Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(1): 194-197

Received: 19-11-2018
Accepted: 24-12-2018

Aruna Ambadahalli Siddaiah
Cold Storage Plant, National Silkworm Seed Organization, Central Silk Board, Ministry of Textiles, Mysore, Karnataka, India

Manjunath Danagoudra
Department of Sericulture, University of Mysore, Mysore, Karnataka, India

Correspondence
Aruna Ambadahalli Siddaiah
Cold Storage Plant, National Silkworm Seed Organization, Central Silk Board, Ministry of Textiles, Mysore, Karnataka, India

Role of diet on longevity of an eulophid parasitoid *Nesolynx thymus* Girault

Aruna Ambadahalli Siddaiah and Manjunath Danagoudra

Abstract
Predators, parasitoids and pathogens play an important role in pest management. Many parasitoids have been recommended as a biocontrol agents of pests. Unlike the immature sages, adult parastioids are free living and usually feed on nectar and honey dew in nature. Upon emergence the parasitoid need to locate feed for survival and suitable host in order to propagate. Reports are available emphasizing the importance of adult diet on the reproductive performance of many parasitoids. Adult diet is known to affect parasitoid lifetime reproductive success as it enhances adult longevity. In the present investigation an attempt was made to study role of adult diets on the longevity *Nesolynx thymus*. The results revealed that the parasitoids fed on honey survived longer (25.57 days) followed by sucrose (19.76 days), glucose (19.58 days), sugarcane juice (19.73 days) and jiggery (17.83 days).

Keywords: *Nesolynx thymus*, biological control, honey, sucrose, glucose

1. Introduction
Parasitoids form the important components in the biological control of insect pests. They include egg, larval, larval-pupal, pre-pupal, and pupal parasitoids. They may be ecto- or endo-parasitoids of solitary / gregarious nature. Unlike the larval stages, adults are free living, usually feeding on nectar or honeydew in nature. In general, irrespective of the sex, the parasitoid females lived longer than males. Likewise, longevity was superior for bigger parasitoids than smaller ones. The parasitoids, *Dirhinus anthracia* and *Trichopria* sp. [1] *Anastatus semiflavidus* [2], *Aptesis basizonia* [3], *Encarsia formosa* Gahan [4] and *Exoristobia philippinensis* and *N. thymus* [1] lived longer when fed 100% honey. Failure of egg development in *Brachymeria lasus* (Walker) [5] and reduction in fecundity in *Trichogramma plateneri* [6, 7] and *Trichogramma pretiosum* [8] in the absence of adult diet also have been reported, thus emphasizing the importance of adult diet on the reproductive performance of a parasitoid. Diet of adult female parasitoid has important effects on lifetime reproductive success [9, 16, 11] as it enhances adult longevity and fecundity [9, 12, 10, 11, 13, 14]. Obviously, a parasitoid that has been mass cultured for field release is required to be adequately fed in the laboratory for realizing its enhanced performance as a biological control agent. *Nesolynx thymus* Girault (Hymenoptera: Eulophidae) is an endo-pupal, gregarious parasitoid of the uzifly, *Exorista bombycis*, a major endo-larval parasitoid of mulberry silkworm *Bombyx mori* L. (Lepidoptera: Saturnidae). The estimated loss due to *E. bombycis* is to the tune of 40-45%. Owing to possession of desirable attributes of a biocontrol agent *viz*., short life cycle, amenability to mass production under laboratory conditions, high parasitisation potential, efficient host searching ability, good adoptability to survive under field conditions, ability to synchronize its life cycle with that of host, *N. thymus* has been recommended as a biocontrol agent of *E. bombycis* apart from including in IPM programme. The present study evaluated the effect of honey, sucrose, glucose, sugarcane juice and jiggery as dies on adult longevity of *N. thymus.*

2. Materials and Methods
The parasitoid was cultured on *E. bombycis* pupae in the laboratory of Department of Sericulture, University of Mysore, Mysore. The following diets were used singly as well as in combination to record their impact on female longevity of *N. thymus*:
Diets: Honey, Sucrose, Glucose, Jaggery, and Sugarcane juice.
Diet concentrations: 10, 30, and 50%
Diet combinations: All combinations each with two diets at 50%.

For each of the treatments 10 parasitoid females were confined to a glass test tube (12.5 cm length and 1.5 cm dia) and were fed the diets daily. The test tubes were plugged with cotton. The diet was smeared on a small piece of paraffin paper and inserted in the test tubes. Data on mortality of the parasitoid adults were recorded at 24 h interval. The data was subjected to one way ANOVA followed by DMRT using Statistical Package for Social Sciences (SSPC) version 20.

3. Results

3.1 Effect of combinations of diets on the longevity of *N. thymus* females

The results pertaining to the effect of diets (honey, sucrose, glucose, jaggery, and sugarcane juice) at 10, 30, and 50% concentrations on the longevity of *N. thymus* females are furnished in Table 1. Among the diets at 10% concentration, honey provided maximum longevity (25.57±0.48 days) followed by sucrose (19.76±0.61days), sugarcane juice (19.73±0.50 days), glucose (19.58±0.70 days), and jaggery solution (17.83±0.40 days). Comparison of mean values revealed that the parasitoid female longevity with honey was significantly higher ($P \leq 0.01$). The longevity values observed for the parasitoid fed sucrose, glucose, and sugarcane juice while being *at par* were significantly higher than longevity obtained with jaggery solution.

As far as the longevity of *N. thymus* females fed diets at 30% were concerned, honey conferred the highest longevity (27.14±0.32 days) followed by glucose (21.71±0.41 days), sucrose (21.24±0.52 days), sugarcane juice (21.04±0.43 days) and jaggery solution (19.62±0.42 days). Statistical analysis of the results showed significantly higher ($P \leq 0.01$) longevity on honey as compared to the rest of the diets. Similarly, the values for the parasitoid survival duration were comparable and significantly superior on rest of the diets, except jaggery solution (19.62±0.41 days).

N. thymus female longevity with reference to diets at 50% concentration was significantly higher ($P \leq 0.01$) on honey (27.14±0.32 days) and sucrose (27.80±0.74 days). The values for glucose (23.83±0.78 days) and sugarcane juice (23.08±0.40 days) while being identical were significantly higher than the longevity on jaggery solution (21.73±0.87 days). The data for longevity of the parasitoid females when compared among different concentrations of each diet, the following results were obtained: The longevity was significantly prolonged ($P \leq 0.01$) when the parasitoid females were fed 30 and 50% honey when compared to 10%. When the parasitoid females were fed sucrose, the adult life span was significantly longer ($P \leq 0.01$) on 50% as against 30 and 10%. Similarly, the adult survival duration was significantly higher ($P \leq 0.01$) when fed 50% sugarcane juice in comparison to 30 and 10%. Further, *N. thymus* female longevity was significantly superior ($P \leq 0.01$) on 50% glucose and on 50% jaggery followed by 30 and 10% of the diets. In addition, correlation analysis of the data for the parameter established significant positive relationship with concentration of honey (0.466), sucrose (0.825), glucose (0.661), jaggery (0.658), and sugarcane juice (0.701).

The above results further indicated that irrespective of diet concentrations, the longevity of the parasitoid females on honey was consistently higher than on other diets and that observed on jaggery solution was consistently inferior to other diets.

3.2 Effect of combinations of diets on the longevity of *N. thymus* females

Results pertaining to the impact of combinations (50%) of honey, sucrose, glucose, jaggery, and sugarcane juice on the longevity of *N. thymus* females are presented in Fig. 1.

Altogether, 10 diet combinations were evaluated and the parasitoid longevity values among the treatments varied between 22.64±1.23 days (honey + sucrose) and 15.64±1.07 days (jaggery + sugarcane juice). The parasitoid longevity on all the diet combinations with honey, except jiggery (18.07±0.36 days), was comparable and significantly higher ($P \leq 0.01$) than that on most of the remaining diet combinations. This apart, the diet combinations with jaggery such as jaggery + glucose (16.17±1.24 days), jaggery + sucrose (16.01±0.92 days), and jaggery + sugarcane juice (15.64±1.07 days) caused considerable reduction in the longevity of *N. thymus*.

Table 1: Impact of different concentrations of diets on the longevity of *Nesolynx thymus* females

Diet	Female longevity (days)			F value	r
	10%	30%	50%		
Honey	25.57 ± 0.48^{aB}	27.14 ± 0.32^{aA}	27.14 ± 0.32^{aA}	5.490 **	0.466 **
Sucrose	19.76 ± 0.61^{bB}	21.24 ± 0.52^{bB}	27.80 ± 0.74^{aA}	45.304**	0.825**
Glucose	19.58 ± 0.70^{bC}	21.71 ± 0.41^{bB}	23.83 ± 0.78^{bA}	10.461**	0.661**
Jaggery	17.83 ± 0.40^{cC}	19.62 ± 0.41^{cB}	21.73 ± 0.87^{cA}	10.354**	0.658**
Sugarcane juice	19.73 ± 0.50^{bB}	21.04 ± 0.46^{bB}	23.08 ± 0.40^{bcA}	13.481**	0.701**
F value	28.382 **	44.246 **	15.680 **		

Values given in the Table are the means of 10 replications (mean ± SE)

* - Significant at 5%;

Figures followed by the same small superscript in columns and capital letters in rows are statistically not significant

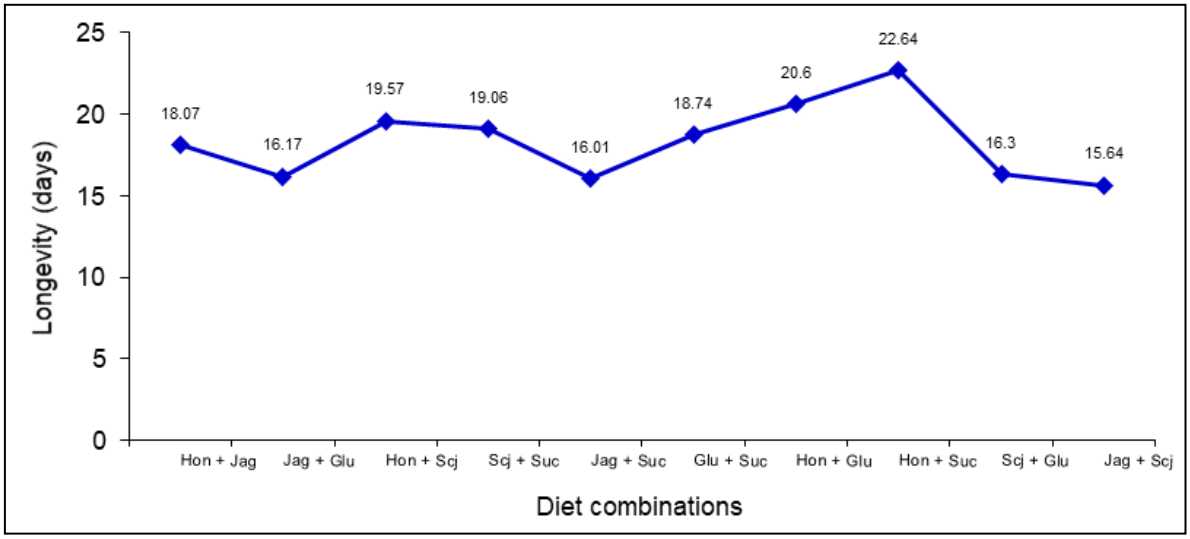

Fig 1: Effect of combinations of diets on the longevity of *Nesolynx thymus* females

Data are the means of 10 replications
The mean values at most treatments were statistically comparable. Where they differed, the level of sign ificance was 1%.

3. Discussion

Literature is replete with respect to studies on impact of adult diet on parasitoid longevity and reproduction. Different concentrations and combinations of diets like, glucose, fructose, honeydew, floral nectar, honey, sucrose, erlose, yeast, jaggery, etc. have been used as parasitoid adult diets. Syme (1995) reported that the sugar solutions increased the longevity of *Hyssopus thymus*. Provision of supplemental foods *viz*., honey water solutions, floral nectar, and sucrose (sugar) water solutions has been reported to increase the longevity and fecundity of *Bathyplectes curculionis* (Thompson) [16]. Wäckers (2001) observed that sucrose provided greater benefit in *Cotesia glomerata* than glucose, fructose, and erlos. The adults of *B. curculionis* lived longer on glucose than on other diets, except fructose [16]. The parasitoid adult longevity reported to be longer for both the sexes when 100% honey was provided as food in *D. anthracia* [1], *Anastaus semiflavidus* [2], *Aptesis basizonia* [3], *Encarsis formosa* [4] and *E. philippinensis*, and females of *N. thymus* [18]. Veeranna and Jyothi (1991) observed increased longevity of *Trichopria* sp. on 10% honey compared to 100% honey. Similarly, Morales-Ramos *et al.* (1996) reported higher longevity of *Catalaccus grandis* (Burks) females when fed 30% sugar solution than 50 and 70% solutions. The longevity of *Trichogramma minutum* [20] and *E. philippinensis* [21] reported to be higher when these parasitoids were fed 25% sucrose. Likewise, longevity of females of *Trichopria* sp. was longer on 25% honey [21].

In the present investigation, different concentrations and combinations of the diets *viz*., honey, glucose, sucrose, jaggery, and sugarcane juice were used to record their impact on longevity of *N. thymus*. Irrespective of diet concentrations (10, 30, and 50%), the parasitoid longevity was highest for honey followed by sucrose, glucose, sugarcane juice, and jaggery. Based on the adult survival duration of *N. thymus* with respect to different combinations of the above diets at 50%, it was found that all the combinations containing honey as one of the diets promoted the longevity, while jaggery with other diets, except honey, caused reduced longevity. Thus, it is obvious that honey alone as well as in combination with other diets greatly supports the survival of *N. thymus*. These observations are in conformity with those of Veeranna and Jyothi (1991), Finlayson and Thelma (1957), Veeranna and Nirmala (1989, 1992) and Van Lenteren *et al.* (1987) who too observed higher longevity of parasitoids when honey was provided as diet.

4. Conclusion

We conclude that honey alone at different concentrations or in combination with other diets is more effective in parasitoid survival, that allow for better levels of parasitoid progeny production and host searching at field, which is also to improve mass multiplication of the parasitoid for purpose of biological control of mulberry uzi fly, *E. bombycis.*

5. References

1. Veeranna G, Jyothi HK. Influence of various diets on the longevity and emergence of adults of *Dirhinus anthracia* Walk. (Hymenoptera: Chalicididae) and *Trichopria* sp. (Hymenoptera: Diapriidae) parasites of *Exorista sorbillans* Wiedemann (Diptera: Tachinidae). J Biol. Control. 1991; 5(2):74-77.
2. Barnes OL. Feeding experiments with the range caterpillar of egg parasite *Anastatus semiflavidus* Gahan. J. Econ. Entomol. 1994; 37:544-545.
3. Finlayson LR, Thelma F. Influence of adult food on viability of early stages of *Aptesis basizonia* (Grav.) (Hymenoptera: Ichneumonidae) a parasite of pine sawflies (Diprionidae). Can. Ent. 1957; 89:507-509.
4. Van Lenteren JC, Van Vianen A, Gast HF, Korten Hoff A. Parasite – host relationship between *Encarsis formosa* (Hymenoptera: Aphelinidae) and *Trialeurodes vapororium* Westwood (Hymenoptera: Aleyrodiae). J Appl. Entomol. 1987; 103:69-84.
5. Mao H, Kunimi Y. Longevity and fecundity of *Brachymeria lasus* (Walker) (Hymenoptera: Chalcididae), a pupal parasitoid of the Oriental tea tortrix, *Homona magnanima* Diakonoff (Lepidoptera: Tortricidae). Appl. Entomol. Zool. 1994; 29(2):237-243.
6. McDougall SJ, Mills NJ. The influence of host, temperature and food sources on the longevity of Trichogramma platneri. Entomol. Exp. App. 1997; 83:195-203.
7. Hohmann CL, Luck RF, Oatman ER. A comparison of longevity and fecundity of adult *Trichogramma platneri* (Hymenoptera: Trichogrammatidae) reared from the eggs

of the cabbage looper and the Angoumois grain moth, with and without access to honey. J Econ. Entomol. 1988; 81:1307-1312.
8. Bai B, Luck RF, Forster L, Stephens B, Janssen JM. The effect of host size on quality attributes of the egg parasitoid, Trichogramma pretiosum. Entomol. Exp. Appl. 1992; 64:37-48.
9. Hagan KS. Ecosystem analysis: Plant cultivars (HPR), entamophagous species and food supplements. In Interactions of Plant Resistance and Parasitoids and Predators of Insects. D. J, Boethel and R. D. Eikenbary., John Wiley and Sons, West Sussex, UK, 1986, 151-197.
10. Jervis MA, Kidd NAC. Host-feeding strategies in hymenopteran parasitoids. Biol. Rev. 1986; 61:395-434.
11. Heimpel GE, Rosenheim JA, Kattari D. Adult feeding and lifetime reproductive success in the parasitoid *Aphytis melinus*. Entomol. Exp. Appl., 1997; 83:305-315.
12. Hagley EAC and Barber DR. Effect of food sources on the longevity and fecundity of *Pholetesor ornigis* (Weed) (Hymenoptera: Braconidae). Can. Entomol. 1992; 124:341-346.
13. Stapel JO, Cortesero AM, de Moraes CM, Tumlison JH, Lewis WJ. Extrafloral nectar, honeydew, and sucrose effects on searching behaviour and efficiency of *Microplitis croceipes* (Hymenoptera: Braconidae) in cotton. Environ. Entomol. 1997; 26:617-623.
14. Olson DM, Radamiro H, Lundgren JG, Heimpel G. Effects of sugar feeding on carbohydrate and lipid metabolism in a parasitoid wasp. Physiol. Entomol. 2000; 25:17-26.
15. Syme PD. The effects of flowers on the longevity and fecundity of two native parasites of the European pine shoot moth in Ontario. Environ. Entomol. 1975; 4:337-346.
16. Jacob HS, Evans EW. Influence of different sugars on the longevity of *Bathyplectes curculionis* (Hymenoptera: Ichneumonidae). Jen, 2004; 128(4):316-320.
17. Wäckers FL. A comparison of nectar and honey dew sugars with respect to their utilization by the hymenopteran parasitoid *Cotesia glomerata.* J Insect Physiol., 2001; 47:1077-1084.
18. Veeranna G, Nirmala MR. Effect of various diets on the longevity and emergence of adults *Exoristobia philippinensis* (hymenoptera: Eulophidae) parasites of *Tricholyga bombycis* Beck. (Diptera: Tachinidae). Indian Nat. Sci. Acd. 1989; B55:31-34.
19. Morales-Ramos JA, Rojas MG, King EG. Significance of adult nutrition and oviposition experience on longevity and attainment of full fecundity of *Ctolaccus grandis* (Hymenoptera: Pteromalidae). Ann. Entomol. Soc. Am. 1996; 80(4):555-563.
20. Narayan PS, Mookherjee PB. Effect of nutrition on the longevity and rate of reproduction in *Trichogramma evanescens* minutum Riley (Hymenoptera: Chalcidoidea). Indian J Ent. 1955; 17:376-382.
21. Veeranna G, Nirmala MR. Effect of diets on the longevity and adult emergence of parasitoids of *Exorista sorbillans* Wied. (Diptera: Tachinidae). Bioecol. & Control Ins. Pests, 1992, 133-137.