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General Summary

Arthropod vectors are organisms that play a role in the transmission of a pathogen between humans or from animals to humans. Vectors tend to be blood-sucking insects that ingest the disease-causing organism with the blood from an infected host and then inject it into a new host at the time of their next blood-meal. New strategy to control the vector should absolutely be developed and involved in integrated vector management (IVM), because it is one of the most effective means of dealing with the problem while waiting for a vaccine or another effective dengue control strategy. In this center, based on collaboration between our center and institutions in endemic countries such as Burkina Faso, Nigeria, and Taiwan, entomological studies promoting multilateral approaches have been performed to gather fine knowledge of diagnosis, ethology, immunity, and epidemiology of vector species on effective vector control.

Research Activities

RNAs as potential targets for Wolbachia-mediated phenomena

Wolbachia, endosymbiotic bacteria prevalent in invertebrates, manipulate their hosts in a variety of ways; they induce cytoplasmic incompatibility, male lethality, male-to-female transformation and parthenogenesis. We revealed that, in *Drosophila melanogaster, Wolbachia* infection restored defective *Sex-lethal* (*Sxl*) mutant female germline stem cells (GSCs) through the *Wolbachia* effector protein TOxic Manipulator of Oogenesis (TomO). TomO targeted host *nanos* mRNAs and hindered their interaction with a translational repressor Cup, a component of the maternal ribonucleoprotein (RNP) complex. The resulting enhancement of Nanos prevented the premature differentiation of GSCs, the discernible defects in the *Sxl* mutants. Another fascinate feature of *Wolbachia* involves the positive-stranded RNA virus blocking. The histochemical and biochemical analyses revealed that *Wolbachia* closely associate with Dengue virus genomic RNAs and hamper amplification of Dengue single-round infectious particles, which indicate that replication of viruses could be prohibited by *Wolbachia*. The *Drosophila* maternal RNP complexes associated with *Wolbachia* are reported to include various RNA binding proteins, some of which are the components of the RNA virus replication machinery. We are now testing the hypothesis that the *Wolbachia*-RNP interaction is also the causal element of the RNA virus blocking.

A highly secure method for rearing Aedes aegypti mosquitoes

Vector-borne infectious diseases are caused by pathogenic microorganisms transmitted

mainly by blood-sucking arthropod vectors. In laboratories, the handling of insects carrying human pathogens requires extra caution because of safety concerns over their escape risk. Based on standard insect containment practices, there have been cases where costly enhancements were required to definitely protect laboratory workers and neighbors from potential infection through mosquito bites. Here, we developed a mosquito rearing method that provides a reliable and cost-effective means to securely contain pathogen-infected females of the yellow fever mosquito *Aedes aegypti*. To debilitate the motility of *Ae. aegypti* females, mosquitoes were rendered completely flightless by ablation of either wing. The "single-winged" mosquitoes exhibited a severe defect in flying ability and were incubated in a container with inside surfaces covered with a net stretched to approximately 1-mm mesh, which helped the mosquitoes hold on and climb up the wall. In this container, flightless females consistently showed similar blood feeding and egg laying activities to intact females. Eighty-five percent of the flightless mosquitoes survived at 1 week after wing ablation, ensuring feasibility of the use of these mosquitoes for studying pathogen dynamics. This mosquito rearing method, with a detailed protocol, is presented here and can be readily implemented as a highly secure insectary for vectors carrying human pathogens. For researchers in an environment where highly strict containment practices are mandatory, this method could offer appropriate opportunities to perform research on pathogen-mosquito interactions *in vivo*.

Publications

Ishii M*[1,2]*, Kanuka H, Badolo A*[3,4]*, Sagnon N*[3]*, Guelbeogo WM*[3]*, Koike M*[2]*, Aiuchi D*[2] *([1]Iwate Univ, [2]Obihiro Univ, [3]Centre National de Recherche et de Formation sur le Paludisme (CNRFP), Ouagadougou, Burkina Faso, [4]Laboratoire d'Entomologie Fondamentale et Appliquée, Université, Ouagadougou, Burkina Faso). Proboscis infection route of Beauveria bassiana triggers early death of Anopheles mosquito. *Sci Rep.* 2017; **7:** 347.