

Effect of different food resources on feeding behavior and physiological factors of parasitoid wasps on rice and vegetable pests

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Title: Effect of different food resources on feeding behavior and physiology of parasitoid wasps attacking rice and vegetable pests

(異なる餌資源がイネと野菜害虫を攻撃する寄生蜂の摂食行動と生理に与える影響)

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Thesis summary

During the adult stage, insect parasitoids must find food or sugar sources to meet their short-term nutritional needs. The impact of parasitoids on their hosts can depend mainly on the parasitoid's longevity, fecundity and host-finding efficacy, all of which are influenced by the presence and quality of food source that adult parasitoids can find out. Lack of suitable food sources has long been suspected to be an important constraint to the success of biological control programs. Non-host or non-prey food such as nectar has a great impact on the reproductive success of natural enemies like insect parasitoids and predators. Many species of insect parasitoids including biocontrol agents of agricultural pests greatly depend on sugar- or carbohydrate-rich sources, such as floral nectar and honeydew, to sustain their activity. Although countless number of studies addressed the importance of food on the life expectancy and reproduction of parasitoids, very few studies have examined how food type and sugar concentration affect their feeding behavior.

The present study focused on the effects of sugar-food type (sucrose solution vs. diluted honey) and concentration (5%, 20% and 40%) on food searching behavior of *Itoplectis naranyae*, a synovigenic solitary endoparasitoid wasp attacking lepidopteran pests in rice paddies. In addition, the life expectancy after the final sugar meal was examined. While food type, sugar concentration and wasp age did not affect their feeding responses, *i.e.*, the feeding decision and the time taken to find a food source, males were more likely to locate and feed on test food than females were, and smaller wasps approached more quickly to food. Sex- or size-linked differences in survival were not detected but food type did affect life expectancy; wasps that had fed sucrose lived longer. Also, wasp age had a great impact on life expectancy after the last meal, and older wasps had lower life expectancy, suggesting that

older wasps have to find a suitable sugar source more frequently. The implications of the present results were discussed in the context of the importance of food on the life expectancy and reproduction of parasitoids.

Moreover, the influences of motivation (hunger level) on food searching behavior, feeding behavior and feeding decision were examined on the basis of a laboratory assay. Depending on the hunger level, *Itoplectis* parasitoids changed their behavior and decision to eat the food. The different levels of hunger degree had an influence on the capacity of the parasitoid. The parasitoid's nutrient resource was declined as the hunger level increased. The nutrient stock thus affects not only parasitoid's fitness but also on feeding behavioral decision. This is the first demonstration that such nutrient resource can affect the parasitoid's longevity.

Furthermore, the food searching behavior of parasitoid wasps were also focused on this study. Nutrition storage capacity was assessed for two parasitoid species, *Itoplectis naranyae*, a major natural enemy of lepidopteran pests of rice, and *Hemiptarsenus varicornis* attacking *Liriomyza* pests of vegetables. Test parasitoids were given only water and life expectancy were examined. Although the life span differs markedly between the two species, the former lived more than 4 days while the latter died within 2 days, after food interruption. The nutrition storage capacity of *I. naranyae* was therefore greater than *H. varicornis*. This suggests the importance of food availability in the field can differ between the parasitoids, and small parasitoids with a limited storing capacity require suitable food sources that are easy to find or to access in the surrounding environment.

It can be seen that the degree of the importance for food provision is different depending on parasitoid species. Food sources should be continuously available in the environment for the survival and reproduction of leafminer parasitoid which has a low nutrition carrying capacity. Basing on the results, the availability and accessibility of food source can be the key factors for successful biological control but their importance may differ depending on parasitoid species.