

Remote Copulation – A Reproductive Strategy to Enhance A Male Spider’s Chances of Fatherhood

Biologists have known for decades that the male sex organ, called palp, in orb-web spiders is often broken off during sex with females; what hasn’t been so clear is why. Now, new research by Assoc Prof Li Daiqin of the Department of Biological Sciences and his team of researchers Joelyn Oh, Simona Kralj-Fišer and Matjaž Kuntner from Singapore and Slovenia, have found, as they describe in their paper published in a leading international biology journal *Biology Letters*, and as featured in *Nature* (1 February 2012), that in an extremely sexually dimorphic and cannibalistic orb-web spider *Nephilengys malabarensis*, sperm continues from the severed male organ pumping into female genitals long after the male spider has fled or been consumed.

Sex is often considered cooperative and harmony. In nature, many animals are actually into rough sex – so treacherous for the males that some will often “emasculate” themselves, leaving behind their entire sex organ that is lodged inside the female – a behaviour so-called “eunuch phenomenon” that has puzzled evolutionary biologists for years because on the face of things, it renders the males sterile. Dr. Li Daiqin’s team, however, comes up with a new theory, the “remote copulation” hypothesis that the male’s sex organ still works without being attached to the male.

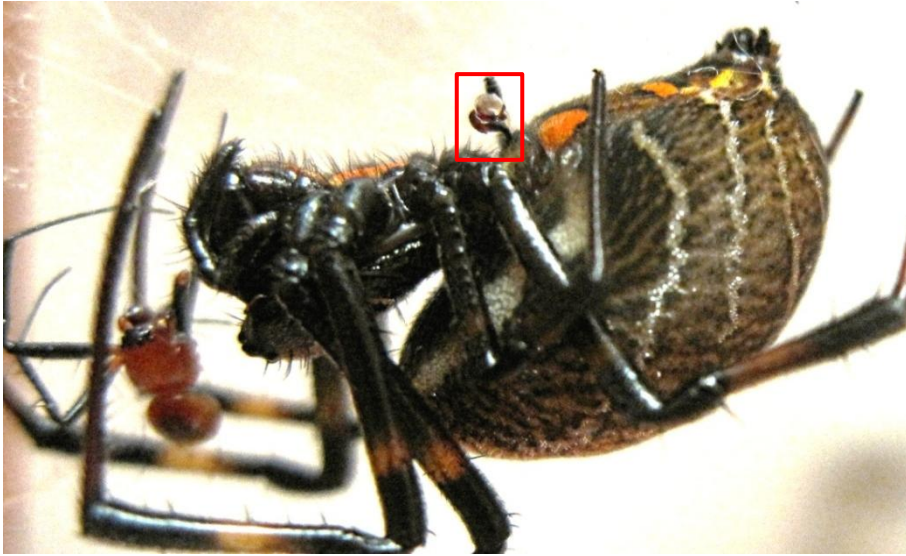
To make this discovery, the team staged 25 pairs of males and females, removed the severed palp in a certain period of time after palp breakage, dissected both the severed palp and female genital to see how much of the sperm from the male had made its way to the female and how much was still in the severed palp. The team found that the palp had delivered only 30% of their sperm after the female terminated copulation. However, the sperm continued pumping through the severed palp into female genitals.

They also discovered that the longer the severed palp is left in the female genitals, the more sperm it transfers, and female-initiated palp breakage induced even faster sperm transfer once the palp was broken off.

So the researchers think that full genital emasculation has evolved as a male counter-adaptation to both female cannibalism and the female's desire to control the duration of copulation. They concluded that the remote copulation serves to increase the chances of fertilization success, thus perpetuating the male’s genes.

Previous work conducted by the team found that by breaking off his sex organ, the male can prevent other males from mating with the female. The (survived) eunuch also becomes more aggressive and guards the female from rivals while the sperm is being transferred.

These studies shed new insight into sexual selection and particularly how sexual conflict between males and females drives antagonistic co-evolution in which adaptations in each sex select for counter-adaptations in other in animals in general and in spiders in particular.



Despite breaking off its reproductive organ (red box), this male orb-web spider did not escape being eaten by the female. Photo: Joelyn Oh.