Nectar carried from the hive: adaptive significance of using concentrated nectar in honeybee pollen collection

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Honeybee foragers carry nectar from the hive as fuel for flight and glue to build pollen loads. Since the mass of nectar incurs metabolic cost in flight, adjustment of nectar carried from the hive may be an important feature of social bees for their efficient foraging. Previous studies showed that the amount of nectar carried from the hive was adjusted depending on distance to food sources, type of target food and experience of foraging. The concentration of carried nectar also changed by those factors. Departing pollen foragers had significantly more concentrated (62 % on average) nectar in the crop than departing nectar foragers (44%). However, how and why they use nectar at different concentrations depending on the factors were yet to be investigated. To investigate the adaptive significance of concentration-selective use of nectar by foragers, the size of pollen load was measured in *Apis mellifera* pollen foragers when the concentration of nectar carried from the hive was lowered by mass feeding with diluted (30%) sugar solution. The feeding successfully reduce the concentration of nectar that pollen foragers carried from the hive but increased the volume of nectar and did not affect the total amount of sugar carried from the hive for a trip. The size of pollen load decreased significantly in fed colonies. The data also showed positive correlations between estimated concentration of nectar carried and the size of pollen load in both fed and unfed colonies. These results suggested that concentrated nectar facilitates pollen collection in honeybees.