

# Urbanization affects diets of butterflies

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Mr. Anuj Jain from the NUS Department of Biological Sciences conducting studies on butterflies. Credit: National University of Singapore

A study led by researchers from the National University of Singapore (NUS) revealed that most tropical butterflies feed on a variety of flower types, but those that are 'picky' about their flower diets tend to prefer native plants and are more dependent on forests. These 'picky' butterflies also have wings that are more conspicuous and shorter proboscis. The reduction in native plants due to urbanisation affects the diet of such butterflies, and researchers suggest that intervention may be needed to manage their preferred flower resources.

These findings are the outcome of a three-year study on how urbanisation affects the diets of [tropical butterflies](#). "Butterfly species exhibit different levels of flower preferences and flower specialisation. Understanding the complex phenomenon of flower specialisation of butterflies is important as butterflies are known to be important pollinators of tropical forests. Changes in vegetation structure due to urbanisation could alter butterfly behavior, and in turn, result in changes in native plant pollination and reproduction," explained Mr Anuj Jain, who conducted the study as part of his doctoral research at the Department of Biological Sciences at NUS Faculty of Science.

"It is worrying that butterflies that are flower specialists may become increasingly dependent on fewer native flower sources. To conserve such butterflies, there is a need to develop intervention measures to maintain the availability of suitable flowering plants," Mr Anuj added.

Results of the study were published online in the journal *Biological Conservation* in July 2016.

## **Impact of urbanisation on tropical butterflies**

When butterflies hunt for nectar, they collect pollen on their legs and body, which helps in pollination for the reproduction of plants. Studying the [flowers](#) that butterflies feed on is critical in understanding the

reproduction and dispersal of different types of plants.

"So far, studies on the flower-feeding patterns of butterflies have been concentrated in temperate countries, such as the United Kingdom and Spain, but this area is not well-studied for the tropics. With massive landscape transformation that is happening in the tropics, there is a need to understand flower use by butterflies, to assess the implications on pollination and plant reproduction, as well as conservation of butterfly species," said Associate Professor Edward Webb from the Department of Biological Sciences at NUS Faculty of Science, who supervised the study.

To address this research gap, Mr Anuj collaborated with Assistant Professor Krushnamegh Kunte from the National Center for Biological Sciences in India, and butterfly experts from the Nature Society (Singapore) to look deeper into the flower-feeding patterns of tropical butterflies.

Over a period of three years, the research team surveyed 62 sites in Singapore, which included both forested areas and urban parks, and recorded 3,092 flower visits by 190 butterfly species feeding on 149 plant species.



Yellow vein lancer (*Pyronaura latoia*) butterfly, a flower specialist that feeds on a single native flower species, feeding on flowers of the *Leea indica* plant.  
Credit: Tea Yi Kai

### **Some tropical butterflies benefit from urban vegetation while others suffer**

The researchers found that among the 190 butterfly species observed nectaring during the study, 30 were flower specialists who are 'picky' about their diets, feeding only on selected flower species, while the rest feed from a wide array of flowers.

A few forest butterflies were found to be critically dependent on single native flower species. One of them is the Yellow Vein Lancer (*Pyronaura latoia*) butterfly, which fed on flowers of the native plant *Leea indica* in 74 per cent of feeding observations. The team also found that the Lycaenidae family of butterflies, which is the most extinction prone and most habitat-specialised butterfly family in Singapore, is the most flower-specialised.

Of the 19 butterfly species that made at least 10 flower visits in both forests and urban parks, five species expanded their diet when they are in urban parks, which have more non-native plants compared to forested sites. This suggests that non-native flowering plants may be benefitting some butterflies by providing extra nectar resources.

"Native flowering plants in the forests of Singapore tend to be spatially dispersed and flowering events are short, sporadic and few, except during times of mass flowering. The presence of non-native plants may make up for this shortfall in native flowering events. The impacts of non-native flowering plants can be complex, potentially benefiting generalist species while being detrimental to specialists," explained Mr Anuj.

## **Flower specialisation and evolutionary adaptation of butterflies**

The research team also studied the factors that made butterflies flower-specialists or generalists and found that butterflies that feed on fewer flower species (i.e. specialists) have wings that are more conspicuous.

Mr Anuj said, "Our results suggest that the conspicuousness of the butterflies may be an important evolutionary adaptation to escape predators during feeding. When butterflies are feeding, they tend to be vulnerable to predation. They will need to optimise foraging strategies or

morphologies to reduce the time they spend on flowers, which may reduce exposure to predators and may lower predation."

It was also found that butterflies that are flower generalists had longer proboscis lengths than specialists. Possession of a long proboscis is beneficial to butterflies because it widens food choices by allowing access to nectar in deep flowers, which typically secrete more nectar than short flowers.

Future studies to focus on impact of tropical butterflies on plant reproduction

In their current study, the research team could only quantify flower use by butterflies, but did not investigate the impact that the butterflies have on seed production, seed dispersal and establishment of native plants.

To further their understanding on the true costs and benefits of non-native plant species to [butterflies](#) in tropical forests, the team hopes to carry out community-level experiments involving multiple plant species over the entire plant reproduction cycle.

**More information:** Anuj Jain et al, Flower specialization of butterflies and impacts of non-native flower use in a transformed tropical landscape, *Biological Conservation* (2016). [DOI: 10.1016/j.biocon.2016.06.034](#)

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