Orb web spiders found to be better guards after sex

June 14 2012, by Bob Yirka

Nephilengys malabarensis. Image (c) Daiqin Li/University of Singapore

Previously, Daiqin Li and colleagues at the National University of Singapore found that the male orb web spider loses its sex organ, called a palp, due to it breaking off during sex because it allowed the male to continue pumping in sperm even as the male was either eaten by the female or fled the scene. Now new research by the same team has found that for those males that escape the female after mating, the loss of the heavy palp affords the survivors more stamina in warding off other would be suitors, thus helping to ensure that the original male produces offspring. The team has published a paper on their findings in the journal *Biology Letters*.

Sex for male orb web spiders is truly a risky business. The researchers found that only about twenty five percent of them survive the encounter

as the females are bigger and stronger and eat the males whenever they get the chance. Because of this, the researchers say, the male has evolved to where it allows its palp to break off during the tryst so that he might better escape being eaten, while still finishing the job he set out to do, namely, copulate to produce progeny. After he's dead or gone, his palp continues to push his sperm into the female, thus increasing his chances of producing offspring. But the researchers have now found that those that do survive make much better guards than they would were their palps still attached due to increased stamina. This is because the palps are pretty big and heavy compared to the rest of the spider's anatomy.

To find out just how much more stamina the spiders have without their palps, the researchers removed them manually from several volunteers and then subjected them to endurance testing. In so doing, they found that spiders with one palp removed (which reduced its body weight by four percent) had 32% more endurance than did spiders that retained both. Even more remarkably, when both palps were removed, reducing its body weight by nine percent, the spiders showed an increase in endurance of up to 80%.

This is important for the spiders because once they've mated, their sole reason for living is warding off other suitors seeking to replace the original mater's sperm with some of their own. With their lowered weight, those spiders that have already mated not only have more endurance but are lighter on their feet so to speak, giving them a huge advantage over other males still carrying around their cumbersome palps.

More information: Emasculation: gloves-off strategy enhances eunuch spider endurance, *Biology Letters*, Published online before print June 13, 2012, doi: 10.1098/rsbl.2012.0285

Abstract
Males of sexually cannibalistic spiders commonly mutilate parts of their

paired genitals (palps) during copulation, which may result in complete emasculation or the 'eunuch phenomenon'. In an orb-web nephilid spider, Nephilengys malabarensis, about 75 per cent of males fall victim to sexual cannibalism, and the surviving males become half-eunuchs (one palp emasculated) or full-eunuchs (both palps emasculated). While it has been shown that surviving eunuchs are better fighters compared with intact males when guarding the females with which they have mated, mechanisms behind eunuchs' superior fighting abilities are unknown. The previously proposed 'gloves-off' hypothesis, attributing eunuchs' enhanced locomotor endurance to the reduction in total body weight caused by genital mutilation, is plausible but has remained untested. Here, we tested the gloves-off hypothesis in N. malabarensis by comparing the time until exhaustion (i.e. endurance) of intact males with half- and full-eunuchs created experimentally. We found that by reducing body weight up to 4 per cent in half-eunuchs and 9 per cent in full-eunuchs through emasculation, endurance increases significantly in half-eunuchs (32%) and particularly strongly in full-eunuchs (80%). Our results corroborate the gloves-off hypothesis and further point towards the adaptive significance of male emasculation.

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