Colony demography adapts to parasite pressure in a polymorphic bee

Author(s): Francisca Segers, Francisca Segers , Lucas von Zuben , Christoph Grüter

Institution(s): Institute for Organismic and Molecular Evolution, University of Mainz, Germany ; Departamento de Biologia, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Brazil ; Institute for Organismic and Molecular Evolution, University of Mainz, Germany ; Institute for Organismic and Molecular Evolution, University of Mainz, Germany

Many colonial animals rely on a soldier caste for their defence. Adaptive colony demography theory predicts that colonies should flexibly adjust the investment in different worker castes depending on the colony needs. For example, colonies should invest more in the defensive workers (e.g. soldiers) in dangerous environments. However, evidence for this prediction has been mixed. We combined descriptive and experimental approaches to examine whether defensive investment and worker size are adjusted to local ecology in the only known bee with polymorphic workers, *Tetragonisca angustula*. Colonies of *T. angustula* are defended by a morphologically specialised soldier caste. Our study included three populations that differed in the density of food competition and the occurrence of a parasitic robber bee. We found that colonies coexisting with robber bees had on average 43% more soldier bees defending the nest entrance, while colonies facing stronger foraging competition had c. 6-7% smaller soldiers. We then experimentally relocated colonies to areas with different levels of competition. When released from intense food competition, body sizes of guards and foragers increased. After introducing chemical robber bee cues at nest entrances, we found both a short-term and a long-term up-regulation of the number of soldiers defending the colony. Active soldier numbers remained high after the experiment for a duration equivalent to 2-3 average worker life-spans. How information about past parasite threat is stored in the colony is currently unknown. Thus , *T. angustula* adjusts both the number and the body size of active soldiers to local ecological conditions. Our study supports adaptive colony demography theory in a eusocial bee and highlights the importance of colony threats and competition as selective forces shaping colony phenotype.