Project 11.2

Improved Mosquito Disease Detection & Prevention of Spread in the Torres Strait

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Emerging Infectious Diseases

EXISTING DISEASE TRANSMITTED TO A NEW HOST

CHYTRID

DISEASE MOVED TO A NEW AREA

AVIAN MALARIA
Understanding Disease Risk

- Disease detection is higher in developed world
- Disease risk is higher in tropical frontier regions
Understanding Disease Emergence

1) Human land use

2) Inadequate disease surveillance
Our research challenge was to work in the Torres Strait – a remote tropical area – and with limited funds.
Step 1: Develop & trial novel mosquito sampling methods for remote regions

- Standard CDC mosquito trap with battery & CO₂ from dry ice
- New passive box trap (no power) with CO₂ from yeast & sugar
Field trial results

Dry ice generates more CO₂

But importantly the same species are caught with yeast attractant (where mosquitoes are abundant RF & Man).

Novel method can replace standard sampling for remote areas!

Fig. 3. Mean number of species (±1 SE) captured with control, dry ice, yeast 1, and yeast 2 treatments in (a) rainforest, (b) mangroves, and (c) dry forest—(y-axes vary). Different letters denote significant differences.

Overcoming the Challenges of Mosquito (Diptera: Culicidae)
Sampling in Remote Localities: A Comparison of CO₂ Attractants on Mosquito Communities in Three Tropical Forest Habitats

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Step 2: Field Study in the Torres Strait
A comparison of mosquitoes in villages & native habitat on 4 islands, 2 years
Step 3: A novel method for disease detection in mosquito vectors (& capacity building in North Qld)

- Honey-coated FTA® (Flinders Technology Associates) cards installed in traps to collect mosquito saliva
RESULTS

~ 12,000 mosquitoes captured & identified
Does habitat type and island influence species richness?

34 species, 10 genera
Species Composition

Mosquito community varied strongly in response to island & habitat

- Saibai & Boigu similar
- Badu & Moa similar
- villages & natural vegetation support different communities
- 6 species were important

Caution: no long-term study (8 weeks)
Medically important species

*Culex annulirostris* (Ross River, Japanese encephalitis, Murray Valley, Kunjin & many more) the most dominant species in our study.

*Anopheles farauti* (main malaria vector in Australia): mainly captured on Boigu & Saibai

**RECENT INVADER**

*Aedes albopictus* (dengue, Chikungunya, dog heartworm): mainly captured in villages (only 1 in natural vegetation!)
Disease detection

- extracting viral RNA from honey-treated FTA® cards
- followed by PCR (performed in Molecular Lab at JCU Cairns)

- avian & human Malaria
- Dengue
- Ross River fever
- Kunjin
- Japanese encephalitis
- Chikungunya
Step 4: Future research

• Continue to trial different yeast varieties & trap modifications
Conclusions

- Torres Strait is one of the most “at risk” communities in Australia with respect to mosquito-borne EID’s

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Outbreak of Chikungunya Virus Infection, Vanimo, Papua New Guinea

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In June 2012, health authorities in Papua New Guinea detected an increase in febrile illnesses in Vanimo. Chikungunya virus of the Eastern/Central/Southern African genotype harboring the E1:A228V mutation was identified. This ongoing outbreak has spread to ≥8 other provinces and has had a harmful effect on public health.

The Study

In late June 2012, an increase in cases of fever for ≥3 days was reported from the Vina Hospital in Vanimo, Sandaun Province. The illness was characterized by high fever (temperature ≥39°C), anorexia, myalgia, arthralgia, nausea, vomiting, and severe pruritus. In most patients, symptoms subsided within 24-72 hours and patients went into remission after abatement of initial signs and symptoms. In many patients, symptoms returned within a few days requiring repeat medication.

Serum samples were collected from 86 patients with acute fever during September–October 2012. All samples were screened for CHIKV by using a reverse transcription PCR (4), and 31 (36.6%) were positive. The remaining sera were tested by using an IFA (4), and 35 (40.7%) were positive.
Collaboration with TSRA Land and Sea Management Unit Staff

- Established contact with communities of four islands: Boigu, Saibai, Badu and Moa
- Arranged permits for community visits and field work
Collaboration with TSRA Land & Sea Management Unit - Rangers

• TSRA Land & Sea Management Unit staff worked with scientists on field schedules & ranger availability

• Rangers worked closely with scientists in selecting field-sites, logistics, & field trapping of mosquitoes

• Knowledge sharing was an important result, scientists learning about the Torres Strait & TSRA rangers learning about the risk of mosquitoes & the diseases they carry to the Torres Strait communities
Acknowledgements

• RNTBC’s, Elders and Island Councils, Staff of the Torres Strait Regional Authority, & the communities that welcomed us!
• Paul Zborowski, Richard Russell & John Clancy,
• Natalie Dillon, DAFF & Volunteers