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Seasonal abundance of ecto-larval parasitoids of coconut black headed caterpillar, *Opisinia arenosella* Walker under south Gujarat conditions

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ABSTRACT: Survey was conducted in coconut plantations to document the natural occurrence of larval parasitiods of black headed caterpillar under Navsari conditions from January 2015 to December 2015 and results revealed that two larval parasitoids *viz*., *Goniozus nephantidis* (Muesebeck) (Hymenoptera: Bethylidae) and *Habrobracon hebetor* Say (Hymenoptera: Braconidae) were noticed on *Opisinia arenosella* Walker (Lepidoptera: Crytophasidae). Among them, *G. nephantidis* was the dominant species under Navsari condition of Gujarat state. The maximum parasitism of *O. arenosella* by *G. nephantidis* and *H. hebetor* was observed during 2nd fortnight of May (17.69 and 15.65%) for the both parasitiods, respectively. However, the lowest per cent of parasitism by *G. nephantidis* was found during 1st fortnight of the October (2.23%). Moreover, the per cent parasitism of *H. hebetor* was nil during 1st fortnight of the August to 1st fortnight of the September. The highest numbers of *O. arenosella* larvae were parasitized by *G. nephantidis* and *H. hebetor* during 2nd fortnight of May (52 and46 larvae), respectively. The total number of adults of *G. nephantidis* and *H. hebetor* emerged from host larvae were maximum during 2nd fortnight of May (347 and 213 adults), respectively. Moreover, the number of adults of *G. nephantidis* emerged from single larva was highest during 2nd fortnight of the September (8.80 adults/larva). While, the maximum adults of *H. hebetor* emerged from single larva was noticed during 2nd fortnight of the February (7.57 adults/larva).

Keywords: Coconut, ecto latval parasotoids, *Goniozus nephantidis, Opisinia arenosella,* survey

INTRODUCTION

The coconut palm, *Cocos nucifera* L. belongs to family Arecaceae is "Tree of Life" as well as "*Kalpa vriksha"* provides livelihood to billions of people across the world. The coconut palm is infested by a number of insect pests. Among them, *Opisina arenosella* Walker causes the severe damages to the foliage, depriving the palm of its photosynthetic area and thus, directly affecting the yield (Sujatha and Chalam, 2009). The black headed caterpillar, *O. arenosella* is one of the serious and endemic pest of coconut in India (Cock and Perera, 1987 and Gurav *et al*., 2014). The black headed caterpillar is attacked by many entomophagous insects during its developmental stages. Among them, *G. nephantidis* is a gregarious larval parasitoid and responsible for the reduction in the population pest under field conditions (Cock and Perera, 1987 and Venkatesan *et al*., 2008).

Parasitoids are preferred by virtue of their self perpetuating tendency and cost effectiveness in the long run; they can be conserved, preserved and multiplied under laboratory condition for the purpose of field release against target pest (Dhanapati *et al.,* 2015). Parasitoid plays a major role in the management of pests in the field thus maintaining a proper balance in the insect population. Exploring the parasitoids which are found parasitizing to the black headed caterpillar in the field is necessary for effective usage of them in biological control programme (Ansar *et al.,* 2014). To understand the changing scenario of black headed caterpillar and its natural enemies, it is essential to study the natural occurrence of larval parasitiods of black headed caterpillar and the intensity of parasitism under south Gujarat conditions heavy rainfall zone. Hence, the present study was undertaken to document the species of parasitoids of black headed caterpillar in coconut ecosystem under south Gujarat conditions.

MATERIAL S AND METHODS

Method of observations

To record the natural occurrence of larval parasitoids of coconut black headed caterpillar under Navsari, fixed plot survey was carried out in coconut plantation garden at Regional Horticultural Research Station (RHRS), Navsari from January 2015 to December 2015. The methodology suggested by Sujatha and Chalam (2009) was employed with slight modification

Plate-1: Coconut leaf damaged by black headed caterpillar, *O. arenosella*

Plate-2: Severe damage made by black headed caterpillar, *O. arenosella*

Plate-3: Silken galleries made by larvae of *O. arenosella* oncoconut leaflet

Plate-4: Collection of larvae of *O. arenosella* during survey programme in plastic vial

Plate-5: Adult of *G. nephantidis*

Plate-6: Adult of *H. hebetor*

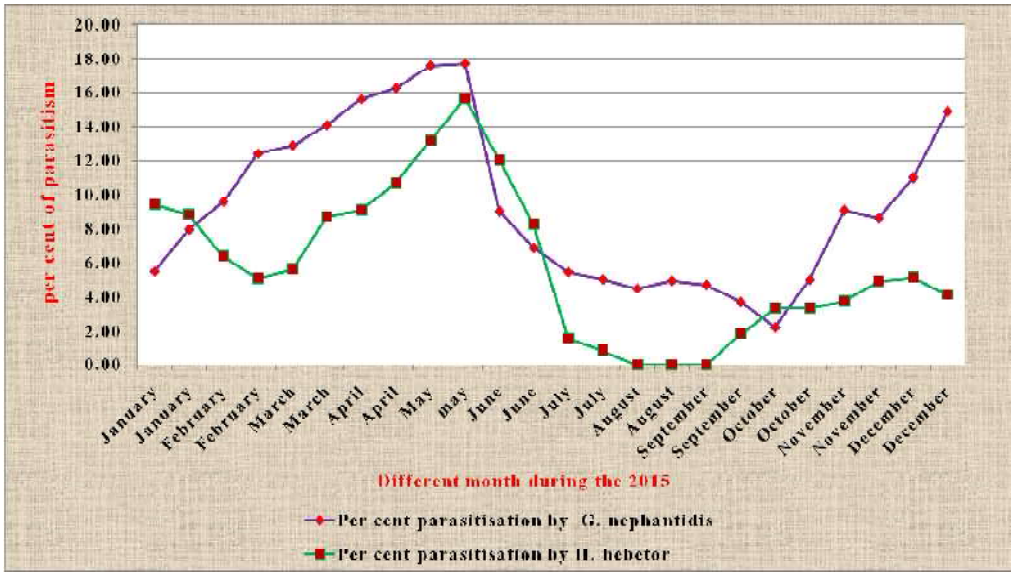

Fig. 1. Per cent parasitization by larval parasitoids of the black headed caterpillar, *O. arenosella*.

Table 1. Occurrence of larval parasitoids on black headed caterpillar, *O. arenosella* under Navsari condition.

Fortnight/ Date of observation	No. of larvae collected from 20 selected palms on 5 lower leaflets	Per cent parasitisation by *G. nephantidis*	Per cent parasitisation by *H. hebetor*	Per cent parasitisation by both parasitoids
10-01-15	127	5.51	9.45	14.96
31-01-15	113	7.96	8.85	16.81
01-02-15	125	9.60	6.40	16.00
15-02-15	137	12.41	5.11	17.52
07-03-15	124	12.90	5.65	18.55
22-03-15	149	14.09	8.72	22.82
05-04-15	231	15.58	9.09	24.68
24-04-15	252	16.27	10.71	26.98
09-05-15	273	17.58	13.19	30.77
17-05-15	294	17.69	15.65	33.33
06-06-15	166	9.04	12.05	21.08
21-06-15	145	6.90	8.28	15.17
05-07-15	128	5.47	1.56	7.03
25-07-15	119	5.04	0.84	5.88
15-08-15	111	4.50	0.00	4.50
29-08-15	121	4.96	0.00	4.96
12-09-15	106	4.72	0.00	4.72
22-09-15	108	3.70	1.85	5.56
06-10-15	179	2.23	3.35	5.59
24-10-15	239	5.02	3.35	8.37
14-11-15	187	9.09	3.74	12.83
29-11-15	162	8.64	4.94	13.58
05-12-15	136	11.03	5.15	16.18
20-12-15	121	14.88	4.13	19.01

during the present investigation. For this purpose, coconut garden having one ha area was selected; among them 10 per cent area was selected as a sample size. The palms were selected randomly at each observation and observations were recorded at fortnightly interval from lower five leaflets per selected palm. From each selected palm, all the larval stages of black headed caterpillar were collected, to know the natural parasitism.

The collected larval stages of black headed caterpillars were brought to P. G. Research Laboratory, Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari for the emergence of adults of parasitoid. These collected parasitoids were kept individually in a separate plastic glass vials (7x2.5 cm) to avoid the assimilation of species. Adult specimens of parasitoids were also collected directly by aspirator and differentiated on the basis of their morphological characters. Thus, the number of different species present on each selected palm was worked out. These collected stages were kept individually in plastic vials (7x2.5 cm) for the emergence of parasitoid under constant supervision. The number of parasitoids emerged from each larval stage of black headed caterpillar were recorded daily. Thus, per cent parasitization of black headed caterpillar was worked out. The collected specimens of parasitoids were sent to ICAR-National Bureau of Agricultural Insect Resources (NBAIR) (Formerly, NBAII and PDBC), Bengaluru (Karnataka) for Identification.

RESULTS AND DISCUSSION

The present investigation on the occurrence of larval parasitoids of black headed caterpillar under Navsari condition revealed that two larval parasitoids *viz.*, *G. nephantidis* and *H. hebetor* (Plate 1 to 6). Among the two parasitoids, *G. nephantidis* was the dominant species throughout out the year.

Data presented in Tables 1 and 2, Figure 1 revealed that the highest per cent of parasitism by *G. nephantidis* and *H. hebetor* was recorded during 2nd fortnight of May (17.69 and 15.65%) and followed by 1st fortnight of May (17.58 and 13.19%) for both the parasitiods. Lowest per cent of parasitism by *G. nephantidis* was noticed during the 1st fortnight of the October (2.23%) there after gradual increase in the parasitism was observed up to 2nd fortnight of December (14.88%). In case of *H. hebetor*, no parasitism was recorded during the 1st fortnight of August to 1st fortnight of September. The highest number of *O. arenosella* larvae were parasitized by both the parasitoids (*G. nephantidis* and *H. hebetor*) during the 2nd fortnight of May (52 and 46 larvae) and followed by the 1st fortnight of May (48 and 36 larvae) for the both parasitiods respectively, and lowest number of the larvae were parasitized by *G. nephantidis* during the 2nd fortnight of September to 1st fortnight of the October (4 larvae) later on number of larvae parasitized was increased up to 2nd fortnight of December (18 larvae).

Table 2. Adults of parasitoid emerged from *O. arenosella* under Navsari condition.

Fortnight/ Date of observation	Total adults of *G. nephantidis* emerged	Total adults of *G. nephantidis* emerged/ larva	No. of adults of *H. hebetor* emerged	No. of adults of *H. hebetor* emerged/ larva
10-01-15	44	6.29	68	5.67
31-01-15	54	6.00	67	6.70
01-02-15	71	5.92	33	4.13
15-02-15	113	6.65	53	7.57
07-03-15	104	6.50	45	6.43
22-03-15	130	6.19	62	4.77
05-04-15	275	7.64	122	5.81
24-04-15	246	6.00	134	4.96
09-05-15	312	6.50	149	4.14
17-05-15	347	6.67	213	4.63
06-06-15	90	6.00	85	4.25
21-06-15	78	7.80	72	6.00
05-07-15	41	5.86	11	5.50
25-07-15	35	5.83	6	6.00
15-08-15	30	6.00	0	0.00
29-08-15	25	4.17	0	0.00
12-09-15	44	8.80	0	0.00
22-09-15	31	7.75	10	5.00
06-10-15	25	6.25	29	4.83
24-10-15	77	6.42	43	5.38
14-11-15	108	6.35	45	6.43
29-11-15	88	6.29	41	5.13
05-12-15	103	6.87	38	5.43
20-12-15	143	7.94	16	5.33
-	**Av. ± S.D.**	**6.53 ± 0.93**	**Av. ± S.D.**	**4.75 ± 2.01**

However, parasitism by *H. hebetor* was found to be nil from 1st fortnight of the August to 1st fortnight of September.

The total number of adults emerged from host larvae for *G. nephantidis* and *H. hebetor* were maximum during the 2nd fortnight of May (347 and 213 adults) followed by the 1st fortnight of May (312 and 149 adults) for both parasitiods, respectively and the total numbers of adults were emerged from host larvae for *G. nephantidis* was least during the 2nd fortnight of August (25 adults) in case of *H. hebetor* while it was nil during the 1st fortnight of August to 1st fortnight of September. Moreover, the number of adults of *G. nephantidis* emerged from single larva was maximum during the 2nd fortnight of September (8.80 adults/larva) followed by 2nd fortnight of December (7.94 adults/larva) and it was minimum during the 2nd fortnight of August (4.17 adults/ larva). While in case of *H. hebetor* the total adults emerged from single larva was highest during the 2nd fortnight of February (7.57 adults/larvae) followed by 1st fortnight of February (6.70 adults/larva) and it was nil from 1st fortnight of August to 1st fortnight of September. Moreover, thetotal number of *O. arenosella* larvae parasitized by both parasitoids was maximum during 2nd fortnight of May (98 larvae) followed by 1st fortnight of May (84 larvae) and it was found to be minimum (5 larvae) during 1st fortnight of August and 1st fortnight of September.

Kapadia (1987) reported that the maximum parasitism by *P. nephantidis* was 5.98 percent in November month. The average parasitism during throughout four years was maximum in February (3.66%) and the activity of the parasitoid was low in May (1.04%). Further, Gubbaiah *et al.*, (1989) reported that the larval parasitoids [*B. brevicornis* and *P. nephantidis* (*G. nephantidis*)] and pupal parasitoids (*Brachymeria* spp.) occurred naturally on *O. arenosella*; Earlier, Pillai and Nair (1995) reported that *B. hebetor*, *B. brevicornis* and *G. nephantidis* parasitized the larvae of *O. arenosella*. Pushpalatha and Veeresh (1995) recorded the three species of natural enemies on *O. arenosella viz. G. nephantidis* and *Apanteles taragamae* Vierick, and the carabid predator, *Parena nigrolineata* (Chaudoir); Jongok and Seunghwan (2006) reported five species of *Goniozus* on *O. arenosella* in Korea *viz.*, *G. koreanus*, sp. nov., *G. mesolevis* Lim, sp. nov., *G. akitsushimanus*, *G. yoshikawai* and *G. maurus*. Shivanand and According to Veeramuthu *et al.*, (2015), July to December was found to be most favourable period to the hymenopteran insects. The findings of above workers support the present investigation while discrepancy in seasonal abundance of two important parasitoids on black headed caterpillar might be due to variation in test insect, host insect and prevailing ecological conditions.

It can be concluded that two ecto-larval parasitoids *viz.*, *G. nephantidis* and *H. Hebetor* are very effective in

the natural regulation of the coconut black headed caterpillar, *O. arenosella*. Therefore, the above two parasitiods could be exploited in future for the field management of *O. arenosella* in coconut growing belt of Gujarat as well as other parts of the country.

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