Reproductive and non-reproductive division of labour in laboratory colonies of a primitively eusocial wasp

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In most primitively eusocial wasps new nests are initiated by a single female or by small groups of females. To study the emergence of division of labor (DOL) among the nest foundresses and to determine its possible effect on nest productivity we maintained newly eclosed females of Ropalidia marginata in small boxes with one, two, or three nestmate wasps of the same age per box. Only one wasp developed her ovaries and laid eggs in each box, while the other wasp(s) built the nest, brought food, and fed larvae, demonstrating the spontaneous emergence of reproductive DOL and cooperation in the presence of more than one wasp. In nests with three wasps there was also a strong negative correlation between intranidal and extranidal work performed by the two nonreproductive workers, suggesting the spontaneous emergence of nonreproductive DOL; such nonreproductive DOL was absent in nests with two wasps. Both reproductive and nonreproductive DOL were modulated by dominance behavior (DB). In nests with two wasps the egg layer showed significantly more DB than the non-egg layer before nest initiation; in nests with three wasps queens showed significantly more DB than intranidal workers, which in turn showed significantly more DB than extranidal workers. Productivities of nests (as measured by total brood on the day of eclosion of the first adult) initiated by one or two wasps were not different from each other but were significantly lower than that of three wasps. Thus, nonreproductive DOL, and not merely reproductive DOL, is necessary for increase in productivity.