STUDIES ON *PARADASYNUS ROSTRATUS* DIST. (HETEROPTERA: COREIDAE) A PEST OF COCONUT

CHANDY KURIAN, V. A. ABRAHAM, AND K. M. ABDULLA KOYA
Central Plantation Crops Research Institute, Regional Station, Kayangulam, Krishnapuram P. O. - 690 533, Kerala. India.

ABSTRACT

Paradasynus rostratus Dist. a coreid bug was recently recorded as a new pest of coconut in India. The nymphs and adults feed on the tender nuts causing immature nut fall or malformation of nuts. There are five nymphal instars and the total life period is 82-97 days. The description of various stages, life history, nature and extent of damage and the distribution of the pest in space and time are discussed.

INTRODUCTION

Coconut palm is subject to the attack of various insect pests in all stages of its growth. Johnston (1965) published a list of 471 pests of coconut palm from all over the world. Among Hemipterans, bugs of the family Coreidae are reported to cause direct damage to the inflorescence. *Amblypelta cocophaga* China, *Amblypelta lutescens* Distant and *Pseudotheraptus wayi* Brown (Lever, 1969) are serious pests in the Solomon Islands, New Guinea and East Africa respectively. From India the first record of a coreid bug associated with coconut as a pest was made by Kurian *et al.* (1972) from Kerala. Kurian *et al.* (1976) described the damage done by this species in India and related species in other coconut growing countries. However the first collection of this coreid from coconut in India was made from Kerala (Krishnapuram, Alleppey District) by Kurian in 1959. The pest was identified and confirmed as *Paradasynus rostratus* Dist. in 1976. Nair and Remamony (1964) reported this pest from tender cashew nuts collected in Trivandrum. A detailed study of the description of various stages, life-history, extent of damage and distribution in space and time was made at this Research

Institute from 1971 to 1976. Results of the same are reported here.

Materials and Methods

Field collected adults of the bug formed the material for the initiation of biology studies. Male and female, one each was caged in open mouthed glass bell jars with their mouths plugged with cotton rolls. Tender nuts were supplied as food. Eggs laid on tender nuts, rachis etc. were kept under fresh bell jars for hatching. Newly hatched nymphs were caged in bell jars for life history studies. Seasonal variation studies were made by taking observations on one thousand eight hundred bearing coconut palms in CPCRI Regional Station campus at quarterly intervals, for five years from January 1972 to December, 1976, recording the number of damaged nuts. Even if one nut was seen attacked the tree was recorded as infested. Studies on the nature of damage were made observing one month old bunches in the field enclosed along with the pest in muslin cloth cages. Distribution of the pest was studied from the various coconut growing tracts of India by periodical surveys.

Results and Discussion

Eggs

1.5 - 1.75 mm long and 0.75 - 0.9 mm wide at the middle, laid in clusters of 40–60 on leaf-petiole, spathe, spadix or nuts, disposed horizontally. Individual egg is somewhat elongate-oval, brown with an yellowish tinge when freshly laid and reddish hue with golden tinge as it advances the development. Cephalic end with a cresent shaped black marking succeeded by a red dot and vacuole-like airspace closely following behind. On the dorsal aspect can be discerned faint reddish-browne longitudinal striations and a general coriaceous sculptur, revealing on closer scrutiny a shagreened appearance.

First instar

Just hatched nymphs measure 2.5 x 0.75 mm. They are brick red in colour except for comparatively lighter dorsal aspect of metathorax and basal one-third of abdomen and two black markings on the abdomen.

Head nearly as long as thorax, length slightly more than the width, lighter in colour than the rest of the body. Antenna 2.7 mm long, inserted in front of eyes and placed on either side of frons, four jointed; first, second and third antennal joints subequal, third laterally compressed, terminal joint one and a half times the third; somewhat pubescent, with short spines scattered all over; approximately of the same colour as the body except for paler terminal joint. Rostrum prominent, 2 mm long, at rest tucked under the ventral aspect of the body. Eyes prominent, bare, situated laterally at the middle of head, dark red in colour. Ocelli absent, vertex and occiput smooth and shiny.

Pro, meso and metathorax clearly marked. Prothorax at its dorsal aspect with two dark horn-like processess one on either side of the median line, metathorax broader than pro and mesothorax; mesothorax with two processes shorter than those on prothorax; one on either side of the median line. Dorsal longitudinal median line originates from metathorax and appears to continue on the vertex and frons, bifurcates and run to lower orbital borders. Fore, mid and hind legs are nearly of equal size, femur and tibia covered over by spines,nearly of the same size; coxa, trochanter, femur and tibia dark reddish-brown; tarsi darker, three jointed pulvillus/ plantulae present.

Length of abdomen nearly equal to head and thorax combined, width subequal to length; tergites smooth and shiny, very sparsely pubescent; semicircular dark coloured patches run middorsally on fifth and sixth abdominal

tergites projecting into posterior aspect of the just preceding segments (Fig. 1).

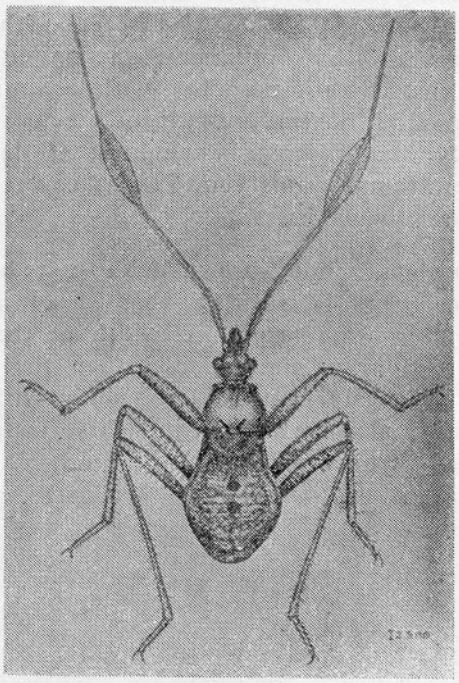

Fig. 1. Ist Instar nymph of *Paradasynus rostratus*

Second instar

Measures 5 mm long and 1mm wide at prothorax, dark ferruginous red to dark reddish-brown with lighter abdomen which has a wine red hue

Head slightly longer than broad, nearly as long as thorax and concolorous with the same. Antenna 7 mm long, dark reddish brown, third joint somewhat lighter than rest of antenna and phyllate. Rostrum prominent, 5 mm long, slightly slender than tarsi, at rest extend very slightly beyond the abdomen and tucked underneath the body between coxae and equal to the length of entire body. Eyes prominent, bulging, bare and dark brown to

black, ocelli absent. Thorax smooth and shiny, mesothorax longer and broader than pro and metathorax, metathorax being the shortest. Head and thorax closely apposed. Prothorax on its dorsal aspect with two prominent spinous papillate processes, one on either side of the median line; metathorax also with a similar pair of processes, but slightly less prominent. Legs concolorous with the body, femur somewhat lighter; all legs nearly of the same size; femur, tibia and tarsi covered over by reddish brown spinous hairs.

Abdomen dark reddish-brown with a reddish hue in certain angles, slightly shorter than head and thorax combined; length nearly equal to width at the apical one-third, more broader at the middle than the rest of abdomen; tergites nearly smooth and shiny with two dark patches medially placed as in the first instar; apex of abdomen nearly truncate (Fig. 2).

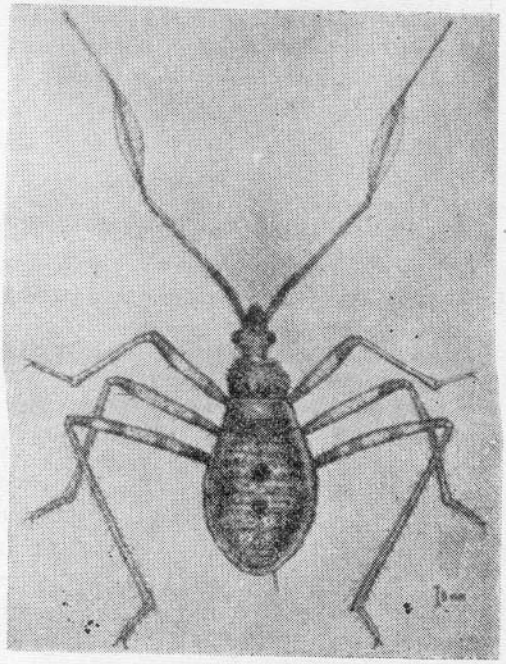

Fig. 2. 2nd Instar nymph

Third instar

Measures 6-6.5 mm long and 1.5 mm wide at prothorax; dark ferruginous red to dark reddish-brown and black, comparatively lighter towards the sides.

Head as long as thorax, nearly one and a half times as long as broad, concolorous with thorax. Antenna 10 mm long, dark reddish-brown, third joint ferruginous red and phyllate, joints subequal. Rostrum 5.5-6 mm long. Eyes as in the previous instar. Ocelli absent.

Pro., meso and metathorax clearly defined, smooth and shiny; mesothorax longer and broader than pro and metathorax, metathorax shortest; prothorax at the point of apposition to head somewhat narrowed, the pair of

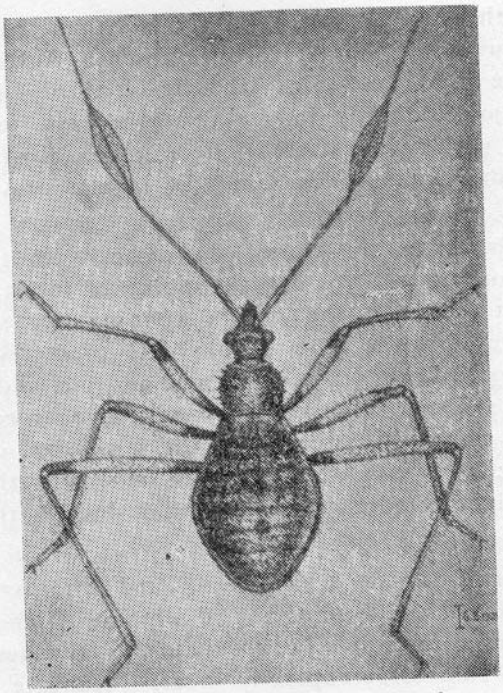

Fig. 3. 3rd Instar nymph

papillate processes on its dorsal aspect definitely larger than that on mesothorax; hind tibia longer than femur and nearly thrice the tarsi combined; femur, tibia and tarsi covered over by reddish-brown spinous hairs.

Abdomen shorter than head and thorax combined; tergites smooth and shiny, with two dark patches in the medio-anterior part of the fifth and sixth abdominal tergites overlapping into the previous tergites; posterior part of abdomen narrows, but apex nearly truncate (Fig. 3).

Fourth instar

Length 8-9 mm and width 2 mm at prothorax, viewed dorsally dark ferruginous red to dark reddish-brown and black, sides concolorous with that of tergites.

Length of head very slightly less than that of thorax, concolorous with thorax; ocelli absent. Antenna 11 mm long, one and one-third the body; third joint phyllate, terminal joint slightly longer than the rest, joints clearly pubescent with few scattered longer setae. Rostrum prominent 7.5 mm long. Eyes same as in the previous instar.

Details of thorax almost the same as in the previous instar; prothorax narrow at the point of insertion of head; carinate at the sides, the carina running posterio-laterally and diverge upto the base of papillate processes. Dorsally and on the prothorax is seen a median line and anteriorly on either side of this are seen the above processes. Wing buds very small. Legs nearly of the same size, concolorous with body; hind tibia longer, but narrower than femur; setation slightly more prominent than in the third instar.

Abdomen shorter than head and thorax combined, tergites smooth and shiny; medially in fifth and sixth tergites are found two dark patches; tergites laterally beset with fine setae apically nearly truncate and bearing a small conical protuberance, medially disposed (Fig. 4).

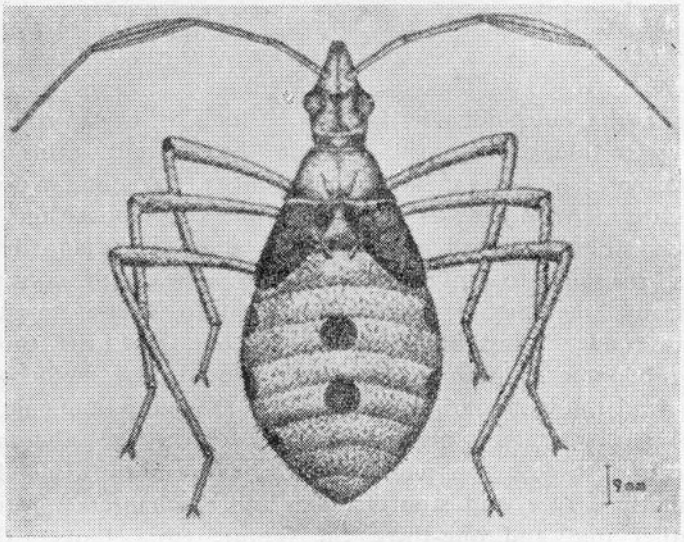

Fig. 4. 4th Instar nymph

Fifth instar

Measures 13 mm long and 2.5 mm wide at prothorax and 3 mm at abdomen; dark reddish - brown in colour with a brighter red tinge on ventral aspect; immediately after moulting from fourth to fifth instar the whole insect appears blood red in colour; wing buds prominent, 4 to 5 mm long.

Head reddish-brown, length two-thirds the thorax, nearly one and a half times as long as broad, bare, ocelli very indistinct and in its place are seen vague projections and black marks; interorbital distance three-fifths the width of the head at the orbital area. Antenna measures 14 mm, slightly longer than the whole body, four jointed; first and second subequal, third shortest, flagellate; fourth joint one and a half times the third. Proboscis subequal to length of body reaching nearly the middle of the penultimate abdominal sternite, concolorous with the body, needle-like stylet, normally disposed within

the longitudinal groove in the proboscis; frons, vertex and occiput nearly smooth and shiny.

Thorax one and a half times as long as head, reddish-brown to black with the margin brick red; prothorax as broad as meso and metathorax, triangular with the apex truncate at the region of apposition to head, sides provided with ridges and a median leniar fossa running to anterior end and appears to continue on head as median longitudinal streak upto level of insertion of antennae. Wing buds more than one-third the thorax and abdomen combined and cover meso and metathorax and first-four abdominal tergites at the sides and upto a level with the first black callous patch in the abdomen. Fore and middle leg nearly of the same size. Hind legs distinctly larger and stouter; coxa and trochanter subequal, together one and one-third the femur; tibia longer than femur and slightly less than coxa., trochanter and femur combined, setation more prominent than in the rest of leg; tarsi 3-jointed, first and third subequal and individually nearly twice the second; plantulae psesent.

Abdomen dark brown with black streaks in the lateral margin, boat shaped, nearly twice the thorax and slightly more than the head and thorax combined; nine tergites visible; fifth and sixth with black rounded callous marks placed in the anterio-median aspect of tergites, overlapping slightly into the preceding tergites; first and second tergites short; third, fourth and fifth larger and remaining tergites gradually becoming shorter and narrower; seventh and eighth combined equal to the sixth; viewed ventrally sides are depressed, seven sternites clearly visible, first ferruginous red, second and third with a blackish tinge and rest concolorous with the first; third and fourth sternites longer and broader than the rest, fifth onwards gradually become shorter (Fig. 5).

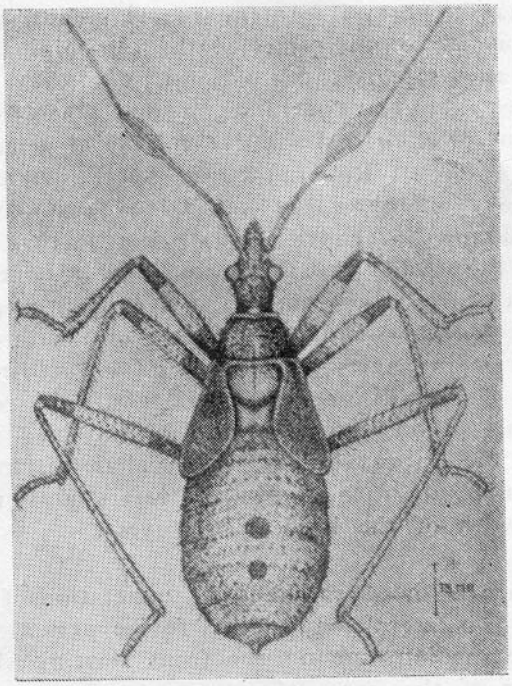

Fig. 5. 5th Instar nymph

Adult

Female

measures 16–17 mm long and 5.5 mm wide at prothorax; female slightly bigger than male with slightly broader abdomen; chocolate brown in colour; wings in position completely cover the abdomen, slightly overlapping the apex; ventrally with a reddish hue and removal of wings reveal the ferruginous red colouration of meta-thorax and anterior part of abdomen.

Head somewhat prognathous, with a slight opisthognathous tilt; colour same as rest of body. Eyes posteriolaterally disposed on the head; head and eyes proportionately small as compared to the rest of the body, in which haracter they differ from the nymphs where the head is

proportionately normal. Antenna same colour as that of body and nearly of the same length; four-jointed, segments nearly of the same length, except the third which is comparatively shorter; fourth segment with basal one-fourth whitish; antennae arise from the middle of gena from two prominent sockets. Rostrum 8 mm long, slender, tucked under abdomen between the coxae and reach middle of second abdominal sternite; colour same as that of body; 4-jointed, first and second subequal, third the smallest and fourth nearly twice the third. Eyes slightly prominent as compared to the small head, dark brown with a metallic lustre in certain angles, bare; situated on either side of the frons; two ocelli present, prominent, with crystalline red hue: placed on vertex, slightly behind the middle of eyes, near the optical border; interocellar distance thrice the ocellocular, interorbital distance very slightly more than half the width of the head at the eyes.

Sculpture of head well defined, punctations finer than in thorax, two lateral longitudinal foviae present on either side of the median line on the frons starting slightly to the interior of the area of insertion of antennae and running to the end of face from where the rostrum arises; two flap-like expansions on either side of the site of origin of rostrum; vertex and occiput with a rough rugose sculpture.

Thorax nearly thrice as long as head, slightly longer than broad. Pronotum large and forms the greater part of thorax when viewed from above, with a collar-like ridge, with two posterio-lateral expansions ending in a spinous process; a faint median carina arises from the anterior ridge, run posteriorly down to a transverse fovea at the posterior end of prothorax; two callous-like areas anteriorly placed, one on either side; rugoso-reticulately sculptured with a leathery appearance. Mesothorax separated from prothorax by a deep transverse fovea; with a median triangular scutellar area, narrowing down posteriorly with lateral carina on either side of the converging sides, still lateral to which are distinct foveae on the

outer aspect of which the mesothoracic wings (forewings) arise. Triangular area of mesoscutellum sculptured same as in prothorax; metathorax nearly concealed by the triangular extension of mesoscutellum and is visible only from the sides, when wings are in the normal resting position. When wings are removed metathorax becomes clearly visible, though when viewed from above medially it is hidden by the triangular apical region of mesothorax; when the whole insect is tilted forward metathorax becomes clearly visible, nearly smooth and shiny, brown with a ferruginous tinge, with a transverse carina covering nearly two-thirds the width of metathorax. The sternites are for the most part fused with the respective pleura; pro, meso and metasternites with a lateral black dot on either side.

Forewings at rest cover the mesothorax except for the triangular area, metathorax and abdomen. The proximal

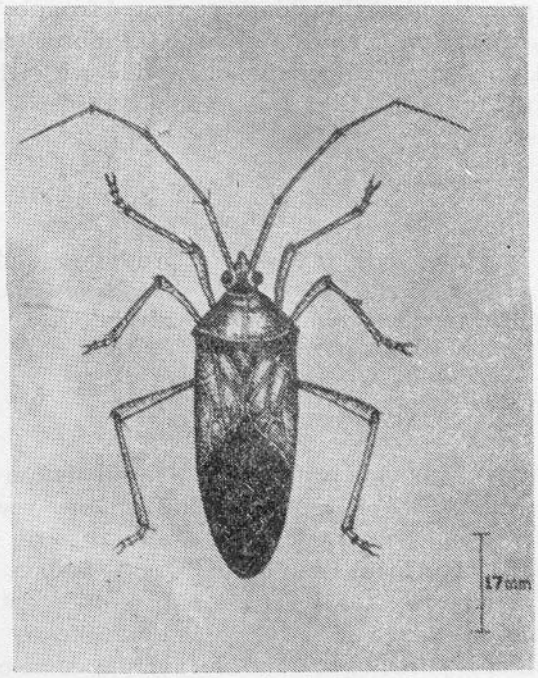

Fig. 6. Adult Female

area covering the corium and clavus is sclerotized, chocolate brown in colour and concolorous with thorax; the distal membranous portion is somewhat transparent, with a light dusky hue more towards the distal end.

Legs yellowish-brown with short dark spines scattered als over giving it a darker appearance. Coxa well embedded in sockets, trochanter as long as coxa, femur slender, more than thrice the coxa and trochanter combined; tibia only half as thick as femur, but nearly equal in length (with no dilation as seen in some coreids); tarsi 3-jointed, together about half the tibia, plantulae present.

Abdomen 5.5 mm wide, boat shaped, laterally raised, nearly concolorous with thorax, slightly darker; 8 tergitel visible, second to sixth larger; first five brown with a ferruginous tinge and apical three darker; viewed from below seven sternites visible; first narrow, second to sixth broader laterally with black dots one on either side on a line with the punctations in the thorax. (Fig. 6)

Male

15-16 mm long and 5 mm wide at prothorax and 4.5 mm at abdomen; other details nearly the same as in female except for the slightly smaller size and narrower abdomen.

Life history

Female lays eggs in clusters (Fig. 7); maximum recorded for a single female is 58. Eggs were laid in 4 or 5 rows closely apposed end to end, otherwise no definite pattern was seen in deposition. The incubation period was 8-10 days with an average of 9 under a temperature range of 26 - 30.5°C and relative humidity range of 83-89%. At the time of hatching the operculum is pushed open and the nymphs come out. The crawling ant-like small nymphs of first instar are seen congr-

egating near the spadix and they cause only light damage to the tender buttons. They shun bright light. First instar period last for 4-5 days with a mean of 4.5. Moulting takes place by a longitudinal rupture of the cuticle dorsally. The second instar nymphs also feed on very tender buttons and are seen to congregate on the spadix or buttons. Second instar was completed in 5-7 days with a mean of 6. Third instar nymphs are found mostly in coconut bunches with buttons/tender nuts and cause severe damage and nut fall. The period of growth varies from 4-6 days with a mean of 5. In the fourth instar also they cause severe damage and nut fall. It is completed in 4–6 days with a mean of 5. Fifth instar period was 8-10 days with a mean of 9. These last instar nymphs cause extensive damage, almost eqnal to that done by adults. Total nymphal period covers 25-34 days with a mean of 29.5 days.

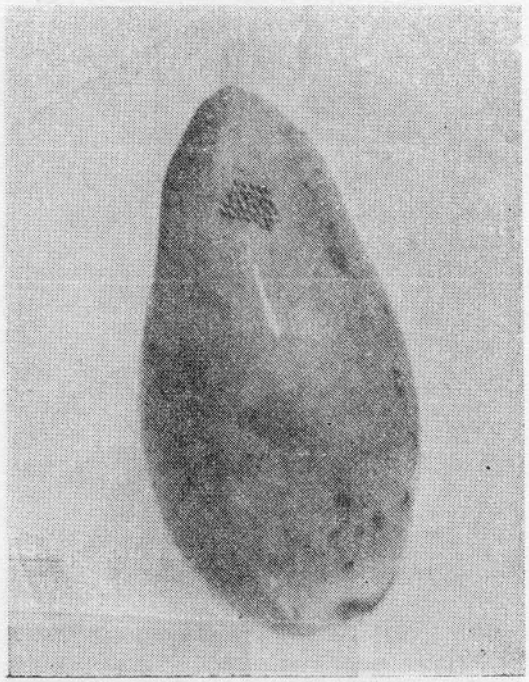

Fig. 7. Eggs laid in clusters

Fig. 8. Adult attacking tender nut

Fig. 9. Crinkles produced by the feeding of bug

Adult bugs are seen on inflorescence and bunches. They cause damage to buttons and tender nuts (fig. 8). They are seen in batches of two or three. Mating takes place a few days after emergence, both in day and night. In the field eggs are seen deposited on spathe, spadix, petiole, leaf-axil or any part of inflorescence. Adult longevity vary between 49-53 days.

Nature and extent of damage

The nymphs as well as adults feed on tender nuts. The feeding caused characteristic, permanent and somewhat deep furrows or crinkles with gummosis on the nuts (fig. 9 and 10).

Fig. 10. Crinkles produced by feeding of bug.

In the field fourth instar nymphs of the bug caged with muslin cloth bag on inflorescence, had fed on all the twenty-one one month old buttons and caused shedding. In another

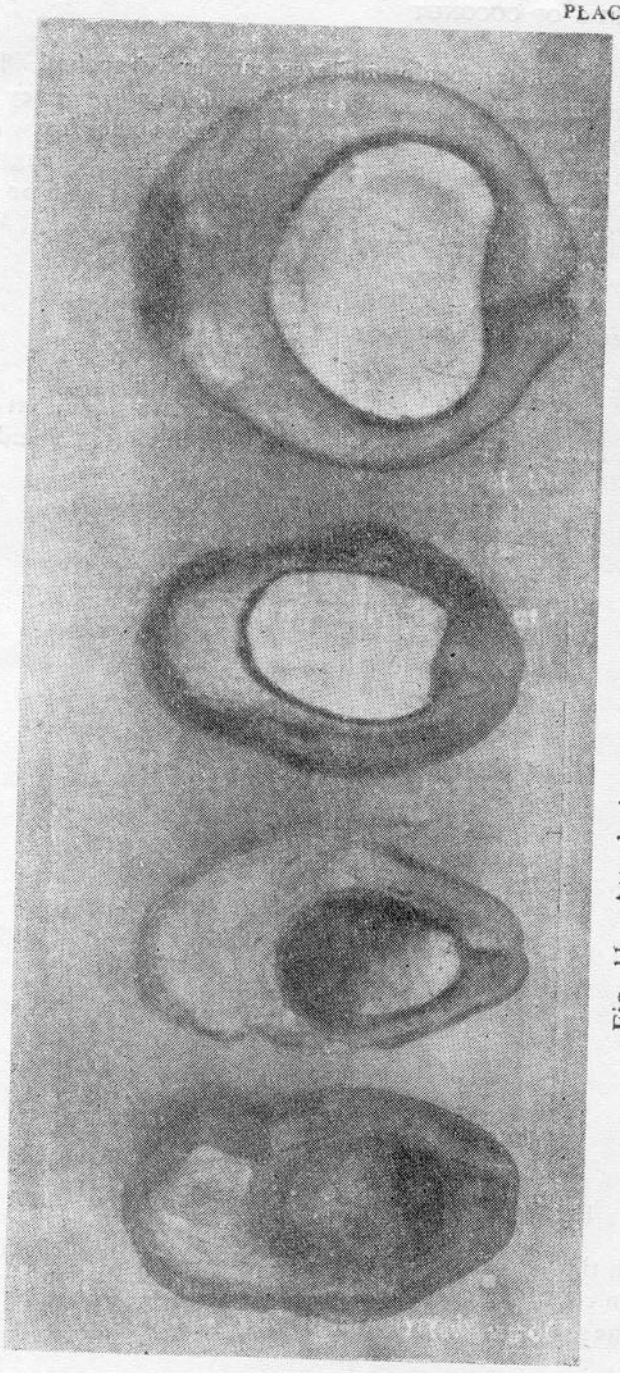

Fig. 11. Attacked nuts compared to unattacked nuts.

bunch those buttons which escaped sedding inspite of attack by the bug developed into undersize or barren nuts with crinkles and gummosis.

This insect possesses a long needle-like proboscis. They thrust this organ into the tender nuts just below the perianth and suck the sap. Such feeding punctures later on develop into necrotic lesions, with deep furrows or crinkles and gummosis. This possibly is due to the action of the toxic principles present in the saliva, injected into the tissue while feeding. Most of the infested nuts are shed. Those that escaped shedding developed into undersized and crinkled or barren nuts (fig. 11). Sometimes bunches with numerous nuts dry as such. Shedding or retention of nuts probably depends on the depth of entry of the stylets and the quantity of saliva injected into the nuts.

Distribution

Infestation was first recorded during 1971 (Kurian *et al* 1972). Subsequently detailed survey was carried out to locate the foci of infestation. Observations revealed that the pest is present throughout Kerala in varying degrees of intensity. The infestation was noted from Marthandom upto Cannanore in the West Coast of India. The pest was also recorded from Thirthahalli in Karnataka State.

This pest causes extensive damage to tender cashew nuts. The affected nuts shrivel and fall off. Recently, it has been observed to infest developing fruits of tamarind *Tamarindus indica* also in Kerala and neighbouring parts of Tamil Nadu. The extent of losses due to this pest upto 65% of the total production during certain years has been observed.

Seasonal variation in infestation

The pest incidence was studied in relation to the four quarters of the year for 5 years at the Institute farm. Maximum average incidence namely 1.91% was observed in January - March and 0.54 in July - September,

a period of direct sunshine and heavy rain. This dip in population holds good for a related species *Amblypelta cocophaga* China (Lever, 1977 personal communication). The percentage incidence in April - June and October-December was 1.64 and 1.08 respectively.

Natural enemies

Nair and Remamony (1964) reported two species of egg parasites *Hadrophanurus* sp. (Scelionidae) and *Anastatus* sp. (Eupelmidae) as natural enemies of the pest. However the extent of control exerted by them is yet to be ascertained.

Conclusion

This study brings to light the details on some aspects of biology of a comparatively unknown or little known but potentially a very important new pest on coconut in India. Though it has also been reported from Thirthahalli, Karnataka, for the present it is mostly confined to Kerala. The importance of the pest, realised from the heavy loss in yield in some areas, warrants a very detailed study on all aspects and the same will be pursued at CPCRI, Kayangulam.

Studies on the control of the pest are being done in pest infested coconut gardens in farmers fields, using 0.1% BHC and endosulfan and 0.05% carbaryl and trichlorphon. Based on our preliminary studies made in CPCRI, Regional Station, Kayangulam and indications obtained therefrom, Department of Agriculture, Kerala State has used carbaryl 0.05% for a large scale field control of the pest in Chirayinkeezhu Panchayat area, Trivandrum District, achieving the desired results. Lever (1977-personal communication) reported that control has been achieved on a related species *Amblypelta cocophaga* in the Soloman Islands by encouraging the spread of *Oecophylla smaragdina* and suggested that this might prove possible in Kerala.

ACKNOWLEDGEMENTS

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