I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3.03

Effect of Adult Nutrition on Parasitization Potential of *Goniozus nephantidis* under Laboratory Conditions

Hegade P. B[1]., Mehendale S. K[2]., Desai V. S[3] Dhobe N. S[4]. and Turkhade P. D[5].

ABSTRACT: *Laboratory experiment entitled 'Effect of adult nutrition on parasitization potential of* Goniozus nephantidis *under laboratory condition' was under taken during March 2012 to June 2012. Effect of adult nutrition on biological parameters like grub production, pupation success, adult emergence, sex ratio, adult longevity and number of* Corcyra *larvae paralyzed by* Goniozus *were studied. As an adult nutrition source, different natural sources of Carbohydrates, Proteins, Fats, Lipids, Amino acids, etc. like Honey, Fructose, Whole eggs, Resin, Milk, Maize pollen, Date were selected and evaluated for their effect. For comparison, only water and unfed female was also maintained .Results revealed that, T1 (Honey 50%) produced the highest number of grubs (27.00) and was at par with T7 (Date) with 24.00 grubs. Maximum numbers of pupae produced from grubs were observed in T1 (24.50). Whereas, T2 (Whole egg) with 5.25 showed less pupation. T1 was having highest number of adult emergence (24.25) and it was at par with T7 (21.75). There was very low adult emergence from T2 (5.25). Considering adult longevity T1 (26.25days) was best effective treatment. Whereas, T2 (5.25days) and T8 (water) 7.00 days were less effective treatments. Number of* Corcyra *larvae paralysed by parasitoid fed on adult diets showed non-significant results. Sex ratio (male: female) was highest in T3 (1:47)* i.e. *fructose.*

Key words: *Parasitization potential, Adult nutrition, biological parameters, Parasitization,* Corcyra *larvae*

INTRODUCTION

Goniozus nephantidis (Muesebeck) an important larval ectoparasitoid of *Opisena arenosella* (Walkar) (i.e. Coconut black headed caterpillar) is easily mass produced in bio control laboratories either on *Corcyra* or *Gallaria melonella* (linn) as factitious hosts and *O. arenosella* as natural host. Very important aspect of the mass production of any natural enemy is its own nutritional improvement. It is now well known that most of the adult natural enemies take additional food in the form of nectar, pollen and host exudates as their requirement to full fill the nutrients required for their ovarian development, longevity etc. In mass production of a particular natural enemy under laboratory conditions, one can feed the adults of parasitoids/ predators by some protein, carbohydrate, vitamin/mineral resources externally; which can improve the overall performance of that natural enemy. This was proved by earlier workers (Hariprasad and venkatsan 2006, Bonte and Cleroq 2008, Mehendale *et al.* 2009, Mhaske *et al.* 2010).

There is continuous demand for *Goniozus* throughout the coconut growing area. The main aim of bio-control laboratory is timely availability of the natural enemies both qualitatively and quantitatively to the end users. A considerable work on the biology of *Goniozus* is available in India. However the literature on adult nutrition in respect to this parasitoid is yet scanty. In this view, it was felt necessary to conduct a research work on mass production of *G. nephantidis,* with special interest in adult nutrition.

MATERIALS AND METHODS

The following materials were used for rearing of *Corcyra cephalonica* (Stainton) and mass multification of *Goniozus nephantidis* (Muesebeck).

for rearing of *C. cephalonica* – Wooden rearing boxes (50 x 25 x 15 cm), Food grains (Sorghum, Groundnut), Eggs of *C. cephalonica,* Streptomycin sulphate, Formalin (0.1%), Yeast, Sugar, Miscellaneous.

[1, 5] Ph.D. Scholars, [2,3]Assistant Professors, [4] Senior Research Assistant (Dept. of Agril. Entomology)
Department of Agricultural Entomology, Dr. Balasaheb Sawant konkan Krishi Vidyapeeth, Dapoli-415712, Ratnagiri, Maharashtra, *E-mail- hegadepb@gmail.com*

mass multiplication of *G. nephantidis* – Test tubes (15 x 2.5 cm), Plastic vials (7.5 x 2.5 cm), Plastic trays (40 x 30 cm), Honey (50%), Cotton, Rubber bands, Muslin cloths, Brush, Forceps, Pins, etc.

Procurement of Insect Cultures

For conducting the experiment, *C. cephalonica* is most popular and important factitious laboratory host available. To start with, fresh eggs of *C. cephalonica* were obtained from National Bureau of Agriculturally Important Insects, Bangalore (NBAII).

The culture of *G. nephantidis* was obtained from Biological Control Laboratory of Department of Agriculture Entomology Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

Methodologies Followed

For improving the parasitization potential of female *G. nephantidis* on *Corcyra* Larvae under laboratory condition, the adult nutrition through improvement in the diet of parasitoid was taken into consideration.

As an adult nutrition source, different natural sources of Carbohydrates, Proteins, Fats, Lipids, Amino acids, etc. like Honey, Fructose, Whole eggs, Resin, Milk, Maize pollen, Date were selected and evaluated for their effect. For comparison, only water and unfed female was also maintained.

Fresh collected maize pollens from field were cleaned and then preserved into refrigerator. The hen egg, resin, milk and date were purchased from market and also preserved into refrigerator.

A Camlin brush of fine tip (number 6) was used for applying food for females of *G. nephantidis.* The food in the form of liquid like honey (50%), whole eggs, fructose (50%) and water were given by smearing the brush inside plastic vials near the top in which female of *Goniozus* was released. Two small holes were made on lid for proper aeration. Adults of parasitoid were starved during mating period of 3-4 days after emergence. Adults of *Goniozus* were allowed to feed on the respective diet for 24 hours, and then the fifth instar Larvae of *C. cephalonica* was released into vials. Fresh food was provided at the time of removal of paralysed Larvae. However, in case of water as it evaporated earlier, it was provided daily. In case of solid food like date and resins, there was no need to change food immediately. Date and resin were chopped into small pieces and then stuck inside the whole vials, near the top. In case of honey, milk, egg and fructose precaution was taken that; adult female should not stick to food. Hence, small droplets of liquid food were smeared inside the vials.

Fifth instar Larvae of *Corcyra* was used for studying effect of adult nutrition on parasitization potential from a rearing media (Sorghum + Groundnut + Yeast) with each treatment replicated four times. The paralized larve of *C. cephalonica* were removed from the vials and another larva was again provided to the same female parasitoid for parasitization till her death. Parasitized larvae were maintained individually in a separate plastic vial for further observations. Following observations were recorded.

1. Number of Larvae parasitised per female: Out of the *Corcyra* Larvae which were reared on different rearing media and provided to each female of *G. nephantidis* for parasitisation, those Larvae paralysed by adult female of *Goniozus* till her death were counted as number of Larvae parasitised per female.

2. Number of grubs produced per female: After paralysing the *Corcyra* Larvae, the eggs were laid on body of *Corcyra* Larvae by each *Goniozus* female eggs hatched within 2-3 days and the grubs were emerged from eggs which remained attached to the body of Larvae Such grubs from each female were counted and taken as number of grubs produced per female. The grubs were counted under the 10x lens.

3. Number of pupae produced per female: Number of pupae formed by the grubs was counted to determine number of pupae produced, per *Corcyra* Larvae per female.

4. Number of adults produced per female: The newly emerged males and females of *G. nephantidis* from the pupae were considered as adults and counted as number of adults produced per female.

5. Sex ratio (Male: Female): The newly emerged adults of *Goniozus* in individual vials were distinguished on the basis of their morphological characteristics to determine sex ratio (male : female). The Females were larger than the males with tapering abdomen.

RESULTS AND DISCUSSION

Number of grubs produced on larvae of *C. cephalonica* per female *G. nephantidis* fed on different adult diets

The data on Number of grubs produced per female of *G. nephantidis* female fed on different adult diet are presented in Table 9 and Fig. 6. Data revealed that, treatment T1 produced the highest number of grubs 27.00. However, T1 was also at par with T7 (24.00). The treatment T2 (7.00) was very less effective treatment and at par with T8 (7.75) in producing less number of grubs. Further treatments *viz*., T3 (15.50),

T4 (14.75), T6 (13.75) and T5 (13.50) stood at par in producing comparatively better number of grubs. However, treatments T6, T5 and T9 (11.00) were also at par.

From above results it was clear that, for production of more number of grubs through the fertile eggs and profused egg laying by female of *Goniozus*, a diet specifically containing carbohydrates and amino acids was useful as indicated by honey and, further also in date fruit pulp; both are considered to be rich source of carbohydrates and some amino acids. These nutritional sources might have produced more ova in female which further has given maximum number of grub per female.

Number of pupae produced per female of *G. nephantidis* fed on different adult diets

Result revealed that the treatment T1 (24.50) was superior treatment and was at par with treatment T7 (22.75). Whereas, treatment T2 (5.25) *i.e.* whole egg was less effective treatment among rest of all the treatments. Treatment T8 (7.25) and T9 (10.25) were at par with each other, while T9 was at par with T5 (12.75), T6 (13.00). Remaining treatments T4 (14.00) and T3 (14.50) are also at par with T5 and T6.

The results further indicated that, the treatments T1 and T7 were significantly effective treatments among all the treatments for maximum production of pupae from grubs and treatment T2 (whole egg) was less effective treatments.

There may be some reasons for less production of grubs by parasitoid in T2 (whole egg) and also less development of pupae from grubs. This may be due to earlier decomposition and decaying of food materials (whole egg) which was provided to female of *G. nephantidis* on the inner surface of vials. Another reason may be due to bad, offensive and rancid odour of decomposed food materials. There may be change in the oviposition behavior of parasitoid. Also, there was decomposition of *Corcyra* larvae observed due to pathogenic infection (may be bacteria or fungi). Fungal growth was also observed in the same treatment (T2). Grubs of parasitoid were also infected by fungal growth. That's why there may be less formation of pupae from grubs. So also even though T2 may be nutritious food and source of protein and fats, it was less effective due to above reasons.

The same reason may be present in treatment T5 i.e. Milk, where rancid odour, fungus and bacterial infection on the *Corcyra* larvae as well as grubs and pupae of *Goniozus* was also noticed due to which results may be poor.

Zhang *et al.* (2001) reported that *T. brassicae* (Hymenoptera : Trichogrammatidae) females fed on corn pollen and water (wet filter paper dusted with pollen) showed The cumulative life time fecundity (Pupae number of the offspring per female) was 82.53 when fed on pollen and water, which was significantly higher than only water (61.70) but comparatively lower than 99.97 and 95.70 when fed on pollen and honey or honey alone, respectively.

Number of adults produced from *Corcyra* larvae per female of *G. nephantidis* fed on different adult diets

The data on adult produced are presented in Table 2 which indicated that, treatment T1 (24.25) was having highest adult emergence but it was at par with treatment T7 (21.75). There was very low adult emergence from the treatment T2 (5.25) as compare to rest of treatments. Further treatments in this order were T3 (14.50), T4 (13.75), T5 (12.75), T9 (10.00) and T (7.25).

Results revealed that, T1 (Honey 50%) and T7 (Date) were best effective treatments for giving highest adult emergence.

The reason behind the poor adult emergence in the treatment T2 was the same as discussed earlier in 4. 2. 2.

Adult longevity of *G. nephantidis* female fed on different adult diets on *Corcyra* larvae

The data on female of *Goniozus* fed on different diets are presented in Table 2 and results based on data indicates that, treatment T1 (26.25days) was best suitable and effective treatment among all the treatments. Next effective treatment was T7 (22.50days). Treatment T2 (5.25days) showed very lowest longevity and was at par with T8 (7.00days). Treatment T8 was further at par with T9 (9.75days), while T9 was further at par with T6 (12.50days), and T5 (12.75days). Whereas, T6, T5 (12.75days), T4 (13.75days) and T3 (14.25days) were also at par with each other's.

Table 1
Adult Nutrition Sources for *G. nephantidis*

Treatments	*Adult nutrition sources*
T_1	Honey
T_2	Whole egg (Hen)
T_3	Fructose (50%)
T_4	Resin
T_5	Milk (50%)
T_6	Maize pollens
T_7	Date
T_8	Only water
T_9	Control (without food)

Table 2
Effect of Adult Nutrition on Parasitization Potential of *Goniozus nephantidis* under Laboratory Condition

Treatment	*Mean number of grubs produced*	*Mean number of pupae produced*	*Mean number of adult produced*	*Mean adult longevity (days)*	*Mean no. of Corcyra larvae paralysed*	*Sex ratio (Male: Female)*
T_1	27.00 (5.29)	24.50 (5.05)	24.25 (5.02)	26.25	4.00 (2.24)	1:12.66
T_2	7.00 (2.81)	5.25 (2.46)	5.25 (2.46)	5.25	2.00 (1.73)	1:12.00
T_3	15.50 (4.06)	14.50 (3.93)	14.50 (3.93)	14.25	3.00 (1.99)	1:47.00
T_4	14.75 (3.96)	14.00 (3.87)	13.75 (3.83)	13.75	3.00 (1.99)	1:14.00
T_5	13.50 (3.80)	12.75 (3.70)	12.75 (3.70)	12.75	3.00 (1.99)	1:4.20
T_6	13.75 (3.84)	13.00 (3.74)	13.00 (3.73)	12.50	3.00 (1.99)	1:2.23
T_7	24.00 (4.99)	22.75 (4.87)	21.75 (4.76)	22.50	4.00 (2.23)	1:10.14
T_8	7.75 (2.95)	7.25 (2.86)	7.25 (2.86)	7.00	3.00 (1.99)	1:7.73
T_9	11.00 (3.45)	10.25 (3.33)	10.00 (3.29)	9.75	3.00 (2.00)	1:1.23
S.Em±	0.14	0.15	0.15	1.05	NS	
CD at 5 %	**0.41**	**0.44**	**0.43**	**3.02**	**NS**	

(Figures given in parentheses are "n+1 transformation)

Results revealed that, treatment T1 was the best adult diet followed by T7 and thus the both treatments were effective treatments for increasing longevity of female parasitoid. While T2 and T8 were very less effective treatments among all the treatments.

Mcdougall and Mills (1997) concluded that sugar sources were necessary to prolong longevity of *T. plateneri,* but a source of amino acid not promoted longevity. Honey solutions greater than 10 per cent and 43 per cent Fructose and Sucrose solutions increased longevity from 10-13 days to 15 -20 days in comparison to water.

Onagbola *et al.* (2006) revealed that, longevity of egg parasitoid *Pteromalus cerealellae* (Ashmead) was increased due to sugar feeding (64.2 ± 9.2) as compared to sugar starved (44.5 ± 6.8).

According to Mehendale *et al.* (2009), the longevity of egg parasitoid *Trichogramma chilonis* (Ishii) female and male was maximum in sucrose 10% (5.73 and 3.53days), respectively.

Number of *Corcyra* larvae paralyzed by female *G. nephantidis* female fed on different adult diets

The data presented in Table 2 based on the number of *Corcyra* larvae paralyzed by *G. nephantidis* showed non-significant results as all the females of *G. nephantidis* took equal number of larvae of *Corcyra* for parasitization in their whole life cycle.

Thus above results revealed that, there was no any effect of food on parasitization of number of *Corcyra* larvae.

Sex ratio (Male : Female) of *G. nephantidis* fed on different adult diets

Sex ratio a most important factor, because female *Goniozus* are actually playing role as bio-agent for control of *O. arenosella* on coconut. Male are not useful commercially because they only play role of fertilization and after few days they die. So in present investigation maximum number of female parasitoid production was focused.

Results from the data in Table 2 revealed that, there was highest production of female *Goniozus* in T3 (1:47). Next treatment T4 (1:14) showed good results as compare to other treatments. While T1 (1:12.66) was the next to follow. Further T2 (1:12), T7 (1:10.14), T8 (1:7.73), T5 (1:4.20), T6 (1:2.23) and T9 (1:1.23) *i.e.* whole egg, date, water, milk, pollen and control (without food) were the next treatments to follow. Treatment T9 showed poor results among all the treatments was less less effective treatment.

Thus, the above treatments T3, T4, T1 showed best results as compared with rest of the treatments.

According to the Onagbola *et al.* (2006) longevity and sex ratio of *Pteromalus cerealellae* (Ashmead) increased due to sugar solution feeding to adults.

Mehendale *et al.* (2009) studied the effect of adult nutrition on *T. chilonis* and revealed that, Sex ratio after emergence from *Corcyra* eggs parasitized by parasitoid female fed on *Corcyra* egg extract was (1:1.71) followed by milk powder 10 per cent solution (1:1.60). Thus, present findings are in accordance with that of above results.

REFERANCES

Bonte, M. and Clercq, P.D. (2008), Developmental and reproductive fitness of *Orius laevigatus* (Hemiptera: Anthocoridae) reared on factitious and artificial diets. *J. Econ Entomol*. **101**(4): 1127-1133.

Hariprasad, L. U.; Venkatesan, T. (2006), Effect of nutrition on parasitisation, fecundity and longevity of *Goniozus nephantidis*. Annals of Plant Protection Sciences; 2006. **14**: 2, 502-503.

Mcdougall, S. J.; Mills, N. J. (1997), The influence of hosts, temperature and food sources of the longevity of *Trichogramma platneri* Nagarkatti. *Entomol.exp.appl.*, vol. **83** : 195-203.

Mehendale, S. K. (2009), Nutritionnal aspect of factitious host *Corcyra cephalonica* and Parasitization potential of egg parasitoid *Trichogramma chilonis* (Ishii) under south Gujrat condition. Ph.D. (Agri) Thesis, submitted to Navsari Agriculture University, Navsari (Gujrat).pp. 108-116.

Mhaske, S.V. and Mehendale, S.K. (2011), Effect of artificial diets on the longevity and fecundity of *Chrysoperla zastrowi arabica* (Henry). M.Sc.(Agri) thesis, submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Pp 21-50.

Onagbola, O.E.; Fadamiro, H. Y. and Mbata, G. N. (2006), Longevity, fecundity and progeny sex ratio of *Pteromalus cerealellae* in relation to diet, host provision and mating. *Biological Control*. **40**: 222-229.

Zhang, G. R., Zimmermann, O. and Hassan, S. A. (2001). Corn pollen as a food source for *Trichogramma brassicae*. *Egg parasitoid News*, **13**: 19.