BORDER HEALTH NEWSLETTER – August 2015

WELCOME!

Hi everybody! Here is a shot of the attendees of the ship sanitation course in Wellington.

We might see some of you at our vector course in October.
If we look back to August the numbers of the mosquitoes hit rock bottom. But now it is official, spring has arrived and it is time to dust off our mosquito gear.

SAMPLES

During August 377 samples were collected by staff from 12 DHBs with 38 positive. The numbers in August are as usual very low and only the larvae of *Aedes notoscriptus* kept us busy.

Species	Adults		Larvae	
New Zealand Mozzies	**August 15**	**August 14**	**August 15**	**August 14**
Aedes antipodeus (winter mosquito)	Nil	Nil	Nil	Nil
Ae. australis (saltwater mosquito)	Nil	Nil	Nil	Nil
Ae. notoscriptus (striped mosquito)	20	Nil	868	1029
Culex astilae	Nil	Nil	Nil	Nil
Cx pervigilans (vigilant mosquito)	1	6	27	3
Cx. quinquefasciatus (southern house mosquito)	2	9	4	57
Opifex fuscus (rockpool mosquito)	Nil	Nil	1	24
Total	**23**	**15**	**900**	**1122**

INCURSIONS/INTERCEPTIONS

We have had two interceptions in August:

7.8.2015 Live non-mosquitoes found in two containers of Bananas from Ecuador in Auckland – Turners and Growers. After fumigation mosquito specimens were found. Samples sent to the lab included 9 non-mosquitoes, 1 male *Mansonia humeralis,* 1 female *Culex (Culex) sp* and 2 unidentified females.

20.8. One live Culex pervigilans was found in Seaview – Lower Hutt in a container from China as well as many Drosophilidae (vinegar flies) pupal casings.

NEW ZEALAND BIOSECURE

PICTURE OF THE MONTH

Is this the future of mosquito surveillance? A trapdrone! Credit: https://www.behance.net/gallery/15499913/Trap-Drone

NEWS OF THE MONTH

2015 Microsoft's Project Premonition smart trapdrone captures mosquitoes for use as DNA collectors

Stuff

September 2 by CHRIS GARDNER

SUPPLIED: Mosquito feeding: Microsoft's Project Premonition is using the insect to predict the spread of diseases.

The blood sucking mosquito is turning out to be humankind's saviour.

The insect, responsible for spreading diseases like malaria among humans and animals the world over, is being used to save lives and money in a new project which will help predict the spread of both known and unknown infectious diseases across the world.

It's called Project Premonition and is being spearheaded by Microsoft Research in Redmond, USA, which is using the insect as a biological drone.

MICROSOFT: Project Premonition's lead researcher Ethan Jackson.

"The benefits, and the range of people we can assist with them, is just mind blowing," said lead researcher Ethan Jackson.

Jackson, speaking at the Microsoft Ignite NZ 2015 technology conference in Auckland, said his ten-strong team had built an automated mosquito trap that could be deployed by radio controlled drone into remote parts of the world.

The internet connected smart trap could use its sensors to sort mosquitoes from other bugs, removing the need for a human to manually pick them out from a pile of bugs, squish them, and analyse their DNA and RNA.

"This trap is designed to do what a biologist does. It is the biologist. It sits there for 12 to 18 hours, listens and decides what it wants to catch, it can distinguish a mosquito from something else, and then squishes them for analysis," he said.

The smart trap, which is about the size of a football, could collect up to 64 mosquitoes, one per cell, compared to about half a dozen collected over 14 hours using conventional traps whose contents need to be manually sorted by a scientist.

"You can build a map of genomes in space and time."

The information collected would help monitor diseases in the animal and human populations and while Jackson could not share the overall cost of the project he said the trap sensors cost US12 cents each.

The trap also had its own processing power for crunching data.

"The thing we want to do is see the disease coming," Jackson said. "There is a huge amount of disease that is unknown. About 75 per cent of the viruses."

Such technology would have helped prevent at least some of the 8000 Chinese cases of Sars in 2003, which cost the Chinese economy US$6.2 billion, and some of the four US cases of Ebola, which cost US$2.8 billion.

Jackson said a pilot project in Granada had proved the technology worked, and he thought it would be another year before it was fully deployable.

"It's always a moving target, but by the end of the year we will have a really good sense of what it needs to deploy autonomously," he said.

Asked whether the technology was likely to be used in New Zealand, Jackson said: "If you know of somebody, we would talk about deploying in New Zealand."

One obvious use is monitoring cattle health, with a particular interest in bovine TB.

VECTOR-BORNE DISEASES

Recent Local News

Disease warning for travellers

The Dominion Post
Stuff.co.nz – health
Deidre Mussen 8.9.2015

Major outbreaks of mosquito-borne diseases in the Pacific Islands have reached New Zealand, including the first cases of Zika, a new disease ripping through the Pacific.

Health authorities and the Ministry of Foreign Affairs are warning island-hopping travellers to protect themselves against mosquito bites so they avoid catching dengue, chikungunya or Zika fevers, after epidemics of all three diseases began there last year.

New Zealand's first Zika case was diagnosed in March and since then a total of 53 cases have been notified to Environmental Science and Research (ESR). There has also been a surge in dengue and chikungunya cases since the Pacific Island outbreaks, although both diseases had reached New Zealand's shores in previous years.

Everyone diagnosed with Zika in New Zealand had become infected in the Pacific Islands before returning home or were travellers and almost all contracted the disease in the Cook Islands, ESR clinical microbiologist Deborah Williamson said.

None of the three diseases could be transmitted in New Zealand because their vector, Aedes mosquito, was not normally found here.

"To our knowledge, we haven't had any transmission here."

Considered an emerging disease by health authorities because of its expanding geographical spread, Zika occurred only in African and Southeast Asian countries until 2007, when it was detected in Micronesia.

The Pacific Island outbreaks began about October last year and the worst affected were French Polynesia, New Caledonia and the Cook Islands.

Wellington-based infectious diseases physician Michelle Balm said Zika was milder than chikungunya and dengue, with no hospital admissions recorded in New Zealand.

However, it had some nasty side-effects that could linger for several months, including joint pain and lack of energy.

"They can really wreck a holiday."

Balm, who works for Capital & Coast District Health Board, did a presentation about the Zika virus at a travel medicine conference in Rotorua last month.

It was vital that New Zealand maintained tight biosecurity because it was possible the type of mosquito that spread the diseases could establish in New Zealand's warmer regions, she said.

Immigration New Zealand said it was not undertaking border screening for Zika because it was found only in people who had recently travelled overseas and was unable to be transmitted in New Zealand.

WHAT IS ZIKA FEVER?

A mild viral disease spread by Aedes mosquitoes, which are active during daytime. Incubation is 3 to 12 days post-exposure and is diagnosed by a blood test plus a history of travel to a country where it occurs.

Flu-like symptoms include low-grade fewer, joint pain and possible swelling, muscle pain, rash, headache, a lack of energy or strength and conjunctivitis.

Acute symptoms typically resolve within a week but a loss in energy or strength can last several months.

No treatment other than medications to reduce fever and pain, plus drinking plenty of fluids and

resting.
Preventing mosquito bites is the best protection, including using repellent, covering limbs and avoiding large pools of stagnant water.
First case diagnosed in New Zealand in March this year and, to date, 53 cases notified, mostly people recently returning from the Cook Islands.
First discovered in 1947 in the Zika forest of Uganda, and later spread to other African countries and Southeast Asia.
In 2007, the first cases in the Pacific occurred in an outbreak in Micronesia.
An epidemic began in French Polynesia in October 2013 and island-hopping led to its spread around Pacific Islands.
A few rare Zika cases in French Polynesia have been linked to Guillain-Barre syndrome, an auto-immune disorder affecting the nervous system, which causes muscle weakness and possible paralysis.
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World Health Organization
Western Pacific Region

Pacific syndromic surveillance report
Week 35, ending 30 August, 2015

Chikungunya fever: There were four new cases in the week ending 30 August in Marshall Islands, a total of 1314 cases since the beginning of the outbreak in early February 2015.

Dengue: Serotype-3 outbreaks are ongoing in American Samoa and Samoa. American Samoa: As of 2 September there have been 370 cases since May 2015, including 32 new cases in the past week. Of these cases; 133 were hospitalised.

ESR - MONTHLY NOTIFIABLE DISEASE SURVEILLANCE REPORT - July 2015
Chikungunya fever: Two confirmed cases were notified in July 2015 compared to one probable case notified during the same month of the previous year. Both cases reported overseas travel to the Cook Islands during the incubation period.

Dengue fever: Nine cases of dengue fever (7 confirmed, 1 probable, and 1 under investigation) were notified in July 2015 compared to 13 confirmed cases notified in the same month of the previous year. The travel history was recorded for all cases. The countries most commonly visited were Indonesia and Samoa (2 cases each). Some cases reported travel to more than one country.

USA

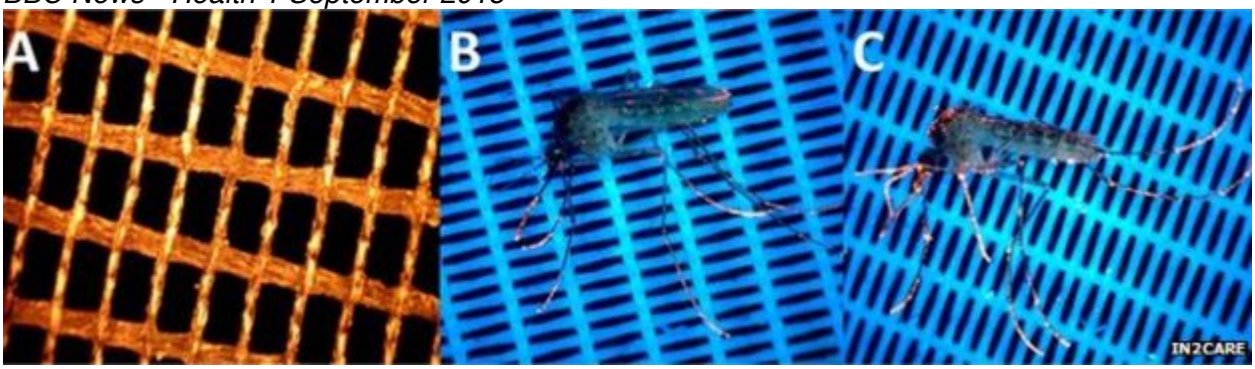
West Nile Virus Found in Cheshire Mosquitoes
The mosquitoes were recently trapped for testing.
Cheshire Patch
By VINCENT SALZO September 2, 2015
Mosquitoes that were trapped at Lock 12 Historical Park in Cheshire have tested positive for carrying the West Nile Virus.
The mosquitoes, which were trapped at the park on N. Brooksvale Rd. (Route 42) on Aug. 25, that tested positive were the *Culex pipiens*, according to the Connecticut Agricultural Experiment Station.

The CAES tests more than 90 trapping stations throughout Connecticut on a weekly basis.
The Chesprocott Health District, which covers Cheshire, Wolcott and Prospect, said in a press release that the mosquitos that typically carry this virus start to become active this time of year and continue through September. Last year six human cases were reported in Connecticut. The CDC reports that while most people (70-80%) who become infected with West Nile virus do not develop any symptoms. About 1 in 5 people who do become infected will develop a fever accompanied with other symptoms such as headache, body aches, joint pains, vomiting, diarrhea, or rash. Most people who become infected will recover completely, but fatigue and weakness can last for weeks or months. Less than 1% of those who become infected will develop a serious neurologic illness such as encephalitis or meningitis which is the inflammation of the brain or surrounding tissues.

WORLD OF MOSQUITO SCIENCE

Insecticide coating effective against mosquitoes

BBC News - Health 1 September 2015



The electrostatic coating of insecticide on netting under UV light shows mosquitoes being killed off

Electrostatic net kills resistant mosquitoes

Chemistry world

1 September 2015 by Jon Cartwright

A mosquito net that binds insecticides with electrostatic forces could be a significant step towards eradicating tropical diseases like malaria and dengue, according to the researchers who have developed it. The net is claimed to be up to ten times more effective at killing insecticide-resistant mosquitos, and works even when the insects land for just a few seconds.
Mosquito-borne diseases are a huge global problem, particularly in developing countries. According to the World Health Organization, malaria alone kills more than half a million people every year. There are no vaccines against these diseases, and so controlling them means killing the mosquitos that carry them, often with insecticides.
Unfortunately mosquitos have become more and more resistant to insecticides, evolving either to prevent the chemicals from adhering or to generate enzymes that break the chemicals down. The only way to kill such mosquitoes is to administer higher doses, but this is tricky. 'They can rest and breed almost everywhere,' says Marit Farenhorst, a malariologist and member of In2Care BV, the Netherlands-based company that has co-developed the net. 'They have very tiny legs and therefore only pick up very small amounts of insecticide when they make contact with a treated surface.'
Farenhorst and colleagues' answer is the development of a polyurethane-based coating with a platinum catalyst. Although the researchers cannot reveal much about the coating's makeup for commercial reasons, they say that, when it dries on a net, the platinum forms electrostatic charges

that last for up to two years, or 20 washes. These charges bind to insecticide powder strongly enough to prevent it from blowing off, but not as strongly as the waxy exterior of mosquitos, says Farenhorst. 'A mosquito leg that contacts our powdered gauze will get a lot of powder particles attaching,' she adds.

The electrostatic coating concentrates insecticide powder (fluorescent) on the net so mosquitoes pick up more of it © Hans Smid

In tests, mosquitos suffered significantly higher mortality rates on the electrostatic net than on a conventional insecticidal net. Indeed, the electrostatic net could kill 100% of certain resistant mosquitoes, compared with just 10% for a conventional net. The new net was effective even when the mosquitos alighted for just five seconds, or when just one-fifteenth of the normal insecticide was applied.

Graham White, an expert in mosquitos at the US Department of Agriculture in Gainesville, Florida, believes the claims are fully substantiated, and points out that the net even boosts the effectiveness of less potent insecticides. 'All looks very promising to me,' he says. Nicolas Mabon of the Walloon Agricultural Research Centre in Gembloux, Belgium, calls the net a 'real innovation', but warns that the tests have only been carried out in Europe. 'I'm not convinced yet that behaviour of this electrostatic coating will be the same under a tropical atmosphere with high moisture levels … To go further, experiments have to be performed in tropical places.'

MOSQUITO DISCUSSION

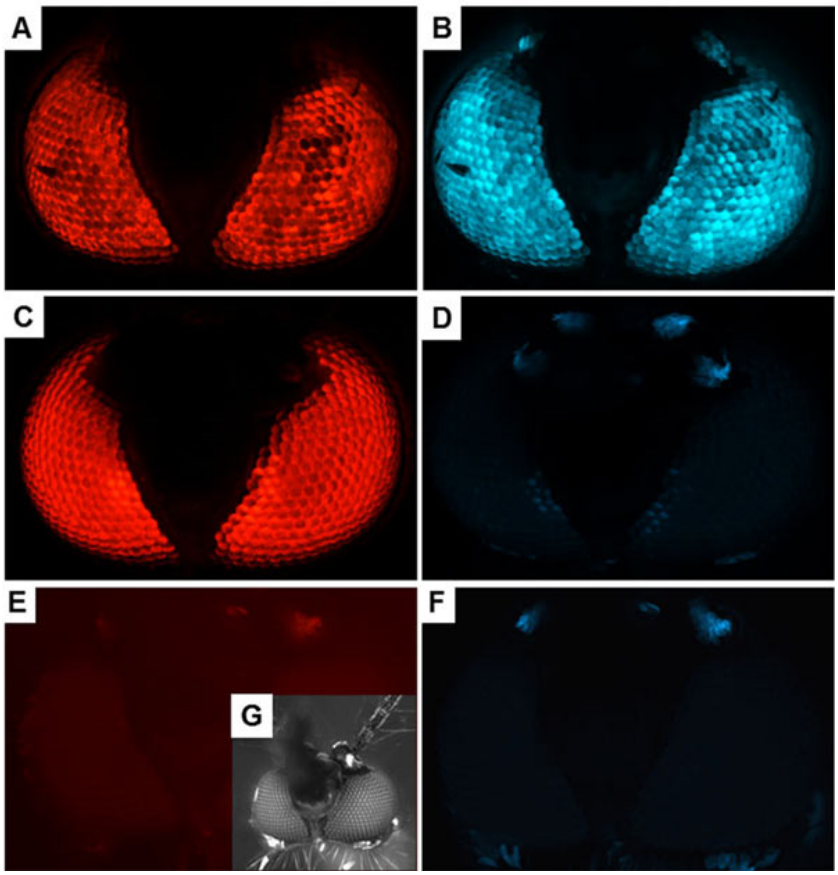
Gene-editing has potential to neutralize disease-carrying abilities of mosquitoes

Horsetalk.co.nz 3 September 2015

Researchers say they have an effective way to edit the genes of mosquitoes, raising the possibility that the insects could be genetically modified so they can no longer carry and transmit viruses and parasites that are harmful to humans and animals.

Mosquitoes are a key contributor to the spread of potentially deadly diseases in horses, including West Nile Virus and Eastern Equine Encephalitis Virus.

Now, researchers at the University of Missouri have adapted a gene-editing technique for use in mosquitoes that opens the door to future research.



Dong and his fellow researchers successfully disrupted the gene in mosquitoes that creates both a blue and a red florescence in their eyes. Image B shows a mosquito with blue eyes, and images C and D shows a newly bred mosquito that maintains the red florescence without the blue florescence.

"By successfully editing specific genes in the *Aedes aegytpi*, the mosquito species which transmits the dengue virus, we have established techniques which can be used in future research to target the virus-carrying capabilities of this mosquito," says Shengzhang Dong, a postdoctoral fellow in the Department of Veterinary Pathobiology in the university's College of Veterinary Medicine.

For their study, Dong and his colleagues used the CRISPR/Cas9 gene editing system, and adapted it for use in mosquitoes to disrupt the blue fluorescent eye color gene in a previously generated genetically-modified mosquito line, which originally expressed both fluorescent blue and red color genes in their eyes.

As a consequence, future generations of these mosquitoes no longer showed the blue color, but still showed the red color expression in their eyes. This new trait was stably inherited over several mosquito generations.

"While, for this study, we simply disrupted a fluorescent marker in the eyes of mosquitoes using CRISPR/Cas9, we were able to prove that this system can be used to perform more impactful gene edits in the future," says Dong, who is the first author of the study.

Alexander Franz, an assistant professor of veterinary pathobiology at the university and senior author of the study, says future research using this established technique could search for ways to genetically edit mosquitoes so they cannot harbor diseases like dengue.

"Infection of a mosquito with a human pathogen, such as dengue virus, alters the gene expression profile of the mosquito due to innate immune responses produced by the insect," Franz says.

"These complex genetic interactions are not well understood. However, being able to knock out an individual mosquito gene that responds to the presence of a virus will allow researchers to

understand the gene's underlying molecular mechanism in order to find ways to genetically block virus infection in the mosquito."
Franz says in the case of viruses such as dengue, blocking the ability for the virus to reproduce in the mosquito will interrupt the viral disease cycle with the consequence that humans no longer become infected when bitten by the mosquito.
This study was published in PLOS ONE and was funded by a National Institutes of Health.

DID YOU KNOW?

WHY CAMERAS ARE TAKING THOUSANDS OF MOSQUITO PICS

UNIVERSITY OF WARWICK, Futurity
Posted by Tom Frew-Warwick on September 2, 2015

Engineers and entomologists have teamed up to capture and analyze lots of high-resolution images of mosquitoes in a swamp in Tanzania.
They want to use the data to develop better netting and physical protection against *Anopheles gambiae* mosquitoes—the species responsible for transmitting the malaria parasite.
To observe how mosquitoes engage with insecticide-treated barriers such as netting, researchers have in the past mainly relied on recording the final landing location, which does not give a full picture of how the insects approach and handle protective barriers.

Two cameras positioned at a research site in Tanzania capture 50 images of mosquitoes every second. For every hour of operation, each camera takes 360,000 images—each 1.4 terabytes in total size.(Credit: AFPMB/Flickr

Entomologists at the Liverpool School of Tropical Medicine are carrying out experiments at the site in Tanzania, which has a stable mixed population of mosquitoes, some resistant to insecticide and others not.
They built a hut that resembles common housing) and sleeping arrangements. They're using advanced cameras and near infrared backlighting to photograph the insects at night. Mosquitoes can't perceive near infrared light, so it doesn't affect their natural behavior.

Two cameras capture 50 images of mosquitoes every second. For every hour of operation, each camera takes 360,000 images—each image is 4 million pixels, or 1.4 terabytes in total size.
To process the large number of high-resolution images, engineers at the University of Warwick developed new software, which has processed more than 50 terabytes of data so far.
"There is a lot of interest in the analysis of so-called 'big data'—here we have the added complexity of capturing information from the field with everything powered from petrol-fueled generators, and we need very robust algorithms to be tolerant of the natural variability in behavior exhibited by wild mosquitoes," says David Towers, an engineering researcher professor at Warwick.
The team has published initial results in Nature Scientific Reports.
The work is part of a research project called AvecNet, funded by the European Commission. The next phase of the project will involve eight cameras, collecting up to 10 terabytes of data per hour, to map not just the sleeping area but also the hut as a whole. This will enable the team to fully map the behavior of the mosquitoes as they approach targets.