

ATTEMPTS ON INTRODUCTION AND COLONIZATION OF THE EXOTIC REDUVIID PREDATOR, *PLATYMERIS LAEVICOLLIS* DISTANT FOR THE BIOLOGICAL SUPPRESSION OF THE COCONUT RHINOCEROS BEETLE *ORYCTES RHINOCEROS* L.

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ABSTRACT

Vander Plank (1958) detected along the east coast of Africa *Platymiris laevicollis* Dist., a predaceous bug preying on natural populations of *Oryctes monoceros* Oliv., and *O. boas* F., which are pests on coconut palm in those regions. However, no such predator attacking and killing adults of *O. rhinoceros* L. has been recorded from India so far. Hence its predatory habits and alienity have been taken advantage of in a trial on its introduction and colonization against *O. rhinoceros* in India. Viable culture of the predator was obtained from different sources including its native home viz. Zanzibar. In an attempt to colonize the predator under different agro-ecological conditions, laboratory bred bugs were released in large numbers on the crowns of palms at Pandalam (Kerala), Androth (Lakshadweep) and Vittal (Karnataka). At Pandalam where field release of the bugs was done from 1968-74, the live population of the beetles in the crowns of one hundred palms under release was observed to be comparatively less than that of the dead beetles collected from the palms on which the predators were released. Consequent on the decrease in population of the beetle and the corresponding dip in incidence of the pest on the crowns of palms the intensity of infestation on leaves and unopened inflorescence had also come down. In Androth Island these bugs were released on 200 palms which were very heavily infested by the beetle with a high population density (243 beetles on 155 palms). On the fifth day after the release of the predator 213 beetles were found fed on and killed by the bug whereas 45 beetles including the newcomers were alive. Indications of establishment of the bug were also noticed at Pandalam, and at Vittal, where the bugs are being released regularly from 1971 onwards. At Vittal the incidence of the beetle in the crown of palms and the consequent reduction of damage on the spindle and spathe continued to be comparatively less than the pre-release incidence. Release of the predator at Vittal Centre is being continued.

INTRODUCTION

Platyeris laevicollis Distant (Heteroptera : Reduviidae), earlier known as *P. rhadamanthus* Gerst., is a native of the Ethiopian Region where different species of *Oryctes*, other than *O. rhinoceros*, are present. In this region along the east coast of Africa including Zanzibar Island, Vanderplank (1958) observed on the crowns of the coconut palms these assassin bugs preying on populations of *O. boas* Fabricius and *O. monoceros* Oliver which cause serious damage to leaves and inflorescences of the coconut palms. But such an insect predator attacking and killing adults of *O. rhinoceros* is not met with in the Oriental region or any other region where this pest has been newly introduced. So the predatory habit and alienity of this exotic predator have been taken advantage of in a trial on its introduction and colonization for the biological suppression of *O. rhinoceros* which is ubiquitous and serious along the coconut growing tracts of the Indian Union.

Rhinoceros beetle because of its wide distribution and remarkable adaptive capabilities for breeding in a variety of larval feeding media; the adults feeding on different kinds of host plants and of the unrestrained havoc it causes in the islands where it has been newly introduced, the biotic method of suppression will be more easy and successful and economical than other means of pest suppression. The arboreal habit of this predator is also beneficial since its prey, the beetle, also is arboreal in habit during most of its life time.

MATERIALS AND METHODS

A nucleus culture of *P. laevicollis* in its different stages was obtained from three different sources. During 1957, the first consignment of 20 eggs was got down from Mauritius through Dr. T. V. Venkataraman, (South Pacific Commission Entomologist). Second source of supply was the Common wealth Institute of Biological Control, Indian Station, Bangalore. One hundred eggs and 10 second instar nymphs were consigned during 1967 followed by another consignment of 25 third and fourth instar nymphs during 1968. Added to

these a bulk supply of 1738 eggs was also received during 1968 from Mr. A. Catley, Project Manager, Research on the Control of the Coconut palm rhinoceros beetle, Western Samoa. With these materials, the biology and behaviour of this exotic predator under local conditions were studied and techniques for mass multiplication were evolved and perfected subsequently. By July 1969 a mass culture of the predator with all stages from egg to adult was built up. So, in order to study its establishment and efficacy in suppressing the beetle population in the field, three places, one in Lakshadweep and two in the mainland at Pandalam, Alleppey district, Kerala and Vittal, Karnataka, under different agro-ecological conditions having very heavy beetle incidence on the crowns of palms were selected. The bugs released in the field were mostly gravid females and adult males (30-40 days old) and also nymphs of the third, fourth and fifth instars

The schedule of release of the bugs for Pandalam was four times a year just before and after the North-East and South West monsoons. For Androth Island (Lakshadweep) no such schedule was observed, but releases were made as and when the passage to the island was convenient and for Vittal it was mostly once in three months. Releases of the bugs were made on the crowns of 100 palms each at Pandalam and Vittal and on 200 palms at Androth Island, the number released at each time being 1-5 bugs per palm. At Pandalam 50 palms on the border of the release site were kept as checks. At Androth Island the release of the bug was commenced during 1968 and continued till 1971 with a total release of 3188 adults and 500 third and fourth instar nymphs. At Pandalam during the period from 1969 to 74, 9100 bugs including 800 fourth and fifth instar nymphs and at Vittal the release was initiated during 1971 and till date 8516 adults and 900 third, fourth and fifth instar nymphs were liberated and is being continued. Sex ratio of the adults, male to female was 1:3. Pre and post release conditions of the selected palms at Pandalam and Vittal with regard to injury to leaves and inflorescences, fresh incidence and the presence of beetle as well as bugs, both live and dead were recorded.

At Pandalam even after the discontinuation of the release of the bugs a follow-up observation of the 150 palms after a lapse of two years was again made. In Androth the pre-release condition of the 200 palms with regard to intensity of infestation and population density of the beetle was first observed. In order to study the immediate effect, on the natural beetle population after releasing, 1,000 bugs at the rate of 5 bugs per palm, the palms were again observed on the 5th day after the release.

RESULTS AND DISCUSSION

Two hundred palms selected at Androth Island for the release of bugs were of very high intensity of beetle infestation, certain palms having more than three beetles each on the crown. Of the 200 palms having a total of 5565 leaves and 1697 inflorescences including immature bunches, more than 90% of the total leaves and 40% of the inflorescences and bunches were damaged by beetle. Along with the release of the bugs (at the rate of 5 bugs per palm) a census of the beetle population on each of the 200 palms revealed the presence of 243 live beetles on 184 palms. On the fifth day, after the release of the bugs, from the leaf axils of 154 palms 213 dead and 45 live beetles including the newly migrated ones were observed on 32 palms. Maximum number of dead beetles present on a single palm was three. In certain palms even though live bugs were present the beetles were not killed. Bugs were also found dispersed towards the periphery of the island. Follow-up search made during 1971 for the establishment of the predator did not show any of the progeny of the released ones in and around the site of release.

At Pandalam, in Kerala State in an area of nearly 60 ha having about 2150 palms, 100 palms for the release of the bugs and 56 as check palms along the border were selected adopting a simple random sampling technique from the heavily infested group of palms. The pre-release condition of the one hundred palms having a total of nearly 2500 leaves and 284 unopened inflorescences, 1132 leaves and 44 inflorescences showed symptoms of damage caused by the

attack of the beetle. Besides 56 of the one hundred palms showed fresh incidence of the beetle on the spindle with 24 live beetles, one each on 20 palms and two each on 2 palms. Fresh incidence on the inflorescence, one in each palm was observed on two palms but without any beetle. In the 50 border check palms having 1253 leaves and 147 inflorescences, 498 leaves and 19 inflorescences were subject to beetle damage and fresh incidence on the spindle was on 27 palms with 7 live beetles, one on each of the 7 palms. On 2 palms fresh incidence on the inflorescence was observed without the presence of the beetle. The pre-release observations of 100+50 palms are presented in Table 1.

Table 1. Pre-release condition of the 100 palms under release and 50 border check palms.

Year of release	No. of palms	% of attacked		Fresh incidence on		Beetle Present
		Leaves	Infls.	Spindle	Infls.	
1969	100 (under release)	45.28	15.49	56	2	24
July	50 (Border)	39.74	12.99	27	2	7

Annual observations following the release of the bugs showed a gradual decline in the pest population with a remarkable decrease in fresh incidence on spindle as well as on unopened inflorescences. On both groups, palms under release as well as check palms on the border (without release) more number of dead beetles were present. The ultimate result after inundative release of a total of 9,100 bugs during 1969-74 was as follows:- The leaf attack of 100 palms on which periodic release of the bugs were made has come down from 45.28% to 23.43%; attack on inflorescence was nil against 15.49% with the fresh incidence on the spindle reduced from 56 to 5 and that on the inflorescence from 2 to nil, with 26 dead beetles and 7 live beetles distributed on the crowns of 23 palms as against 24 live beetles on 21 palms before the

the commencement of the release. The border palms which are maintained as check to study the dispersal of the predator also showed its effect on the border population of the beetles as well as its damage. Attack on leaf has come down from 39.74% to 24.16%, inflorescence attack from 12.99% to nil with the fresh incidence on spindle from 27 to 4 and that on the inflorescence from 2 to nil with 9 dead and 2 live beetles on the crowns of 9 palms. Presence of live as well as dead bugs was also noticed on the palms under release as well as on border palms. Nymphs were also present along with the adult bugs. The post release data are summarised and presented in Table 2.

Two years after the discontinuance of release of the bugs, during July 1976 the condition of the 150 palms was assessed again as before. Beetle population was found to be on the increase, with the result that an increase in the attack on leaves and inflorescences with increased fresh incidence on spindle as well as on unopened inflorescence was noticed. In the 100 palms on which the bugs were released the percentage of attack on leaves and inflorescences has shown an increase from 23.43 to 40.07 and from nil to 14.72 respectively with 3 dead and 12 live beetles in the crowns of 13 palms. So also fresh incidence on spindle has gone upto 41 and that on inflorescence from nil to 2. A similar increase in pest population with a consequent increase in the number of the attacked leaves with increased number of incidence on the spindle as well as the inflorescence with greater number of live beetles was observed. Observations after the discontinuation of release are summarised in Table 2. Pre and post release condition of the palms under release and the border check palms and also the conditions of the both group of palms after the discontinuation of release are compared in Figure 1.

At Vittal in Karnataka State, the release of the exotic predator was initiated in November 1971. The prerelease observation of 100 experimental palms revealed 59.2% leaf attack, 2.5% spathe attack and 37% fresh incidence. During the latest round of observations 27.6% leaf attack, 1.20% spathe

Table 2. Post-release condition of the 100 palms under release and 50 border palms with the follow-up observations after the discontinuance of release.

Year of Release	No. Released	Date of Observation	No. of Palms	% Attacked Leaves	Infls.	Fresh incidence on Spindle	Beetle / Bug present Live	Beetle / Bug present Dead	
1969	400	Nov. 1969	100	42.95	3.39	18	9/7	17/Nil	
			50	37.24	3.57	2	Nil/Nil	3/Nil	
1970	500	Nov. 1970	100	24.75	Nil	5	5/4	12/2	
			50	30.18	Nil	7	3/Nil	2/2	
1971	1300	Nov. 1971	100	24.48	Nil	7	4/6+2	10/5	
			50	28.12	2.89	5	2/1+3	3/Nil	
1972	1800								
1973	1300								
Observations not recorded									
1974	3000	Aug. 1974	100	23.43	Nil	9	7/4+3	26/4	
			50	24.16	Nil	4	2/2+1	9/3	
After Discontinuance of release		July 1976	100	40.07	14.72	41	12/Nil	3/Nil	
			50	34.60	13.33	23	9/Nil	2/Nil	

+ 1, + 2 and + 3 represent the number of nymphs present in the crowns of palms.

Pre- and Post-release Condition of the palms under experiment with the follow up Observations two years after discontinuation of release of bugs.

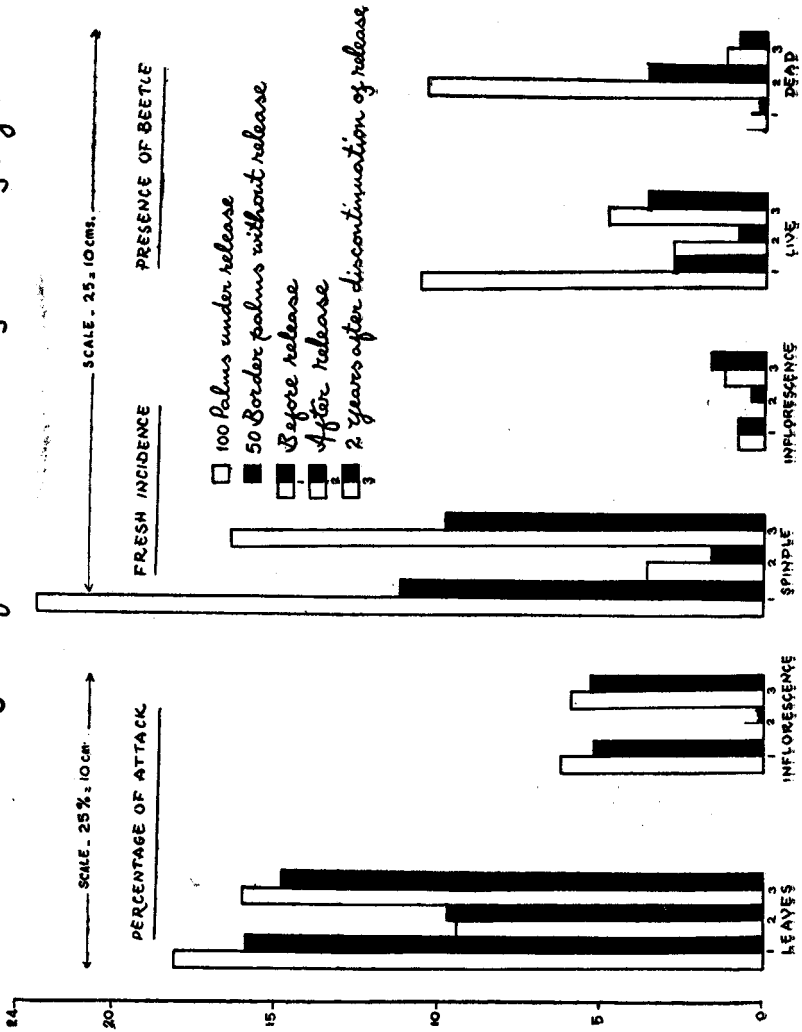


Fig. 1

attack and 18% fresh incidence were recorded. The reduction in percentage of leaf attack and fresh incidence and presence of a high proportion of dead beetles on the crowns of palms indicate the efficacy of released predator in bringing down *Oryctes* population. The release of the predator is being continued and its establishment watched.

An introduction programme is not complete until we have determined the establishment of the introduced species and also its rate of dispersal. This is usually done by making field observations. The presence of the introduced species may be determined visually in the field. But such observations with regard to a nocturnal insect like *P. laevicollis* during day time cannot be taken as the correct record. After the initial determination of the simple presence of the introduced organism we will have to determine dispersal from the point of release/establishment. In this case only the adults have wings and they disperse by flight. At Androth Island no establishment could be observed since no progeny of the introduced bugs could be traced out. But at the same time individuals from the released population were found on the crowns of the adjoining palms at a distance of nearly 1 km. from the release site after the lapse of one year. Hence it is evident that the adult bug is capable of dispersal. But there was no build up of population and establishment in the island. The population density of the pest in the island was quite high and as such there was no dearth of prey for the introduced adult predator. But food for the early instar nymphs such as small insects were comparatively less in the crowns of palms and so the early stage nymphs may be starved to death and thus its multiplication can be hindered. The efficacy of the introduced predator in the island was clearly indicated by the presence of a high proportions of dead beetles on the crowns of the palms under release.

At Pandalam and Vittal indications of some sort of a temporary establishment were obtained by the presence of progeny of the released ones as fourth and fifth instar nymphs and eggs. At Pandalam, dispersal from the palms under

release to the border and other adjoining palms were also observed. But there was no further build up of the population and even if they multiply they got dispersed to the adjoining areas since those release sites were not completely isolated. They get diluted and therefore only a meagre population could be observed at the release site during day time.

The final stage of natural enemy introduction programme is the assessment of its effectiveness. Until we can explain why an introduction programme is a success or failure, biological insect suppression will remain an art, not a science. If we observe that the establishment of the introduced species followed by its increase in numbers at the expense of the target stage of the pest and the target pest population obviously decreases then we have established a probable cause-effect relationship. The effectiveness of the predator in suppressing the beetle population at the three places of release is quite evident from comparison of the pre-and post release data. At Pandalam and Vittal suppression of the beetle continued as long as the release of the bug is continued. Comparatively larger number of dead beetles were collected from the crowns of palms. Thus a decrease in pest population without any multiplication and increase of the introduced predator was observed. Thus the introduction programme can be considered to be a partial success. Even though this exotic predator has not got all the desirable attributes of an efficient biological control agent, in the absence of an endemic insect predator on adult beetle in India it offers some promise as a biological control agent which has got the potential of reducing beetle population numerically to some extent.

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