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In our paper “Asexually produced Cape honeybee queens (Apis mellifera capensis) reproduce sexually” (Beekman et al. 2011), we report the simple finding that queens known to be the sexual offspring of workers mate and produce new workers sexually. Our rationale for the study was 2-fold. First, we knew that unmated Apis mellifera capensis queens can lay eggs both thelytokously and arrhenotokously (Oldroyd et al. 2008), and we thus wanted to see if our queens had mated or were laying workers thelytokously. Second, asexually produced queens would not be able to produce offspring sexually if thelytoky is strictly genetically determined (Lattorff et al. 2005, 2007) and transferable across castes.

Pirk et al’s critique appears to revolve around 2 main points: 1) the fact that it has been known for more than a century that queenless A. m. capensis colonies are capable of requeening themselves from laying worker offspring and that these new queens “behaved no differently from queens produced from fertilized eggs.” To the best of our knowledge, however, it remains possible that worker offspring in these colonies were thelytokously produced. Beekman et al. (2011) confirm what was always believed but previously never known: that the thelytokously produced queens of Cape honeybees reproduce sexually and are indeed normal.

We are at a loss with respect to the suggestion made by Pirk et al. that we should have investigated if these queens could produce haploid drones. As we have shown that all the queens are able to reduce the genetic complement allowing for fertilization resulting in diploid females, their ability to produce haploid drones is surely trivial.

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We acknowledge that the origin of the completely homozygous larvae found by Jordan et al. (2008) remains elusive. We have attempted to use the technique described in Oldroyd et al. (2011) to determine if the homozygous individuals were heterozygous at the region flanking the complementary sex-determining locus, csd. Our unpublished result showed that at...
least one individual was indeed heterozygous at this region, whereas the others were not. We therefore cannot exclude that at least some of the homozygous individuals were indeed males. However, we argue that at least one individual was a thelytokously produced female. Because in further work we failed to find homozygous female offspring among the adult queen population and in older larval instars, we suggest that such offspring are inviable (Beekman et al. 2011).

Even if the completely homozygous individuals were males, we think this is interesting. Honeybee queens rarely, if ever, make mistakes when deciding to lay diploid or haploid eggs (Ratnieks and Keller 1998). So why would a queen accidentally lay a haploid egg in a queen cell? As in the ants Cataglyphis cursor (Pearcy et al. 2004) and Wasmannia auropunctata (Fournier et al. 2005), an A. m. capensis queen would benefit from producing her workers sexually but daughter queens clonally. Unlike the ants, it appears that once she is mated an A. m. capensis queen is no longer capable of thelytokous reproduction. It remains a possibility, albeit just a possibility, that the laying of male-yielding eggs in queen cells may well be the result of her attempt to exclude the paternal genome when producing daughter queens.

References


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