Desiccation limits recruitment in the pleometrotic desert seed-harvester ant *Veromessor pergandei*

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July 18, 2020

Abstract

The desert harvester ant Veromessor pergandei displays geographic variation in colony founding with queens initiating nests singly (haplometrosis) or in groups (pleometrosis). The transition from haplo- to pleometroic founding is associated with lower rainfall. Numerous hypotheses have been proposed to explain the evolution of cooperative founding in this species, but the ultimate explanation remains unanswered. In laboratory experiments, water level was positively associated with survival, condition, and brood production by single queens. Queen survival also was positively influenced by water level and queen number in a two-factor experiment. Water level also was a significant effect for three measures of queen condition, but queen number was not significant for any measure. Foundress queens excavated after two weeks of desiccating conditions were dehydrated compared to alate queens captured from their natal colony, indicating that desiccation can be a source of queen mortality. Long-term monitoring in central Arizona, USA, documented that recruitment only occurred in 4 of 20 years. A discriminant analysis using rainfall as a predictor of recruitment correctly predicted recruitment in 17 of 20 years for total rainfall from January–June (the period for mating flights and establishment) and in 19 of 20 years for early plus late rainfall (January–March and April–June, respectively), often with a posterior probability > 0.90. Moreover, recruitment occurred only in years in which both early and late rainfall exceeded the long-term mean. This result also was supported by the discriminant analysis predicting no recruitment when long-term mean early and late rainfall were included as ungrouped periods. These data suggest that pleometrosis in V. pergandei evolved to enhance colony survival in areas with harsh abiotic (desiccating) conditions, facilitating colonization of habitats in which solitary queens could not establish even in wet years. This favorable-year hypothesis supports enhanced worker production as the primary advantage of pleometrosis.

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