THE INTERSECTION OF Mosquito Management & Pollinator Protection

Elmer W. Gray and Jennifer Berry
Department of Entomology

UNIVERSITY OF GEORGIA
EXTENSION

Mosquitoes can transmit a wide variety of pathogens and significantly reduce our quality of life with their aggressive biting behavior. Pollinators, and honey bees in particular, are a critical part of our natural environment, contributing significantly to food production and ecological diversity. Unfortunately, these two groups of insects often have overlapping habitats. As a result, proponents of both mosquito management and pollinator protection must find a way to communicate effectively and work together for the betterment of both society and these important entities.

Mosquitoes pose a significant public health risk due to their disease transmission potential. While West Nile virus is the most common mosquito-borne disease in Georgia, other diseases like Eastern equine encephalitis and LaCrosse encephalitis are also regularly detected. In addition to their disease transmission potential, biting mosquitoes are a perennial deterrent to outdoor activity in many communities. As a result of their pervasive pest status, many different techniques are used to suppress mosquito populations. Comprehensive mosquito control today should be conducted using integrated pest management practices. This approach typically includes education, source reduction, surveillance, larviciding, and adulticiding. When conducted properly, scientific studies and repeated operational observations have demonstrated that an integrated pest management approach does not pose a significant risk to honey bee colonies.

That being said, pollinators are extremely important and seemingly at risk. Pollination, the process of transferring pollen, is necessary for the production of seeds and fruits in many crops. While many insects such as flies, beetles, moths, butterflies, and wasps can be important pollinators, bees outperform them all because of their dietary need for pollen and nectar, their hairy bodies that carry pollen grains easily, and their rapid flight from flower to flower. In addition, of all insects considered beneficial, none is more favorably viewed by the public than the western honey bee, *Apis mellifera*.

Protecting honey bees

Unfortunately, honey bees face many challenges. In 2006, beekeepers began to report unusual colony losses throughout the U.S. Scientists adopted the term "colony collapse disorder," or CCD, and over the past two decades all aspects of honey bee biology and ecology have been intensively studied. The resulting research has identified many factors that are contributing to the stressors facing honey bees. The most important factors include the nonnative, ectoparasitic mite, *Varroa destructor*; viruses spread by these mites; pesticide exposures; and habitat/forage degradation and the resulting poor nutrition from this degradation.

Honey bees, along with other pollinators, are susceptible to pesticides, and significant bee kills have occurred due to mistimed or misguided pesticide applications. These types of events should not occur, and all parties involved must work in a more thoughtful and diligent manner to ensure that they don't. However, in today's society and economy, pesticide applications are conducted in many parts of our environment by a wide range of individuals with varying levels of training and expertise. Commercial pesticide applicators involved in mosquito control activities are required by law to possess a pesticide applicator's license, which typically includes pollinator protection training and education. In addition, all pesticide applications are regulated by the pesticide label, which now include pollinator awareness specifications. The training and education of all pesticide applicators is of high importance and emphasis for UGA Cooperative Extension.

While all pesticide applicators bear a significant responsibility to minimize pollinator exposure to pesticide applications, bee keepers also have a responsibility to inform applicators about the presence and location of their honey bee colonies. ***The importance of this level of communication between both parties cannot be overstated.*** Pesticide applicators, and mosquito control districts in particular, cannot avoid honey bee colonies if they are not aware of their presence. Consequently, the best thing a bee keeper can do to protect their hives from mosquito control activities is to be educated about the local mosquito control practices. Areas with organized mosquito control programs have an operational administration that would serve as the point of contact for both local beekeepers and beekeeping associations/clubs. Communicating with the local mosquito control district will provide the best information related to the current mosquito control efforts in the area and how beekeepers can protect their hives and minimize pesticide exposure. In some areas today, the local public health administration is involved in mosquito control activities and would also be another effective point of contact. Most everyone involved in vector and pest management is aware of the concerns about pollinator health and the need for improved levels of communication and diligence.

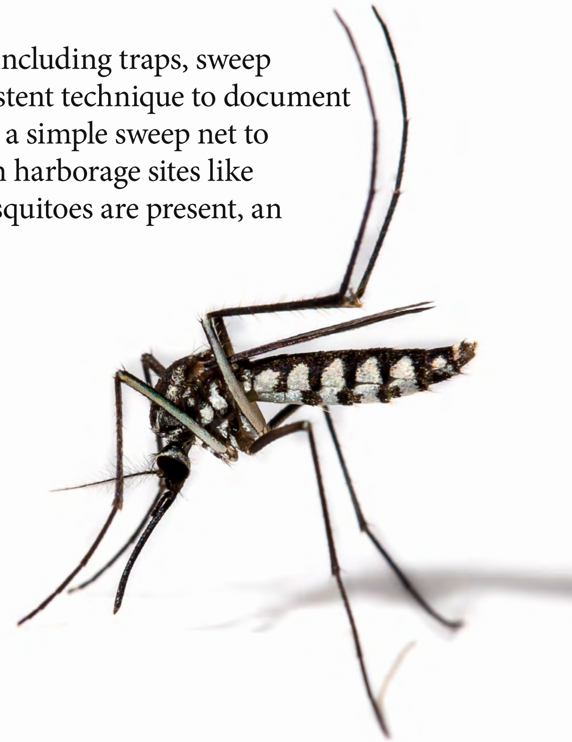
For mosquito control practitioners, knowing a honey bee colony is present is just part of the equation. Mosquito control is a complex issue. It is conducted in a wide range of habitats and social structures and includes both public health and nuisance aspects. There are usually valid reasons to justify the effort and expense of a mosquito control application. Either surveillance data has identified a significant nuisance population, there is a public health issue due to an identified disease transmission risk, or multiple complaints have been received. No matter the cause, mosquito populations that are building to levels sufficient to warrant a mosquito control application should be targeted in a comprehensive manner. Mosquito control professionals should fully support the use of UGA Extension Circular 1154, *Best Practices of Integrated Mosquito Management*, which includes a stepwise progression of activities that will suppress a mosquito population in the most efficient manner. Education, source reduction, surveillance and larviciding can all be conducted prior to considering an adulticide application. Education is the foundation that all levels of mosquito control builds upon. Knowledge of the mosquito life history provides a better understanding of how to target the pest populations most effectively using the wide range of techniques that are available.

Mosquito biology and larviciding

As part of this educational process, a brief synopsis of mosquito biology would include the following information from UGA Extension Circular 1155, *Mosquito Biology and Behavior.* All mosquitoes require standing water for larval and pupal development. Female mosquitoes deposit their eggs on the surface of standing water or in places that later become flooded or filled with water. After the eggs hatch, the larvae develop through four instars. Under ideal conditions, which include warm temperatures and abundant food (small plants, animals, and particles of organic matter), the larval stage may only require 5–6 days, but it usually takes longer. After completing the larval stage, pupation occurs. The pupal stage is a period of transition and often requires 2–3 days before the adult mosquito emerges onto the water's surface. Both male and female mosquitoes feed on nectar and other plant juices to provide energy for flight, but only the female mosquito requires a blood meal to acquire the nutrients needed to stimulate egg production. It is this requirement of a blood meal that causes the mosquito to be our most important arthropod vector.

It is important that the public and mosquito control practitioners have a basic understanding of the mosquito's life cycle and integrated mosquito management (IMM) practices. Homeowners can often reduce mosquito populations around their homes and neighborhoods by being vigilant about eliminating all forms of standing water (see UGA Extension Circular 1266, *Mosquito Control Around the Home*). The trays under potted plants are one of the most common larval habitats around the home. Reducing sources by eliminating areas of standing water through improved drainage or community cleanups permanently eliminates larval habitats and provides mosquito control with no pesticide applications. Constant vigilance around homes and neighborhoods is required, as larval habitats will develop and change over the course of the year. Larval habitats that cannot be eliminated, but have larval mosquito populations present, can be treated with larvicides approved by the U.S. Environmental Protection Agency. A complete listing of approved larvicides can be found in UGA Extension Special Bulletins 28 and 48, the *Georgia Pest Management Handbook*. Larviciding is very efficient and effective, but sometimes the larval habitats are expansive, inaccessible, or unknown. As a result, adulticiding remains an integral part of IMM. However, adulticide applications should not be conducted until adult mosquito surveillance has detected a pest population present.

Mosquito surveillance and adulticiding



Adult mosquito surveillance can be conducted using a variety of techniques, including traps, sweep netting, or landing rate counts. It's most important to use a reliable and consistent technique to document that a pest population is present. Commercial pest control companies can use a simple sweep net to determine whether adult mosquitoes are present in a yard or around common harborage sites like hedges, shrubs, vegetative ground covers, and protected areas. If no adult mosquitoes are present, an adulticide application is not warranted at that time. At this point, enhanced education, surveillance, and source reduction efforts can be conducted to adhere to IMM best practices, which demonstrates a priority of environmental stewardship for the company. These practices will reduce pollinator exposure to unnecessary pesticide applications, help to preserve pesticide susceptibility, and reduce costs while being environmentally responsible.

If adult mosquitoes are present and an adulticide application is warranted, there are a variety of techniques and products that could be used. Adulticide applications commonly occur in one of three forms, ultra low volume (ULV), thermal fogging, or a residual barrier application. The ULV and thermal applications produce a mist or "fog" of small (10-50 µm) droplets and are representative of the current version of the familiar, long-time mosquito spray truck. Today ULV applications can be conducted from planes, helicopters, trucks, ATVs, or handheld devices, depending on the size of the area to be treated and the resources of the applicator. Thermal fogging is typically conducted on a smaller scale, either from truck, ATV, or by hand. Both of these technologies typically require applications late in the day to the overnight period when meteorological conditions are most conducive to keeping the insecticide droplets closer to the ground where mosquitoes are active. Residual barrier sprays are commonly applied with powered backpack sprayers but can be applied with a manual pump-up sprayer. This technique uses a coarser spray to target surfaces where resting or hiding mosquitoes will land. Barrier sprays are typically applied during daylight hours and should be carefully applied to avoid all flowering vegetation. No matter the technique, if an insecticide application is warranted, ***the label is the law,*** and pollinator awareness information is now included on that label.

Calibrating application equipment is critical to an effective adulticide application. ULV applications target a specific droplet size based on the equipment and pesticide being used. Proper calibration will maximize the effectiveness of an application and thereby help to reduce the number of subsequent applications. The ULV application is conducted so that the mist of the pesticide droplets is released into the environment where, and when, the adult mosquito is active. It is imperative that the target pest species is active when the insecticide droplets are present. As a result of most mosquitoes being crepuscular (active during twilight) or nocturnal, ULV adulticide applications are typically conducted between dusk and dawn. This is good for pollinators because most applications are conducted after most pollinators have returned to their hives or nests in the late afternoon. It has also been determined that bees are approximately 100 times less susceptible to an appropriately calibrated application of mosquito adulticide than mosquitoes.

Minimizing risk to hives

While mosquito control personnel work to minimize adulticide applications using IMM best practices, the responsibility for the health and welfare of bee colonies rests ultimately with the beekeeper. As a result, there are things beekeepers can do to minimize the risk to their hives. In addition to communicating with the local mosquito control authorities, hives can be located in a deliberate manner. Strategically positioning hives 300 ft or more away from potential truck spray routes can significantly decrease the potential exposure to all ground-based adulticide applications. For situations where hives will be located closer to spray routes, barriers such as fencing, hedges, or shrubbery can offer significant protection by reducing the exposure potential. Barriers on two sides are good, but a three-sided barrier would be even better. Hive openings should face away from the potential spray route, again reducing the potential for bees to be exposed to mosquito control applications. When mosquito control practitioners notify beekeepers of an adulticide application, hives can be covered with moist burlap, sheets, hive nets, or any other type of breathable material to keep bees in the hive during the timed application and reducing the potential for pesticide deposition on the hive. Keeping the foragers inside for a short period will help to reduce any potential residual pesticide exposure. However, honey bees have the potential to forage up to 5 miles in search of pollen and nectar and as a result can be exposed to pesticides in many scenarios beside mosquito control applications. This biological trait requires that beekeepers be cognizant of all facets of the environment around their selected colony site location. Mosquito control is usually conducted to reduce the potential for disease transmission or reduce nuisance populations. The less densely populated an area, the less likely it is to have significant mosquito control activity.

However, the recent rise in individual yard treatments for mosquito control has significantly increased the number of residual barrier treatments being conducted in some communities. Concerned homeowners need to communicate with their neighbors, particularly when vegetation that is highly attractive to pollinators is present near property lines. When possible, vegetation that is most attractive to pollinators should be planted toward the center of a property so that pollinators are less likely to be exposed to a neighbor's control treatments. Fences and vegetative border plantings that are less attractive to pollinators will also help to minimize the impact of a neighbor's pesticide application. In addition to civil communication between neighbors about pesticide applications, creating a cooperative, diligent approach to eliminating standing water in a community to reduce mosquito habitats can go a long way toward protecting all of our pollinators.

Conclusion

In summary, both mosquito control practitioners and beekeepers play a vital role in reducing the risk of pesticide applications to pollinators. Mosquito control should be conducted according to best practices of IMM, which includes educating the public on how to prevent and eliminate larval habitats, determining exactly what species is causing the nuisance or public health risk, and eliminating any available larval habitats. Larval habitats that can't be eliminated through source reduction efforts should be treated with an EPA approved larvicide. If larval habitats cannot be located and eliminated, then an adulticide application may be required. It is at this point that communication, hive placement, and care becomes the most important parts of the intersection of mosquito control and pollinator protection. Beekeepers should know when mosquito spraying is taking place and mosquito control **must** know where honey bee colonies are located in order to minimize pollinators being exposed unnecessarily. Enhanced training, education, and communication should become routine practice for both groups in order to reduce the exposure of all types of pollinators to mosquito control applications.

The permalink for this UGA Extension publication is extension.uga.edu/publications/detail.html?number=C1188

Circular 1188 **Revised August 2024**

Published by the University of Georgia in cooperation with Fort Valley State University, the U.S. Department of Agriculture, and counties of the state. For more information, contact your local UGA Cooperative Extension office.