

Spatial organization of food distribution on the nests of the primitively eusocial paper wasp *Ropalidia marginata*

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In social insect colonies, food transferred through space and time via nestmates carries both nutrition and information. We followed, spatially and temporally, food brought into semi-natural colonies of a tropical paper wasp *Ropalidia marginata*, to understand the mechanism and efficiency of its distribution among adults as well as to larvae. Wasps divided the tasks of bringing food to the nest and feeding larvae, among themselves. Using the analogy of the travelling salesman problem and the Hamiltonian path problem, we found that individuals optimized their routes in order to feed the randomly distributed larvae. Within each feeding bout, different feeders randomly fed larval cells resulting sometimes in repetitive feeding of the same cells by different wasps. This lack of spatial segregation of their feeding effort helped provide redundancy that should avoid larvae going hungry. Considering all the bouts put together, the larvae closer to the centre of the colony were fed significantly more frequently than larvae at the periphery. The cause of this variation could be the nest's geometry and needs to be studied further. The consequence of differential rates of larval feeding can, however, shape the fate of these larvae; previous work has shown that well-fed larvae develop into adults that are more likely to become egg-layers while poorly-fed larvae develop into adults more likely to become non egg-layers. Understanding the spatial organization of food transfer may be a key to understanding how insect societies achieve efficient social organization and division of labour.

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