OR363

Ants in flight: the Found or Fly tradeoff in queens

Jackson Helms, Mike Kaspari

Flight is crucial for most social insect life histories. In ants, queens and males fly to mate and disperse. The queens then locate a nest site, shed their wings and begin laying eggs. Flight is both the deadliest part of the colony life cycle and vital for reproduction, suggesting that flight related selection may drive queen evolution. Because ant flight is brief and difficult to observe, however, we know little about how queens fly. We propose a model, the Found or Fly (FoF) Hypothesis, which links queen morphology to the competing demands of colony founding and flight. It posits a tradeoff between colony founding success and flight ability mediated through abdominal nutrient investment. Heavier abdomens help a queen survive through colony founding and rear her first workers. At the same time, they decrease a queen's ability to mate, disperse and survive the flight phase by adversely impacting metrics of flight ability, namely flight muscle ratio, wing loading and abdomen drag. We evaluate the assumptions and predictions of FoF through comparative studies and live flight experiments. In doing so, we discover a previously unrecognized cost in the evolution of a common reproductive strategy - claustral founding. Claustrally founding queens don't feed during colony founding and require large abdominal energy reserves, resulting in lower flight muscle ratios. Several claustral species are on the verge of flightlessness, with flight muscle ratios among the lowest of any flying insect. This suggests a simple mechanism for the ubiquitous evolution of queen flightlessness. In addition, reproductive strategy may drive evolutionary changes in wing size and lead to dispersal polymorphisms within species. By emphasizing function, FoF links reproduction and dispersal, underscores the role of flight in queen evolution, and provides a quantitative framework for comparing ant life histories.