

Australia is home to many unique spiders with most species occurring nowhere else on Earth. Many have their origins in the distant past, when Australia was part of Gondwana in the Mesozoic, ca. 180 million years ago. Australia, New Zealand, South America, Africa, Madagascar, Antarctica and the Indian sub-continent, plus a few small islands, once formed a massive southern supercontinent that gradually fragmented from the Jurassic, ca. 180–160 million years ago. Evidence of the connection between these continental blocks can be found in the fossil record of some plants and animals, but most strikingly in the presence of related groups of organisms in the modern biota.

But back to spiders. There are three major groups of spiders: the Mesothelae (a group of primitive spiders now only found in Asia), the Mygalomorphae (trapdoor spiders and their relatives) and the Araneomorphae (all other spiders). The Australian mygalomorphs include trapdoor, funnel-web and mouse spiders, and tarantulas.

Most Australian mygalomorph spiders have their origins in Gondwana. The highly venomous Sydney funnel-web spider (*Atrax robustus*) and its relatives only occur in eastern Australia (and many species are most likely to have been impacted by the recent disastrous fires). Mouse spiders (genus *Missulena*) occur only in mainland Australia, with their nearest relatives in South America. The spiny trapdoor spiders (family Idiopidae) are found all over Australia, with their closest relatives in South America, Africa and Madagascar. The pygmy trapdoor spiders (family Migidae) occur in eastern and south-western Australia, but also in South America, Africa and Madagascar. This pattern recurs throughout the Australian mygalomorph fauna suggesting that the majority of families have been in Australia for at least 180 million years.

However, some recent studies have found different geographic patterns that show that they haven't been here the entire time and are relatively recent interlopers.



## The road travelled by Australian trapdoor spiders

The first is a small migid spider found on Kangaroo Island in South Australia that lives in shallow burrows with a flap-like lid, was discovered by Adelaide University PhD student, Sophie Harrison, to be most closely related to spiders of the same genus from South Africa. Using molecular sequence data, Sophie found that the spider, *Moggridgea rainbowi*, diverged from its African cousins sometime between two and 16 million years ago, which is way too late to have been the result of Gondwanan continental drift. Sophie and her co-authors speculated that the spider rafted its way to southern Australia on a big chunk of soil or in a floating log, sealed inside its tube to avoid salt water and desiccation. This voyage of several thousand kilometres to a new life in Australia is one of the longest recorded journeys of a mygalomorph spider.

The second pattern was studied by Joel Huey and his colleagues from the Western Australian Museum, who examined the genus *Conothele*. It's long been suspected that *Conothele* arrived from Asia during the Cenozoic era when Australia was in close proximity to Asia, enabling the spiders to island hop, especially when sea levels were low. *Conothele* is widespread throughout south-east Asia, including various Indonesian islands. Joel found that the entire Australian fauna only arrived some

20 million years ago. Once again, this is way too young to be the result of a Gondwanan origin but perfectly fits the timeline of Australia bumping into Asia. He also noted that there were two distinct habitat preferences for Australian *Conothele*. Some species constructed burrows on tree trunks in tropical Australia, but others dug burrows in the soil. This second group used this amazing behavioural shift to colonise the majority of the Australian arid zone.

They also found that there were plenty of species. Many could be recognised using morphological differences, mostly in the adult males. But others were discovered using the DNA data. Distinct groups could be seen in the phylogenetic tree (which looks like a family genealogy) and each is thought to be an independent species. The variation was so great that it looks like there at least 60 species. And unfortunately not a single one of these has yet been named in the scientific literature. This diverse group awaits a detailed study and the use of a good Latin dictionary to find some euphonious species names.

The biological road to Australia has been paved by ancient Gondwanan relicts, followed by ring-ins from Asia and elsewhere. Mygalomorph spiders show these distinct patterns, making them ideal subjects of further study.