Craning for a better view of pollination

March 2003

They're small, generally inconspicuous and sometimes annoying. They're insects and they play a crucial role in maintaining the huge diversity of our tropical rainforests. Rainforest CRC researcher Professor Roger Kitching and his team have a unique way of finding out what the insects of rainforest canopies are up to by using the Canopy Crane at Cape Tribulation. Over the past two years they have discovered how insects respond to flowering species and the part they play as pollinators in the rainforest canopy.

A background of biodiversity

Earlier work on rainforest canopy insects revealed a remarkable diversity of insects. Hundreds of new species were encountered in the rainforests of south-east, central, north and far north Queensland. One tree alone yielded over 400 beetle species. Having discovered the incredible diversity of canopy insects, the focus is now on the functions of the different animals, identifying interactions between them and their host plants and working out how specialised these interactions are. For example, do insects tend to visit the flowers of many plant species, or are they more specialised? Are there many species of insects that can pollinate certain flowers, or just a few?

Breaking with the old

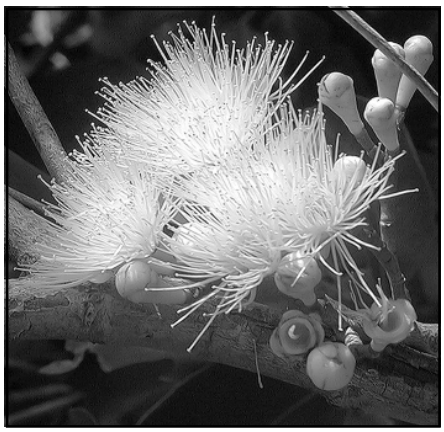
Getting researchers into the canopy in the past has always been logistically difficult and often dangerous. Now the Australian Canopy Crane provides ready and safe access into and over the canopy where research assistants Sarah Boulter and Brad Howlett spend many hours setting and collecting traps and observing insect movements. The crane allows them to access flowers anywhere within one hectare of rainforest from the uppermost canopy to the ground.

Traditionally, researchers have avoided plants in flower when fogging the canopy in order to minimise the complexity of samples and to simplify data interpretation. This is the very time Sarah and Brad conduct their fieldwork on insect and host plant interactions. When buds burst, flowers provide insects with new and highly desirable resources like nectar, sugars, protein and pollen. The trees fairly 'buzz' with activity at this time.

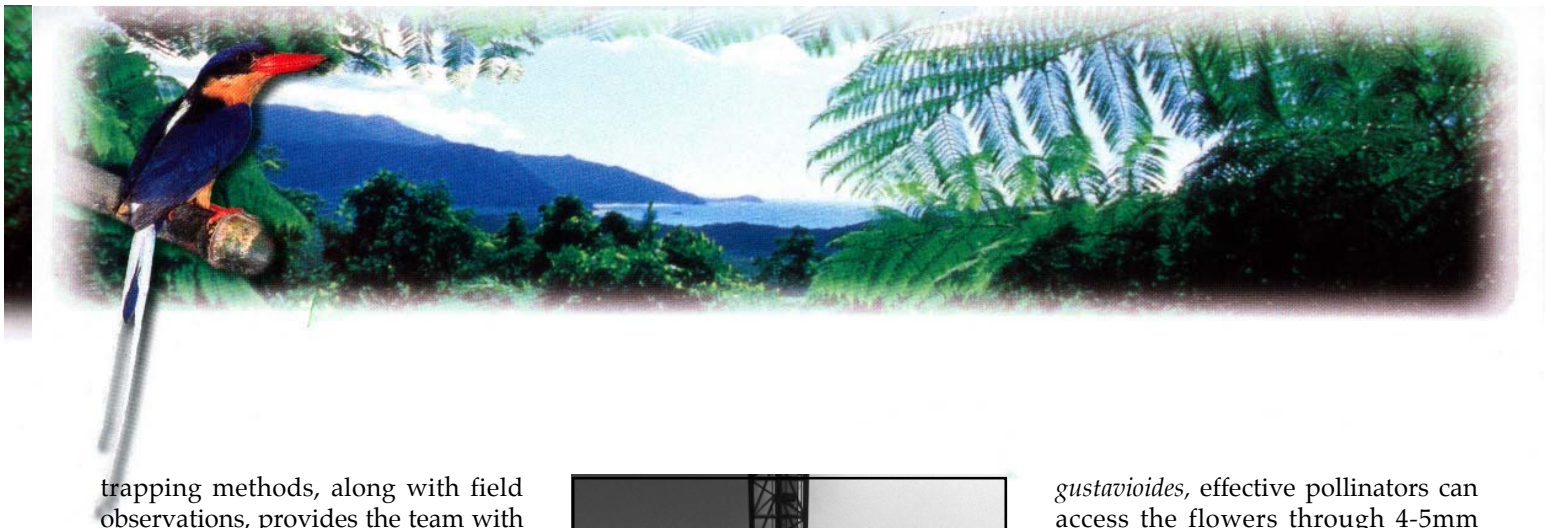
Predators are likely to be amongst these pollinators, preying on other insects and taking full advantage of increased numbers. Increased activity could also be the result of a population boom in response to the increased resources, or a result of opportunists, just making the most of an abundant food supply.

Linking insects to hosts

In their search for pollinators amidst the multitude of insects present, the canopy crane project looked at two distinct types of insects - residents and visitors. Residents are those insects that actually live and feed on the buds and flowers of plants. These are called in-fauna and can be collected simply by washing them from the buds and flowers in question. Residents use the host flower to meet mates, as brood and shelter sites, as well as a source of food. The temporary visitors however, are collected using combination sticky/intercept traps. Using both



Left: One of the canopy plants under close scrutiny, *Syzygium sayeri* in full flower.
Right: A coarse mesh net cage encloses a flower head at the bud stage to exclude potential pollinators over a certain size.



trapping methods, along with field observations, provides the team with a comprehensive picture of how the insect community responds to flower opening. Any of these resident or visiting insects are likely pollinator candidates, from the smallest thrip to largest butterfly. Significant increases in both resident and visiting insects after flower opening have been confirmed. Particularly interesting is the variation between different plant species. From the ten different canopy plants sampled so far, including palms, vines and trees, each species has shown a definite response from a different organism or set of organisms. Resident thrips increased when *Acmena graveolens* and *Normanbya normanbyii* flowered, but there was no such increase on *Licuala ramsayii* or *Chlerodendrum tracyanum*. Once the buds of *Syzygium gustavioides* burst, numbers of beetles and flies visiting increased, as did the resident thrips and beetles. Increases in particular insects found on or near flowers but absent from buds of the same plants definitely makes them potential pollinators of those particular plants. Their presence alone cannot be used to confirm this though, because of the likely presence of predators and opportunists as well.

Finding the Pollinators

For this experiment, swelling of the flower receptacle is used as a sign of successful pollination. Exclusion experiments have begun to identify potential pollinators of a subset of flower species within the canopy. These experiments involve caging flowers at the bud stage to exclude certain

The Australian Canopy Crane - safe and reliable access for canopy researchers

pollinators. The cages are constructed using plastic acetate sheets and net fabric of different mesh sizes. The different mesh sizes allow or deny access to the various insects and therefore help build up a picture of the size of insects assisting pollination of the species in question. For *Syzygium gustavioides*, effective pollinators can access the flowers through 4-5mm square mesh. Amongst the resident and visiting insects collected for this species were large numbers of two small beetle species that fitted through this gauge mesh. With the high numbers found on the flowers and their mobility, these are both good pollinator candidates. Increases in successful pollination with increased mesh size can indicate more than one effective pollinator, with a larger species also contributing to pollination success. A low level of success in flowers enclosed by the smallest mesh size might indicate either self-pollination or else very small fauna like thrips are mediating low levels of pollination.

Why Pollinators Matter

Knowing more about the roles various organisms play in maintaining healthy, functional rainforests is essential to ensure effective management of these ecosystems. As pollinators, insects play a crucial role in maintaining the diversity of our rainforests. Knowledge of their relationships with the flora that supports them is imperative if we are to protect and conserve that unique diversity.

For more information contact:
Professor Roger Kitching,
Griffith University, Nathan,
Queensland 4111, Australia
Phone: (07)3875 7491
Fax: (07)3875 5014
R.Kitching@mailbox.gu.edu.au
To contact the Australian Canopy Crane Research Facility:
Phone: (07)4042 1242
Email: michael.cermak@jcu.edu.au

PHOTOS: PETER LIK: WETROPICS