

# Swimming In Tarantulas

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Tarantulas are not what instantly comes to mind when one thinks of arthropods that can swim. With that said, there have been a few reports (Hull-Williams 1986; Webb 1987; Reger 1994) and wildlife programs which show that tarantulas can, and do, swim in the wild and in captivity. These swims, however, are almost always the result of a spider being chased, or accidentally falling into a large body of water, and it might be expected that those most prone to such accidents are arboreal tarantulas living in trees overhanging lakes or rivers. It has been speculated that a limited swimming ability enabled some species to colonize island habitats (Hull-Williams 1986). Yet even burrowing tarantulas might find themselves flushed out by a flash flood or similar mishap immersing them in a watery peril.

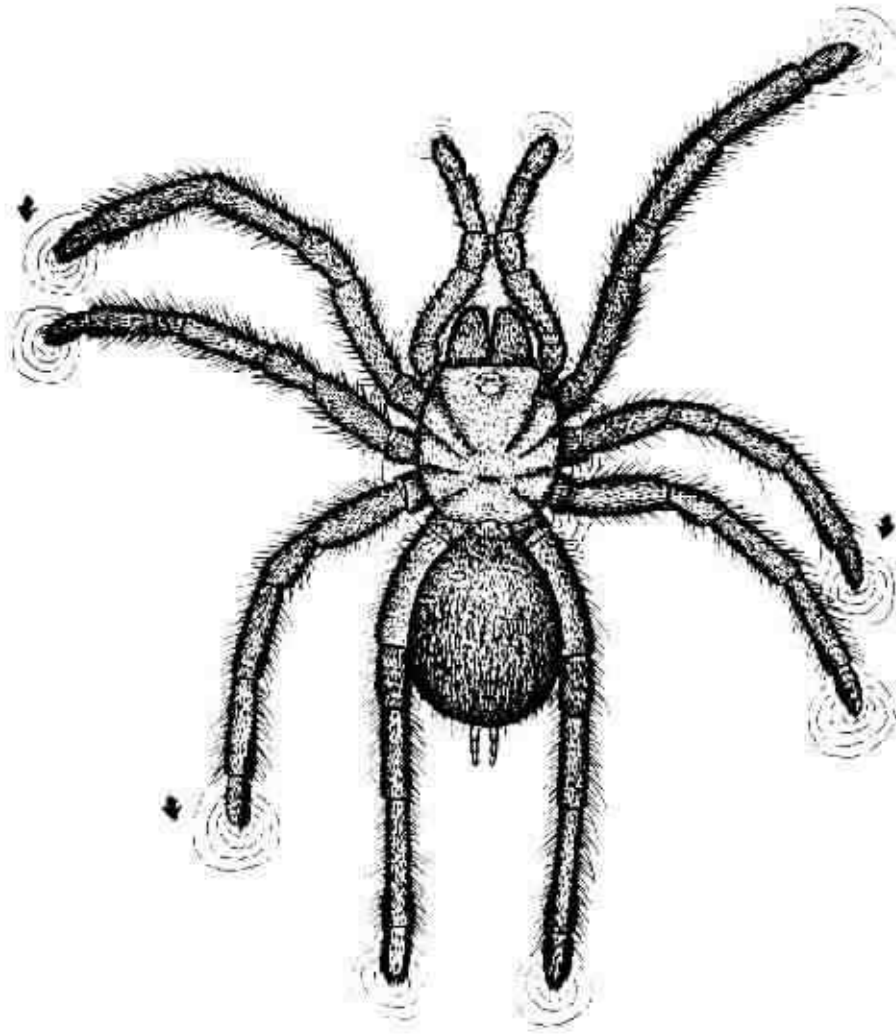
What interested me was how tarantulas cope with being in a large body of water, how their behavior changes, and how they actually swim. Swimming was investigated in a number of species coerced into a large tray of water, a few centimeters deep. The first observation was, perhaps unsurprisingly, that tarantulas do not take kindly to large bodies of water. They are clearly able to detect its presence and receptors on the legs called hygroreceptors, which are known to detect humidity, are probably involved. All the specimens actively tried to avoid the water and had to be nudged into the middle of the tray or floated out on a substrate which was then submerged.

The second observation was that most of the time the tarantulas did not sink. The larger (and heavier) the spider, the more likely it was to sink, in which case it tended to curl in its legs and not move, and needed to be rescued. However, most of the time the tarantulas floated on the surface film of water. A layer of air trapped by the dense coat of hairs on the legs and body is probably an important factor here. The waterproofing ability of the spider cuticle, with its waxy outermost layer, was impressively demonstrated and the tarantulas emerged completely dry from the water, none the worse for their ordeal.

As for the actual swimming, the spider sometimes paused for a short while, but then undertook a rapid flurry of legs until it reached the safety of the tray's edge where it climbed out. I estimate my champion swimmer, a large immature *Brachypelma vagans* (Ausserer), reached about five to eight cm per second. This is faster than its usual walking speed, but not as fast as it can run on dry land.

So what is their swimming mechanism? I began by considering two possibilities. Either they simply 'walk on water' using exactly the same walking pattern as they do walking on any other substrate, or they change their walking pattern to adapt to the rather different conditions of water compared to firm ground. This is a significant question.

My colleagues here at Manchester working on walking and swimming techniques in both living and fossil arthropods reliably informed me that walking is most efficient when the legs are moved out of phase. In other words, the opposite and adjacent legs are not moved at the same time. For example; in a tarantula, legs RI, LII, RIII, and LIV move together followed by legs LI, RII, LIII, and RIV moving together -- out of phase. Conversely, arthropods which swim efficiently, such as portunid crabs and certain water beetles, tend to move their paddle-like limbs in phase. They move the corresponding left and right swimming limbs at the same time.



So, are tarantulas adaptable and do they swim as efficiently as they can, or do they struggle badly in water with a ‘hard-wired’ walking technique? Well, the first comment must be that their walking is not as ‘hard-wired’ as I made out above. While tarantulas do mostly walk with their legs out of phase they can change this pattern at very slow speeds, or if they lose a leg, or have two legs experimentally tied together (Wilson 1967). In all these circumstances, tarantulas can adapt their leg movements to cope with the new situation, and so clearly have some flexibility in their movements.

To return to the swimming question, careful observations were made of the way in which the tarantulas swam. The tarantula primarily used its first three pairs of legs to swim, while the last pair of legs tended to be dragged behind it (see diagram). The first three leg pairs were moved out of phase (as in walking); the arrows on the diagram show three legs simultaneously moving to propel the spider forwards. Also, the legs were angled sideways slightly so that more surface area of the legs was being used to push through the water (see diagram). The pedipalps were held out in front of the tarantula and generally did not contribute to the swimming process.

Tarantulas effectively swim by ‘rowing’ on the surface of the water, using their first three pairs of legs like paddles. Rowing is the typical mechanism used by swimming arthropods, as

opposed to swimming by ‘flying’ underwater, moving their limbs up and down as, for example, in penguins.

What this study showed is that, though tarantulas are not able to adapt to what would be predicted as the most efficient swimming mechanism (in-phase legs), they do modify their leg movements from a typical walking pattern. In walking, the last pair of legs provides much of the driving force for locomotion, but in water, these legs are trailed backwards, serving a minor role in locomotion. The anterior three pairs of legs which provide the driving force in a swimming tarantula are also angled slightly to work as crude paddles, rather than moving up and down as in normal walking. It would be interesting to compare the mechanisms of tarantula swimming to those of habitually swimming spiders, such as the water spider *Argyroneta aquatica* (Clerk) (Argyronetidae, the water spiders), or those that sometimes hunt on the water’s surface such as the fishing spiders, *Dolomedes* spp. (Pisauridae, the nursery web spiders), and some wolf spider species (Lycosidae, Breene et al. 1988).

Most tarantulas probably never have to face the need to swim, but it is clear that if they must swim, they have the behavioral plasticity to do so. □

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