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Biological Parameters of Arecanut Root Grub (*Leucopholis lepidophora* Blanch.)

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Abstract

An experiment was conducted to study the biological parameters of arecanut root grub, *Leucopholis lepidophora* Blanch. under greenhouse conditions during *kharif* of 2005. The females of *Leucopholis lepidophora* laid 17 to 33 eggs with an average of 28.8 ± 9.79 eggs singly in moist sandy loam soil, under plant debris at a depth of 0 to 15 cm. The mean incubation period was found to be 14.7 days. Mean duration of I, II and III instar grubs were 79.58 ± 12.28, 82.15 ± 23.78 and 129.71 ± 18.45 days, respectively. Total larval period lasted for 226 to 346 days. Pre-pupal and pupal period ranged from 25 to 30 and 23 to 37 days, respectively. Teneral adult period (duration in soil) ranged from 28 to 35 days. The longevity of adults male and female beetle ranged from 20 to 27 and 28 to 36 days, respectively. Total life cycle (egg to adult) ranged from 302 to 448 days with an average of 391.10 ± 48.23 days.
Key words : Arecanut, Root grub, Biology, Growth stages.

Arecanut (*Areca catechu* L.) is one of the commercial crops and finds a place in all religious, social and cultural functions in India. Preliminary studies on the white grubs affecting arecanut indicated a complex of species of the genus, *Leucopholis* (1) of which *Leucopholis lepidophora* Blanch. is the biggest species first reported by Puttarudraiah and Channabasavanna (2) in Karnataka, which infests arecanut, coconut, sugarcane, paddy and groundnut. It is most dominant in Western Ghat areas of Karnataka and Maharashtra (3—5). In Shimoga district of Karnataka *L. lepidophora* is causing severe damage on arecanut, leading to reduction in area, production and productivity of arecanut. Several workers studied the biology of *L. lepidohora* under laboratory and field conditions, but due the regional variations the life cycle is varied. Hence there is a need to study the biology of this pest under greenhouse conditions. This paper reports the detailed biology of arecanut root grub under greenhouse conditions.

Methods

The studies were conducted at college of Agriculture, Shimoga during *kharif* 2005. To study the biology of *Leucopholis lepidophora*, freshly emerged adults of male and female beetles were collected from the arecanut gardens. One female and five male beetles were released into individual wooden cage.Thirty such cages were used for this study. The bottom of the cages were provided with 20 cm layer of moist sandy loam soil and covered with leaf litter. Observations on mating period, depth of egg laying, preoviposition, oviposition period and fecundity were recorded. The eggs were collected daily by observing the soil and transferred to the petriplates of 15 cm diameter having sterile moist sandy loam soil for recording the incubation period. The newly hatched first instar grubs were transferred into petriplates having a mixture of 1 : 1 sandy loam soil and well decomposed organic manure. The soil-manure mixture was properly moistened. When the grubs were sufficiently grown up for handling, these were transferred into 30 mud post (30 × 20 cm) which were already planted with two year old arecanut seedling. These pots were watered as and when required.

Development and survival of the grubs were examined by removing the soil after every week except during the third larval instar. The newly formed and over wintered pupae present in the larval chambers were removed and transferred to the earthen crucibles (5 cm diameter) filled with moist sandy loam soil and covered with another crucible in inverted position. The paired crucibles containing pupae were kept in-

Table 1. Biological parameters of eggs of *Leucopholis lepidophora.*

	Egg parameter	Mean ± SD (range)
1	Fecundity (No. of eggs/female)	28.8 ± 9.79 (17—33)
2	Hatchability (%) (n = 150)	70.6 ± 9.93 (64—78)
3	Incubation period (days)	14.7 ± 4.43 (13—17)
4	Egg length (mm)	4.94 ± 0.34 (4.8—5.1)
5	Egg width (mm)	2.94 ± 0.32 (2.8—3.1)

side the mud pots (30 × 20 cm) filled with soil and proper moisture was maintained to record the pupal period and sex differentiation was made to know sex ratio. The newly emerged beetles were allowed to stay in the crucibles for three days, as these were quite delicate with soft elytra. After the hardening of elytra, the beetles were transferred into the beakers (1,000 ml) filled with loose and moist sandy loam soil for studying duration of beetle in the soil. Further, observations like the longevity of male and female beetles after emergence was also recorded. All the biological parameters were reported as mean ± SD.

Results and Discussion

The females of *Leucopholis lepidophora* laid solitary eggs of 17 to 33 in moist sandy loam soil at a depth of 0 to 15 cm. Fresh eggs are pearly white oval to creamy white and started swelling assuming an almost spherical shape before hatching. The length of eggs ranged from 4.8 to 5.1 mm and width from 2.8 to 3.1 mm. The incubation period ranged from 13 to 17 days (Table 1). Kumar (4) reported that this grup can lay eggs up to 10—25 cm deep in the soil.

The newly hatched larvae were characterized by deep brown head which is disproportionately larger than the width of the body. The neonate larvae were light creamy color and measured from 14.8 to 16.9 mm in length and from 2.9 to 3.6 mm in width with an head capsule width ranged from 2.9 to 3.1 mm. The duration of the first instar grub ranges from 60 to 92 days. Second instar grub measured from 29 to 37 mm in length and 7.3 to 7.9 mm in width with an head capsule width ranges from 4.5 to 4.7 mm. The duration of the second instar grub ranged from 52 to 106 days. While the third instar grubs were dark creamy white in color and measured from 57 to 62 mm in length and 19 to 22 mm in width with an head capsule width ranged from 5.9 to 6.1 mm. Third instar lasted for 114 to 148 days (Table 2). The present results are in confirmation with the results of Veeresh et al. (1), Adsule and Patil (3), Kumar (4) and Vijayvergia et al. (5) with slight variations. However, the slight variations in the present results are may be due to change in green house conditions, edaphic and ecological factors. The total larval period lasted for 226 to 346 days. This result is in agreement with the studies of Vijayvergia et al. (5) who reported that the total larval period *L. lepidophora* was 226 to 395 days.

Pupae were yellow to deep yellow and could be sexed easily. Males were having a knob like structure on the last abdominal segment while females had a V shaped notch. Similar observations were also made by Veeresh et al. (1), Patil and Adsule (6), Adsule and Patil (3), Kumar (4) and Vijayvergia et al. (5). In the present study the pre-pupal period varied from 25 to 30 days. Pupal period ranged from 23 to 37 days. Pupal length ranged from 37 to 42 mm and 18 to 21 mm width. Teneral adult period ranged from 28 to 35 days

Table 2. Grub length, width, head capsule width and grub duration of *Leucopholis lepidophora* (mean ± SD). Values in the parentheses indicate the range.

	Grub instar	Grub length (mm)	Grub width (mm)	Head capsule (mm)	Grub duration (days)
1	I instar	15.62 ± 2.05 (14.8—16.9)	3.16 ± 0.74 (2.9—3.6)	3.03 ± 0.22 (2.9—3.1)	79.58 ± 12.28 (60—92)
2	II instar	32.3 ± 8.00 (29.0—37.0)	7.66 ± 0.71 (7.3—7.9)	4.59 ± 0.23 (4.5—4.7)	82.15 ± 23.78 (52—106)
3	III instar	59.2 ± 5.05 (57.0—62.0)	20.4 ± 3.52 (19.0—22)	6.01 ± 0.22 (5.9—6.1)	129.71 ± 18.45 (114—148)

Table 3. Biological parameters of pupa of *Leucopholis lepidophora.*

	Pupal parameter	Mean ± SD (range)
1	Pupal length (mm)	39.00 ± 4.89 (37—42)
2	Pupal width (mm)	19.30 ± 3.17 (18—21)
3	Pupal period (days)	28.55 ± 9.81 (23—37)
4	Pupal eclosion (percentage)	86.6 ± 16.33 (80—100)

under laboratory conditions (Table 3).

The adult beetles were larger in size. Body was uniformly black and covered with creamy, sub-ovate with pressed scales with a slight apical projection. Pygidium broader than long and broadly triangular. Compound eyes were black in color and beetles having lamellate type of antennae. They had smooth metasternal spine, apex roundish and slightly raised above the surface. Prosternal process slightly raised, sub triangular, surface smooth interspersed with few scales and hairs. These observations are in agreement with the findings of Veeresh et al. (6) and Kumar (4).

The antennal length of male beetle ranged from 6.9 to 7.2 mm and the flagellar segments varied from 7 to 8. The longevity of adults male ranged from 20 to 27 days. The antennal length of female beetle ranged from 7.4 to 7.6 mm and the flagellar segments varied from 8 to 9. The longevity of adult female beetle ranged from 28 to 36 days. The newly emerged adult female slightly fluttered her wings without making any audible sound. This behavior was followed by the attraction of males. The process of wing fluttering continued for several times until at least one male was attracted. The attracted male showed brisk movement towards the female, while so moving the aedeagus was protruded and encountered the female. Later male climbed over the female and held on to the female with his hind legs. Occasionally dislodging the male from its body successfully and moved a few centimeters forward and waited for a few seconds before fluttering the forewings again. Alternatively by a mechanism, which could not be clearly made out, the male managed to insert the aedeagus in the anal opening of the female and slowly moved backward and released the hold. This resulted in formation of upside down capula position. Mating period ranged from 45 to 65 minutes with an average of 54.00 ± 15.3 minutes.

Table 4. Duration of different stages of *Leucopholis lepidophora.*

	Developmental stage	Range (days)	Mean ± SD (days)
1	Egg stage (incubation period)	13—17	14.7 ± 4.43
2	Larval Stage		
	First instar	60—92	79.58 ± 12.28
	Second instar	52—106	82.15 ± 23.78
	Third instar	114—148	129.71 ± 18.45
	Total larval duration	226—346	290.25 ± 54.51
3	Pre-pupal period	25—30	27.54 ± 3.39
	Pupal period	23—37	28.55 ± 9.81
4	Duration in soil (teneral adult)	28—35	32.00 ± 5.48
5	Total duration (egg–Adult)	302—448	391.10 ± 48.23
6	Longevity of male	20—27	23.60 ± 5.69
7	Longevity of female	28—36	32.60 ± 7.88

The average pre-ovipostion and oviposition periods were 12.01 and 16.8 days, respectively. The present result is in agreement with Veeresh et al. (1) who reported that the pre-oviposition period of *L. lepidophora* as 2 to 20 days while, Vijayvergia et al. (5) reported that oviposition period in the laboratory was 15 to 29 days. The slight fluctation in the present results may be due to change in laboratory and soil conditions. The total life cycle ranged from 302 to 448 days with an average of 391.10 ± 48.23 days (Table 4). More than one year life cycle was observed in the laboratory which was comparable with the studies of Adsule and Patil (3) who reported that duration of total life cycle *L. lepidophora* which ranged from 284 to 507 days. Patil and Adsule (3) reported that the developmental period from egg to egg occupied 384 days in sugarcane ecosystem.

Conclusion

Based on this study it can be concluded that the arecanut root grub has got only one generation per year with three grub instars with mean duration of I, II and III instar grubs were 79.58 ± 12.28, 82.15 ± 23.78 and 129.71 ± 18.45 days, respectively.

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