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Biology of Arecanut Spindle Bug, *Carvalhoia arecae* Miller and China (Heteroptera : Miridae)

N. C. KANTHARAJU THIPPESWAMY, VENKATESH HOSAMANI, YALAVAR SHIVASHARANAPPA AND SIDDALINGAPPA

Department of Agricultural Entomology, College of Agriculture
Navile, Shimoga 577204, India

Abstract

The biology of arecanut spindle bug was studied on potted arecanut plants under net house conditions from June to August 2006. The bug completes its life cycle in 30—39 days. The incubation period ranged from 10-11 days. The nymphal stage passed through five instars. The mean duration of I, II, III, IV and V instar was 2.60 ± 0.51, 4.20 ± 0.78, 4.50 ± 0.84, 5.20 ± 0.78 and 8.60 ± 0.51 days respectively. The total nymphal duration of the bug ranged from 22-28 days. The preoviposition and oviposition period occupied 2.45 ± 0.43 and 2.00 ±0.40 days respectively. The bug had the fecundity rate of 10-18 eggs. The adult male and female lived for 12—28 days and 14—35 days with a mean of 18.77 ± 6.39 and 25.66 ± 7.85 days respectively.

Key words : Biology, Spindle bug, Arecanut, Instar, Net house.

The spindle bug *Carvalhoia arecae* Miller and China (Heteroptera : Miridae) was first reported as pest of arecanut palm from Dakshina Kannada (Karnataka) (1). While this as a new genus and species from *Areca catechu* (2). These are brightly colored red and black bugs, inhabit the innermost two or three leaf axils and are of a chronic problem in areca plantations of Kerala, Karnataka and parts of Tamilnadu (3). Both nymphs and adults hiding in leaf axils suck the sap from the emerging spindle and tender leaflets. Fresh feeding marks appear as watery streaks on the infested leaflets and spindle. These linear lesions turn brown and become necrotic resulting in small shot holes. As a result of feeding, the spindle often dries and fails to open. Complete decay and death of the spindle during rainy season is also noticed. Persistent incidence of this pest without preventive measures would be detrimental to the general health and longevity of palm. Seedling and young palms under such condition may die. Now, the spindle bug has assumed the pest status extensively in areca gardens of Shimoga region and causing severe economic loss to the farmers. Only few workers (4, 5) studied the biology of the arecanut spindle bug. For effective management studies on biology of spindle bug is necessary. Hence the present studies summarizes the life history of arecanut spindle bug under net house conditions.

Methods

The detailed study on the biology of the arecanut spindle bug was conducted in the net house during June to August, 2006. The bugs collected from the fields were released on the arecanut plants which was covered with nylon net cage in the net house at College of Agriculture. Shimoga and the stock culture of the bug was maintained for further investigations.

For studying the biology of arecanut spindle bug, freshly emerged first instar nymphs were released on the arecanut plants of one year age, which were enclosed in nylon net. Thirthahalli local, a cultivar of arecanut was used for the studies. The plants were kept free from infestation of all stages of the bug and other insects. Ten freshly hatched nymphs of *Carvalhoia arecae* from the stock culture were released on each plant by using camel hair brush and each plant was immediately covered with nylon net. Observations were made twice a day for recording the nymphal duration, feeding behavior and habit of the nymphs till they moulted into adults.

A pair of newly emerged female and male bugs were released into each arecanut plant, free from infestation of any other insects, to study the biological characters like feeding behavior, mating behavior, preoviposition period, oviposition period, fecundity and adult longevity. Each plant was covered with nylon

Table 1. Duration of different life stages of *Carvalhoia arecae* under net house conditions.

	Stage of insect	Range (days)	Mean ± SD
1	Egg period	10—11	10.50 ± 0.52
2	Nymphal duration		
	I instar	2—3	2.60 ± 0.51
	II instar	3—5	4.20 ± 0.78
	III instar	3—5	4.50 ± 0.84
	IV instar	4—6	5.20 ± 0.78
	V instar	8—9	8.60 ± 0.51
3	Total Nymphal duration	20—28	25.10 ± 2.46
4	Total life cycle (egg to adult)	30—39	36.80 ± 2.72
5	Adult longevity		
	Male	12—28	18.77 ± 6.39
	Female	14—35	25.66 ± 7.85

net cage and five such plants were maintained. For all the observations magnification lens (10 x) was used.

Results and Discussion

Results on biology of spindle bug was described in Tables 1 to 3.

Oviposition

Eggs were laid both during day and night hours. The bugs thrusted the eggs singly into the tissues of tender, unopened spindle of plants. Some times two or three eggs were also found laid together. The site of egg laying became dark in color. Only the operculum of the eggs was seen from outside which appeared as shining mark with two thread like filaments projected out of spindle and rest of the egg was embedded within the tissue of spindle. Eggs were usually oriented more or less parallel to the plant surface

Table 2. Reproductive biology of *Carvalhoia arecae.*

	Parameter	Range	Mean ± SD
1	Mating duration (minutes)	43.00—75.00	53.83±14.90
2	Preoviposition period (days)	2—3	2.45±0.43
3	Oviposition period (days)	1.5—2.5	2.00±0.40
4	Fecundity (numbers of eggs/female)	10—18	13.66±2.87
5	Per cent egg hatch	98—99	98.40±0.61

Table 3. Morphometric data on different stages of *Carvalhoia arecae.*

Stage	Length (mm) Range	Length (mm) Mean ±SD	Width (mm) Range	Width (mm) Mean ± SD
Egg	1.35-1.60	1.44±0.09	0.30-0.35	0.32±0.24
Nymph				
I instar	0.90-1.50	1.26±0.25	0.50-0.90	0.66±0.16
II instar	1.80-2.20	2.00±0.14	1.10-1.40	1.24±0.12
III instar	2.80-3.10	2.94±0.10	1.60-1.90	1.76±0.10
IV instar	3.50-4.00	3.78±0.17	1.80-2.50	2.12±0.27
V instar	4.20-5.30	4.74±0.37	1.90-2.60	2.34±0.25
Adult				
Female	5.20-5.60	5.40±0.14	2.80-3.30	2.84±0.44
Male	4.80-5.20	5.00±0.14	2.50-2.90	2.68±0.14

but some time perpendicular to the plant surface was also noticed when laid in groups.

Egg

The eggs were oval shaped and creamy whitish in color with slightly blackish operculum. The anterior end of the egg was provided with oval convex operculum. Operculum was thicker and rigid. The chorion of the egg was smooth and leathery. There were two silvery shining bristles like structures arised from each end of the operculum. One was large and straight and another was small and curved. The egg measured 1.35 to 1.60 mm in length with an average of 1.44 ± 0.09 mm and 0.30 to 0.35 mm in width with an average of 0.32 ± 0.24 mm (Table 3). The eggs turned to pink and then to reddish due to development of nymph inside. The incubation period lasted for ten to eleven days.

Hatching

Normally eggs hatched during morning hours. Just prior to hatching, the emerging nymph pushed out the operculum of the egg and it crawled out through the opened end of the egg.

Nymph

Five nymphal instars were observed and each instar is described here under along with their duration and morphometric data (Tables 1, 3).

First Instar Nymph

Freshly hatched nymphs were greenish with yel-

low abdomen. Thorax and border of abdomen were light violet brown in color. The head was light yellow with red eyes. The abdomen was oval in shape with nine visible segments. Antennae were four segmented and carried deep brown colored spatulate hairs with transparent tips. The whole body was covered with spatulate hairs including legs. The first instar nymphs were very active and moved fast. The length of the first instar nymph varied form 0.90 to 1.50 mm with an average of 1.26 ± 0.25 mm and width ranged from 0.50 to 0.90 mm with an average of 0.66 ± 0.16 mm. The duration of first instar nymph lasted for two to three days with an average of 2.60 ± 0.51 days.

Second Instar Nymph

The second instar nymphs appeared similar to the first instar except for the size and color. Thorax, border of abdomen, basal portion of legs and antennae were reddish violet in color. Whereas dorsal side of head was light violet in color. Abdomen was greenish yellow in color. Similar to first instar nymph, the whole body was covered with spatulate hairs. The second instar nymphs were also very active and moved very fast. The length of second instar nymph varied from 1.80 to 2.20 mm with an average of 2.00 ±0.14 mm and width ranged from 1.10 to 1.40 mm with an average of 1.24 ± 0.12 mm. The duration of this instar nymph lasted for three to five days with an average of 4.20 ± 0.78 days.

Third Instar Nymph

The third instar nymph was much darker than the second instar. The thoracic region was much darker and the posterior margins of meso and meta thoracic segments were slightly projected backwards indicating the appearance of wing pads. Third instar nymphs were not much active unlike first and second instars. They moved slowly. The length of third instar nymph varied from 2.80 to 3.10 mm with an average of 2.94 ± 0.10 mm and width ranged from 1.60 to 1.90 mm with an average of 1.76 ± 0.10 mm. The duration of third instar nymph ranged from three to five days with an average of 4.50 ± 0.84 days.

Fourth Instar Nymph

It was similar to third instar nymph in appearance with fairly well developed wing pads. The head was elliptical with bulged eyes. Abdomen was greenish in color with dark reddish violet border. This instar moved slowly when disturbed. They were less active. This instar measured 3.50 to 4.00 mm in length with an average of 3.78 ± 0.17 and 1.80 to 2.50 mm in width with an average of 2.12 ± 0.27 mm. Fourth instar nymph occupied four to six days with an average of 5.20 ± 0.78 days (Table 2).

Fifth Instar Nymph

The fifth instar nymph was larger and darker. The head was broader than previous instar. Wing pads well developed reaching upto the third abdominal segment. Abdomen triangular, greenish with reddish brown margin. Last three segments of abdomen were also reddish brown. Many specimens had reddish patch extended anteriorly along mid dorsal line upto third abdominal segments. The length and width of the fifth instar nymph ranged from 4.20 to 5.30 mm and 1.90 to 2.60 mm with an average of 4.74 ± 0.37 mm and 2.34 ± 0.25 mm, respectively. The duration of this instar ranged from eight to nine days with an average of 8.60 ± 0.51 days.

Total Nymphal Duration

The nymphal duration of the bug varied from 20 to 28 days with an average of 25.10±2.46 days.

Adult

The adult was bright, red and black in color having trichoid type of hairs unilike spatulate hairs in nymphs. The head transverse with prominent dark brown eyes. Antennae were dark brown in color. Wings were red and black in color. Extreme apex of corium, cuneus, membrane parts of wing was black in color and remaining was in red color. Legs were slender. The apex of abdomen and genital segments were black in color. Adults moved faster than nymphs.

Female

The female bug was larger than male and measured 5.20 to 5.60 mm in length with an average of 5.40 ± 0.14 mm and 2.80 to 3.30 mm in width with an

average of 2.84 ± 0.44 mm. The abdomen of female broader and stouter when compared to male. The abdominal sterna had a black coloration extended upto the fourth abdominal segment.

Male

The male bug was slightly smaller than female. Here the black coloration in the abdominal sterna confined to lateral border of sixth, seventh and whole of eighth abdominal segment. The male bug measured about 4.80 to 5.20 mm in length with an average of 5.00 ± 0.14 mm and 2.50 to 2.90 mm in width with an average of 2.68 ± 0.14.

Mating

The bugs mated during early morning hours and late evening hours. The mating period ranged from 43 to 75 minutes with an average of 53.83 ± 14.90 minutes. The male and female faced in opposite direction and moved about during copulation. They got separated when disturbed.

Pre Oviposition Period and Oviposition Period

The preoviposition period of the bug ranged from two to three days with a mean of 2.45 ± 0.43 days. The egg laying period of this bug varied from 1.50 to 2.50 days with a mean of 2.00 ± 0.40 (Table 2).

Fecundity

The female bug had a fecundity rate of 10 to 18 eggs with an average of 13.66 ± 2.87 eggs.

Adult Longevity

The adult female lived for 14 to 35 days with an average of 25.66 ± 7.85 days whereas adult male lived for 12 to 28 days with an average of 18.77 ± 6.39 days.

Total Life Cycle

Total life cycle of the bug from egg to adult varied from 30 to 39 days with an average of 36.8 ± 2.72.

Nature of Damage

The injury to the palm by *C. arecae* started with oviposition by adult bug. The adult bugs oviposited on the emerging spindle. As a result of this, the site of insertion of egg became dark brownish in color and later turned to black gradually. Both nymphs and adults congregated at base of spindle and in first two or three leaf axils. The insect settled on a suitable spot and fed for several minutes and moved on to a fresh spot. Fresh feeding marks appeared as a longitudinal narrow discolored zone and progressively extended between the parallel veins. The feeding spots measured 8.00 to 25.00 mm in length and 2.00 to 5.00 mm in width. In some cases several such feeding marks were formed and coalesced to form extensive areas of damaged leaf lamina. In advanced condition, the feeding area became necrotic and dried resulting in small shot holes. In severe condition of feeding the whole spindle got dried up and often the spindle failed to open. This affected the emergence of succeeding leaves and choked the growth of palm.

There is a slight deviation in present findings from earlier workers (5) who reported that the total duration from egg to adult varied from 22 to 27 days with an average of 24.08 days. Similarly the total life cycle of this bug as 24—33 days (4). This variation might be due to change in weather conditions such as temperature, relative humidity and photo period regimes, which influenced the growth and development of the bug.

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