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Sperm precedence in polyandrous, resource-defending wool-carder bees

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Polyandry is rare in aculeate Hymenoptera (bees, wasps, ants), with some exceptions in both solitary and social groups. Females of polyandrous European Wool-carder Bees, *Anthidium manicatum*, mate continuously over the course of their reproductive life, while males defend patches of food plants where copulations occur. To better understand the evolution of this mating system we investigated offspring paternity using cage experiments and microsatellite genotyping of brood. We found that, although females possess a spermatheca for long-term sperm storage, most brood was fathered by males that had only recently mated with the breeding female, indicating pronounced last (or at least 'late') male sperm precedence. In the absence of males a large proportion of eggs remained unfertilized (resulting in haploid male offspring), but some daughters arose from fathers that had been removed up to two weeks earlier. It appears that most *A. manicatum* eggs are fertilized with sperm from the bursa copulatrix, while the spermatheca serves only as a back-up reservoir. To our knowledge this is the first demonstration of last male sperm precedence in aculeate Hymenoptera. We suggest that it has co-evolved with and promoted both male resource defence and polyandry in anthidiine bees. Multiple mating combined with 'late male' sperm precedence creates an incentive for males to defend resources, which on the other hand will benefit females through an enhanced resource base. Thus, polyandry may have arisen in these bees exclusively through direct (non-genetic) benefits for males and females.