Introduction

Commercially available blood can be used as an alternative to live animals to feed mosquitoes; however, the extent to which alternative blood sources affect mosquito vector competence for dengue virus (DENV, family Flaviviridae, genus Flavivirus) is unknown and may have implications for evaluating results of laboratory vector competence experiments. We aim to improve mosquito colony propagation techniques and inform future research using artificial blood delivery methods to assess vector competence.

Objective

• To determine the extent to which commercially available blood source affects life table characteristics and vector competence of Aedes albopictus for DENV.

Materials and Methods

Figure 1. Experimental design

- Mosquitoes fed blood meals (defibrinated: 7.4 ± 0.3 log_{10} plaque-forming units (pfu) DENV/mL; citrated: 7.3 ± 0.1 log_{10} pfu DENV/mL).
- Fully engorged mosquitoes transferred to individual cages containing an oviposition cup and substrate.
- 4 d post-feeding, water added to cups and the presence of eggs checked daily.
- If eggs observed, oviposition substrate removed and eggs counted.
- Eggs allowed to hatch and larvae counted.
- At 14 and 21 d* post blood feeding, 15 mosquitoes taken from each infected treatment group to test for DENV in bodies (infection), legs (dissemination), and saliva (transmission). *Mosquitoes from 21 d time point are still being processed.
- Viral RNA isolated; qRT-PCR to quantify DENV.
- Calculations:
  - Fecundity = # eggs/female
  - Fertility = # eggs hatched / # eggs laid
  - Infection rate = # DENV-positive bodies / # blood fed females
  - Dissemination rate = # DENV-positive legs / # DENV-positive bodies
  - Transmission rate = # DENV-positive saliva / # DENV-positive bodies

Results

Figure 2. Mean number of eggs/female

- Infected mosquitoes laid significantly more eggs than uninfected mosquitoes (P = 0.001).
- Infected defibrinated mosquitoes laid significantly more eggs than any other group (P = 0.015).

Figure 3. Hatch rate

- Hatch rate significantly higher in uninfected mosquitoes compared to infected mosquitoes fed citrated blood (P = 0.038).

Figure 4. DENV titer at 14 d post-infection

- Mosquitoes fed defibrinated blood had significantly higher DENV body titers than all other groups (P = 0.039).

Conclusions

- Vector-virus interactions are complex and affected by biological and environmental factors.
- Blood source impacts Ae. albopictus life table characteristics and vector competence for DENV.
- This knowledge is important to improve risk predictions of mosquito populations for virus transmission.