The role of sperm in the short and long term control of post-mating pheromonostasis in *Choristoneura rosaceana*

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We previously reported that the neural inhibition of pheromone synthesis, a phenomenon called pheromonostasis, occurs between the first and third hour following mating in *C. rosaceana* (Delisle and Simard, 2002). For species in which pheromonostasis is neurally meditated, it has been hypothesized that the presence of sperm in the spermatheca was the factor responsible for the regulation of this process (Gibultowicz et al., 1991). Male Lepidoptera transfer two types of spermatozoa: a large nucleated eupyrene sperm and a narrower anucleated apyrene one, so if sperm is implicated then the two types may play different roles. However, dissection of the reproductive tract at different times post- mating showed that apyrene sperm took 4 h to reach the spermatheca, followed by the eupyrene sperm 6 hours later (Marcotte et al., 2003). Therefore, as there was no spermatozoa in the spermatheca at the time where the neural signal triggering the inhibition of pheromone production occurred, other factors are responsible for the short term post-mating control of pheromonostasis in *C. rosaceana*. However, this does not mean that sperm cannot be implicated in some aspects of pheromonostasis. The mass of the spermatophore transferred by *C. rosaceana* males to a virgin female decreased significantly over three successive matings (Delisle and Bouchard, 1995) and we now have data showing that this decrease in mass is also accompanied by a significant decline in the density of both types of sperm. Furthermore, in the days following mating, the rate at which both types of sperm migrate to the spermatheca was higher for the smaller ejaculates. Similarly, the rate at which the spermatheca emptied was faster if the ejaculate sperm content was lower. We, therefore, examined the possibility that the long term maintenance of the female refractory state was related to patterns of sperm depletion. This is the case as females mated with previously-mated males not only had a higher propensity to remate that those mated with virgin males, but they also did sooner after the mating. The temporal dynamics of eupyrene sperm indicates that the resumption of female receptivity coincided with the presence of < 5000 eupyrene sperm within the spermatheca. Thus, the lower numbers and faster rates of sperm migration in females paired with previously mated males would explain why they reach this sperm threshold sooner. The results of this study clearly show that the quantity of sperm received at mating may significantly influence the behaviour of the female. In addition this could also have a marked impact on the male reproductive success, especially if sperm precedence occurs, as he will sire very few of the progeny produced after the second mating.

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