquito larva and pupae control. THESE CLEANERS ALTER THE SURFACE TENSION OF WATER SO THAT LARVAE AND PUPAE HAVE DIFFICULTY MAKING CONTACT WITH THE AIR ABOVE THE WATER SURFACE film. Adult mosquitoes can not maintain surface contact on water properly treated with preformed enzyme cleaners. Late winter treatment of potential breeding water will preclude breeding. Other insects, as well as leaves, etc., do not remain on surface of water properly treated with preformed enzyme cleaners, but sink below the surface.

It is interesting to note that the pupal stage is the most quickly affected by preformed enzyme cleaners, whereas larvae tend to persist for longer periods both in field and laboratory experience. The opposite is found to be the case in the use of "registered" insecticide poisons, where the larval stage is the one most quickly killed. In stagnant water, large ponds, bird bathes, etc. you will note ultra-active response of the aquatic organisms upon initial addition of performed enzyme cleaners, as siphon tubes can no longer make contact with outside air. In many instances 100% control has been achieved. It is less effective and has less residual effect in moving water or in a pond with both inlets and outlets.

**Muck and Organic Sediment Removal:** Safe Solutions enzyme cleaner and/or other bacteria, especially when combined with Clean Flo's lake, pond and sewage aeration/inversion systems, really can digest bottom debris.

**NOTE: Both enzyme cleaners, either with or without peppermint by Safe Solutions, Inc., 1-888-443-8738 are not currently registered for use as pesticides by the EPA; the above information was obtained in field tests by independent parties using enzyme cleaners and listed for informational/educational purposes only - they are only noted for their potential for use in safe, effective mosquito control.**

**GARLIC** - 1 gallon of concentrate will treat almost 3 acres. The concentrate should be applied 48 hours before any rainfall because it needs time to systemically enter the vegetation. Then it repels mosquitoes for 1 - 2 weeks and as long as 1 - 2 months during a dry spell. Mix the concentrate 2 oz. per gal. of cool water via hose-end sprayer or canister or boom spray rig or, better yet, a mister. Make sure you are using at least 99% pure garlic juice; the

stinkier the better. Apply just before sunset when there is no dew on the ground. The odor will leave in about 1 hour. This treatment will generally repel fleas, ticks, deer, rabbits and geese, and has some fungicidal qualities.

## OTHER WAYS TO CONTROL MOSQUITOES

Altosid® or methoprene induces damaging morphological changes in the second, third and fourth instars of mosquito larvae, resulting in the failure of adult mosquitoes to emerge from pupae. Timing is very important because only mature larvae are effected. Impregnated on sand or packaged in slow-release briquettes, this IGR is effective for 30 days in standing water. It can be also applied as a spray solution from the air or ground. We also highly recommend the use of predatory mosquito larvae (*Toxorhynchites spp.*), the mermethid or mosquito-attacking nematode, *Romanomermis culicivorax* and/or the mosquito-eating fish, *Gambusa affinis*, killfish (fundulidae), minnows (cyprinidae), and/or tilapia and/or tadpole shrimp (*Triops longicaudatus*) and or guppies, e.g., *Legister reliculatus* wherever possible. The killfishes (Fundulus) in salt water and the top minnows (*Gambusia*, *Labistes*, and *Panchax*) in fresh water are most useful. The effective use of any chemical control depends on species of mosquitoes, the area of country, the time of year and many other factors. It is very difficult to obtain satisfactory control of night flying mosquitoes by treating even very large areas with synthetic pesticide poisons, so never try a "spot" application. Mosquitoes are attracted to carbon dioxide, so use dry ice traps. Avoid exercising outside, especially at dusk, when they are most voracious. However, there are some methods which will reduce a mosquito problem on an individual structure basis. **Safe Solutions, Inc. enzyme cleaners quickly kill all stages of all mosquito species and often remain active as long as they are wet - so use with caution.**

## INTELLIGENT PEST MANAGEMENT® CONTROL OVERVIEW

- A. **First correctly identify the adult species.** Use a gravid or light trap for monitoring adult mosquitoes. The Centers for Disease Control have standardized the design of light traps used for mosquito monitoring. Such traps cannot be used for mosquito control; however, because their capacity is too limited. Mosquitoes are attracted to the light or dry ice, enter the trap and are then blown downward by a small fan into a mesh bag, from which they cannot escape. Note: DEET was originally patented as a mosquito attractant.
- B. **Establish tolerance, annoyance, action or injury levels.** Find and note the larval source of all the biting adult species. Eliminate the larval sources if at all possible by draining and/or filling them in. Install bat and/or purple martin houses outside. Use other biological controls/predators/fans.
- C. **Inspect the premises thoroughly** for standing water and other breeding sites. All receptacles in which water can accumulate should be routinely emptied, filled in and/or destroyed if possible. Plumbing leaks which are causing puddles should be repaired. Bird baths, watering troughs and other water storage points which cannot be treated with Safe Solutions, Inc. Enzyme Cleaners (#1 or #2) should be emptied and cleaned at least once a week. Fog inside and outside with enzyme cleaner and/or peppermint soap. Fill in all holes or burrows in the ground, stumps, trees, etc.
- D. **Permanent standing water**, such as ponds, streams, swamps, and drainage ditches, **may be treated** to control mosquito breeding by using IGR's like methoprene, marketed as Altosid by Zoecon, Bti, or by goldfish, tilapia, nematodes, guppies (*Poecilia reticulata*) or the like. Where injury to vegetation is not a problem, oil base sprays may be applied lightly to cover the water surface. These should be applied at weekly intervals during the mosquito season. Do not use poisons to treat garden fish ponds or any water which will be used or consumed by humans or animals. Prevent breeding situations by regular emptying and cleaning with Safe Solutions, Inc. enzyme cleaners or by screening and caulking.
- E. **Buildings and homes which are constantly invaded by mosquitoes usually have defective, missing screening.** All screens on windows and doors should be inspected, repaired and tightened. Sixteen to 18 mesh screening should be used to prevent mosquito entry. Be sure to also thoroughly caulk all holes, cracks, crevices and other openings which may also allow entry.
- F. **Mosquitoes inside a finished building can be temporarily controlled** by Safe Solutions, Inc. Enzyme Cleaners or vacuums and permanently by eliminating standing water accumulations. It should never be necessary to apply long-term synthetic pesticide poisons in buildings with proper screening.
- G. **For personal protection on outside, protective clothing is always your best defense;** try using fans and soybean oil/or cedar oil, Skin-So-Soft® by Avon, oils of citrosa, coconut, birch, *Lantana camara* (Linnaeus), *Tarchonanthus camphoratus* essential oil, neem, blue stem grass, rosemary, yarrow, spearmint, menthol, crushed citrosa or lemon thyme leaves, oils of sweet basil, cinnamon, citronella, cedar-wood, lemongrass, peppermint or eucalyptus, electronic repellents and if all else fails, a combination of

these. Applied to exposed skin, sleeves and trouser cuffs, garlic repellents can prevent mosquito bites for several hours. If you are not allergic, try Ultra Muskol®. The Author has had good results with some electronic mosquito repellers, but others have had no effect. Caution: The effective ones (that really sound like dragonflies) may attract bats at night. Now the Author uses Safe Solutions Insect Repellent. Buzz Away by Quantum is a non-toxic, outdoor protection formula of natural ethyl alcohol from plants, plus essential oils of citronella, cedarwood, lemon grass, peppermint and eucalyptus, or use Safe Solutions Enzyme Cleaner with Peppermint or Kiss Off! from Kiss My Face contains citronella oil and Rhodinol (from grasses grown in Sri Lanka) and Terpineol (from pine trees) along with moisturizers and botanicals. Menthol will repel some ticks, so try it on mosquitoes, citronella candles often draw mosquitoes into the flame. **Don't forget to simply vacuum them up - use fans. Avoid using sweet scents and avoid cool, moist places, especially at dawn or dusk.** Try mixing some vitamin B1 in Vaseline and cover the skin lightly.

- H. **Adult mosquito control outdoors is accomplished by using fans...** **mosquitoes** are not very strong fliers and will not bother you in the wind. Wear light colors and prints. Bathe regularly with peppermint or unfragranced soap. **Mow the lawn regularly.** Mist with Safe Solutions, Inc. enzyme cleaner or Not Nice to Bugs™ or peppermint, garlic, cedar or eucalyptus oils or soaps. **Trim trees/shrubs.**
- I. **Cover the top of rain barrels with a fine screen 14-18 wires per inch - rain water can pass through but mosquitoes can not.** Put in some flathead minnows if you can not screen.
- J. **Plant garlic or scented geraniums or citrosa plants, lemon thyme, citronella grass, common marigold, catnip, tomato, eucalyptus, sweet basil, and/or sassafras by gardens, walks, doors, windows, decks, pools and patios to help repel mosquitoes.** Note: Most plants release significant amounts of repellent oils only when their leaves are crushed. Rub crushed leaves on a small portion of your skin to see if you get an allergic reaction before treating" your whole body or pet. Florida residents have been spotted wearing Bounce® fabric softener sheets on their belts or sticking out of their pockets to repel mosquitoes. **Warning: Eating bananas and drinking beer attracts mosquitoes to you.**
- K. **Beneficial Organisms** such as bats, praying mantis, toads, birds, dragonflies, minnows, sunfish should be enticed or introduced into the area with houses and/or releases to permanently control these serious pests by natural predation. Mosquitoes are a key source of food for many species of amphipods (fresh water shrimp) ants, backswimmers, bacteria, bats, birds, crabs, dragonflies, minnows, sunfish, frogs, toads, fungi, copepods, giant waterbugs, ground beetles, hydra, mites, insectivore plants, parasitic nematodes, predacious snails and spiders. A mouse-eared bat can eat 600 mosquitoes per hour. A large dragonfly can eat up to 100 mosquitoes in one forage at speeds up to 30 mph or more. The snail parasite (*Plagiorchis elegans*) is a worm that eats mosquito larvae. Take an infected snail and release it into the water; when the sun goes down, the snail releases thousands of mosquito hungry worms into the water. The snails do this as long as they live, even retaining the parasite through winter hibernation.
- L. **Candles - Mosquitoes are drawn to carbon dioxide/light and are killed by the flame.** Citronella candles are said to repel mosquitoes, but never burn them inside; the Author believes the fumes are also harmful to your health.
- M. **Non-toxic (permanent) mosquito control** - Safe Solutions Enzyme Cleaner with Peppermint or #2 enzyme cleaner have all proven to be extremely effective in field tests for mosquito larvae and pupae control. They alter the surface tension of water so that larvae and pupae have difficulty making contact with the air above the water surface film. Adult mosquitoes cannot maintain surface contact on water especially treated with enzyme cleaner. Late winter treatment of potential breeding waters will even preclude breeding. Other insects, as well as leaves, etc. do not remain on surface of water treated with enzyme cleaner, but sink below the surface. It is interesting to note that the pupal stage is the most quickly affected by enzyme cleaner, whereas larvae tend to persist for longer periods both in field and laboratory experience. The opposite is found to be the case in the use of insecticides, where the larval stage is the one most quickly killed. In stagnant water, large ponds, baths, etc., you will note ultra-active erratic response of the aquatic organisms upon initial addition of enzyme cleaners, as siphon tubes can no longer make contact with outside air. The active ingredient, the protease enzymes, can last for a long time in still or recirculated water. In many instances 100% control has been achieved. They both are less effective and have less residual effect in moving water or in a pond with both inlets and outlets.  
Directions: Both can be applied as a spray or dripped into an inlet source. They are both instantly soluble in water. Application should result in a final pond or tank or pond solution of one part of either commercial product to 50,000 parts water, but stronger solutions may be used. **Be careful; control may be virtually permanent!**
- N. **Resist going on a swatting rampage when biting insects start hovering overhead.** Studies

- indicate such movement can double the number of mosquitoes attracted to you.**
- O. French radio station FUGUE FM broadcasts an electronic impulse at 16KHz to repel mosquitoes.
- P. In 1952, Penfold and F.R. Morrison in Australia found the most effective repellent oils against mosquitoes, march flies and sand flies were the oil of Huon pine wood (*Dacrydium franklinii*) and leaf oils from *Backhousia myrtifolia*, *Melaleuca bracteata* and *Zieria smithii*.
- Q. **Mosquitoes in your room?** Turn off the lights and let them settle on the ceiling (or wall), then flip on the lights and vacuum them up. **Sleep in the breeze of a fan inside or outside.**

**DEET NOTE:** In the 1990s, in the U. S. alone 50 to 100 million units of insect repellent were sold each year. The New York Department of Environmental Conservation (NYDEC) banned insect repellents containing more than 30% DEET. Florida health officials noted some serious reactions involving children (including a few deaths) have been reported that may have been linked to this repellent (that melts plastic) and recommend that products containing DEET should not be used on children age 5 and under. So use DEET only with great caution. DEET can cause eye and sinus irritation, headaches, insomnia, confusion, etc. Never use DEET on someone with open wounds. DEET can dissolve nylon and plastic. **DEET at low concentrations can attract mosquitoes.**

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list\\_uids=2230775&dopt=Abstract](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=2230775&dopt=Abstract)

**Natural Floodwater and Salt Marsh Mosquito Control** - You can prevent these pests by maintaining high water over the annual floodplain during the mosquito's oviposition season. Salt marsh mosquitoes, e.g., *Aedes taeniorhynchus* and *Aedes sollicitans* and floodwater mosquitoes, e.g., *Aedes vexans* and *Aedes sticticus* need soil on which to lay their eggs, and if the area is continuously flooded during this period, they cannot complete their life cycle. If you can not flood, use black pepper extract, mosquito fish, *Gambusia affinis*, Safe Solutions, Inc. enzyme cleaners, garlic, methoprene and/or an effective *Bti* product or the new *Bacillus sphaericus*.

**Overall Control Summary** - Try planting scented geraniums (mosquito control plants) near entrances and other openings; rub your skin with the crushed leaves; these plants also make the bathroom smell nice, or try cedar oil and/or fabric softener sheets. Adult female mosquitoes are the only ones which bite, can irritate and annoy humans and our pets, and can transfer such diseases as malaria, encephalitis and dog heartworm. Communities nationwide thus have intensive control programs for these pests. Sadly, many programs unnecessarily rely solely on spraying potentially hazardous adult-killing pesticides (adulticides). Mosquitoes develop resistance to all chemical pesticides over time, which renders all of the volatile, "registered" poisons ineffective. Adulticides, such as the highly toxic organophosphate chlorpyrifos (Dursban™), present considerable risk to all living things, and kill beneficial insects and other non-target organisms. Natural mosquito predators such as dragonflies, damselflies and beetles are killed by adulticides and take longer to come back. (Dr. Wald from Libertyville, Illinois may have started the "rumor" that a purple martin can eat 6,600 mosquitoes a day. Dr. Wald sold aluminum purple martin birdhouses.) According to the President of the American Mosquito Control Association (AMCA), excessive spraying may exacerbate and even create mosquito problems by eliminating natural predators. Sensible control strategies involve reduction of breeding sites, which provides long-term restraints on mosquito populations, and controlling the mosquito during aquatic stages before they mature and have a chance to reproduce, transfer disease and annoy. Bug zapping lights can attract more pests into a yard than they kill, and do not reduce the numbers of mosquito bites. Safe Solutions Insect Repellent, volatile oils and perfumes, such as Skin-So-Soft, Noxema and cedarwood, can repel insects but wear off rapidly so must be applied repeatedly. Use fans to cover localized areas to harmlessly remove mosquitoes. Habitat reduction measures can often be simple and can provide long-term effectiveness. Install bat houses to encourage these mosquito feeders to establish residence. Enhancing drainage of flood canals, irrigation ditches and fields; keeping street gutters and catch basins free of debris and flowing properly; enhancing drainage, or creating permanent deep pools in marshes, and the elimination of other large and small breeding habitats, e.g., cans, tires, bird baths, plugged rain gutters, etc., all are good preventative measures. Tracking larval and adult population numbers, species types and breeding locations provides invaluable information used for determining when, where and what control measures might be needed. Larvaciding allows effective control for mosquitoes at the source before they become a nuisance and can be done with biological control techniques or Safe Solutions enzyme cleaners. Mosquito fish of the *Gambusia* genus are distributed by the thousands nationwide. Only indigenous species should be used. Be aware that they have occasionally triggered algal blooms after consuming algae eating organisms. *Bti* (*bacillus thuringiensis* var. *israelensis*), one of the most popular and effective least-toxic biological controls, is a bacterial strain which, when sprayed into larval pools, is ingested by feeding larvae and kills them, or try *Bacillus sphaericus*. Oils kill via mechanical

means by coating water surfaces which suffocates all stages of mosquito larvae and mosquito pupae. Arosurf MSF® is a very thin vegetable-based oil that not only kills larvae but sinks egg rafts and adults on the surface by changing the water tension. It is registered for application into potable water, is applied at rates of only .2 to .5 gallons per acre, and biodegrades in three to ten days. Unfortunately oils can kill non-target organisms, including some predators, which similarly breathe from the surface. Golden Bear Oil® is another popular larvicide. It is petroleum-based oil which, while purer than more traditional diesel oils, persists and affects non-target organisms. Methoprene is an insect growth regulator supposedly of low toxicity to mammals that disrupts normal growth patterns to arrest development in the pupal stage, which leaves larvae available as food for wildlife but prevents the emergence of adults. Methoprene is an insect growth regulator supposedly of low toxicity to mammals that disrupts normal growth patterns to arrest development in the pupal stage, which leaves larvae available as food for wildlife but prevents the emergence of adults. Other insect growth regulators, like dimilin, kill larvae when they molt by interfering with outer shell development. Unfortunately, other insects and crustaceans can also be killed upon molting by disruption of the same processes. Try an overall broadcast application of Safe Solutions, Inc. enzyme cleaner, but remember enzymes and surfactants will also kill all insects even the beneficial ones. Try applying dilutions of various essential oils to pulse points on your body every hour or so as described in the section [Blood Feeders Overview](#). If practical, wear two layers of tightly knit or woven (tucked in) clothing, avoid sandals, floral prints, loose clothing, the color blue (the preferred color of mosquitoes), hair spray, perfumes and other attractive fragrances. Stay away from stagnant water. If in a serious attack cover your skin with mud and/or seek immediate refuge in a building or a thicket or body of water. Fog/mist the area with Safe Solutions, Inc. Enzyme Cleaners or Not Nice to Bugs™ or garlic or citrus extracts or cedar oils to down/destroy/repel mosquitoes. You can also lightly dust the area with food grade diatomaceous earth. Piperidine (sometimes called picoridin) is derived from pepper and is almost watery when you apply it to repel mosquitoes.

### **Mosquitoes - Typical First Strikes by Housekeeping & Maintenance**

1. Remove all sources of stagnant or standing water if possible, e.g., old tires, bird baths, cans, trash barrels, wading pools, etc., or add Safe Solutions, Inc. Enzyme Cleaners, at a rate of a few drops per gallon of water. Don't forget to fill in any low areas that hold water for more than 7 days!
2. Spray the area and drains with Safe Solutions, Inc. #2 Enzyme Cleaner (4 oz. per qt. water) or Safe Solutions, Inc. Enzyme Cleaner with Peppermint (1 oz. per qt. water) or Not Nice to Bugs® (2 oz. per qt. water). Remove or spray bushes and dense shrubbery and vines by doors and patios with hose-end sprayers and enzyme cleaners. Adding xanthan gum to water kills mosquito larvae.
3. Turn on fans to "blow them away." (Note: A misting fan works best.) Sit in the breeze (even if it is from a fan). They will not bother you.
4. Mosquito bite relief: Soak bites in Epsom salt water or apply a paste of salt or protease enzymes mixed into lard or cold cream. Not Nice to Irritations and bentonite clay also help relieve bites and stings.
5. Spraying diluted Safe Solutions Enzyme Cleaner with Peppermint (1 oz. per gal. water) or garlic oil or liquid garlic will control mosquitoes immediately. Garlic, cedar, peppermint or lemon oils or citrus-based sprays also kill mosquitoes and other insects. Safe Solutions Insect Repellent works well as a safe repellent.
6. Rub 4% citronella oil into 96% Vaseline, cedarwood, lavender or soybean oil or scented geraniums on clothing and/or exposed areas or burn citronella candles. CNN 8/28/01: Iowa State says catnip is 10x more effective than DEET. Lemongrass, clove oil, basil, oils of avocado, birch, mint, thyme, pine, rosemary, spearmint and/or yarrow all repel mosquitoes. **Be sure you are not sensitive.**
7. Solutions of aspirin or Ben Gay® or bisabolene or pennyroyal, rubbed on the skin (if you are not sensitive), tansy or scented geraniums planted near a door, or basil plants will repel mosquitoes. Myrrh burned as incense will also repel mosquitoes. **Wear protective clothing or put geraniol or geranium oil, catnip or Noxema, soybean oil or vinegar on the skin if you are not sensitive. Caution: If you are pregnant, don't use pennyroyal, even topically, as it may increase the risk of miscarriage. Note: Citronella oil has been known to attract female black bears.**
8. Practice proper exclusion; repair 16 to 18 mesh screens; seal windows and doors and caulk.
9. Lightly dust the surface of the water with Safe Solutions, Inc. food-grade diatomaceous earth or powdered starch.
10. Caution - Test anything you want to put on your skin on a small area first.
11. Some people are more attractive to mosquitoes than others. Mosquitoes are attracted to dark clothing, carbon dioxide and sweat. Prime feeding times are



**late dusk and early evening.** Some people react more seriously to mosquito saliva, the chemical that causes the bites to swell and itch. Carry a small “spritzer” bottle filled with diluted Safe Solutions, Inc. enzyme cleaner, apply and rub into to bite area - this will reduce the swelling and itching.

12. **How to make an attractive Toxic Sugar Mosquito Bait:** To lay eggs, females do need blood for its iron and protein. But usually mosquitoes subsist on modest sips of nectar from flowers or from ripe or rotting fruit. And that, according to scientists from Hebrew University in Jerusalem, is an ... Achilles' proboscis - through which the pests can also be poisoned... That's how we came up with fruit juice ...Attractive Toxic Sugar Baits... “You can't move flowering trees around,” said Yosef Schlein, a parasitologist at the University's medical school. “So you have to use movable bait. That's how we came up with fruit juice.”

Supported by a grant from the Bill and Melinda Gates Foundation, Dr. Schlein and his research partner Günter C. Müller concocted an array of nectar poisons known as Attractive Toxic Sugar Baits that are easy to make, environmentally friendly and inexpensive. In tests in Israel and in West Africa, the baits knocked down mosquito populations by 90 percent. Even better, they nearly eliminated older females, the most dangerous mosquitoes. (Only females bite humans, and only mosquitoes that have already picked up malaria, dengue or another disease from one human can inject it with their saliva into another human.)

Dr. Müller and Dr. Schlein tested their idea five years ago at a desert oasis near the Red Sea. Putting out vases of flowering tree branches, they learned that acacias — the thorn trees common in Africa — attracted the most mosquitoes. They sprayed branches with a mixture of sugar water and Spinosad, a bacterial insecticide considered harmless to humans and most beneficial insects. The mosquitoes feeding on them died. Their next test was in a Greek Orthodox monastery in the Judean hills where mosquitoes laid their eggs in underground rainwater storage cisterns. They filled old soda bottles with a solution of brown sugar, the juice of rotting nectarines, Spinosad and a dye. They put each in a sock with a wick that helped keep the sock soaked with the colorful fatal elixir. They suspended a bait at the opening of each cistern. Trapping later showed that up to 97 percent of all mosquitoes in the area were marked with the dye, meaning they had landed on a toxic sock at least once. Within a week, the female population had crashed to near zero; it stayed there for a month.

The toxic sugar bait developed by scientists at Hebrew University Medical Center in Jerusalem is made with a combination of fruit juice essences, which are attractive to mosquitoes, and boric acid - a mild, inorganic powder that kills insects when they ingest it. In experiments in a semi-arid region of Mali, in West Africa, the bait - in this case a blend of boric acid with guava and honey-melon fragrances - was applied using a hand sprayer on the vegetation near a cluster of man-made ponds. These ponds are important dry-season water supplies for local villagers and their livestock. They are also breeding grounds for *Anopheles gambiae*, the mosquito that carries the most deadly form of malaria. For comparison, investigators sprayed grasses and leaves near other ponds with a solution of sweet fragrances only. Both baits contained a dye that marked any mosquito making contact, so scientists could count how many had actually fed on the lure. Josef Schlein, a medical entomologist who led the study, says the results after 38 days showed the bait containing both sweet fragrances and boric acid proved to be very effective at killing mosquitoes. “In Mali, we got down by some 80 percent, the females, and 90 percent of the males,” he said. “But the area is full of little ponds in there, so it is impossible to stop mosquitoes from flying from an untreated pond to a treated pond.” At the control sites that were treated with fragrances only, Schlein says upwards of 75 percent of mosquitoes fed on the fake bait.

Their most recent study, published in Malaria Journal, was done in West Africa, where malaria is a major killer, especially of young children. The scientists chose a rural road in Mali running past ponds where two aggressive mosquito species breed — *Anopheles gambiae* and *Anopheles arabiensis*. They sprayed weeds there with a solution of the fermented juice of local guavas and melons mixed with dye and boric acid. Within a few days, they saw 90 percent die off. Boric acid is much less expensive than Spinosad. It is also about as harmless to humans as table salt is. It is a chief ingredient in Silly Putty. Dr. Schlein said he had heard that some Malians sampled the alcoholic bait brew, with no ill effects. But it kills insects that eat it. It is common in cockroach control; when a thin layer is spread on floors, cockroaches take it in when they preen their feet. “You can buy it by the truckload,” Dr. Christensen said. “And it kills in so many ways that there's never been resistance to it. Some authorities think there never will be.”

<http://www.malariajournal.com/content/9/1/210>

Schlein explains most people don't realize that female mosquitoes typically feed on sweet plant nectars to survive. Their more familiar blood meals, when mosquitoes bite people, are part of the reproductive cycle. The researchers' goal now is to make a lure that's even more irresistible to mosquitoes. Research leader Josef Schlein notes that boric acid poses little risk to humans and other mammals, so it's possible a mosquito lure could be developed for use indoors. Given the non-toxic simplicity of this new bait, the Hebrew University entomologist says it's a marvel that other scientists didn't think of it sooner. **The Author has previously noted that adding aspartame to sugar-spiked solution would kill mosquitoes. The Author suggests adding some yeast to the above-mentioned sugar bait to make it even more attractive to biting mosquitoes. (See below.)**

#### **How to make a great Mosquito trap - Materials Needed:**

2000ml (2-liter) bottle  
50 gm brown sugar  
1 gram (0.035 ounce) yeast  
Thermometer  
Measuring cup  
Knife or sharp scissors  
Black paper/Black tape

#### Instructions:

- a. Cut off the top of the bottle where it begins to turn in - so that it can later be inverted to create a funnel into the bottle.
- b. Put 200ml (.85 cup) hot water in a separate container, stir with 50gm (1.8 ounces) brown sugar. Wait for water to cool down to 40C or 120F.
- c. After cooling down, pour the sugar water into the bottle, then add the yeast. This will activate the yeast to create carbon dioxide, which will attract mosquitoes.
- d. Place the top part of the bottle upside down like a funnel and secure with black tape.
- e. Cover the surface of the entire bottle with black paper or black tape.
- f. Place the trap at a dark corner.
- g. Replace the solution every two weeks.

Visit <http://www.youtube.com/watch?v=JAp3Mr2YzN8> for video

**The Author believes the above-mentioned mosquito trap can be easily adapted to control other blood feeders, e.g., Fleas, Bedbugs and Ticks.**

#### **How to make great Flea, Bedbug or Tick traps - Materials Needed:**

several (2-liter) bottles  
50 gm brown sugar per bottle  
1 gram (0.035 ounce) yeast per bottle  
Thermometer  
Measuring cup  
Knife or sharp scissors  
cloth or non-woven fabric

#### Instructions:

- a. Cut off the tops of the bottles where they begin to turn in - so that they can later be inverted to create funnels into the bottles.
- b. For each trap - Put one cup of hot water in a separate container, stir in 2 ounces of brown sugar. Wait for water to cool down to 40C or 120F.
- c. After cooling down, pour the sugar water into each bottle, then add a gram of yeast. The cooled sugar liquids will activate the yeast to create carbon dioxide, which will attract blood feeders like fleas, ticks and bedbugs to your traps.

- d. Place the top part of the bottles upside down like a funnel into the bottles after you carefully add a little Vaseline to the old outer edges and secure with adhesive or duct tape.
  - e. Cover the entire outer surfaces of the bottles (and tape) with cloth or non-woven fabric. (For Flea Control you could simply use a shallow bowl with a drop of soap in the solution.)
  - f. Place the traps wherever you have seen recent flea, tick or bed bug activity.
  - g. Empty the traps into the toilet and replace the solution every two weeks
13. Turpentine and eucalyptus oils, garlic extracts, surface oils, extracts of orange and lemon peel will all control mosquito larvae as will water treated with 15% borax, **but be careful not to pollute potable water!**
- 14. If you still are seeing mosquitoes, read the entire chapter.**

**Murphy's Law of Pest Control:** To treat a malaria outbreak in Borneo in the 1950s, the World Health Organization (WHO) decided to spray DDT to kill mosquitoes. The DDT also killed parasitic wasps which were controlling thatch-eating caterpillars. As a result, the thatched roofs of many homes fell down, and the DDT-poisoned insects were eaten by geckoes, which were in turn eaten by cats. The cats perished, which led to the multiplication of rats, and then outbreaks of sylvatic plague and typhus. To put an end to this destructive chain of events, WHO had to parachute 145,000 live cats into the area to control the rats.

The following is from "The Coming Plague" by Laurie Garrett. The book was copyrighted in 1994 and the situation has become worse since then: "It seems we have a much greater enemy in malaria now than we did just a few years ago," Dr. Wen Kilama said. The director-general of Tanzania's National Institute for medical Research was frustrated and angry in 1986. He, and his predecessors, had meticulously followed all the malaria control advice meted out by experts who lived in wealthy, cold countries. But after decades of spending upward of 70 percent of its entire health budget annually on malaria control, Kilama had a worse problem on his hands in 1986 than his his predecessors in 1956...Since the days when optimists had set out to defeat malaria, hoping to drive the parasites off the face of the earth, the global situation had worsened significantly. Indeed, far more people would die of malaria-associated ailments in 1990 than did in 1960...In 1990 more than 80 percent of the world's malaria cases were African; 95 percent of all malarial deaths occurred on the African continent. Up to half a billion Africans suffered at least one serious malarial episode each year, and typically an individual received some 200-300 infective mosquito bites annually. Up to one million African children died each year of the disease. And all over the continent the key drugs were failing.

**DEET warnings:** In April, 1998 EPA quietly announced products containing DEET can no longer be labeled as "child-safe" and must contain many new restrictions when using on children. EPA has given the industry 26 months to apply the new restrictions and allowed the old labeled repellents to be sold for another 50 months — so you will not see the new restrictions for a long time.

**DEET-free Products** - Fasst Products in New York makes a timed vapor release glo-wristband using 30% geraniol that supposedly is reuseable for up to 60 hours. It is advertised to repel mosquitoes, gnats and fleas in all outdoor activities including swimming. Your body heat activates the volatile oil in about 10 - 15 minutes. It may cause a skin reaction in rare cases. Safe Solutions has another DEET-free insect repellent that combines corn oil, rosemary, thyme, peppermint and castor oils; this product is said to be far superior to DEET and Skin-So-Soft.

American Biophysics based in East Greenwich, RI is marketing the Mosquito Magnet, a device about the size of a gas barbecue that emits a plume of carbon dioxide that attracts mosquitoes. The device then sucks them into a small vacuum where they dehydrate and die within a day. Biosensory, Inc. of Willimantic, CT is expected to market the Dragonfly, a similar trap in the shape of an 18" bird.

**Mosquito Attractant** - The summer cypress, a/k/a the burning bush because it is so deep red in the autumn, contains an oil or fatty acid in its seeds that can be used or converted into a pheromone-like substance that attracts females of all Culex species to a water source where they can lay their eggs. Squeeze the oil from the seeds and place it directly near water diluted with 1 part Safe Solutions, Inc. enzyme cleaner per 500 - 1000

parts of water. The Asian tiger mosquito occurs throughout the Orient and earlier in the 1900s invaded Hawaii. It invaded Texas in 1985 and had invaded most southern states east of the Mississippi and as far north as Ohio, Indiana, Delaware, Illinois and Maryland within 3 years. How did we get this pest? In 1983 - 1985 we paid for 4.5 million used truck tires to be sent from Asia to be retreaded and sold. Asian tiger mosquitoes first arrived into our port cities in ship loads of these tires. Their eggs can survive for months out of the water waiting for some rain to cause them to hatch. The female is an aggressive daytime feeder with a "racing stripe" and can lay 300 eggs per female. Feeding occurs mainly in the early and/or late afternoon. Walk in the shade and you will soon be surrounded by hungry females who will hit you low (ankles and knees). You probably will not even hear them buzz! You may have many bites and yet not have felt one bite! The Asian tiger mosquito is considered to be a potential vector of encephalitis and other arboviruses! Because it likes to breed in little pools of water, it could become a major back yard pest. It can go from egg to biting adult in 2 weeks! Treat tires with diluted Safe Solutions, Inc. enzyme cleaners, olive oil, garlic juice or oil and/or lemon juice or citric acid or cedar oil.

**Lime** - It has been suggested by a field engineer that lime (calcium oxide) be added to stagnant water to control mosquitoes, but the Author has not yet field tested this control technique as to dosage or safety or efficacy.

**Lime** - Pediatricians in Brazil tell parents to place cloves in a cut lime to repel mosquitoes away from their children.

**Listerine** - The Author has been told that simply spraying Listerine Mouthwash controls mosquitoes for days.

**Marigolds, *Tagetes minuta* (L.)** - Whole plant extracts of this species of marigold are extremely toxic to adults and larvae of mosquitoes, e.g., *Aedes aegypti* (L.). Caution: The extracts may also kill or negatively effect non-target aquatic insects and other organisms. Add a little mineral or canola oil and dish soap to your mix and add to stagnant water.

**Noxema** - We have found that Noxema applied to the exposed skin repels mosquitoes.

**Potential Bait - I was told to put a few drops of Lemon Joy dishwashing detergent on a white plate to attract and kill mosquitoes** - I am looking forward to trying this on several species.

**Isostearyl Alcohol Ethoxylate** - This non-irritating alcohol derived from plant oils has no odor and is used in the cosmetic industry. When it is applied to standing water at about a quart per acre, it will quickly cover the entire surface and control mosquito larvae and pupae. The film reduces the surface tension of the water so larvae and pupae can not attach easily and it also blocks their breathing tubes. Done properly, the film is not visible, phytotoxic or toxic to most non-targeted species.

**Mosquito Magnet®** - There are several new propane devices that attract and control mosquitoes. In 2002, Dr. Warren Porter said he saw the Mosquito Magnet® in action at midnight in a swamp on the Georgia-Florida border and he never got bitten even though he had no other protection.

**Egg Yolks** - Break open an egg yolk and let it spread over the surface of the water to suffocate mosquito larvae for several days. Repeat as needed. Remember, an egg yolk can only spread so far, so use as many as you need. You can check the efficiency in a few hours with a glass container; dip some water and see if you "got them all."

**Panic Caution:** In 1999 the City of New York found the vector of West Nile virus from birds to man, at that time, to be the Northern House Mosquito, *Culex pipiens* (Linnaeus). The adults are brownish with white or gray markings with dark legs. These particular mosquitoes are the only known vectors of West Nile virus and fly only 100 - 300 feet in their lifetime and are only minimally active at night. They only breed in artificial containers, ditches, bird baths, sewers and polluted water. New York City had isolated incidents of infestation, yet chose to give out Deet to "protect" all of the children and to bomb all five boroughs during the daytime with helicopters and trucks. There were pictures in the newspapers of the spraying and of children putting Deet on during the day. None of these daytime "controls" would work, but the frost did. Then in 2000 the City decided to again "protect" the people. Their plan does not mention the dangers of their "registered controls". Their "plan" does not mention "organophosphates" nor alert the populace of the health effects of their poison "controls". Their "plan" does not consider safer, simpler and far more effective alternatives that take into consideration the species of mosquito that they are "trying to control." At an NCAMP meeting the Author noted that if he had violated the pesticide labels and the federal law that states it is illegal to say that even the labeled use of any pesticide

is "safe" as much as the City of New York had done during the Fall of 1999, I would have been arrested. Sit in the breeze of a fan, have the people drain or remove the breeding sources or add a little lime, soap, vegetable oil or diluted Safe Solutions, Inc. enzyme cleaners to the stagnant water. These mosquitoes are not very active biters (even at night) so keep on moving.

Newsday noted in August, 2000 that six mosquito species have been found to carry the West Nile virus (WNV) and each has different breeding and feeding habits. The New York area is home to at least 75 different species or types of mosquitoes, most of which have not been tested for their ability to carry West Nile virus. Scientists at the U. S. Army Medical Research Institute of Infectious Diseases at Ft. Detrick, MD have tested 18 species and found they all were capable of transmitting the disease to some degree in their laboratories. Finally, a laboratory in Beloit, WI announced on 10/26/00 that birds in its laboratory became ill with WNV from other infected birds without any mosquito vectors. I would like to point out that to try to "control" every mosquito using volatile pesticides simply will not work.

**Following is a testimonial letter regarding food-grade DE - To Whom It May Concern:** This past year, we were introduced to a new product by Steve and Roz Tvedten. They knew that we were the owners of thoroughbred horses and were being plagued by flies and mosquitoes. Steve asked my Husband to try the product and promised we would be thrilled with the results.

We have 44 horses and decided to treat them into two different groups. Group one was placed on the product, and group 2 received nothing but its normal feed. Group one had DE (food quality diatomaceous earth) and granulated garlic added to its feed daily. We placed approximately 3 tablespoons of each item and sprinkled it on top of the horse feed. The animals in this area were not bothered with flies or mosquitoes and we had no illness at all in this area. Even the manure from the animals did not get covered with flies which definitely help keep the pasture and barn from disease.

Group two was fed just its normal grain supplement. This field was hit very hard with flies and mosquitoes. We also experienced illness in the pasture which we could not explain. We had to call in the doctor because we lost four animals. The doctor took blood and felt we were dealing with the West Nile disease. Immediately, we placed group two on the mixture of food quality diatomaceous earth and granulated garlic. At first, we increased the dosage giving them it twice a day. We had no problems with that group after the treatment and definitely felt that controlling the flies and mosquitoes helped control disease. This Spring all animals will be placed on the mixture. The test result from the untreated field turned out to be our worse nightmare—The West Nile Disease. Sincerely, Passingwinds Farm, Nick and Donna LaFleur, 1-20-2003

**West Nile Virus Innoculations:** There is a study from the University of Florida that said double innoculations of horses still had West Nile infestations. Even some horses with triple innoculations still got West Nile Virus.

**Tuning Fork Control** - Take a tuning fork that has a pitch (humming frequency of 300 to 800 cycles per second) and tap it. Place the vibrating fork near virtually any mosquito population and watch the (sexually mature) male mosquitoes take flight and gather around the fork; while the fork is humming, the males will stay next to it and you can literally lead them around and put them into a cage or destroy them. Not all mosquitoes breed in the air. A New Zealand mosquito, *Opifex fuscus*, usually breeds the female before she takes to the air. The male watches for a pupae to surface for air; he waits or even helps during the emergence. If the emergent mosquito is female, the male may attempt to breed her even before she is out.

**U.S. Department of Agriculture** scientists have identified components of *Jatropha curcas* seed oil that are responsible for mosquito repellency. Laboratory experiments showed free fatty acids and triglycerides were among a number of active compounds found to be effective at preventing mosquitoes from biting.

**Aspartame** - Mosquitoes have a great thirst for nectar from flowers and nectaries on plant leaves and stems; the Author believe that spraying sugar solutions spiked with aspartame on all sugar sources that nectar-seeking mosquitoes are attracted to will destroy all local mosquito populations. In dry areas, control would be easier to obtain than in wet areas with many nectar sources. Cater to their sweet attraction.



**Doing Nothing** - Doing nothing but allowing the natural control mechanisms to "catch up" generally is the best policy. Natural products, e.g. dragonflies, will control mosquito infestations better and safer than "registered" poisons. The Author believes once the birds develop an immunity to the West Nile Virus, this should help control this disease. **Mosquitoes function best at 80° F., become lethargic at 60° F. and can not function below 50° F.**

SEVERAL KINDS OF PEST MOSQUITOES				
Scientific Name	Common Name	Breeds In	Flight Distance	Diseases or Other
<i>Aedes aegypti</i> (Linnaeus)	yellow fever mosquito	clean water	1 - 5 miles	yellow fever, canine heartworm dengue, encephalitis
<i>Aedes albopictus</i> (Skuse)	Asian tiger or forest day mosquito	tires, artificial container	1 - 5 miles	dengue
<i>Aedes dorsalis</i> (Meigen)	salt marsh mosquito	fresh or brackish water, moist soil	1 - 30 miles	encephalitis
<i>Aedes nigromaculatus</i> (Ludlow)	—	muddy pastures	2 - 5 miles	encephalitis
<i>Aedes sierrensis</i> (Ludlow)	tree hole mosquito	tree holes, tires, containers	½ mile	canine heartworm
<i>Aedes sollicitans</i> (Walker)	salt marsh mosquito	brackish marshes and saline areas	5 - 20 miles	—
<i>Aedes squamiger</i> (Coquillette)	California salt marsh mosquito	salt marsh, rain water filled depressions	5 - 20 miles	aggressive biter, encephalitis
<i>Aedes taeniorhynchus</i> (Wiedi)	black salt marsh mosquito	salt marsh, flats flooded by high tides	5 - 20 miles	aggressive biter, encephalitis
<i>Aedes vexans</i> (Meigen)	swamp mosquito	temporary pools	5 - 20 miles	aggressive biter, canine heartworm
<i>Aedes washinoi</i> (Washino)	woodland pond mosquito	woodland depressions, pools , mud holes	—	aggressive biter, unknown
<i>Anopheles freeborni</i> (Aitken)	Western malaria mosquito	fresh water, rice fields	1 - 10 miles	malaria
<i>Anopheles quadrimaculatus</i> (Say)	common malaria mosquito	permanent fresh water	1 - 2 miles	malaria, canine heartworm
<i>Culex pipiens</i> (Linnaeus)	Northern house mosquito	foul water, containers, ditches, etc.	1 mile	West Nile, encephalitis, canine heartworm
<i>Culex tarsalis</i> (Coquillette)	encephalitis mosquito	stagnant water with vegetation	2 - 10 miles	West Nile, encephalitis
<i>Culiseta incidens</i> (Thomson)	cool weather or fish pond mosquito	creeks, ponds, containers, etc.	½ mile	large bites at sunset, heartworm
<i>Culiseta inornata</i> (Willistion)	winter marsh mosquito	rain filled ponds, man made sources	½ mile	large bites at sunset

Sources: Service 1980, Almeda 1999, Olkowski et al . 1991, etc.

**Note:** Most mosquitoes breed in small bodies of stagnant water, so remove the conditions conducive to their survival.

**West Nile Treatment Note:** Vitamin C i.v.'s can be used to treat any situation involving a viral component, including West Nile Virus. Very high therapeutic levels or doses of vitamin C are required, much more than is possible to absorb orally. There are very few contraindications to vitamin C i.v. and thousands of cases of HIV, AIDS, SRS, West Nile Virus and the flu have been successfully treated with virtually no side effects.

**West Nile Virus Meeting in Phoenix, AZ —** On September 15, 2004 Maricopa County Supervisor, Fulton Broch, asked the Author to speak at a County Board Meeting to be held on Monday, September 27, 2004 at 3 p.m. The Meeting was scheduled to discuss the dangers and futility of continuing to follow the CDC's recommendation that Phoenix, Arizona must use pesticides to "combat" West Nile Virus in the desert. During the

meeting it was determined that the Phoenix Health Department, acting on a CDC Control Mandate, had been spraying 24,000+ acres of desert on a nightly basis in an attempt to "control" adult mosquitoes in order to stop the spread of West Nile Virus. Several people testified that they had lived in the desert for many years and had never seen a single mosquito in their particular area that was being sprayed. The head of the Health Department, Dr. Jonathan Weisbuch, said that he knew the sources of adult mosquitoes basically were and are thousands of "green" or abandoned swimming pools in the area, but rather than finding and larvaciding these small areas, he chose to continue to spray Anvil 2-2 on tens of thousands of acres of open desert and city on a nightly basis. While it is against the federal law to say that even the labeled use of any registered pesticide is "safe". Al Brown from the Health Department testified that "their" spraying of insecticide poisons was "safe". Dr. Weisbuch said, "In public health we are often confronted with two evils: In this case, one is a virus that has taken the lives of 7 people. The other evil is that pesticides are toxic chemicals. There are no safe chemicals we can produce, whether pesticides, aspirin or penicillin. Do we allow a disease to progress because we fail to take action? Or do we exploit a chemical to stem an epidemic? It would be irresponsible and scientifically unsound to cease and desist spraying." Both Weisbuch and Brown said that no one had ever (acutely) died from this particular insecticide and they will continue adulticiding the entire area, in order to "protect" 3½ million people. There were many medical doctors and patients who testified at the Arizona Board of Supervisors Meeting on September 27, 2004 about all of the ongoing health problems the nightly pesticide spraying was causing them and their patients. Dr. Rapp noted that the WNV "epidemic" was misleading because no brain autopsies were performed on the original victims; therefore, any death due to WNV is unproven. It was also testified that many products like lead paint, asbestos, tobacco, etc. were initially considered to be "safe" but are now banned! The Author was given ten minutes and he briefly talked about the ineffectiveness of adulticiding mosquitoes noting in particular Al Brown's comments that even after months of spraying pesticide poisons on a nightly basis their monitoring traps last week still contained thousands of adult mosquitoes. Mosquitoes are becoming more and more resistant to synthetic pesticide poisons.

If you think pesticides control mosquitoes, please check out:  
<http://www.nospraynashville.org/14cities.html>.

An article in the **Journal of the American Mosquito Control Association** clearly notes that, under normal circumstances, 95% of an adult mosquito's offspring are eaten by natural predators, but spraying broad spectrum pesticide POISON(S) is not "normal" and these poisons quickly destroy these natural predators. In New York's experience, for example, over an 11-year "treatment" period, spraying led to a 15-fold increase in the resident mosquito population, and the subsequent generations of mosquitoes appeared to be more resistant to pesticide POISONS and more aggressive. The Author has consistently noted the same results in Florida, Michigan, Ohio and elsewhere for many years. It is a scientific fact that more and more pesticide POISONS are routinely sprayed each and every subsequent year, and the only result is that pest problems and pesticide contamination problems continue to increase. It reminds the Author of a man spraying flies in his home with all of the windows and doors open. Until he screens or closes the windows and doors, he will always have more and more flies. Until Phoenix controls the source of their WNV/mosquito problem, it will always have the mosquito problem and many more people will be sickened by the Health Department's ongoing pesticide applications. Quebec has successfully tackled the virus mainly by treating municipal sewer systems, rural marshes and swamps with products that kill mosquito larvae each spring. The Author specifically pointed out to the Board and the audience that if "someone" advocated the spraying of pesticide POISONS to try to "control" West Nile Virus or any mosquito born disease - that person or persons should be held personally and criminally liable for any person, animal or bird who contacted the mosquito borne disease after all of their expensive POISON "treatments" and they should also be held criminally and personally liable for all of the resulting chemical trespass, injury and/or death of people, birds and animals their use and/or recommendation of "registered" pesticides created. The Author then gave Dr. Jonathan Weisbuch a copy of his Mosquito Control chapter from THE BEST CONTROL II and offered to try to get him a sample of any alternative the Author mentions in this Chapter. The Author also left the Board members a website where they could get the same Chapter on Mosquito Control -  
<http://www.thebestcontrol.com> (Now at <http://www.thebestcontrol2.com>.)

When those responsible for advising and/or applying "registered" pesticide POISONS are made to be held legally and/or criminally liable for any/all of the diseases or sickness and/or deaths their ineffective POISONS allow and/or create in people, birds and/or animals, as well as being held liable for all of the resulting "collateral damage," chemical trespass and contamination, the Author guarantees you "they" will quickly find and use safe and far more effective alternatives. It is as simple as that!

**Please note: Safe Solutions, Inc. enzyme cleaners and other products**, e.g., food-grade DE or dry, concentrated enzyme cleaner, or liquid enzyme cleaner with peppermint, can be purchased directly from Safe Solutions, Inc. at 1-888-443-8738, web site: <http://www.safesolutionsinc.com>.

There are also numerous dealers that sell these cleaners. None of the above-mentioned cleaners are sold as "registered" pesticides. The companies do not claim to mitigate pest problems in any way, but only sell these products as cleaners at this time.

Note: The mosquito has caused more deaths of animals and people than any other species or weapon, making it the most deadly creature on earth! Remember, only the females bite and take blood to lay eggs, but both the females and the males feed on nectar and plant juice.

**I do not believe in the thesis, "Let the buyer beware."  
I prefer one that states: "Let the seller/applicator be honest."**

**Can I purchase dragonflies to safely and effectively control my mosquito infestations?**

Live adult dragonflies used to be available from Safe Solutions Inc. either directly from their website located at: <http://www.safesolutionsinc.com> or by calling 1-616-677-2850. The nymphal stages are too cannibalistic to send, but the adults can be sent overnight virtually to anywhere in the world. Most of the females are already bred and all of the adults are ready to search out and destroy those pesky mosquitoes as soon as you release them.

**All About Dragonflies**



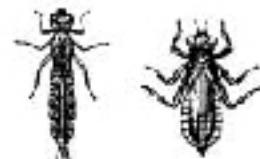
**Where are dragonflies found?** Dragonflies can be found in many different types of habitats. Small ponds, cat-tail/bulrush marshes, and sedge marshes tend to be the most productive and contain a wide variety of different kinds of dragonflies. However, some dragonflies prefer specific types of wetlands and bodies of water. A few are only found in streams. Some live in acidic bogs. Others prefer the alkaline lakes and still others can even take advantage of puddles and temporary ponds that dry up over the course of the summer. Dragonflies are found all over the world. In Michigan alone there are 114 species.

**Is a dragonfly a fly?** No. Flies are insects with two wings. Dragonflies have four wings. However, both flies and dragonflies are insects, meaning that they have six legs and three body parts: a head, a thorax, and an abdomen.

**Why are they called dragonflies?** The name comes from their fierce jaws, which they use to catch flies (among other winged insects).

**Where do dragonflies come from?** During their lifetime, dragonflies have two totally different lifestyles. In almost all cases, the egg and larval stages are spent in water while the adult stage is spent in the air. They are normally found near water: Ponds, lakes, canals, streams, rivers and swamps. Some dragonflies who have a short larvae cycle (a few weeks) also can live in rain puddles after heavy rains.

The dragonfly begins its life as an egg. After mating, female dragonflies lay dozens or hundreds of eggs. Different species place them in different places in or near freshwater. Some put them in the water, some in plants over the water, some in mud or algae at the edge of the water. Sometimes, the eggs are laid on the surface of the water. The eggs look like long cylinders surrounded by a jelly-like mixture. After about two weeks, the eggs hatch and an immature dragonfly, or nymph, emerges. The nymphs are not pretty like the adults. They have tiny wings and a large lower lip, which they use to catch their prey. As the nymph grows bigger, it sheds its skin up to 15 times.



The nymph has gills like a fish which help it to breathe under the water. When dragonflies are in the nymphal stage, they eat tiny water creatures that live in ponds. As the nymphs grow, they eat bigger foods such as water fleas and mosquito and mayfly larva that also live in ponds. When the nymph is much older and larger, it eats small fish, tadpoles, water beetles and even big worms. Dragonflies even eat each other! Dragonfly nymphs live in the water. As they grow, they molt (shed their skin). Nymphs of some species may take as long as three

years to mature. When the dragonfly nymph reaches maturity, it crawls out of the water onto a plant stem. Then its skin begins to split. First the head, then the thorax, then the legs, and then the wings of an adult dragonfly emerge. Soon the newly emerged dragonfly is able to fly. The process takes about two hours. It takes about two days before the adult dragonfly's beautiful colors are fully developed. Adult dragonflies can be very colorful, some are red, blue, yellow, or green. Most adult dragonflies live only a few weeks to a few months.

**How do dragonflies behave?** Dragonflies need sunny warm weather to fly, usually the temperature must be over 65° Fahrenheit. If it is too cold or wet, they hide in vegetation. Adult male dragonflies often establish territories along the edges of ponds or streams. They only defend the territory against other males of their species. Some large dragonfly species migrate south to warmer climates at the end of the summer. Their offspring may then migrate north the following year.

**How long have dragonflies been around?** Dragonflies are very ancient insects. They were here on earth even before the dinosaurs! Ancient dragonflies may have been considerably larger than those we see today. We know that dragonflies lived 300 million years ago and one was named *Meganeura monyi*, it's known from fossils and had a wingspan of 27.6 inches.. Today, the largest dragonfly is found in Central America and is named *Megaloprepus coerulatus* and has a wingspan of slightly over seven inches. There are several small dragonflies in the genus *Agriocnemis* with a wingspan of just about 7/10 inch. Other than being smaller, modern-day dragonflies do not look very different from their ancient ancestors.

**How many kinds of dragonflies are there?** Entomologists have named at least 5413 species of damselflies and dragonflies. New species are still being discovered. Many damselflies and dragonflies live in rain forests where few dragonfly researchers have been.

**Are dragonflies like other insects?** Dragonflies and damselflies belong to an order of insects all their own, called Odonata. Although the two are similar, damselflies are smaller than dragonflies. In addition, damselflies can fold their wings over their backs when they are at rest. Dragonflies can't fold their wings, so they rest with their wings held straight out.

**Are dragonflies harmful or beneficial to humans?** Dragonflies are definitely not harmful to humans. They do not bite or sting. They are very beneficial for they eat all sorts of insects including mosquitoes, flying ants, swarming termites, flies, gnats, and just about anything small enough for them to catch. Dragonflies are sometimes called "mosquito hawks" because they catch and eat so many mosquitoes. Always on the hunt, dragonflies consume gnats, flies, and mosquitoes—all of which humans consider pests.

**How fast do dragonflies fly?** Dragonflies have the most accomplished flying technique in the entire animal kingdom. They can fly forward and backward, and their quick darting ability assists them in escaping predators. Catching prey or avoiding predators is simplified by their sharp vision. The dragonfly's compound eyes have 10,000-30,000 facets. It's hard to measure the flight speed of a dragonfly since they almost never fly with constant speed in a straight line. A dragonfly has two sets of wings or four wings in total. Each wing has its own muscle inside the thorax. That means that each wing can be controlled separately and can beat up to 30 times per second!. This helps dragonflies to fly very quickly. Large dragonflies can fly up to 60 kilometers an hour- that's as fast as a car! The maximum flight speed varies a lot between different species. As a rule of thumb - a bigger dragonfly fly faster than a smaller one. A ten minute walk for you is only about a 30 second flight for them.

**Why are dragonflies such good hunters?** The Dragonflies' speed and ability to maneuver makes them able to simply out-fly their prey. But dragonflies also have the advantage of excellent eyesight. Look at their huge eyes. Each of the two large eyes is made up of thousands of six-sided units. The position of all these little lenses gives the insect a 360 degree field of vision and 80% of their brain is devoted to sight. Together, these facts enable a dragonfly to detect even the slightest movement.

**Who are predators of dragonflies? How do they avoid capture?** Frogs/toads, fish, large spiders, birds, bats and larger Dragonflies are known predators of Dragonflies. Immature dragonflies avoid predators by hiding, and by jetting away if they have to. Adult dragonflies avoid predators with their quick and agile flight, and hide in vegetation when it is too cold to fly. Some plants, like the sundew plant, eat dragonflies. In some countries, people eat dragonflies in soup or as a crunchy snack.

**The Devil's Darning Needles - Fact or Fiction?** Dragonflies were known as the "devil's darning needles" because it was believed that they would sew the lips of wicked children together while they were sleeping. And it was thought that dragonflies could bring snakes back to life. As a result, they were also known as "snake doctors." Despite their appearance, rapid speed, and "rattling" approach dragonflies are harmless to humans. The clasper at the end of the abdomen of the insect is often mistaken for a stinger. The male actually uses it to hold onto the female dragonfly when mating!

## MOSQUITO SUMMARY

