# MIDGES AS BIC

Dreaded by convalescents the world over, tapioca — also known as cassava or manioc, made from the tuber-like root of *Manihot esculenta* — is just one of the many forms of one of the Third World's staple foods. Boiled, pulped and dried to form cassava flour (with the juices saved to make alcoholic drinks) or especially treated to form tapioca 'pearls', cassava originated in central America and has since been exported to Asia and Africa.

Yet its origins have sometimes been forgotten, to the cost of its new users. In 1973, a new species of mealybug was found attacking cassava plants in central Africa; the pest, identified in 1977 as *Phenacoccus manihoti*, spread rapidly and by 1980 was causing production losses of 80% of the cassava grown in all of tropical Africa.

Agriculturists thought the pest had somehow arrived in Africa from the Americas, the original source of cassava, and in 1977, when scientists located what was thought to be the same insect in northern South America, they also discovered parasitic wasps attacking it. These wasps were quickly introduced into tropical Africa, but the region's cassava crops continued to decline: the biocontrol agents refused to reproduce on the African mealybugs.

The situation caused grave concern; continued losses of four-fifths of the cassava crop could easily lead to famine. A solution was soon found however and, ironically, it was found by practitioners of one of the least valued branches of biology. Taxonomy — the science of naming, classifying and discovering the natural relationships between organisms, extant or extinct — is a far from fashionable discipline, regarded more as belonging to dusty museum collections than to life-and-death decisions.

But it was taxonomists from the mother of all biological collections, Britain's Natural History Museum, who correctly identified the mealybug as a species from central America, not further south. When scientists extended the quest for natural enemies of *Phenacoccus manihoti* to central America, they found the parasitic wasp *Epidinocarsis lopezi* which soon provided spectacular biocontrol. By 1990 it was successfully established in 24 African countries, and had spread over more than 12·7 million square kilometres. The mealybug is now considered to be under complete control throughout its range in Africa.

By 1988, $14·6 million had been spent on attempts to control the pest; accurate identification led to an estimated annual benefit of $200 million — a saving that looks likely to continue indefinitely.

What has this story, cheering though it may be, of a central American insect to do with Australia? Put simply, it provides a telling example of the importance of correctly identifying organisms, whether for personal health and safety (failing to identify the venomous snake that bit you could cost you your life) or, indeed, for the health and safety of the environment.

Dr Peter Cranston, a taxonomist with the CSIRO Division of Entomology in Canberra, has been applying his expertise in the identification and classification of midges — ephemeral flies, ranging from 2 millimetres in length to 2 cm — that belong to the family Chironomidae. Midges are familiar to those who live near lakes and rivers, since they form dense clouds during their brief spring and summer breeding season, attracting swifts… and, more importantly to anglers, inspiring trout to rise to flies natural or artificial. As adults they live for only a day or so, never feeding (although they have functional mouthparts) and spending their brief lives mating and laying eggs.

by Carso

# D-INDICATORS

There are thousands of species of midges around the world (virtually any environment that contains running water will also contain 100 to 200 of them), but Dr Cranston has been concentrating on the 200-odd species to be found in the Alligator Rivers region of the Northern Territory — the heart of Kakadu National Park.

Working on behalf of the Office of the Supervising Scientist within Kakadu, Dr Cranston has been looking at the midges that inhabit the rivers and creeks downstream from the Ranger uranium mine, using these insects as indicators — or, as he puts it, as 'surrogates for ourselves' — to determine the health of the rivers and to monitor the effects of any potential leakage from the mine. He has collected larvae, pupae and adults of most of the midges known in the Alligator Rivers area, examining and describing them in minute detail to build up a comprehensive picture of each kind (complete with its variations).

The end purpose of this work is to provide environmental scientists with a kind of living Geiger counter: a means of assessing whether pollution or environmental degradation has occurred and, further, a means of assessing how far that degradation has proceeded.

This is possible not only because variations in the bilateral (comparing one side with another) symmetry of midges and other insects tend to reflect the degree of pollution (see 'Monitoring environmental stress', *Ecos* No.70), but also because the range of species represented in any one area tends to change as a result of environmental stress — especially if that stress takes the form of a sudden influx of nutrients or heavy metals.

Dr Cranston dissected and described tiny larvae and exuviae (the skin that is shed when the adult emerges from its underwater pupal stage), and listed subtle differences in minor anatomical features, collating these in an 'anatomical atlas' of Kakadu's midges. This gives scientists an early warning system to detect environmental stress before it turns into degradation or, at an extreme level, the disappearance of whole species.

One of the most interesting aspects of Dr Cranston's work is that it makes use of the complete life cycle of Kakadu's midges to provide useful and timely information. Larvae indicate, by their variety and abundance, the health of a stream; pupal exuviae indicate not only which species are present and in what ratios, but how successfully larvae have survived to become pupae and then adults; and adult members indicate how well particular species are surviving, or persisting, in particular micro-habitats.

As well, his technique has made collecting easier for environmental scientists, who have not only limited entomological expertise but also limited resources for long-term monitoring. Larvae must be collected from stream-bottoms, but exuviae and other pupal body parts can be collected in simple drift nets spread across streams at appropriate locations ... and adults can be collected in their thousands when clouds of midges fill the late-afternoon air above Kakadu's floodplains.

**More on midges**


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