Mosquitoes and mosquito-borne pathogens in St. Kitts, West Indies

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Many old and recently emergent diseases of people and animals are transmitted by mosquitoes; dengue was first described in the third century and Zika in the mid-20th century. Due to the wide distribution of mosquito vectors, many millions of people are at risk of infections, which can cause transient illness and even permanent disability and death. Animals infected with the viruses can serve as reservoirs of infection for people. An in-depth understanding of the ecology of mosquito-borne diseases is essential for the development of strategies to alleviate the burden of infections in people and animals.

Much of the original field-based research into arboviruses, their animal reservoirs (often nonhuman primates), and mosquito vectors was conducted in the Caribbean and Central and South Americas at the start of the 20th century. Even today, outbreaks of arboviral diseases continue to impact the Caribbean islands and are considered ongoing threats to the region, necessitating studies on transmission cycles and the roles of potential animal reservoirs.

The active transmission of chikungunya and Zika viruses, in 2014 and 2016, respectively, in St. Kitts presented researchers at Ross University School of Veterinary Medicine (RUSVM) with the opportunity to investigate whether sylvatic (forest) transmission cycles of chikungunya, dengue, and Zika viruses could exist in the monkeys on the island, as is the case in the ancestral homes of these viruses in Africa and Asia. St. Kitts was an ideal site for this NIH-funded study as it is small (68 square miles) and has a large population of monkeys (about 55,000, which is probably greater than the human population), distinct ecosystems, good infrastructure, and newly established biosafety level-2 laboratory research facilities at RUSVM.

The scope of the investigation was expanded by wide collaboration with experts from universities and institutions in North America and Europe. The project enabled over 30 RUSVM students to receive hands-on research experience while assisting with the testing of almost 1,000 island monkeys and nearly 10,000 mosquitoes for infections with chikungunya, dengue, and Zika viruses. The study showed there was no evidence of sylvatic transmission on St. Kitts and produced baseline data on the mosquito species on the island and their distribution and seasonality.

In follow-up studies of the mosquitoes, Rickettsia felis, a bacterium previously found in cat fleas on the island and the agent of flea-borne spotted fever in people, was identified. This pathogen has also been found in mosquitoes in China and the United States, and current studies are investigating the possible role of mosquitoes in the epidemiology of R felis and its effects in monkeys. Further, the microbiomes and viromes, in particular Wolbachia spp and insect-specific viruses, of Aedes aegypti are being studied, again with international collaborators. Such research will contribute to the development of new strategies for controlling arboviral transmission and the establishment of fine-scale data on mosquito populations.