

## **3Qs: Why a mosquito is more than just a summertime pest**

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You know that mosquito bite you're scratching like crazy on that hot, summer night? According to Rebeca Rosengaus, associate professor of biology in the College of Science, it may be a vector, or carrier, for diseases. And while we may think that spraying pesticides to prevent the spread of some of these diseases, such as West Nile Virus, may be a good solution, Rosengaus says it's not sustainable. Northeastern University news office asked the expert to explain why a mosquito is more than just a summertime pest.

### **How do insects, such as mosquitoes, become vectors for disease or parasites and then transmit them to us?**

Insects comprise about 83 percent of the known animal life, and 50 percent of all living organisms. Today at least 1 million insect species have been identified. While many insects are beneficial to humans, some of them are also detrimental, particularly those that become agricultural pests and carriers of diseases.

The microorganisms that cause diseases such as Eastern equine encephalitis, West Nile virus or malaria usually have complex life cycles. The microbes require multiple hosts in order to complete their maturation. Insects happen to be excellent carriers of these pathogens because they are transported from one host and injected into the subsequent host. In a way, microbes are "hitchhiking" inside the unaware insect.

The female mosquito requires a blood meal prior to reproduction. She becomes infected during the blood meal, disperses the microbe while flying and then re-infects a new host once she bites again.

The interactions among the microbial pathogens, the multiple hosts, and the insect vectors have been around for millions of years and do not necessarily only affect humans. In general, mosquitoes could bite any terrestrial warm-blooded animal at some stage of its life.

**Some have called for increasing the use of pesticide spraying after pools began testing positive for the West Nile virus. Is pesticide spraying a sustainable solution to problem? Which other vector-control options are researchers currently investigating?**

Theoretically speaking, you should be able to reduce infection rates by controlling the population size of the insect carriers. This, however, is easier said than done.

Insects can be killed with toxic chemical compounds (pesticides) and biological control agents (fungal or bacterial insect pathogens), and by irradiation and subsequent release of infertile males.

Researchers have recently attempted to genetically engineer the mosquito itself or its gut bacteria so that the mosquito becomes refractive to Plasmodium, the malaria-causing microorganism. The later strategy of manipulating the bacteria in the gut of the mosquito seems to be effective. When mosquitoes were fed a blood meal containing the genetically engineered bacteria, the prevalence of Plasmodium in the gut of the insect was reduced by 85 to 90 percent. These different techniques vary in their effectiveness, and it is important to keep in mind that both short- and long-term cost/benefit analyses of these strategies need to be

taken into consideration if we are to control insect vector populations successfully.

In the short term, pesticides would be efficient in reducing mosquito density. However, mosquito populations can evolve resistance against pesticides, rendering them nonsusceptible to the pesticide in the long run. An identical scenario has been responsible for the evolution of antibiotic resistance in bacteria. Thus, we should learn from previous experience and avoid fostering the evolution of pesticide-resistant mosquitoes by restricting the widespread use of pesticides.

## **Scientists have connected global warming to expanded migratory patterns for insects. How will global warming impact the range of incidence of mosquito-borne diseases?**

There is no doubt the Earth is warming. This phenomenon has been accompanied by an expansion northward of animals that otherwise would have been restricted by the cold winter months to lower latitudes.

Insects are no exception. The probability also exists that infected mosquitoes can now not only reach new locations, but also thrive in warmer environments for longer periods of time. This will translate into higher risks of infection for humans and other animals as the mosquitoes search for new blood meals.

Provided by Northeastern University

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