Reproductive plasticity in workers of the African honey bee Apis mellifera capensis

Author(s): Fiona Nelima Mumoki, Abdullahi Ahmed Yusuf , Christian W. W. Pirk , Robin M. Crewe

Institution(s): Social Insects Research Group, Zoology and Entomology Department, University of Pretoria ; Social Insects Research Group, Zoology and Entomology Department, University of Pretoria ; Social Insects Research Group, Zoology and Entomology Department, University of Pretoria ; Social Insects Research Group, Zoology and Entomology Department, University of Pretoria

In honey bee colonies, queen mandibular gland pheromone (QMP) maintains reproductive dominance by inhibiting ovary activation and production of queen-like mandibular secretions in workers. Biosynthesis of components of the mandibular gland (MG) fatty acids begins with stearic acid which undergoes caste-selective hydroxylation and oxidation to produce the queen-typical 9-oxo-2-decenoic acid (9-ODA) and 9-hydroxy-(E)-2-decenoic acid (9-HDA), and the worker-typical 10-hydroxy-decanoic acid (10-HDAA) and 10-hydroxy-2 (E)-decenoic acid (10-HDA). We measured the MG fatty acid profiles, ovarian activation and expression of the enzyme alcohol dehydrogenase (Adh) of the intraspecific socially parasitic *Apis mellifera capensis* workers (“clones”) infesting *A. m. scutellata* colonies that were either queen-right (QR) or queen-less (QL). Our work shows that clones infesting QL colonies primarily secreted 9-ODA and 9-HDA in their mandibular glands and had fully activated ovaries, while those from QR colonies had an accumulation of 9-HDA and 10-HDA and inactive ovaries. From the ratio of 9-ODA/(9-ODA+10-HDA), signals from QL clones were classified as queen-like and those from QR clones worker-like, signifying that, while the queen mandibular pheromone (QMP) produced by *A. m. scutellata* queens chiefly inhibits dominance in *A. m. scutellata* workers at the level of hydroxylation of stearic acid (leading to ? hydroxylation), laying workers can bypass this inhibition. QMP then acts on the hydroxylation products from these parasitic workers by inhibiting the reductive-oxidation of 9-HDA into the “queen substance” 9-ODA, shown in this work by the significantly lower transcript levels of the enzyme alcohol dehydrogenase. This is the first report, to our knowledge, showing that *A. m. scutellata* queens can control dominance in *A. m. capensis* laying workers and contributes to our understanding of the evolution of reproductive division of labour in social insects.