

## FREQUENTLY ASKED QUESTIONS

### **How fast can mosquitoes fly?**

Depending upon the species, mosquitoes can fly at about 1 to 1.5 miles per hour.

### **How far can mosquitoes fly?**

Mosquito species preferring to breed around the house, like the Asian Tiger Mosquito, have limited flight ranges of about 300 feet. Most species have flight ranges of 1-3 miles. Certain large pool breeders in the Midwest are often found up to 7 miles from known breeding spots. The undisputed champions, though, are the saltmarsh breeders - having been known to migrate up to 100 miles in exceptional circumstances, although 20 to 40 miles are much more common when hosts are scarce. When caught up in updrafts that direct them into winds high above the ground, mosquitoes can be carried great distances.

### **How much do they weigh?**

Smaller species found around houses commonly weigh about 2.5 milligrams. Our largest species weigh in at a whopping 10 milligrams.

### **How much blood does a mosquito take in a meal?**

When feeding to repletion, mosquitoes imbibe anywhere from 0.001 to 0.01 milliliter.

### **Why do mosquitoes feed on blood?**

Female mosquitoes imbibe blood so that their eggs can mature prior to laying. It serves no nourishment function. Males do not take blood meals at all. In order to obtain energy, both male and female mosquitoes feed upon plant nectars - much in the same manner as honeybees.

### **What good do mosquitoes do?**

Mosquitoes fill a variety of niches which nature provides. As such, placing a value on their existence is generally inappropriate. Although the fossil record is incomplete, they have been known from the Cretaceous Period (about 100 million years ago) in North America. Their adaptability has made them extraordinarily successful, with upwards of 2,700 species worldwide. Mosquitoes serve as food sources for a variety of organisms but are not crucial to any predator species.

### **How long do mosquitoes live?**

Lifespan vary by species. Most adult female mosquitoes live 2-3 weeks. Some species that over-winter in garages, culverts and attics can live as long as 6 months.

### **If mosquitoes were eradicated, how would this affect the ecosystem?**

Given that Nature abhors a vacuum, other species will fill the niches vacated by the mosquitoes after an initial shuffling period of variable length. Be advised, though, that species replacing mosquitoes may be even worse - it's extremely difficult to predict. Mosquitoes' ability to adapt to changing environments would make them all but impossible to eradicate.

### **How high do mosquitoes fly?**

In general, mosquitoes that bite humans prefer to fly at heights of less than 25 ft. Asian Tiger Mosquitoes have been found breeding in treeholes over 40 feet above ground. In Singapore, they have been found in apartments 21 stories above ground. Mosquitoes have been found breeding up to 8,000 feet in the Himalayas and 2000 feet underground in mines in India.

### **Can mosquitoes transmit AIDS?**

Many studies have been conducted on this issue in the United States and abroad. To my knowledge, there has never been a successful transfer of the virus from an infected source to another host by bloodfeeding insects under experimental conditions. The experts have concluded that the insects are not capable of such transmission. Many biological reasons would lead one to this same conclusion, but the extensive experimental studies are the most powerful evidence for the conclusion.

1. **HIV DOES NOT** replicate in mosquitoes. Thus, mosquitoes cannot be a biological vector as they are for malaria, yellow fever, or dengue. In fact, mosquitoes digest the virus that causes AIDS.
2. There is no possibility of mechanical transmission (i.e., flying contaminated syringes); even though we all know that HIV can be transmitted by dirty needles. However, the amount of "blood" on a mosquitoes' mouth parts is tiny compared to what is found on a "dirty" needle. Thus, the risk is proportionally smaller. Calculations based on the mechanical transmission of anthrax and Rift Valley fever virus, both of which produce very high titers in blood, unlike HIV, showed that it would take about 10,000,000 mosquitoes that first fed on a person with AIDS and then continued feeding on a susceptible person to get 1 transmission.
3. Mosquitoes are not flying hypodermic needles. Mosquitoes regurgitate saliva into the bite wound (the normal route for disease transmission) through a separate tube from that through which it imbibes blood.

### **Which mosquitoes transmit WNV?**

At least 43 species of mosquitoes have been found infected with the West Nile virus in the United States. Not all of these, however, are capable of maintaining the virus in such a manner as to permit them to transmit it among organisms. Many of these infected mosquitoes feed only upon birds, thus contributing to a cycling of the virus among avian populations. Other species feed upon these infective birds and then will feed upon mammals, including humans. These are called "bridge vectors" because they serve as a conduit for the virus to travel from its reservoir in birds to its final host in humans or other mammals. In urban settings, *Culex pipiens* is usually the primary vector. In rural areas, particularly in the western part of the United States, *Culex tarsalis* is the primary transmitter. As control measures for each of these mosquitoes are considerably different, it's important to know which is known to be in your area. Contact your local mosquito abatement district or the Technical Advisor of the American Mosquito Control Association (904-215-3008) for information regarding the mosquitoes found in your area.

### **Which state has the fewest mosquitoes?**

West Virginia has the fewest species (26), while Texas has the most species (85). A determination of absolute numbers of mosquitoes for each state is extremely difficult, however, as mosquito populations tend to be focal, depending upon amount of breeding habitat, potential hosts and climatological factors - regardless of the number of species. Thus, relatively dry places like Nevada, Arizona and New Mexico may have intense mosquito activity in areas where water is present. Alaska has a relatively short season, but biting activity during that time is prodigious, indeed. Mosquitoes are particularly prolific in areas with rice farming, extensive salt marsh or dredge spoil.

### **What attracts mosquitoes to me?**

Why some people seem to be more attractive than others to mosquitoes is the subject of much repellent (and attractant for traps) research being conducted nationwide. Carbon dioxide is the most universally recognized mosquito attractant and draws mosquitoes from up to 35 meters. When female mosquitoes sense carbon dioxide they usually adopt a zigzagging flight path within the plume to locate its source. Once in the general vicinity of a potential host, other cues predominate, including body odors (sweat, lactic acid, etc.) and heat. Odors produced by skin microflora also play a part in inducing the mosquito to land. Over 350 compounds have been isolated from odors produced by human skin. Either singly or in combination, many of these compounds may be attractants - and many may be repellents. As you can see, the situation is complicated and will require many years of testing

before it can be sorted out. Visual stimuli, such as movement, also factor into host-seeking. What can be safely stated, though, is that ingestion of garlic, vitamin B12 and other systemics has been proven in controlled laboratory studies to have no impact on mosquito biting. Conversely, eating bananas did not attract mosquitoes as the myth suggests, but wearing perfumes does. People drinking beer have been shown to be more attractive to mosquitoes. Limburger cheese has also been found to be attractive. Scientists have theorized that this may explain the attractancy some mosquitoes find for human feet.

### **Which repellent works best?**

N,N-diethyl-3-methylbenzamide (DEET) remains the standard by which all other repellents are judged. DEET was developed by the U.S. Department of Agriculture and was registered for use by the general public in 1957. It is effective against mosquitoes, biting flies, chiggers, fleas, and ticks. Over 25 years of empirical testing of more than 20,000 other compounds has not resulted in another marketed chemical product with the duration of protection and broad-spectrum effectiveness of DEET although the recent additions of picaridin and oil of lemon eucalyptus are remarkably close in effectiveness to DEET. The American Academy of Pediatrics says that all family members over the age of two months can use DEET-based repellents with up to 30% concentration with confidence.

DEET-based repellents have been around for more than 50 years but that hasn't kept the folks who make these products from innovating with new fragrances, new formulations, new product types, and, best of all, products that feel nice when applied. The DEET-based repellent fragrances are pleasant to use and range from fruity to woody neutral scents. Unscented products have a slight alcohol odor (there's alcohol in the formulation) until they dry on the skin. Folks who tend to be allergic to fragrances should try the unscented products.

Today's products start out at a concentration of 5% (lasts 90 minutes or so) and range up to 100% (for approximately 10 hours of protection from bites). Pick one that matches your activity. For an outdoor family barbecue in the evenings, a 10% product is fine. It will help protect from bites for approximately 90 minutes to two hours. Products are available in aerosols, pump sprays, lotions, creams and even towelettes. These are individually packaged and are also sold in a handy plastic container that allows the towelettes to pop up one at a time. There are water resistant and water repellent products. One brand uses a microencapsulation process that helps the DEET release over time after you have applied it. Another goes on dry from an aerosol can, just as powder antiperspirants do.

For those who are in tick country, it's important to use a product with at least a 20% concentration. Lower concentrations of all EPA-registered repellents are not effective at warding off ticks.

Most apparent repellency failures with DEET are due to misapplications, so care should be taken to apply it thoroughly (avoiding the eyes and mucous membranes) and to reapply when necessary. This is crucial to maintain the DEET vapor barrier above the skin. New polymerized 30% DEET cream formulations provide excellent protection not significantly exceeded by higher DEET concentrations. Physicians recommend that a formulation of no more than 10% DEET be used on children, but formulations of over 30% can be used in areas of high disease incidence if label directions are followed.

In April of 2005, the Centers for Disease Control and Prevention (CDC) began recommending two new active ingredients as safe, effective repellents.

The first of these is picaridin, a synthetic developed by Bayer Corporation in the 1980s. This repellent is the most widely used repellent in the world outside of the United States and is marketed as Cutter Advanced. Picaridin is odorless, has a pleasant feel and doesn't plasticize like DEET. Studies have shown it to be as fully repellent to mosquitoes as DEET and can also be applied on infants as young as 2 months. The 15% picaridin formulation, Cutter Advanced Sport, is also an effective repellent for ticks.

The other repellent, often the choice of those wanting a natural product, is oil of lemon-eucalyptus, sold as Repel®.

Repel is a 40% formulation of naturally-derived eucalyptus and has a pleasant scent and feel without any plasticizing properties. It is also effective at repelling ticks.

### **How do mosquitoes get into my house?**

Mosquitoes are singularly adept at entering houses through any portal available, be it through broken window or door screens, attic soffits or through bathroom exhaust vents. A favorite resting spot is the garage, so take care to keep resting female mosquitoes from coming into the house through the garage.

### **What can homeowners do to reduce mosquito bites?**

If possible, schedule your activities to avoid the times when mosquitoes are most active - usually dawn and dusk. You should also dress in light, loose-fitting clothing. If you have a deck, light it using General Electric yellow "Bug Lights". These lights are not repellent, per se, but do not attract mosquitoes like other incandescent lights. Mosquitoes are relatively weak fliers, so placing a large fan on your deck can provide a low-tech solution. Citronella candles have a mild repellent effect, but do not offer significantly more protection than other candles producing smoke.

### **Are backyard misting systems effective?**

Scheduled sprays used by these misters may needlessly broadcast pesticides into the environment, affecting mosquitoes and non-target insects alike. Modern mosquito control strategies emphasize an integrated approach, based upon a profound knowledge of the target, so that its various vulnerabilities can be exploited by the many tools we've developed for that purpose. Effective mosquito control requires continual survey of adult mosquito densities to determine if certain triggers for control are met. This reduces the use of adulticides to only those times when they are required.

### **Do Bug-Zappers Work?**

Black light insect electrocution devices (Bug Zappers, etc.) are purchased in huge quantities by homeowners due to their demonstrated ability to attract and kill thousands of insects over a 24 hr. period. One industry representative estimates that over 1.75 million of these devices are purchased annually in the U.S. But do they really control pest insects? Bug zappers do indeed kill some mosquitoes. However, the only two controlled studies conducted to date by independent investigators at the University of Notre Dame showed that mosquitoes comprised merely 4.1% and 6.4% respectively of the daily catch over an entire season. Even more important was the finding in both studies that there was no significant difference in the number of mosquitoes found in yards with or without bug zappers. What is particularly disconcerting, however, is the number of non-pest insects that comprise the vast majority of trap catch. Many of these insects are beneficial predators on other insect pests. They in turn constitute a major part of the diet of many songbirds. Indeed, reduced numbers of moth and beetle prey species have contributed significantly to the decline of songbird populations in many affluent suburbs. Insect electrocution devices undoubtedly bear some responsibility for this phenomenon. Mosquitoes continue to be more attracted to humans than to the devices. One study conducted in homeowners' backyards showed that of the insects killed by these devices, only 0.13% were female mosquitoes. An estimated 71 billion to 350 billion beneficial insects may be killed annually in the United States by these electrocuting devices.

### **Do Ultrasonic devices work?**

At least 10 studies in the past 15 years have unanimously denounced ultrasonic devices as having no repellency value whatsoever. Yet, consumers flock in droves to hardware stores to purchase these contraptions. Why? The discovery that mosquitoes locate mates in mating swarms via wing beat frequency generated a great deal of research into ultrasound as a potential source of environmentally-friendly control. Yet, all attempts to affect mosquito behavior by ultrasound have fizzled, despite enormous amounts of money spent upon research and development. To be sure, the clever, high-tech, and imperceptible (by humans) use of ultrasound proved to be an exceedingly effective marketing tool for the repeller manufacturers. Homeowners were urged to buy ultrasonic repellents and the like to rid their houses of pests without the need to inhale "even one breath of poisonous spray".

This appeal to the public's chemophobia, while extremely effective in diverting attention away from proven preventive and control measures (and toward their repeller products), has undermined an unbiased review of the subject by consumers desperate for a clean, effective, nonchemical means of mosquito control. Unfortunately, no such miracle cure exists. A pioneering study testing five different ultrasonic devices against four mosquito species convincingly demonstrated that ultrasound in the 20-70 kHz range used by these devices had no effect on reorienting flight by female mosquitoes either toward or away from human subjects. Additional tests have shown that sound generators capable of a wide range of frequencies were also ineffective in repelling mosquitoes. The fact is that these devices just do not work - marketing claims to the contrary.

### **Do mosquito traps work?**

An enormous amount of consumer interest has been generated by the marketing of new devices designed to attract, then either trap or kill, mosquitoes. The general idea is to reduce the number of questing mosquitoes that would otherwise be afflicting the homeowner. Many products even claim to significantly reduce or even collapse local mosquito populations by decreasing the number of egg-laying females through their capture. All of these traps utilize some form of attractant that lures the host-seeking female mosquitoes to a capture or killing device. In some cases, mosquitoes are captured via an impellor fan that suctions them into a net, where they desiccate while other trapping systems use a sticky surface to which the mosquitoes adhere when they land. Still others utilize an electric grid to electrocute mosquitoes drawn into contact. These are not set-and-forget devices. Each requires some level of maintenance, i.e. propane tanks need replacement, capture nets need emptying, adhesive boards require replacement and grids require cleaning to ensure their continued effectiveness, particularly in areas of high catch. The process of a mosquito questing for a blood meal involves a complex, interconnected cascade of behaviors, each probably having its own cues, be they visual, thermal, or olfactory. The complexity of these questing behaviors may account for the bewildering variations in trapping efficiency noted for certain species of mosquitoes at different times, seasons and places. With 174 species of mosquitoes currently recognized in the United States, this is no small issue and will require many years before research can provide a clarification. There is some anecdotal evidence that these baited traps, indeed, capture more females of some species than others, depending, to some extent, on the concentration of carbon dioxide emitted and the mosquito species present. There may also be seasonal and circadian variables that affect mosquito responses to certain attractants. Nonetheless, these devices will trap and kill measurable numbers of mosquitoes. Whether this will produce a noticeable reduction in the mosquito population in each case will depend upon a number of factors, e.g. individual tolerance level, absolute mosquito population size, proximity, size and type of breeding habitat producing re-infestation, wind velocity and direction, and species of mosquito present, and others. Thus, the homeowner must still use repellents and practice source reduction methods as adjuncts to realize any measure of relief. Please be cautioned against putting too much faith in traps as your sole means of control. These traps represent an evolving technology that is a most welcome addition to our mosquito control armamentarium. Their potential is great, but shouldn't be overestimated. It's highly unlikely that these devices, whatever their improvements, will ever fully supplant organized community-wide mosquito control programs, for there is no single silver bullet that will prove to be the ultimate answer to mosquito problems.

### **Do bats serve as an effective mosquito control?**

Recently the public has shown increased interest in the value of insectivorous species of bats in controlling mosquitoes. Although untested lately, this is not a new idea. During the 1920's several bat towers were constructed near San Antonio, Texas, in order to help control malarial mosquitoes. Mosquito populations were not affected and the project was discontinued. Bats in temperate areas of the world are almost exclusively insectivorous. Food items identified in their diet are primarily beetles, wasps, and moths. Mosquitoes have comprised less than 1% of gut contents of wild caught bats in all studies to date. Bats tend to be opportunistic feeders. They do not appear to specialize on particular types of insects, but will feed on whatever food source presents itself. Large, concentrated populations of mosquitoes could provide adequate nutrition in the absence of alternative food. However, a moth provides much more nutritional value per capture than a mosquito. M.D. Tuttle, a world authority on bats, is often quoted for his anecdotal report that bats effectively controlled mosquito

populations at a popular resort in New York State. While there is no doubt that bats have probably played a visible, if not prominent, role in reducing the mosquito problems in many areas, the natural abatement of mosquito populations is an extremely complex process to study, comprising poorly known ecological relationships. Tuttle attempts to underscore the bats role by citing an experiment in which bats released into a laboratory room filled with mosquitoes caught up to 10 mosquitoes per minute. He extrapolated this value to 600 mosquitoes per hour. Thus, a colony of 500 bats could consume over a quarter of a million mosquitoes per hour. Impressive numbers indeed, but singularly unrealistic when based upon a study where bats were confined in a room with mosquitoes as their only food source. There is no question that bats eat mosquitoes, but to utilize them as the sole measure of control would be folly indeed, particularly considering the capacity of both mosquitoes and bats to transmit diseases.

### **Do Purple Martins help reduce mosquitoes?**

It has been known for many years that bird species like purple martins consume large numbers of flying insects. Proponents of their use in mosquito control are quick to cite J. L. Wade, an amateur ornithologist, who reasoned that an average 4 oz. adult purple martin, due to its rapid metabolism, would have to consume its body weight (14,000 mosquitoes) per day in order to survive. Wade recognized that the purple martins diet includes many other types of insects, but this appears to have been lost on many individuals searching for a natural means of control. In fact, during daylight, purple martins often feed voraciously upon dragonflies, known predators of mosquitoes. At night, when mosquitoes are most active, purple martins tend to feed at treetop level, well above most mosquito flight paths. Ornithologist James Hill, founder of the Purple Martin Conservation Association (PMCA), writes, "The number of mosquitoes that martins eat is extremely insignificant, and they certainly don't control them. In-depth studies have shown that mosquitoes comprise no more than 0 to 3 percent of the diet of martins". They eat only flying insects, which they catch in flight. Their diet is diverse, including dragonflies, damselflies, flies, midges, mayflies, stinkbugs, leafhoppers, Japanese beetles, June bugs, butterflies, moths, grasshoppers, cicadas, bees, wasps, flying ants, and ballooning spiders. Martins are not, however, prodigious consumers of mosquitoes as is so often claimed by companies that manufacture martin housing. An intensive 3-year diet study conducted at PMCA headquarters in Edinboro, PA, failed to find a single mosquito among the 350 diet samples collected from parent martins bringing beakfuls of insects to their young. The samples were collected from martins during all hours of the day, all season long, and in numerous habitats, including mosquito-infested ones. Purple Martins and freshwater mosquitoes rarely ever cross paths. Martins are daytime feeders, and feed high in the sky; mosquitoes, on the other hand, stay low in damp places during daylight hours, or only come out at night. Since Purple Martins feed only on flying insects, they are extremely vulnerable to starvation during extended periods of cool and/or rainy weather. Rather than erecting martin houses to specifically attract insect-eating birds for mosquito control, we should at least promote them for their aesthetic and educational value.

### **How do mosquito control districts control mosquitoes?**

The integrated mosquito management methods currently employed by organized control districts and endorsed by the CDC and EPA are comprehensive and specifically tailored to safely counter each stage of the mosquito life cycle. Larval control through water management and source reduction, where compatible with other land management uses, is a prudent pest management alternative - as is use of the environmentally friendly EPA-approved larvicides currently available. When source elimination or larval control measures are clearly inadequate, or in the case of imminent disease, the EPA and CDC have emphasized in a published joint statement the need for considered application of adulticides by certified applicators trained in the special handling characteristics of these products.

A successful mosquito management program should include the following elements:

1. larval and adult mosquito sampling;
2. source reduction;

3. biological control using native or introduced predators and parasites of mosquitoes,
4. larviciding and adulticiding, when indicated by surveillance;
5. resistance monitoring;
6. disease surveillance in mosquitoes, birds, horses and humans, and
7. public education.

#### **Are pesticides used in mosquito control safe?**

Since its inception, the Environmental Protection Agency (EPA) has regulated mosquito control through enforcement of standards instituted by the Federal Insecticide, Fungicide, and Rodenticide Act. This legislation mandated documentation of extensive testing for public health insecticides according to EPA guidelines prior to their registration and use. These data requirements are among the most stringent in the federal government and are met through research by established scientists in federal, state and private institutions. This process costs a registrant several million dollars per product, but ensures that the public health insecticides available for mosquito control do not represent health or environmental risks when used as directed. Indeed, the five or six adulticides currently available are the selected survivors of literally hundreds of products developed for these uses over the years. The dosages at which these products are legally dispensed are at least 100-fold less than the point at which public health and environmental safety merit consideration. In point of fact, literature posted on the websites of the EPA Office of Pesticide Programs, Centers for Disease Control and Prevention (CDC), American Association of Pesticide Safety Educators and National Pesticide Information Center emphasizes that proper use of mosquitocides by established mosquito control agencies does not put the general public or the environment at unreasonable risk from runoff, leaching or drift when used according to label specifications. (For the federal government's position on risks associated with mosquito control insecticides, visit <http://www.epa.gov/pesticides>).

The safety profiles of public health insecticides are undergoing increasing scrutiny because of concerns with how the specialized application technology and product selection protect the exposed public and environment. In fact, well over 200 peer-reviewed scientific studies in various national and international refereed journals since 1980 have documented the safety and efficacy of these public health insecticides at label rates in addition to their application techniques.

#### **How do mosquito districts avoid spraying chemically-sensitive persons?**

Organized mosquito control agencies often go to extraordinary lengths to accommodate individuals who, for varying reasons, prefer their property not be sprayed with approved public health insecticides. When surveys indicate the need for adult sprays, they are approved, planned and conducted with special regard to the concerns of chemically sensitive persons. Personal notification of chemically-sensitive individuals of spray times in addition to using Global Positioning Systems (GPS)/Global Information Systems (GIS) technology to reduce the likelihood of drift over unauthorized areas are but a few of the means utilized to ensure mosquito control serves the entire public spectrum. Should you desire that your property not be sprayed, please notify your local district.

#### **Do mosquito sprays affect animals other than mosquitoes?**

The extremely small droplet aerosols utilized in adult mosquito control are designed to impact primarily on adult mosquitoes that are on the wing at the time of the application. Degradation of these small droplets is rapid, leaving little or no residue in the target area at ground level. These special considerations are major factors that favor the use of very low application rates for these products, generally less than 4 grams active ingredient per acre, and are instrumental in minimizing adverse impacts.

