How GM mosquitoes are produced

Oxitec's genetically modified (GM) mosquitoes have shown to be successful in suppressing wild mosquito populations so far. Every week, the biotechnology company releases 800,000 GM male mosquitoes to mate with wild female Aedes aegypti in two neighbourhoods in Piracicaba. **Carolyn Khew** takes a look at how these mosquitoes are produced.

Mutations

Rapid changes in dengue's genetic make-up allow it to multiply while evading the body's immune response, so it spreads easily from an infected person.

Scientists believe it uses many other tricks to thrive, and are trying to identify them.

Four faces of dengue

There are four closely related dengue viruses: Den-1, Den-2, Den-3, and Den-4. Each strain or serotype interacts differently to evade the body's defences – the antibodies in the blood.

Despite sharing only about 65 per cent of their genomes, each serotype causes the same symptoms and disease.

A fifth serotype?

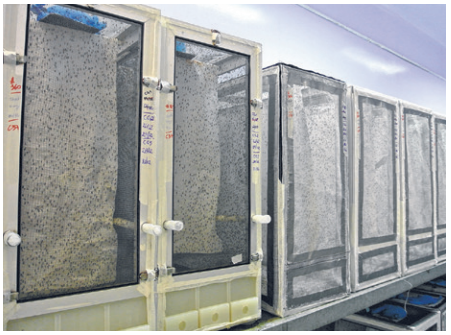
In 2013, scientists claimed to have discovered a 5th dengue serotype transmitted primarily in monkeys, which has evolved very differently from the four strains circulating mainly in humans.

An adult Aedes aegypti mosquito

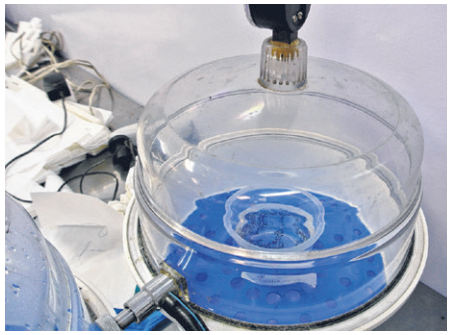
Did you know?

- Only the female Aedes mosquito bites as it needs the protein in blood to develop its eggs.
- The mosquito can lay eggs about three times in its lifetime, laying about 100 eggs each time.

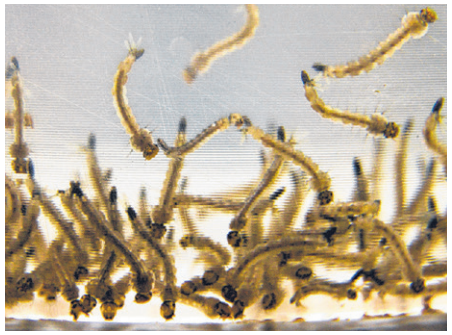
How the GM mosquitoes are reared



1 Adult mosquitoes which contain the genes are placed in cages, and fed with sheep's blood. Once they mate, their eggs are collected.



2 To speed up the hatching rate, the eggs are placed in a vacuum pump to remove oxygen in the chamber. This induces the eggs to hatch in an hour instead of a few days.



3 The mosquito larvae are given an antibiotic which inactivates the self-limiting gene. This enables them to grow.

4 The male and female pupae are sorted in batches of approximately 350,000 a day.

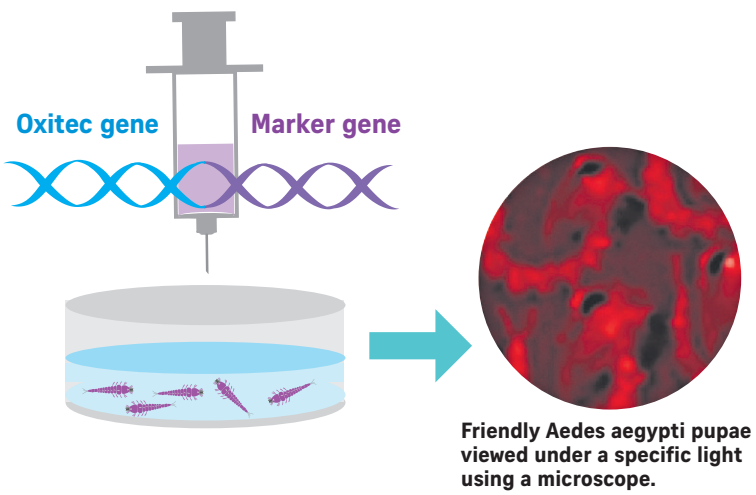
5 The females are destroyed while the males continue to be reared until adulthood before they are released.

How they were developed

In the laboratory, in 2002, Aedes aegypti eggs were injected with the DNA of two genes:

- One gene produces a protein that prevents the mosquito from reaching adulthood.
- The other gene is a marker that causes fluorescence that can be seen under a specific light using a microscope.

The friendly Aedes aegypti strain was developed such that when they reproduce in the laboratory, all their descendants carry the additional genes.

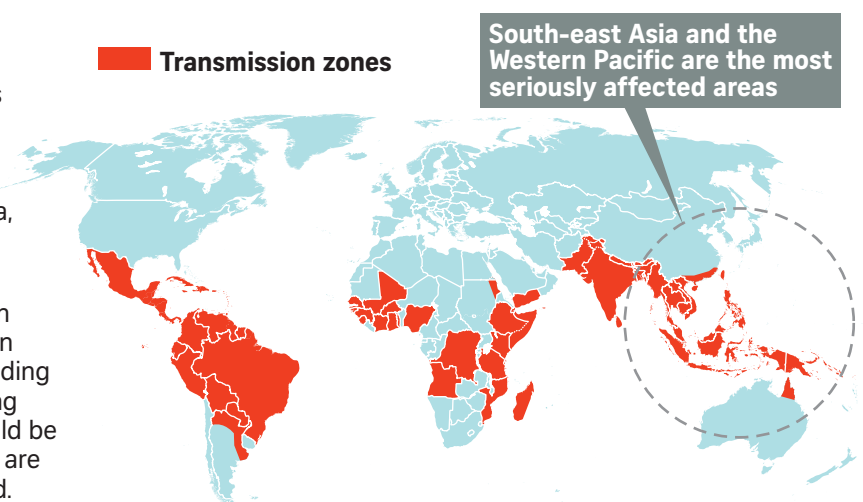


Friendly Aedes aegypti pupae viewed under a specific light using a microscope.

Global blight

About 2.5 billion people, or 40 per cent of the world's population, are at risk of contracting dengue. The disease is endemic in at least 100 countries in Asia, the Pacific, the Americas, Africa and the Caribbean.

The Who Health Organisation estimates that 50-100 million infections occur yearly, including 22,000 deaths, mostly among children. But the figures could be much higher, as many cases are not reported or misclassified.



Sources: AFP, OXITEC, PROF OOI ENG EONG (DUKE-NUS MEDICAL SCHOOL), WORLD HEALTH ORGANISATION PHOTOS: ISTOCKPHOTO, OXITEC, CAROLYN KHEW ST GRAPHICS