



A mangrove in Pulau Ubin, which has one of the largest swathes of mangroves left in Singapore. The insect communities in these habitats are very distinct and are likely uniquely adapted to living in this type of environment, said Dr Darren Yeo of the National University of Singapore, who led the latest research. ST PHOTO: JOEL CHAN

# Mangroves here buzzing with insect life, study shows

**They boast 3,000 species despite having fewer plant species than other forest habitats**

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Mangroves may boast fewer plant species than other types of forests, but they still buzz with life, new research has indicated.

More than 3,000 species of insects have been found in mangrove patches here, with most likely to be new to science or new records for Singapore, said Dr Darren Yeo, a post-doctoral research fellow at the National University of Singapore (NUS).

"The insect communities in mangroves are very distinct and are likely uniquely adapted to living in this type of environment," said Dr Yeo, who led the latest research.

"This means if we suddenly lost

all of our mangroves, most of these insects would become nationally extinct."

His paper was published pending peer review on preprint site bioRxiv last month.

As mangroves have long been considered species-poor for insects due to low plant diversity, the latest findings are significant, said Dr Yeo, who is from the NUS Evolutionary Biology Laboratory.

Earlier research had found that mangrove patches in Singapore have considerably fewer plant species than other forest habitats.

Pulau Ubin, which has one of the largest swathes of mangroves left in Singapore, has about 245 species of plants. In comparison, the rainforest in Bukit Timah Nature Reserve has 1,250 plant species.

"A dominant theory is that the

more plant species there are, the more ecological niches for insect herbivores," Dr Yeo said.

The research was done by first collecting insects at the various habitats. More than 100,000 specimens were collected.

Then came the tedious process of sorting through the samples.

Typically, scientists do this by analysing the physical traits in the specimens – which could be as small as a pinhead – to identify the species. Doing this for 100,000 specimens could be a long process spanning decades, said Dr Yeo.

But the 11 researchers in the study did the sorting using a technique known as next-generation sequencing barcoding. This means they identified the specimens via their genetic sequences instead of how they looked – similar to how barcodes are used in shops to identify products.

Though more than 3,000 insect species were found in mangroves, after standardising for sampling dif-



Left: The *Hercostomus singaporensis* – a long-legged fly – is among the insect specimens found in the latest study. It thrives in mangroves, and its larvae likely feed in the mudflats. PHOTO: THE BIODIVERSITY OF SINGAPORE

ferences across the various sites, the study found that these habitats were home to 1,102 insect species.

Tropical primary and secondary rainforests had 2,188 insect species, while 1,809 were found in swamp forests in Singapore.

Dr Yeo said the figures for insect diversity in mangroves were roughly 50 per cent to 60 per cent of the rainforest and swamp forest diversity, which is a sizeable proportion considering that there are fewer plant species in mangroves.

Highly unique fauna, moderately high species richness and a high risk of habitat loss are factors that contribute to the research team

viewing mangroves as an important area for insects. More research needs to be done to find out why mangroves could be so rich in insect diversity, but Dr Yeo said preliminary analysis suggests that nutrient-rich mangrove mudflats create an alternative ecological niche for many insect species. This means that what mangroves lack in plant diversity, they could make up for in nutrient availability in their sediment.

"We find that the mangrove insect communities tend to have a greater proportion of predator and detritivore species than the other habitat types," he said. Detriti-

vores consume detritus – waste or debris.

Commenting on the findings, mangrove expert Daniel Richards said plant diversity is generally low in mangroves because of the challenging conditions, particularly the high salinity.

Dr Richards, a principal investigator at Singapore-ETH Centre, said animals play an important role in maintaining the health of many forests, although not as much is known about their role in mangroves. In other forests, insects are critical in many processes – for example, they eat plant material and aid decomposition, he said.

"An important finding is the diversity of insects present in mangroves, as well as the fact that many species seem to be unique to mangroves," he said.

"The study found that there were more predatory insect species in the mangrove forests. It will be interesting for future research to look into the unique functions of this predator-filled insect community," he added.

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