



# BORDER HEALTH NEWSLETTER - May 2016

## WELCOME!

Hi everyone! It seems the mosquito filled season is over (almost) but let's get stuck in and prepare for the next one. There are some new and interesting gadgets out there to make our lives easier and the life of a mosquito harder:

You'll find new repellent inventions in the "World of Mosquito technology" topic.

You may also consider a macro lens for your cellphone to capture mosquito pictures (or of other insects). ARPH have successfully used this tool last summer and have sent pictures to the lab for a pre-screening. This turned out to be a very helpful tool especially in the case of suspected interceptions.

The best deal at the moment is a no name 3 in 1 lens kit with a fish eye (180 grad 0.33x), wide angle (0.67x) [that you actually don't need for insects] and a super-macro (10x) for 20 bucks - the quality is limited though and there are other and better brands such as LIEQI, Aukey, olloclip, photojojo, mpow or with the best quality: moment [the price increases with quality of course).

If you get the lens for yourself it might be wise to invest in a stand too as you need a very steady hand otherwise, and some other tips;

- You can also place the cellphone on the ground.
- You need to get really close to the object (working distance 10-15 mm) to get it in focus.
- Don't blow up the magnification on your phone up too much.
- You phone should have an 8 MP camera.
- You need a good indirect light source.
- It is helpful for the lab to have a picture of the belly and the back of the mosquito.



We look forward to seeing your mosquito pictures.

## SAMPLES

During May 659 samples were collected by staff from 12 DHBs with 180 positive. Less adults of *Aedes notoscriptus* have been found this month compared to May 2015 but also more larvae. The numbers of *Culex pervigilans* are stable whereas *Cx. quinquefasciatus* numbers are still higher than usual. It has been a good season for *Opifex fuscus*; we have received the larvae not only from Wellington this year but also increasingly from Taranaki and Northland.

Species	Adults		Larvae	
	May 16	May 15	May 16	May 15
<b>New Zealand Mozzies</b>				
<i>Aedes antipodeus</i> (winter mosquito)	4	2	Nil	1
<i>Ae. australis</i> (saltwater mosquito)	Nil	Nil	1	2
<i>Ae. notoscriptus</i> (striped mosquito)	455	678	1116	819
<i>Culex astilae</i>	Nil	Nil	29	67
<i>Cx pervigilans</i> (vigilant mosquito)	6	3	139	272
<i>Cx. quinquefasciatus</i> (southern house mosquito)	426	75	1629	809
<i>Maorigoeldia argyopus</i>	Nil	Nil	Nil	Nil
<i>Opifex fuscus</i> (rockpool mosquito)	Nil	Nil	206	12
<b>Total</b>	<b>891</b>	<b>758</b>	<b>3116</b>	<b>1984</b>



## INCURSIONS/INTERCEPTIONS

During May four suspected interceptions were detected and responded to. Mosquito activity was detected at the ITB once and three times at transition facilities in Auckland.

Please note that the interceptions of live unwanted mosquitoes are highlighted in red. Exotic species in general are highlighted in light blue.

- 3.5.2016 One live male *Culex quinquefasciatus* was found in the MPI Lab at Freshmax AKL in a container with melons from Australia.
- 13.5.2016 One live female *Cx. quinquefasciatus* was found in the MPI inspection room at Fresh Direct 18, AKL associated to bananas from Panama.
- 16.5.2016 One live male *Cx. quinquefasciatus* flew out of a box containing Okra from Fiji in an airfreight container at Air NZ Cargo AIAL.
- 26.5.2016 One live male *Cx. pervigilans* was found in the MPI search bench at the ITB AIAL.

## PICTURES OF THE MONTH



Illustration by Golly Bard (Check out some of the other wonderful illustrations of plants and animals by Golly Bard at her Etsy site) <https://cameronwebb.wordpress.com/>



STORY OF THE MONTH

Long Island welcomes bats that can eat 1,000 mosquitoes an hour to fight Zika

by Yuka Yoneda, 06/07/16 Via CBS New York

When it comes to controlling the threat of Zika, one Long Island town is stepping up to bat. Residents of North Hempstead have begun installing homemade wooden boxes to attract bats that are able to eat 1,000 mosquitoes an hour as a natural, pesticide-free method of fighting disease in the area. CBS New York recently visited the Clark Botanical Gardens, where several of the "bat boxes" have been installed.

Some of the DIY bat boxes at the gardens were made by boy and girl scouts and required just a few simple materials: scrap wood, stain, nails and screws. North Hempstead Parks Commissioner Jill Weber told CBS that the boxes should be installed at 15-30 feet off of the ground so that the bats feel comfortable. The boxes should also be hung facing south in order to maintain the optimal temperature for the bats.

"They just need to go up 15 to 30 feet to get them off the ground. Bats are more comfortable when they are high up and can eat 1,000 mosquitoes in an hour once situated in an area," Weber said. With that kind of appetite for disease-carrying skeeter



destruction, bats are a great boon for those looking to avoid dangerous chemical pesticides, but should we be worried about any harm the winged creatures can inflict upon humans themselves?

According to CBS, North American bat species feast on insects and fruits, not human or animal blood. The report also points out that only one half of one percent of bats may contract rabies, but warns that you should never try to handle a bat yourself.

Northern Bat (*Myotis septentrionalis*)

VECTOR-BORNE DISEASES - OUTBREAK NEWS

South Pacific



Pacific syndromic surveillance report – Week 20 and 21, ending 29 May 2016

Zika virus: American Samoa: As of May 19 there have been 606 suspected cases since 1 January 2016. Of these 17 lab are confirmed, including 8 pregnant women. There continues to be an average of 2-4 cases seen per day with the greatest number of cases in those less than 10 years of age.

Kosrae, Federated States of Micronesia: As of May 22 there have been a total of 90 cases including 11 confirmed cases.

Samoa: As of 16 May there have been 167 suspected cases including 24 confirmed cases since August 2015. Source: Samoa Ministry of Health.



## NEW ZEALAND BIOSECURE

**Chikungunya:** One imported case with travel history to Fiji reported by New Zealand ESR, (Institute of Environmental Science and Research Ltd) for the period 21/05/16–27/05/16. From 20 February to 27 May 2016 there have been 9 imported cases with travel history to Fiji reported by New Zealand ESR.

**Yellow Fever:** As of 25 May 2016, Angola has reported 2536 suspected cases of yellow fever with 301 deaths. Among those cases, 747 have been laboratory confirmed. Despite vaccination campaigns in Luanda, there is still circulation of the virus in most districts of Luanda and in five additional provinces.

Three countries have reported confirmed yellow fever cases imported from Angola: Democratic Republic of The Congo (DRC) (41 cases), Kenya (2 cases) and People's Republic of China (11 cases). This highlights the risk of international spread through nonimmunised travellers.



### MONTHLY NOTIFIABLE DISEASE SURVEILLANCE REPORT - Feb 2016

**Chikungunya fever:** Six confirmed cases of chikungunya fever were notified in April 2016 compared to three confirmed and one probable case notified during the same month of the previous year. Nine cases have been notified in the year to date compared to 39 at the same time in the previous year. All cases reported overseas travel to Fiji during the incubation period for the disease.

**Ross River virus infection:** One confirmed case of Ross River virus infection was notified in April 2016. The case was a male in the 40–49 years age group from Canterbury DHB. The case had travelled to Australia during the incubation period for the disease.

**Zika virus infection:** Four confirmed cases of zika virus infection were notified in April 2016. Cases were reported in the 30–39 years (2 cases), 40–49 years and 70 years and over (1 case each) age groups. All cases were confirmed by PCR. All cases travelled during the incubation period for the disease, and countries visited were Fiji (3 cases) and Venezuela (1 case).

## ZIKA

**MOSQUITO DISCUSSION** The upcoming 2016 games in Rio de Janeiro have sparked a debate about how much risk is too much.

### Brazil

#### The Zika Olympics

JULIE BECK ET HEALTH

Rio de Janeiro's hostship of the 2016 Summer Olympics has had the unfortunate distinction of becoming a lightning rod for Zika panic. This is not only Olympic Summer—it is Zika Summer, with rising northern hemisphere temperatures bringing the possibility of Zika's mosquito steeds riding north and furthering the spread of the outbreak that is already affecting nearly 50 countries and territories.

For Brazil, the country that's been the seat of much of the outbreak, to host an event as large and global as the Olympics has caused much concern. Senators recently wrote to the U.S. Olympic Committee wanting to know how it plans to protect athletes (it's working with the Centers for Disease Control and Prevention on that). South Korea's team will be wearing special mosquito-proof uniforms. The athletes themselves seem to be of many minds as to whether they're worried about the outbreak—the Jamaican sprinting gold



## NEW ZEALAND BIOSECURE

medalist Usain Bolt said he's not bothered, because mosquitoes "can't catch me." Pau Gasol, a Spanish basketball player, said he's considering not attending, and the British



tennis star Andy Murray seems to be dithering on that point as well.

Also concerned: a group of more than 200 doctors, bioethicists, and public health specialists, who think that no one should be going. They posted an open letter online calling for the Rio Olympics to be postponed or moved "in the name of public health." They invoke the CDC's recommendation that people "consider delaying travel to areas with active Zika virus transmission."

Google Metadata Ricardo Moraes / Reuters

But the World Health Organization refuted claims that the Olympics were a particular danger for Zika, saying in a statement:

Based on current assessment, canceling or changing the location of the 2016 Olympics will not significantly alter the international spread of Zika virus. Brazil is 1 of almost 60 countries and territories which to date report continuing transmission of Zika by mosquitoes. People continue to travel between these countries and territories for a variety of reasons. The best way to reduce risk of disease is to follow public health travel advice.

While the Olympians themselves, who will be staying in a fully air-conditioned athlete's village, probably have less to worry about than most, really anyone who isn't pregnant has very little to worry about when it comes to Zika. Eighty percent of people who get infected never have any symptoms at all, and for the remaining 20 percent, it's a bummer, but they usually don't even get sick enough to go the hospital, and almost never die.

If a Pregnant Woman Gets Zika, What's the Risk of Microcephaly for the Baby?

What everyone's worried about are the possible neurological complications. Guillain-Barré Syndrome, which can cause temporary paralysis, and inflammations of the brain and spinal cord have both been linked to the virus. And then of course, there's the birth defect microcephaly, and other pregnancy problems that have been seen to affect pregnant women infected with Zika.

The likelihood of a fetus getting microcephaly if the mother gets Zika was recently estimated to be between 1 and 13 percent. It's not clear what the chances of Guillain-Barré are for people infected with Zika, but during the 2013-2014 French Polynesia outbreak, when two-thirds of the island's roughly 270,000 inhabitants were infected, there were 42 cases of Guillain-Barré.

A paper published in April calculated the probable number of Zika cases during the Olympics, using dengue transmission during the 2008 outbreak as a model. It found that, on the low end, there would be 1.8 cases per one million tourists, and on the high end, 3.2 cases per 100,000 tourists.

So the concern is not necessarily that tourists will fall ill while they're at the games. (Though everyone seems to agree that pregnant women, at least, should stay away.) But "while Zika's risk to any single individual is low, the risk to a population is undeniably high," the letter reads. The fear is that travelers will bring the virus home, either in their bodies or in the bodies of mosquito stowaways, and it will spread further.

"People talk about that all the time," says Jane Messina, an epidemiologist at the University of Oxford, of the chance of infected mosquitoes hopping on airplanes. "Yeah, they could get on an airplane, I suppose, but I assume any airplane leaving Rio will spray. At the end of the day people move viruses internationally. Mosquitoes don't, really."



Large global gatherings do carry some risk of spreading disease—for example, in 2000 and 2001, the Hajj, the annual Muslim pilgrimage to Mecca, was associated with an outbreak of meningococcus. The CDC has a whole webpage on advice for staying healthy during “mass gatherings.” But it’s still hard to predict the impact of any one gathering affected by any one disease.

And Zika may have already had another, similar opportunity two years ago. Contrary to a popular theory that the virus arrived in Brazil during the 2014 World Cup, a paper published earlier this year in *Science* estimated a 2013 arrival date for Zika by tracking genome mutations and using epidemiological data. In that case, Zika was already around for one big global event in Brazil. Whether the World Cup played a role in spreading Zika is unclear, but “there’s been a lot of opportunity for Zika to get brought over from Brazil already,” says Messina, who has worked on global risk maps of Zika.

But Arthur Caplan, one of the four authors of the letter, and a professor of bioethics at New York University, thinks the nature of the Olympics makes them deserve special consideration. “Others have said there’s tons of travel going on there anyway, but it’s not coming from every nation in the world,” he says. “I don’t think there’s any event that brings the whole world together like the Olympics.”

It might be safer if the people of the world just stayed a little more apart. Or it might be fine. It will be winter in Brazil in August, so the weather won’t be quite as mosquito-friendly. On the other hand, a recent report from Reuters says Rio still has a lot of sewage it hasn’t cleaned up, which, when it comes to mosquito control “doesn’t inspire me,” Caplan says.

“The arguments about moving or postponing the Olympics are largely based on the perception of risk.”

It’s just a very uncertain situation, and uncertainty is pretty much Zika’s calling card. “Most of what we thought we knew turned out to be mistaken,” says Stephen Morse, a professor of epidemiology at Columbia University, referring to Zika’s neurological surprises and the fact that it can be transmitted sexually, neither of which were known before this outbreak. “The great uncertainty that we all feel about this is really underlying a lot of this decision—the arguments about moving or [postponing] the Olympics are largely based on the perception of risk.”

The WHO doesn’t seem to think the Olympics are a bigger risk than regular international travel. “The problem is not the Olympics, the problem is other travel besides the Olympics, if there is a problem,” David Heymann, the chair of the WHO’s panel of independent experts on Zika told Reuters recently. “So it’s just a false security to say that you’ll postpone the Olympics and postpone the globalization of this disease.”

“It seems like trying to scare people a little bit,” Messina adds.

Quick-spreading emerging diseases are becoming a regular reality in this globalized world, and it’s true that a once-every-two-years event probably has only a small role to play in that. And it would be downright gobsmacking if the Olympics were actually delayed over Zika. “Personally, do I think they’re going to postpone or move it? No,” Caplan says.

But it’s becoming clear that while we can’t know what effect, if any, the Olympics will have on Zika’s spread, some people see the risk as too high, and in the face of this uncertainty, would prefer to err on the side of caution. And it’s possible that things less wieldy than the Olympics could be affected—Major League Baseball has already moved games from Puerto Rico to Miami because of Zika worries.

“If you were really committed to minimizing risk, indeed mass gatherings in general should be restricted or canceled,” Morse says.

But how far is it really reasonable to go to protect against an unknown risk? The letter cites Rio’s “severely weakened” health system as a reason not to go forward, but



removing the Olympics from Brazil would surely have economic consequences for the country.

One could say that it's safest, when trying to manage an uncertain public health situation, to "take every precaution necessary. But I think that's excessive," Messina says. "The WHO has already advised against pregnant people traveling, and against having unprotected sex while you're there. Those are serious recommendations; they're not taking it lightly."

In lieu of fulfilling the admittedly long-shot postponement request, Caplan says he'd be happy if the WHO had an open forum to discuss the risks. "Convene the experts, have a public televised debate," he says. "That would get everybody in the position to make an informed choice. I think that's doable."

## CHIKUNGUNYA

### USA

#### Local Case of Severe Mosquito-Borne Disease Found in Texas

Alexandra Sifferlin May 31, 2016 HEALTH INFECTIOUS DISEASE

Health experts in Texas report the first locally-acquired case of the mosquito-borne disease chikungunya in the state. The disease is spread by the same mosquitoes that transmit Zika.

On Tuesday, the Texas Department of State Health Services confirmed the case. The individual got sick back in November 2015 and was diagnosed with a confirmed lab test in January 2016. The health department was informed last month. The person had not traveled, which is how investigators determined that they got the illness from a local mosquito. Until now, the only people who had contracted chikungunya in Texas had gotten the disease while abroad.

Chikungunya causes fever and intense joint pain, and while it's not often fatal, the pain can be debilitating. It's a relatively new virus to the Americas, and has infected millions in the past. In the last couple years, the disease spread rapidly through the Caribbean and Central and South Americas, with some cases in the United States. As of January 2016 there have been around 680 cases of chikungunya with disease starting in 2015 reported to the CDC.

Health experts in Texas say that since the case of chikungunya happened months ago, the primary source of infection remains traveling. The same mosquitoes that spread chikungunya, like the *aedes aegypti* mosquito, also spreads the Zika virus, which is rapidly infecting people in the Americas and Caribbean. The United States anticipates that there will be some local transmission of Zika in the U.S. You can read about how the U.S. is preparing for Zika here.

## DENGUE

### New Zealand

#### Dengue fever sends holiday makers to hospital

Sunday Star Times in *Stuff travel*

MARTY SHARPE May 22 2016

A family holiday to Bali that ended in a trip to hospital for four people struck down with dengue fever has prompted a warning to travellers as mosquito-borne viruses spread and intensify.

Sherilee Reese of Napier was the first to come down with rocketing fevers and crippling stomach pains towards the end of the group's 12-day trip.



Supplied Napier woman Sherilee Reese (at right) with her daughter Courtney (far left), 16, her nieces Vicki, 15, and Jessie, 14, and her youngest daughter Ashleigh, 7, with local children on the island of Nusa Lembongan. This was the day before Sherilee started feeling ill with dengue fever.

Succumbing in short order after her were her brother-in-law Nigel Hanan and his daughters Jessie, 14, and Vicki, 15. They were struck so hard, that at one stage the teenagers were thought to be at risk of internal haemorrhaging.

The four were among thousands to have contracted the mosquito-borne virus in Bali this year, and were lucky not to have been among the 38 dengue-related deaths on the island between January and April.

The number of fatalities this year is already well up on the 29 recorded for 2015 and is a reflection of the increase in total case numbers - 7794 in Bali between January and April, compared to 10,700 cases recorded for all of 2015.

The Bali Health Office said this could be explained in part by the odd timing of wet and dry seasons.

Reese suspects she contracted the virus on the island of Nusa Lembongan, off the southeast coast of Bali.

"Of course we all think mozzies come out in the evening so we sprayed repellent on in the evening," she said. "We didn't know mozzies carrying dengue were out at day. We didn't even think about spraying during the day."

Others in the group were bitten, including her daughters aged 7 and 16, but were not affected.

Sherilee's uncle, who lives on the island, has never had dengue fever.

"I started feeling a bit flat on the ninth day," Reese said.

"My hips and back got really sore and achy. By the next day I started feeling freezing even though it was 32degC. That was me gone from then. We thought it must have been flu, because there was a bit going round Bali. Dengue never crossed our minds."

After a few days curled up in bed she flew home on April 26 with the rest of the group.

"On the flight from Sydney to Auckland Jessie - who had been bitten just once on the whole trip - started getting symptoms. When we got to Auckland they quarantined the plane for 45 minutes. A paramedic came on and checked us out. They made a call that it was 'Bali belly' and everyone was allowed off," she said.

By that stage Nigel had a pounding headache, an early symptom.

Sherilee said by Thursday she was suffering cramps, and her sister had decided to take Nigel and his daughters to hospital.

"They met doctor Andrew Burns, who suspected dengue fever. And the next day I went in. I spent three nights in there," she said.

"I've never felt that bad. Those fevers and aches were something different," said the self-employed handywoman, who now feels "about 98 per cent".

Sherilee said her nieces were hit harder than her. Their platelet counts reached such low levels there was a very real fear they could start internal haemorrhaging.

It was Sherilee's second trip to Bali.

"I got 'Bali belly' the first year and dengue fever the second. I'd love to go back, but it'll be Mahia for me in summer from now on. Bali is a beautiful place and I don't want people not



to go there, but please if you do then make sure you spray yourself with repellent 24/7," she said.

#### AN UNPRECEDENTED PROBLEM

Infectious-disease specialist and Hawke's Bay doctor Andrew Burns, who treated the family, said the world was seeing an unprecedented spread of arboviruses spread by mosquitos such as dengue fever, Zika and Chikungunya.

"Dengue originated in Africa but has spread widely throughout the tropics since the late seventies," Burns said.

"You can get very, very sick from dengue. Symptoms can be intense. The fever is known as 'break back fever' or 'break bone fever' due to the pain down a person's back. There are no effective vaccines at present."

The mosquito involved targets humans and will bite several to feed, he said.

Such viruses were spreading around the world at an unprecedented rate.

"In countries like New Zealand where we don't have mosquitoes that can spread the viruses we just need to be aware of recognising travellers who are returning with these infections."

## YELLOW FEVER

### Africa

#### **Risk of international spread of yellow fever re-assessed in light of the ongoing outbreaks**

*May 31, 2016 Science Daily European Centre for Disease Prevention and Control*

The European Centre for Disease Prevention and Control (ECDC) has updated its rapid risk assessment on the outbreak of yellow fever with the latest developments, more comprehensive information on the current situation in Angola, Democratic Republic of Congo (DRC) and Uganda and an extended threat assessment for the EU. Some of the data used in the assessment were collected during a mission to Angola in May 2016.

ECDC has updated its rapid risk assessment on the outbreak of yellow fever with the latest developments, more comprehensive information on the current situation in Angola, Democratic Republic of Congo (DRC) and Uganda and an extended threat assessment for the EU.

Some of the data used in the assessment were collected during a mission to Angola in May 2016.

From 21 January to 22 May 2016, the Angolan Ministry of Health notified 2 536 yellow fever cases, of which 747 were confirmed and 301 fatal. The number of new suspected and confirmed cases in Angola has been decreasing and a mass vaccination campaign has already reached about half of the targeted population. However, the outbreak in Angola is not yet under control and is currently expanding to additional provinces, further challenging the ongoing mass vaccination campaign. Currently, all regions in Angola should be considered as areas at high risk of transmission of yellow fever.

The yellow fever outbreak in Uganda is unrelated to the outbreak in Angola. Between 26 March and 19 May 2016, health authorities reported 60 yellow fever cases, including seven deaths in six different districts.

As of 23 May, DRC has reported 590 cases of yellow fever, 41 of these had a recent travel history to Angola.

Viraemic patients travelling to areas where suitable vectors and susceptible human populations are present pose a risk for local transmission. Such areas exist in most of the inter-tropical zones of Africa, and the Americas and Asia.

Therefore, the risk of international spread within Africa and beyond is currently high.



### ECDC threat assessment for the EU

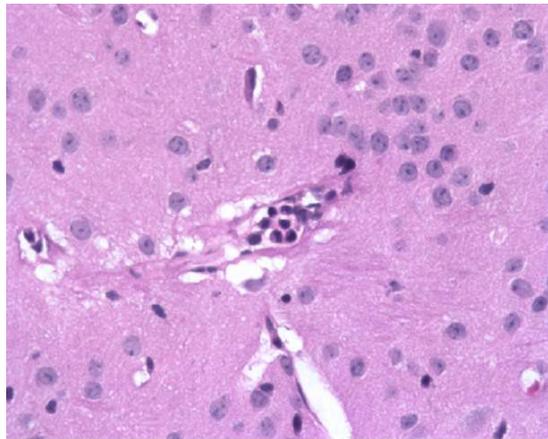
In the EU/EEA, the risk of yellow fever virus being introduced is limited to unvaccinated viraemic travellers coming from areas with active local transmission. Given that outbreaks of yellow fever in urban settings have the potential for rapid spread and that significant yellow fever epidemics are ongoing in Angola, DRC and Uganda, a range of options for response by EU/EEA Member States are presented in the updated rapid risk assessment. These options emphasize the importance of vaccination of travellers and those leaving Angola, preventive measures against mosquito bites in affected areas, as well as awareness raising among clinicians to consider this diagnosis in returning travellers.

## MALARIA

### India

#### Cerebral Malaria disease confirmed in Kozhikode

*mathrubhumi June 7, 2016,*



The Health Department has initiated measures to prevent the spread of the disease.

Five members of a family have been diagnosed with the disease.

The Health Department has initiated measures to prevent the spread of the disease. Cerebral Malaria is a disease which strikes the brain in people with less immunity or when effective treatment is not taken for malaria

The disease is the gravest condition arising out of malaria infection. If the disease is not

diagnosed in time or effective treatment is not taken, it may result even in death.

#### Five of a family infected with cerebral malaria

*Times of India K M Sree | Jun 7, 2016*

Those infected by Cerebral Malaria were identified as Cherupurayil Divakaran (62), his wife Vijayamma (48), their daughter Divya (27), and Divyas children Rithi (5) and Shibi (2). All the infected persons were staying in the same house at Puthiyappa.

While the three adults are undergoing treatment at Beach General Hospital, the children are undergoing treatment at Institute of Maternity and Child Health.

According to health department officials, the persons were suffering from severe fever and head ache from May 31 and June 1.

Cerebral Malaria is caused by *Plasmodium falciparum* and affects neurological complications.

According to officials, it is rare that five members of the same family are infected by *Plasmodium falciparum* at the same time. Five cases of cerebral malaria were reported in the district earlier in 2016 and one death was reported at Vellayil coastal region in the city. A couple more cerebral malaria cases were also reported at Vellayil.



### WORLD OF MOSQUITO SCIENCE

#### Scientific sleuths hunt for Zika-carrying mosquitoes

By Gretchen Vogel Jun. 1, 2016

Zika virus, the once obscure pathogen now widely feared for causing birth defects and other problems, has spread very far very quickly since an outbreak was first noticed in northeast Brazil in early 2015. It has reached more than 40 countries across the Americas, even making it to the Cape Verde islands, off the western coast of Africa. More than a million people have become infected.

As public health officials try to contain the epidemic, researchers are racing to answer a key question with important implications for which areas are at risk, and what methods might work to slow its spread: Which mosquitoes are transmitting the virus? Answering the question is no small challenge. Scientists need evidence from both lab-raised and wild-caught mosquitoes to make the case that a given species is guilty.

Just last week, a team in Rio de Janeiro announced that it had nabbed several *Aedes aegypti* infected with Zika—the first infected mosquitoes found in Brazil. The species, the yellow fever mosquito, has long been the prime suspect, but some scientists believe the Zika virus must have other carriers to have spread so quickly—and they have field and lab studies underway to resolve the issue. Until that evidence is in, “we shouldn’t jump to conclusions,” says Duane Gubler, a virologist at Duke-NUS Medical School in Singapore.

*A. aegypti* has earned suspicion because it spreads dengue and chikungunya as well as yellow fever and is common in urban areas of Brazil where major outbreaks have occurred and throughout Latin America. **But evidence of wild mosquitoes infected with Zika has been lacking. It is harder than one might expect to find them. In dengue outbreaks, says Sander Koenraadt, an entomologist at Wageningen University in the Netherlands, researchers typically find that fewer than 1% of sampled mosquitoes are infected with the dengue virus, even where people are falling sick. “You have to look at a lot of mosquitoes to find [infected ones],”** Gubler says. The mosquitoes “infect people and die before anyone shows up at the hospital” with disease symptoms, says Oliver Brady, an entomologist at the University of Oxford in the United Kingdom.

For the insects to transmit a virus, they must take up infected blood from a human or animal and become infected themselves. The virus then has to travel from their gut to their saliva. Only some species are susceptible to particular viruses.

To test whether a given species is able to transmit a virus, researchers feed insects on infected blood in the lab and a week or so later collect saliva from them. If the saliva contains infective virus, the species is considered a “competent” vector. Not all lab-competent vectors spread disease, however. That depends on several factors, such as how often the species bites, whether it feeds primarily on humans or other animals, and how long it lives. To confirm that a species is transmitting disease, researchers also need to find virus-infected mosquitoes in the wild.

The team that reported the first Zika-infected mosquitoes in Brazil, led by Ricardo Lourenço-de-Oliveira, an entomologist at the Oswaldo Cruz Foundation (Fiocruz) in Rio de Janeiro, vacuumed up mosquitoes from homes and streets in Rio de Janeiro neighborhoods that were home to people complaining of Zika symptoms. Over 10 months they collected more than 1500 mosquitoes, identified them, and tested pooled samples of the same sex and species for the presence of Zika and other viruses. Nearly half were *A. aegypti*, and most of the rest were *Culex quinquefasciatus*, another common mosquito in urban Brazil. Roughly 5% were other species. A species called *A. albopictus*, widely known as the Asian tiger mosquito, which can also transmit Zika in the lab and has been found infected with the virus in Mexico and Gabon, made up only about 2% of the catch, Lourenço-de-Oliveira says. They found Zika virus in three sets of female *A. aegypti*



mosquitoes, but none of the other species.

The lack of virus in *C. quinquefasciatus* is somewhat reassuring, Lourenço-de-Oliveira says, but the case is not closed. Constância Ayres, an entomologist at Fiocruz in Recife, Brazil, says that her lab has evidence that the species is a possible vector; they have found Zika virus in the saliva of *C. quinquefasciatus* that had fed on infected blood. (Her team has submitted its work for publication.)

Lab tests can be misleading, however. “There is a classic discordance between what you see in the lab and what happens in the wild,” Brady says. “*Albopictus* and *aegypti* are both highly competent in the lab” as vectors for dengue. “But in Europe, where we have widespread *albopictus* and almost no *aegypti*, you don’t have huge dengue outbreaks.”

Ayres and others are still searching for Zika in the wild. She and her colleagues have collected and identified more than 5000 mosquitoes in the Recife area since March, from homes where confirmed Zika patients lived and from urgent care centers. She is waiting for promised grant money before she can run the polymerase chain reaction tests to find which viruses the mosquitoes are carrying, she says.

*Culex* mosquitoes transmit several viruses related to Zika, and it would not be particularly surprising if both *Culex* and *Aedes* species could spread Zika, Ayres says. Gubler agrees that *Culex* is a plausible carrier. He notes that several Zika relatives spread by *Culex* mosquitoes, including the West Nile virus, target the nervous system, which Zika also seems to do.

If *Culex* mosquitoes can transmit Zika virus, that will make slowing its spread even more difficult. *C. quinquefasciatus* is found as far north as Iowa and Indiana in the United States, although people there are protected by window screens and other factors. In Latin America, most vector control methods are targeted at *A. aegypti*. Those efforts have made barely a dent in curtailing spread of the Zika virus so far, notes Paul Reiter, an entomologist at the Pasteur Institute in Paris. Targeting multiple vectors at once will only make the job harder. “If [*C.*] *quinquefasciatus* is a vector,” he says, “we can forget anything about mosquito control.”

### WORLD OF MOSQUITO TECHNOLOGY

Moto Repellent vs Mosquito  
DUNCAN MACLEOD



The Duang Prateep Foundation, a non-profit charity in Thailand dedicated to improving the lives of slum residents, has worked with BBDO Bangkok to create Moto Repellent. The charity and agency are using motorcycles to combat mosquito infestation and mosquito-borne illnesses in the slums.

MotoRepellent is a light-weight, mobile device filled with non-toxic mosquito repelling oil and magnetically



attached to the end of a motorcycle's exhaust pipe. Heat from the exhaust activates the oil and mosquito-repelling scent is propelled out into the air via exhaust pressure. As the main mode of transportation in the slums, motorcycles easily navigate the narrow alleys and reach every corner. As the motorcycles pass by, mosquitos within a radius of up to 3 meters are repelled, giving residents a safer, mosquito-free environment.

Mosquitos kill more people every year than any other animal in the world\*, and in 2015 alone, Thailand experienced more than a 207% increase in dengue patients – making it one of the worst years in recent history for this deadly mosquito-borne disease.

*Credits:* The Moto Repellent project was developed at BBDO Bangkok by chief creative officer Suthisak Sucharittanonta, executive creative director/copywriter Chalit Manuyakorn, creative group head/copywriter Peter Oh, art director Sithum Walter, designer Sangvian Suwan, producers Jirapan Vasanabunsongserm, Yada Buachan and Yathip Thanitthanaphat, and account manager Wachira Ampornpachra.

Filming was shot by director Kasemparn Jujindalert via MeOur, Bangkok, with assistant director Teewin Varapaskul, directors of photography Setthawut Samathimongkol (Pop) and Pleng Kangvan.

Music is "Bangkok Mosquitos" by Monrak Kwanpohthai.

### **Canadian innovation for killing mosquito eggs could help Zika fight**

Researchers use mosquitoes' own perfume to lure them to lay eggs in trap

#### *Grand Challenges Canada*

Innovators have successfully tested a low cost, environmentally-friendly way of destroying the eggs of the mosquito genus that spreads dengue, and likely spreading the Zika virus. The 10-month study, conducted in Guatemala, shows the successful development and implementation of a cheap, easy system to reduce virus-carrying Aedes genus mosquitoes by capturing and destroying its eggs.



An 'ovillanta' is created from two 50 cm sections of an old car tire, fashioned into a mouth-like shape, with a fluid release valve at the bottom.

With Canadian Government funding, a team of innovators from Canada and Mexico have successfully tested a low cost, environmentally-friendly way of destroying the eggs of the mosquito genus that spreads dengue, and likely spreading the Zika virus.

The 10-month study, conducted in a remote, urban area of Guatemala, documents a cheap, easy system to reduce virus-carrying Aedes genus mosquitoes by capturing and destroying its eggs. The results appear in the F1000Research.

The system includes an innovative Canadian-designed trap called an "ovillanta," created from two 50 cm sections of an old car tire, fashioned into a mouth-like shape, with a fluid release valve at the bottom.



Credit: Daniel Pinelo

Inside the lower tire cavity, a milk-based, non-toxic solution developed at Sudbury's Laurentian University lures mosquitoes. Inserted to float in the artificial pond is a wooden or paper strip on which the female insect lays her eggs. The strip is removed twice weekly, analyzed for monitoring purposes, and the eggs destroyed using fire or ethanol.

The solution, which now includes mosquito pheromone (the female insect's chemical perfume that helps others identify a safe breeding site), is then drained, filtered, and recycled back into the tire. The pheromone concentrates over time, making the ovillanta even more attractive for mosquitoes.

With a grant from Grand Challenges Canada, funded by the Government of Canada, the researchers, led by Gerardo Ulibarri of Laurentian University with collaborators Angel Betanzos and Mireya Betanzos of the National Institute of Public Health of Mexico, conducted the project in collaboration with Guatemala's Ministry of Health.

They found the rubber ovillanta significantly more effective at attracting the *Aedes* mosquito than standard traps made from 1-litre buckets.

During the 10-month study, the team collected and destroyed over 18,100 *Aedes* eggs per month using 84 ovillantas in seven neighborhoods of the town of Sayaxche (population 15,000), almost seven times the roughly 2,700 eggs collected monthly using 84 standard traps in the same study areas.

A tantalizing but anecdotal observation was that there were no new cases of dengue reported as originating in the ovillanta study test area, a community that would normally anticipate two or three dozen cases in that timeframe.

Targeting mosquito eggs using the ovillanta, Dr. Ulibarri says, is one third as expensive as trying to destroy larvae in natural ponds and only 20% the cost of targeting adult insects with pesticides, which also harm bats, dragonflies and the mosquitoes' other natural predators.

The ovillanta was modeled after a mosquito trap developed at Laurentian University in response to the outbreak of West Nile virus in northern Ontario, which uses a modified solution to lure the *Culex* genus of mosquito, the West Nile carrier thought by some to be also the Zika carrier.

"We decided to use recycled tires -- partly because tires already represent up to 29% of the breeding sites chosen by the *Aedes aegypti* mosquitoes, partly because tires are a universally affordable instrument in low-resource settings, and partly because giving old tires a new use creates an opportunity to clean up the local environment," said Dr. Ulibarri.

Key to the overall system is an online training program to strengthen the mosquito control expertise of local health workers, coupled with a community engagement strategy that involves households in the regular maintenance of their ovillanta.

The community members collect the egg-laden strips of paper or wood from the ovillanta and pass them to the health workers, who conduct the monitoring and destruction using fire or ethanol.

The *Aedes* genus of mosquito -- the principal genus that transmits Zika, dengue, chikungunya, and yellow fever viruses -- has proven extremely difficult to control using other strategies, according to the World Health Organization.

A female, with a natural lifespan of up to three months, can start to reproduce in one week. Pesticide-resistance, dwindling resources, and an increase in mosquito-friendly environments have thwarted traditional methods of controlling the insect's rapid spread.

"Innovation is a key driver underlying the Government of Canada's approach to international development," said Canada's Minister of International Development and



La Francophonie, the Honourable Marie-Claude Bibeau. "Innovative solutions that deliver improved global health outcomes -- such as for the fight against the Zika virus -- are needed."

"While in its early days, this integrated innovation of a mosquito trap coupled with training local health workers and engaging communities in vector control is a promising example of how Canada's leadership in development innovation can respond to public health emergencies such as Zika," said Dr. Peter A. Singer, Chief Executive Officer of Grand Challenges Canada.

### **Permethrin-Treated Clothing Isn't Ideal for Keeping Mosquitoes Away**

*2.6.2013 Patrick Allan PESTS*

Mosquitoes aren't just annoying, they can be dangerous. Even so, before you go buying pricey clothing with built-in insect repellent, you might want to consider cheaper, and possibly more effective, options.

This video from the Consumer Reports YouTube channel shows their tests conducted on two popular brands of permethrin-treated shirts, Insect Shield and Burlington. The results revealed that both brands were somewhat effective pre-washing, but neither were able to completely prevent bites from the type of mosquito that carries the Zika virus pre or post-washing. Not exactly ideal, especially since these shirts can range anywhere from \$20 for a t-shirt, to over \$150 for a permethrin-treated button-up that is made of flame-resistant material. The shirt they treated themselves with DEET, however, performed great during their tests. So you're better off buying highly-effective 30% DEET repellent for less than \$10 a bottle, and treating your clothing yourself. Just hang your clothing up outdoors, spray it with your DEET repellent, and let it dry before wearing.

### **Now, a TV from LG that can keep mosquitoes away**

*The Indian Express Online Media*

*Tech Desk | New Delhi | Updated: June 7, 2016*

LG Mosquito Away TV is equipped with an Ultra Sonic device, which uses the sound wave technology to keep mosquitoes away.

LG Electronics has Mosquito Away TV, that drives mosquitoes and is odorless. Yes you heard it right. A TV that also provides a solution to keep your surroundings mosquito free.

LG Mosquito Away TV is equipped with an Ultra Sonic device, which uses the sound wave technology to keep mosquitoes away, without emitting harmful radiations. The device needs to be first activated.

LG says the technology does not use chemicals, used in other toxic repellents. More importantly, it does not require refilling or any other maintenance. "The new Mosquito Away technology in television is an extension of this philosophy, transiting beyond viewing experience and truly building a healthy environment at home," Howard Lee, Director – Home Entertainment, LG Electronics said.





### DID YOU KNOW?

#### Mosquitoes Use 6 Needles To Suck Your Blood

June 7, 2016 GABRIELA QUIRÓS npr

It's not just idle curiosity that's got scientists hunting down all the bloody details of a mosquito bite. Bites from these bugs are more dangerous to humans than those of any other animal; mosquitoes kill hundreds of thousands of people each year worldwide, and sicken millions more.

Part of what makes mosquitoes so good at getting humans sick, researchers are now learning, is the effectiveness of that bite. The mosquito's mouth, also called a proboscis, isn't just one tiny spear. It's a sophisticated system of six thin, needlelike mouthparts that scientists call stylets, each of which pierces the skin, finds blood vessels and makes it easy for mosquitoes to suck blood.

And these bugs know just where to bite. Mosquitoes have more than 150 receptors — proteins on their antennae and proboscis that help them find victims or figure out if a particular puddle of water has enough nutrients to support mosquito larvae.

Unfortunately, we humans leave an alluring trail. When malaria-causing *Anopheles* mosquitoes, for example, come out at night to look for blood, they track the carbon dioxide we exhale as we sleep, explains Shirley Luckhart, a University of California, Davis, parasitologist and entomologist. As they get closer to us, they detect body heat and substances called volatile fatty acids that waft up from our skin, she says.

Why are some people more likely to get bitten than others? Nobody knows for sure.

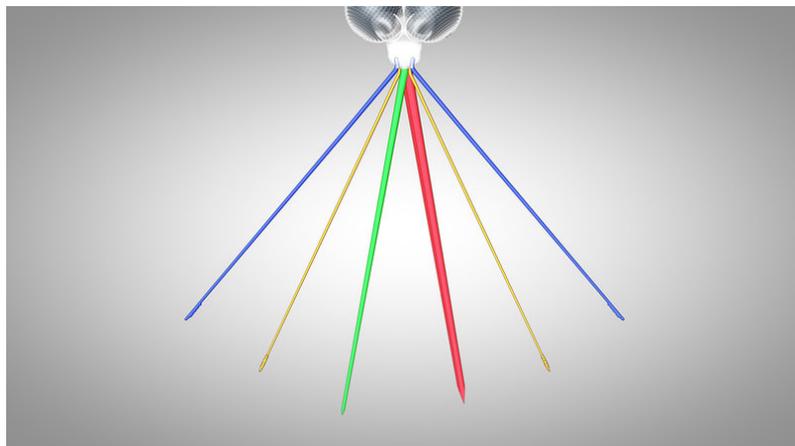
"The volatile fatty acids given off by our skin are quite different [from one person to the next]," Luckhart explains. "They reflect differences between men and women, even what we've eaten. Those cues are different from person to person. There's probably not one or two. It's the blend that's more or less attractive," she says.

When the female mosquito pierces the skin, a flexible liplike sheath scrolls up and stays outside as the insect pushes in the six needlelike parts.

Two of these needles, called maxillae, have tiny teeth that let the mosquito saw through human skin. "They're like drill bits — so sharp we barely feel the bite," says UC Davis biochemist Walter Leal.

Another set of needles, the mandibles, hold tissues apart while the mosquito saws into the skin. Then a fifth needle, called the labrum, pierces a blood vessel.

"Mosquitoes don't find the blood vessel randomly," says Leal. Instead, scientists have



recently discovered that receptors on the tip of the labrum respond to chemicals in our blood that drift up through the tissue like a "bouquet of smells" to help guide the way to a likely vessel.

Once the labrum gets into the blood vessel, it also serves as a straw.

This illustration shows the six needlelike mouthparts that female mosquitoes use to bite people. Usually sheathed by a flexible tube, the weapons include two maxillae (blue) to saw into the skin and two mandibles (yellow) to hold the tissues apart as the maxillae saw. The bugs drool saliva into humans with the hypopharynx (green) and suck up blood with the labrum (red).



Young-Moo Choo, a postdoctoral researcher in Leal's lab, discovered one of the labrum's blood-detecting receptors — 4EP — by painstakingly dissecting the mouthparts and genetically testing each part. He says he hopes his work might one day help drug companies develop new repellents.

Scientists have been trying to figure out the anatomy of the mosquito bite for decades, but the insect's delicate mouthparts tend to fall apart in the hands of beginners. Keen dissection skills — aided by video, powerful microscopes and genetic analyses — are now enabling Choo and other scientists to gather the details they need to figure out how the feeding system works.

As a female mosquito's gut fills up with blood, she filters the nutritious red blood cells from the fluid and excretes the water.

"The red blood cells provide a large protein component," Luckhart says. Eliminating the water lets her take in five to 10 times more blood than she otherwise could.

The mosquito's sixth needle — called the hypopharynx — drips mosquito saliva from the bug into us. That saliva contains substances that keep our blood flowing.



A female mosquito's body concentrates red blood cells and gets rid of fluid she doesn't need — the better to drink even more of your blood, my dear.

Otherwise, "your blood tends to coagulate immediately upon contact with the air," Leal explains. Mosquito saliva is powerful stuff. It makes our blood vessels dilate, blocks our immune response and lubricates the insect's

proboscis. It causes us to develop itchy welts and can serve as a conduit for dangerous viruses and parasites.

"Infected mosquitoes spit highly variable doses, anywhere from one infectious virion to 10,000," says UC Davis virologist Lark Coffey, referring to virus particles. "The number of virions needed to productively infect mice can be as low as one. In theory, one might be enough to cause diseases like dengue or West Nile."

And it takes only eight to 20 early-stage malaria organisms to cause that disease.

"Within 20 minutes they make it to the human liver," says Luckhart. "It's a very fast process."

Mosquitoes don't get anything out of making us sick — they just incidentally pass these viruses and other organisms on to us. In fact, researchers have found that some viruses started out as mosquito-only viruses. This isn't hard to believe; the first organisms that resembled mosquitoes are thought to have developed about 200 million years before the first humans.

Teodros Hailye/KQED, based on research by Young-Moo Choo and colleagues

"As mosquitoes evolved the habit of drinking blood, some viruses have tracked that evolutionary path and become human-vectoring viruses," says microbiologist Shannon Bennett, chief of science at the California Academy of Sciences, in San Francisco.