

Large-Scale Field Validation of Biocontrol Strategy for Management of Coconut Leaf Eating Caterpillar *Opisina arenosella* Walker Utilizing Indigenous Parasitoids

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INTRODUCTION

Opisina arenosella Walker (Lepidoptera: Oecophoridae) is a major pest of coconut palm in India (Nirula, 1956). This pest periodically assumes epidemic proportions in coastal and backwater areas and in the vicinity of water bodies in the interior parts of peninsular India. The caterpillars of *O. arenosella* construct galleries of silken webs reinforced with excreta and scrapes of leaf bits. Hiding in these galleries they feed on the chlorophyll containing parenchymatous tissues. Damage results in drying of the outer and middle whorl of leaves which affects the photosynthetic efficiency and yield potential of the palm. The damage to leaves renders them unsuitable for thatching and other purposes also.

A bio-intensive pest management strategy has been developed for the management of this pest when it is in an epidemic form (Sathiamma, 1993; Nair *et al.*, 1997). Pest incidence can be checked by the biocontrol methods utilizing indigenous parasitoids. Among the parasitoids recorded from India (Pillai and Nair, 1993), the larval parasitoid *Goniozus nephantidis* Mues. (Bethyridae), the pre-pupal parasitoid *Elasmus nephantidis* Rohw. (Elasmidae) and the pupal parasitoid *Brachymeria nosatoi* Habu. (Chalcididae) are the most promising ones. *Bracon brevicornis* Wesmael (Braconidae) also parasitizes the late larval stage of the pest. Sathiamma *et al.* (1987) fixed the norms for field release of these effective parasitoids. Field evaluation of these parasitoids effected significant reduction in the pest population in the field (Sathiamma *et al.*, 1996).

Large-scale field validation programme on biointensive IPM for the management of coconut leaf eating caterpillar was implemented by Central Plantation Crops Research Institute in different geographic locations in coastal Karnataka (Ullal and Jeppinamogru) and Coastal Kerala (Purakkad and Ayiramthengu) in a total area of 1400 ha. All the four locations were the endemic areas of pest incidence. The total area covered was 500 ha each in Ullal (D. Kannada, Dist., Karnataka) and Jeppinamogru (D. Kannada, Dist. Karnataka) and 200 ha each in Purakkad (Alappuzha Dist. Kerala) and Ayiramthengu (Kollam Dist., Kerala). The plots were selected with the help of extension officials of the State Department of Agriculture, Kerala and Department of Horticulture, Karnataka. The operational area was divided into clusters of 25 ha for assessing incidence of the target pest. In each 25 ha cluster, central area of 5 ha was selected for sampling palms and release of parasitoids.

Contact programmes were arranged in the field during the initial period for creating awareness among the beneficiaries. In each cluster, group discussions and demonstrations were conducted on pest identification, sampling, parasitoid identification, parasitoid release, etc.

Studies were initiated during October 1999 and observations continued till March 2002. Pre treatment pest incidence was recorded during October 1999. Ten percent palms in 5 ha of each cluster was selected and marked as sample palms. The data was recorded on intensity of infestation based on percentage of affected leaves assessed from ground observation. For recording detail count of pest stages, 80 leaflets at random were collected from the sample palms in each cluster. Sample leaves were collected from the lower or middle whorl of leaves. The pest stages *viz.*, larvae, pre pupae and pupae were counted. The sampling formula developed by George *et al.* (1982) was used for estimation of pest population in the affected palms. At the initiation of experiment, fully dried one or two outer leaves were removed from highly pest infested palms and burned.

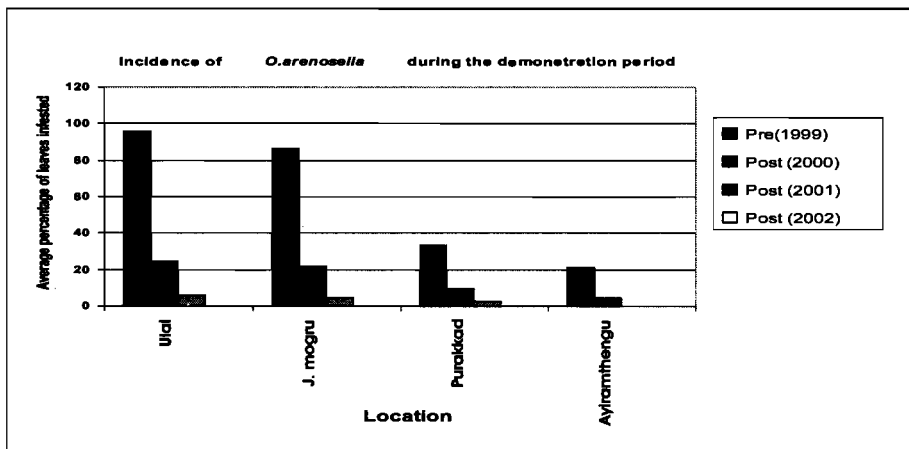
Larval parasitoids (*Goniozus nephantidis* and *Bracon brevicornis*), Prepupal parasitoid (*Elasmus nephantidis*) and Pupal parasitoid (*Brachymeria nosatoi*) were multiplied in the Entomology laboratory of CPCRI, Kasaragod and CPCRI, Regional Station, Kayamkulam. The parasitoids were released in the field after assessing the population of the target stage of the pest at fortnightly/monthly intervals as per the norms. *G. nephantidis*/*B. brevicornis* were released @ 20% of the estimated larval population, *E. nephantidis* @ 49% of the pre pupal population and *B. nosatoi* @ 32% of the pupal population. Whenever multistage population of the pest was observed, parasitoids were released @ 40% of the pest stages estimated based on sampling. The releases of parasitoids were carried out in the initial period at fortnightly intervals for a period of 5-6 months depending on the pest population to effect an inundative release in each location. In the second year, pest monitoring was done every month and the parasitoid releases were done during initial stages of pest build up after the post-monsoon period and also during the peak period of pest population. Details of parasitoid released during the experimental period are given in Table 42.1.

Table 42.1. Details of parasitoids released in the demonstration plots

Parasitoid		Locations			
		Ullal	J. mogru	Purakkad	Ayiramthengu
<i>G. nephantidis</i>	1999	10565	8385	6900	9660
	2000	4500	3730	1200	1380
	2001	560	1110	1080	–
<i>B. brevicornis</i>	1999	31944	25270	2902	4060
	2000	12720	11400	500	580
	2001	1736	3336	456	–
<i>E. nephantidis</i>	1999	400	380	2100	2990
	2000	150	140	350	430
	2001	100	80	330	–
<i>B. nosatoi</i>	1999	220	68	370	52
	2000	40	52	64	74
	2001	20	–	58	–

A total of 8–12 release of parasitoids were made in the first year and need based releases during the subsequent years.

During pre-treatment period, pest infestation in coastal Karnataka was very high with 96% (Ullal) and 86 % (J. Mogru) compared to Coastal Kerala with 33% (Purakkad) and 21% (Ayiramthegu). Pest incidence during the post-release period could be brought down to 4–24% in the first year (with 75–78% reduction) and nil to 6.0% incidence in the 2nd year (93–100% reduction). In the third year, all the plots were free of pest incidence. Incidence of the pest during the observation period is presented in Fig 42.1.

**Fig. 42.1.** Incidence of *O. arenosella* in the demonstration plots

Population count of *Opisina* in the sample palms at pre-release and post-release period are presented in Table 42.2. The pest population showed a sharp decline during the post-parasitoid release period. The pest suppression was very much evident from the end of the first year with a decline of 60–85% in various locations and the pest incidence become very negligible by the second year with 84–100% reduction in pest population. In all the locations the infested palms were free of pest in the third year. Thus, the impact of release of bioagents in the suppression of the pest was clearly visible.

Table 42.2. Population of *O. arenosella* in the demonstration plots

Place	Pre-release 1999	Post release			T value	
		2000	2001	2002	1999-2000	1999-2001
Ullal	790.8 ± 96.2	314.6 ± 55.1	43.9 ± 6.8	0.0	25.5*	35.3*
J.mogru	621.7 ± 92.3	280.4 ± 28.1	82.2 ± 14.8	0.0	17.3*	26.1*
Purakkad	70.8 ± 10.3	12.8 ± 2.2	10.5 ± 1.7	0.0	14.8*	15.3*
Ayiramthengu	98.0 ± 10.6	14.7 ± 1.9	0.0	0.0	24.7*	26.0*

* significant at 1%

There was a build up of released parasitoids in the field. This was evidenced by the observations during post-release period (Fig 42.2).

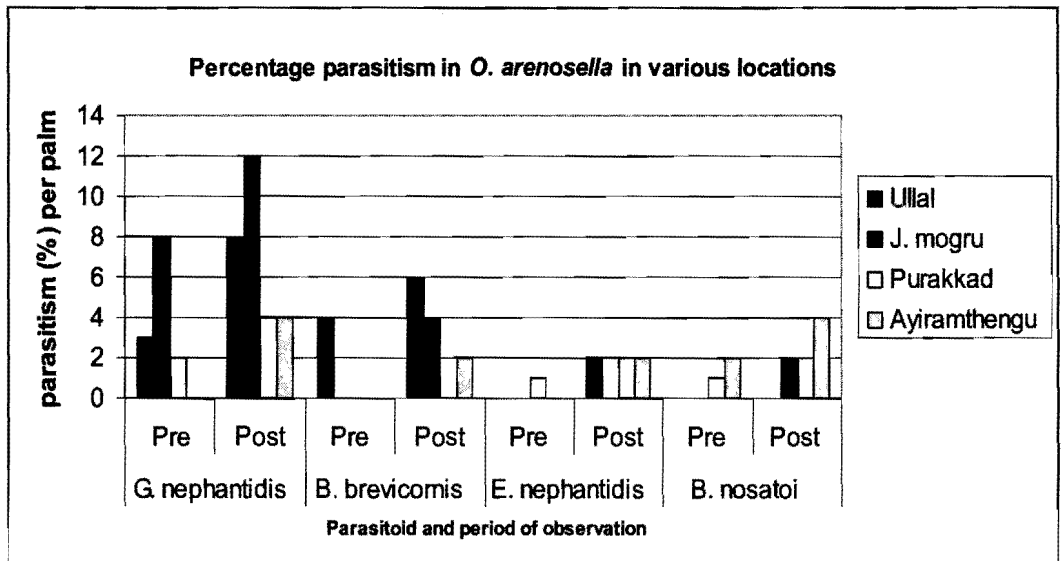


Fig. 42.2. Percentage parasitism on *O. arenosella* during pre and post release period

In the field, natural parasitism by the released parasitoids could be observed to be more frequent (Table 42.3). In addition to the released parasitoids, *Apanteles taragamae* an early instar parasitoid was consistently observed in Ullal. Presence of predators viz., anthocoreids, *Parena nigrolineata* and various species of spiders was noticed in the field in all the locations. The higher frequency of occurrence of *G. nephantidis* in all the locations during post-release period indicated the suitability of this larval parasitoid to adapt in various locations in the coastal belt of Kerala and Karnataka. Similarly the predominance of *Bracon brevicornis*, another larval parasitoid in Coastal Karnataka also highlights the importance of releasing this parasitoid.

Table 42.3. Relative abundance of parasitoids present during the experimental period

Location	<i>G. nephantidis</i>		<i>B. brevicornis</i>		<i>E. nephantidis</i>		<i>B. nosatoi</i>		Other parasitoid and predators
	A	B	A	B	A	B	A	B	
Ullal	++	+++	+	++	-	+	-	+	<i>A. taragamae</i> Anthocoreids
J. mogru	++	+++	-	++	-	-	-	+	Anthocoreids
Purakkad	+	++	-	-	+	+	+	+	Spiders
Ayiramthengu	-	++	-	+	-	+	++	+++	Spiders, <i>Parena</i>

Time of observation: April-May; A – pre-release period (1999); B – post-release period (2001), – Absent or not observed; + present; ++ available more frequently; +++ always available.

The results of this large area field release of parasitoids for management of coconut leaf eating caterpillar indicated that the pest population could be brought down to very negligible level by the timely release of stage specific parasitoids. These results are in accordance with the findings of Sathiamma *et al.* (1996) who had reported 94 % reduction in pest population by the release of stage specific parasitoids at fixed norms and intervals in a heavily infested coconut garden of 2.8 ha (Thodiyoor, Kerala) for a period of four years. Chandrika Mohan ad Nair (2002) reported 52.6 and 94.7% reduction in pest population after one and two years, respectively of parasitoid release in heavily infested homestead coconut gardens in an area of 3 ha in Neendakara (Kerala). For large area field management of the pest in an epidemic out-break, inundative releases of parasitoids in the initial periods at fortnightly intervals and further monitoring and augmentative releases during probable periods of pest build up is required.

The population fluctuation of the pest shows distribution throughout the year with peak in summer months. In all the locations after the pest suppression in the first year of parasitoid release, slight build up of the pest begins at the post monsoon period during October–November. Proper monitoring for the build up of pest population is the most important step to be adopted in endemic areas. Clipping of the affected leaflets and cutting

and burning one or two highly affected lower whorl of leaves, if they do not support the bunch, is helpful to prevent the pest from attaining severe proportion. During early stage of pest build up, one or two inoculative release of parasitoids is essential to maintain the pest/parasitoid ratio.

The present study shows more light on the importance of regular surveillance and monitoring on the pest parasite buildup and is suggestive of triggering augmentative release of appropriate parasitoids at the early stage of pest build up. This technology of non pesticidal IPM for field management of *O. arenosella* can be well integrated in the organic farming technology for better crop protection.

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