



Starve a Worker, Feed a Colony: Nutrition, ovary size, and cooperation in social insect societies

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Animal nutritional state can profoundly affect behavior, including various forms of cooperative behavior. In highly cooperative societies of the eusocial honey bee, nutritional differences during development are known to be important regulators of stark differences in reproductive caste and worker behavioral development. However, it is not known whether nutritional variation affects differences between individual workers in their extent of cooperative behavior. We investigated how nutritional state affects a honey bee worker's likeliness to respond to queen pheromone, a measurement of cooperativeness. We found that nutritional restriction affects a worker's queen pheromone response, but the direction of this effect depends on the life-stage when restriction occurs. Nutritional restriction at the larval stage lead to increased queen pheromone response, but nutritional restriction at the adult stage lead to decreased queen pheromone response. We also investigated how nutritional state affects cooperation in the primitively eusocial paper wasp, *Polistes fuscatus*. Nutritional restriction on adult paper wasps affected cooperation in the way as nutritional restriction on larval honey bees. Nutritional restriction reduced aggressive interactions between nestmates. We suggest that the observed behavioral patterns in nutritionally restricted honey bees and paper wasps are dependent upon differences in reproductive plasticity. Individual worker honey bees and paper wasps may adaptively adjust their behavioral and physiological traits in response to nutritional stress to invest nutritional resources in either their own or their colony's reproduction.