Journal of Biological Control, 25 (4): 316–319, 2011

Research Note

Effect of Adult nutrition on longevity and parasitisation efficiency of *Acerophagus papayae* Noyes and Schauff (Hymenoptera: Encyrtidae)

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ABSTRACT: The role of adult nutrition on longevity, fecundity and male : female ratio was studied in detail for *Acerophagus papayae*. There was significant difference in the longevity and parasitisation efficiency of the adults fed different diets. Adults of *A. papayae* fed on 10% and 50% honey lived for 9.00 and 7.33 days and the number of progeny was 50 and 47.8 numbers with female progenies of 41.56 and 36.37 per cent, respectively. The parasitoids fed with yeast extract along with 10% honey and dried grapes extract lived for an average of 6.00 days and 8.00 days and the number of progeny was 51.06 and 54.93 with 38.36 and 37.29 per cent female progenies respectively. The parasitoid fed with fructose lived for 4.00 days and the the number of progeny was 46.6 and percentage of female progenies was 37.16. But, parasitoids fed with water alone lived for 3.33 days and its parasitisation efficiency was 34.6 with 31.35 per cent of female progeny.

KEY WORDS: Papaya, *Acerophagus papayae*, adult nutrition, efficiency of parasitism

(Article chronicle: Received: 19-7-2011 Sent for revision: 21-11-2011 Accepted: 2-12-2011)

Papaya mealybug, *Paracoccus marginatus* Williams and Granara de Willink, the invasive pest from Central American countries has caused havoc in agricultural and horticultural crops in India. *Acerophagus papayae* Noyes and Schauff is well established and efficient in controlling *P. marginatus* (Kaushalya *et al.*, 2009). Recently, it was introduced to India and it's efficacy was assessed in Tamil Nadu on different crops and found promising. To further improve the efficiency of parasitoids, both in mass multiplication in laboratory as well as field efficiency adult supplementary food is advocated. The life span of adult parasitoids may be regarded as an important factor in the overall quality of the parasitoid (Bigler *et al*., 1987). For the reproductive success of many hymenopterous parasitoids, supplemental feeding is required. Field observations strongly suggest that feeding on pollen and nectar – rich sources of nutrients, particularly sugars and free amino acids (Hagen, 1986) is critically important for maximal life span and parasitism (Syme, 1977). Most parasitoids feed for both longevity and egg maturation (Chan and Godfray, 1993). Males feed principally to ensure longevity. The role of specific sugars in determining longevity either directly or indirectly is a widespread phenomenon in insects, including parasitoids (Olson *et al*., 2000).

Parasitoid wasps generally require food both for the production and maturation of eggs and as an energy source for fight. Parasitoid needs nutritive compounds such as amino acids, vitamins, minerals, cholesterol and a hexose monosaccharide similar to other insects. No information is available on the longevity and fecundity of *A. papayae* on different food sources. Adult nutrition can have important effects on lifetime reproductive success of female parasitoids (Jervis and Kidd, 1996). The aim of this study was to determine the effect of different food sources on the longevity and fecundity in *A. papayae*, which may lead to a better understanding of the role of nutrition in the life of parasitoid.

Two month old Robin eyed healthy potatoes were procured, washed in water and disinfected using 5% sodium hypochlorite solution. Later, two cm incision was made using a sharp blade and treated with gibberalic acid 100 ppm solution for half an hour. The potatoes were air dried and transferred to plastic trays of 18'' diameter containing solarized sand and covered with black cloth to induce sprouting till it is ready for infestation with mealybugs.

P. marginatus was collected from papaya (*Carica papaya* L.) plants and transferred using camel hair brush

over the potato sprouts (each potato with 3 – 5 ovisacs). The rootlets of potatoes were clipped using a sharp scissors to arrest the further growth of the potato sprouts. Twenty five sprouted potatoes colonized with mealybugs were transferred to oviposition cages of 45 x 45 x 45 cm along with ten numbers of *A. papayae* inside the cage for parasitisation.

The treatments such as honey 10%, 50%, yeast extract + honey 10%, dried grapes extract, fructose streaked in wax paper, and water in glass bottles as control replicated four times. After 10 days, the sprouts along with mummified mealybugs were removed from the potatoes using a fine scissors and collected separately in the plastic containers. The parasitoids emerged were collected from the respective treatments using an aspirator. The mouth of the test tube was closed with the georgette cloth after collecting parasitoids. The female parasitoids are large in size compared to male parasitoids and male female ratios has been worked out and number of parasitoid emerged also recorded for each diet. The corresponding diets were given to the emerged progenies and longevity was recorded.

Data on efficiency of adult *A. papayae* parasitoids *viz.,* its longevity, fecundity and female sex ratio are presented in Table 1. Longevity, fecundity and sex ratio of parasitoids that are important factors in quality control, are influenced by nutrition (Pavlik, 1993). Adult parasitoids must not only find hosts for reproductive purpose but also locate food to meet their short term nutrition needs (Lewis *et al*., 1998). The effects of several nutrients such as honey, honeydew, nectar, sucrose, fructose, glucose and protein sources have been investigated on the biological characteristics of adult parasitoids (Wackers, 2001). In our present study the diets honey 10%, honey 50%, yeast extract + honey 10%, dried grapes extract and fructose significantly increased adult longevity and parasitisation rate of *A. papayae*. Adult longevity of the virgin parasitoids fed with honey 10%, honey 50%, yeast extract + honey 10%, dried grapes extract, fructose were 9, 7.33, 6, 8, 4 days respectively compared to 3.33 days in unfed counterparts (Table 1). These findings of the present investigation are in close agreement with the findings of Attaran *et al.* (2000), who opined that the adult females of *Trichogramma brassicae* Bezdenko provided with honey lived 8.06 days in comparison with 2.04 days for the unfed females. Another study by Kim and Morimoto (1995), proved that many parasitoids require carbohydrate rich non-host foods for survival and in the absence of hosts, parasitoids which are given carbohydrate rich food *viz*., dilute honey solution, significantly lived longer than those given only water. Sagarra *et al*. (2000), studied that adult parasitoid *Anagyrus kamali* Moursi of hibiscus mealybug *Maconellicoccus hirsutus* (Green) that were provided with food lived approximately 20 times longer than unfed individuals. The present study demonstrated the importance of energy requirement for adult longevity. Lifespan extension of many parasitoids was mainly determined by carbohydrates (Giron *et al*., 2002).

Fecundity of Parasitoids

Laboratory tests showed that parasitoids not fed honey or sugar solutions supplemented by other nutrients generally displayed reduced longevity and/or fecundity (Thompson, 1990). Current knowledge of the effects of adult feeding on life time reproductive success is fragmented and ambiguous, both with respect to intractable differences in the experimental conditions and interspecific

Table 1. Effect of Adult nutrition on biological parameters of *Acerophagus papayae*

Food source	Adult longevity (Days)	Offspring per female (Numbers)	Total no.of parasitoids emerged	Percentage females emerged
Honey 10%	9. 00	50. 00	250. 33	41. 56
Honey 50%	7. 33	47. 80	239. 00	36. 37
Yeast extract + honey 10%	6. 00	51. 06	255. 00	38. 36
Dried grapes extract	8. 00	54. 93	270. 00	37. 29
Fructose	4. 00	46. 60	219. 66	37. 16
Control (water)	3.33	34. 60	180. 33	31. 35
SEd	0.7252	2.6195		1.8036
CD $P \leq 0.05$	2.3981	5.8367		4.0186

differences in the nature and quantity of the nutrients consumed (Giron *et al*., 2002). Experiments in which the effect of different adult diets on fecundity and longevity were compared suggest that, for many host-feeding species, sugars that occur naturally in nectar or honeydew increased longevity, and that host-feeding provided materials for egg maturation (Heimpel and Collier, 1996). Sugar sources significantly increased adult longevity, the parasitisation rate and the number of offspring per female of *A. papayae*. In our present study, the number of offspring per female was 50, 47.8, 51.06, 54.93, 46.6 and 34.6. These findings of the present investigation are in close agreement with the findings of Olson and Andow (1998) that feeding honey to the females *Trichogramma nubilale* Ertle and Davis increased their parasitism 2-folds over unfed females.

Female progeny sex ratio

In our present study, the diets honey 10%, honey 50%, yeast extract + honey 10%, dried grapes extract, fructose significantly increased the female progenies production**.** Female sex ratio percentage was 41.56, 36.37, 38.36, 37.29, 37.16, and in control 31.35. These findings of the present investigation are in contrast to the findings of Karimian and Sahragard (2000) providing females of *T. brassicae* with honey decreased proportion of female progeny to 66.67% compared to 83.82% for the unfed females. Females of *Trichogramma* species with longer longevity are known to produce more males, probably, due to sperm depletion (Leatemia *et al.*, 1995; Kuhlmann and Mills, 1999). Moreover, 50% of progeny were female for honey-fed group whereas it was 75% for the unfed group (Malati and Hatami, 2010). Therefore, it should be considered that adult nutrition is not omitted. Parasitoids provided with nutritious diet increased the longevity, fecundity and female sex ratio in *A. papaya*e.

ACKNOLEDGEMENT

The authors are thankful to the National Bureau of Agriculturally Important Insects (NBAII) Bangalore for necessary assistance and guidance.

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