

"I am just going outside and may be some time"* – a note on pre-death behaviour of leafcutting ant queens and some speculation as to its meaning. — I visited the Smithsonian Tropical Research Institute, Gamboa, Panama, during March–June 2000, to study waste management in leafcutting ants (Hym., Formicidae, Attini: *Acromyrmex*, *Atta*). These exclusively Neotropical ants culture a symbiotic fungus within their underground nests, which they use for food (for details of leafcutting ant biology see Hölldobler & Wilson, 1990, *The Ants*, Springer-Verlag, Berlin; Weber, 1972, *Gardening Ants: The Attines*, American Philosophical Society, Philadelphia). Queens can live for 15 years or more and colonies can become very large; a mature *Atta* nest can have a million or more workers (Weber, *op. cit.*). *Atta* colonies produce numerous (10^2 – 10^3) numbers of males and queens annually with mating flights often occurring early in the rainy season (Weber, *op. cit.*). This large-scale agricultural system produces copious waste (spent fungus, dead ants), which in *Atta colombica* (Guer), is taken outside and dumped on a waste heap or midden (Weber, *op. cit.*). Workers, carrying waste in their mandibles, exit the nest through a hole dedicated to waste and proceed along a well-defined trail to the midden (Hart & Ratnieks, *in press*, *Behav. Ecol. Sociobiol.*).

While studying the overall waste management system, I observed lightly melanised alate queens (three from nest A, one from nest B; both nests at least 5 years old, local sources) emerging from the waste hole. They walked, unmolested by other workers, along the trail towards the midden. Queen travel speed was estimated by timing queens between two points 1m apart. Queens walked at a much slower speed than laden waste workers (1.26mh^{-1} ($\bar{n} = 4$, $SD = 0.34$), compared with 141.7mh^{-1} for laden waste workers ($n = 30$, $SD = 21.3$)). Once at the middens (approximately 2m from the waste hole), the queens rested motionless on the surface and were dead within 24 hours.

I also observed workers carrying dead queens to middens (5 queens, nest A; 7 queens, nest B). In all cases queens had been sub-divided into small fragments, typically separated at the petiole, dealated and dismembered. Queen fragment transport was haphazard and involved up to 18 workers pushing and pulling. Transport speed was not measured but queen pieces were commonly observed abandoned on midden trails, so that the total time required for an entire queen to reach the midden in pieces might be considerable.

It is interesting to speculate whether this pre-death walk might be adaptive. In pea aphids the presence of a parasite can trigger the suicide of infected individuals, thereby preventing the parasite spreading to other colony members (McAllister & Roitberg, 1987, *Nature*, **328**: 797–799). This could be the case for *A. colombica* queens – if queens were parasitised then rapid removal from within the nest may have weakened them. Furthermore, with a large number of workers available as hosts, the removal of a small number of parasitised queens may not be important.

It is also possible that a second, and novel, adaptive benefit is accrued by the behaviour reported. Waste workers normally carry dead ants to the midden, yet queens are difficult to transport, being considerably heavier than even the largest workers (Weber, *op. cit.*). When workers transport dead queens to the midden, the queens are broken down into smaller pieces and even then queen pieces are frequently abandoned. Perhaps queens near to death can reduce the undertaking costs their death creates by transporting themselves to the midden before they die. This 'long walk' behaviour is reminiscent of the final actions of Captain Lawrence Edward Grace (Titus) Oates, who sacrificed himself in the snow of the Antarctic rather than burden his companions.

Any adaptive value of this pre-death behaviour remains highly speculative, especially given the paucity of my observations. Indeed, it is not my intention here to assert that it is adaptive. However, even seemingly tiny benefits are not invisible to natural selection and so it is interesting to speculate especially given that leafcutting ants are becoming increasingly important as a model system for demonstrating how behaviours and organisation at all levels can reduce the impact of pathogens in social insects (e.g., Hart & Ratnieks, 2001, *Behav. Ecol. Sociobiol.*, **49**: 387–393). — ADAM G. HART, Department of Animal & Plant Sciences, University of Sheffield, S10 2TN, UK. e-mail: bop98agh@sheffield.ac.uk : June 23rd, 2001.

* Last words of Captain Lawrence Edward Grace (Titus) Oates on Captain Robert Falcon Scott's ill-fated expedition to the South Pole, 1912.