

Discussions about millipedes with most people invariably lead to comments about the Portuguese millipede, a nuisance pest that has colonised many regions of the world, including southern Australia. Indigenous millipedes are, however, found all over Australia and hundreds of species have been described. The largest genus, *Antichiropus*, is widespread across the southern two-thirds of Western Australia extending as far north as the Pilbara, with a single species in South Australia. The genus was first described in 1909 by Austrian scientist Carl Attems based on specimens collected during the Hamburger Südwest-Australischen Forschungsreise by Wilhelm Michaelsen and Robert Hartmeyer in 1905–1906. They collected a treasure-trove of natural history specimens in south-western Australia, many of which were described as new species by European scientists.

Antichiropus mostly languished in obscurity until it became the subject of a research project by a Western Australian team led by Cathy Car. The first task was to redescribe the nine previously described species, followed by a review of the species in the Great Western Woodlands. This biologically significant area is relatively well collected for millipedes and Cathy described 30 new species. The third instalment, which was recently reported in the journal *Zootaxa*, concentrated on the species in the Pilbara where 33 new species were described and named. Further regions will be investigated in the future and there are about 160 species in the collections of the Western Australian Museum.

So, how does one distinguish between millipede species, which all seem to look the same? Most male millipedes transfer sperm to the female via modified legs on the seventh body segment. In many millipedes they are rather small and embedded within the body. In *Antichiropus* and its relatives, the gonopods are quite large and are adorned with various spines and processes. Each species has its own characteristic shape: big prongs, curved spikes, concave prongs, serrate processes – the variation is nearly endless. And each new locality in WA seems



Millipedes, it's all in the prongs

to harbour another new species, so it's likely that the true number of species hasn't yet been reached.

Species of *Antichiropus* have small distributions. This is not surprising given their lack of dispersal capabilities; they can only move to adjacent habitats by walking and, although they have many pairs of legs, they can't get very far in their relatively short adult lifetime. More importantly they are usually restricted to specific micro-habitats such as deep leaf litter or near granite rocks, and are unable to traverse unsuitable habitat. This leads to the isolation of populations and the restriction of gene-flow, which over time leads to significant changes in their genetic make-up and eventually, speciation.

Taxa with naturally small distributions are sometimes called short-range endemic species, and *Antichiropus* are a classic example of this natural phenomenon in WA. To ensure that proposed developments that involve the substantial loss of natural habitat in WA do not lead to irrevocable species loss, proponents are mandated by the Environmental Protection Authority to survey for short-range endemic species. Species of *Antichiropus* have thus been actively collected across WA, resulting in excellent collections on which to base the taxonomic work.

Such amazing species diversity within a single genus is not unusual in many terrestrial invertebrate groups, but

Above Male and female *Antichiropus rupinus* mating.

Inset The gonopod prongs of *Antichiropus rupinus*.

Photos – Mark Harvey/WA Museum

understanding how this diversity evolved in *Antichiropus* takes clever detective work. A study by Janine Wojcieszek and Leigh Simmons at The University of Western Australia found evidence for divergence in gonopod shape among populations of the marri millipede, *Antichiropus variabilis*. Nevertheless they also found evidence of stabilising selection where extreme versions of male genital shape are selected against. Sexual selection probably plays a significant role in speciation of this genus with transitions to new genitalic shape occurring over time.

Very little is known of their life cycle. Adults emerge on the surface during the rainy season but no-one knows where they spend the dry months. They presumably reside deep in the soil as juveniles. But what are they feeding on? We know that millipedes are detritivores, which feed on rotting plant matter. But what do they target when underground?

Next time you see a millipede in a bushland habitat, spare a thought for their evolutionary history and complex male genitalia. And if you're lucky, you might have found a new species.