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Biology of leaf weevil, *Cyrtozemia dispar* Pascoe [Coleoptera: curculionidae] infesting groundnut

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Abstract
Investigations on biology of groundnut leaf weevil, *Cyrtozemia dispar* Pascoe were carried out under laboratory condition in Department of Entomology, College of Agriculture, Junagadh Agricultural University, Junagadh during *Kharif*, 2018. The leaf weevil laid eggs mostly on the tips with average incubation period 5.03 ± 0.77 days. The larval stages were passed through five different instars and found inside the soil. Total grub period and pupal period were 25.40 ± 2.00 and 3.08 ± 0.41 days, respectively. Adult found on foliage and the longevity of adult male and female leaf weevil was 17.70 ± 2.67 and 21.85 ± 3.13 days, respectively. The total life period (from egg to the death of adult leaf weevil) of female was 55.35 ± 4.40. While, in male it was 51.23 ± 3.21 days.

Keywords: Biology, *Cyrtozemia dispar* Pascoe, groundnut, leaf weevil

Introduction
Groundnut (*Arachis hypogea* Linnaeus) is a leguminous oilseed crop and In India, Gujarat is the largest producer of groundnut. Gujarat contributes about 33.12 per cent in area with 1.76 million hectares and about 41.71 per cent in production of 3.16 million tones (Anonymous, 2017) [1].

The major factors which hamper the productivity of groundnut are insect pests and diseases. Besides the damage by defoliators and sucking pests, root and pod feeders, *Cyrtozemia dispar* Pascoe damage on foliage was recorded on rain-fed groundnut in Gujarat (Thirumalaisamy *et al.,* 2016) [3]. A coleopteran insect, *C. dispar* was black to dark brown colored weevil with whitish stripes on both the lateral side of thorax as well as abdomen and having chewing and biting type of mouth parts. Adult feeds on young leaves of groundnut and cause notching on the margin of the leaflets and eating away of small patches of leaf lamina. As the immature grubs remain in the soil, they have strong mandibles and feed on the roots of the crop and also damage the flashy stem and rootlets of the plant. The leaf weevil have great importance as adult caused enormous damage to the groundnut by eating the leaves and grubs feed on immature pods and kernels, which results in direct yield loss.

Materials and Methods
The biology of leaf weevil on groundnut crop was studied under laboratory conditions in the Department of Entomology, College of Agriculture, Junagadh Agricultural University, Junagadh. The adults of *C. dispar* were collected from the field of groundnut. For obtaining the eggs, five pairs of male and female adult weevils were kept in petri dishes. Groundnut leaves were provided to leaf weevils for food. The dried leaves, excreta and other waste materials in the petri dish were removed every day and fresh leaves were provided for food. Previous day's leaves were observed carefully and leaves with eggs, if found were separated out. Leaves with leaf weevil eggs were maintained in petri dish for incubation. The end of the leaf petiole was wrapped with the wetted cotton plug to keep the leaf fresh and turgid for longer period. The newly hatched grubs were introduced in petri dishes having fleshy stem, rootlets, immature kernel and pods covered with the moist soil and organic manure. Fully mature grub which would about to pupate was separated and transferred in to the small cavities made in the soil with glass road towards the periphery of the glass beaker filled with moist soil. Sufficient moisture in the soil was maintained.

The emerging adults from the pupa were introduced in a pair in to a petri dish to study the fecundity and longevity. Fresh groundnut leaves were provided in to petri dish for food and oviposition. The leaves were changed every day and the older leaves with eggs were transferred to another petri dish for emergence of progenies.

Results and Discussion

The leaf weevil laid eggs mostly on the tips but some time along the margins of the leaves. By the action of legs, female folds the leaf margins to cover the eggs laid. Leaves showing such folds were a sure indication of leaf weevil egg laying (Fig. 1).

Fig 1: Eggs laid inside folded leaf tip

The freshly laid eggs of leaf weevil were uniformly pearly white in color, soft and oblong-oval in shape. Older eggs are harder, uniformly pale yellow, smooth, glossy and oblong-oval. When the embryonic development was completed the body segments of grub could be seen through the transparent exochorion or thin egg cell. The incubation period of *C. dispar* was varied from 4.0 to 6.0 days with average of 5.03 ± 0.77 days at average temperature of 28.14 ± 1.44 ^{0}C and average relative humidity of 72.15 ± 14.12 per cent. Hatching percentage of eggs of *C. dispar* was varied from 83.33 to 97.44 per cent (av. 92.94 ± 3.91%).

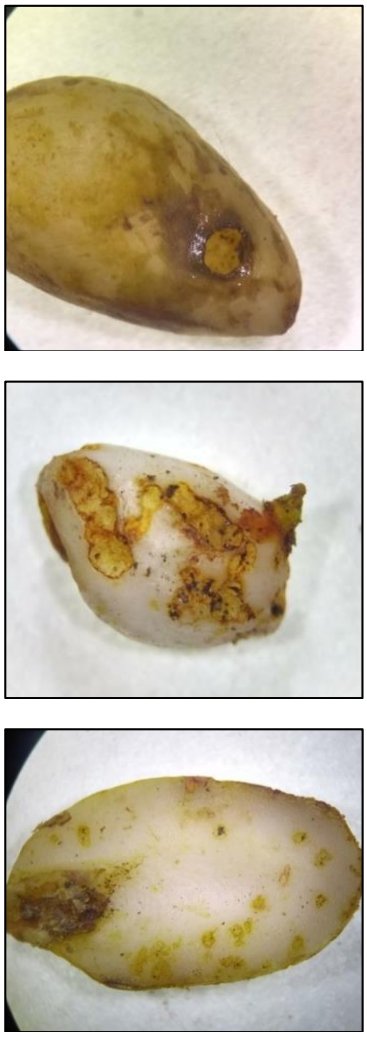

Fig 2: Damage caused by different grub instars of *C. dispar*

After emergence from the egg, grub was enters in the soil. The newly hatched grub is creamy white and apodous. Its body is well curved, soft, slender and moderately tapering towards the posterior end. Body sparsely covered with small setae. Head capsule is slightly inserted in to the prothorax, sub-hemispherical, smooth and light creamy to yellowish brown in color. The mandibles were strong and slightly pointed. Grub period of first instar leaf weevil was ranged from 5.0 to 7.5 days (av. 6.15 ± 0.89 days). The larval stages were passed through five different instars and found inside the soil. The subsequent instars were similar to the first instar in general appearance and morphological characters except in body size. The second instar larval period of leaf weevil was ranged from 5.0 to 6.5 days (av. 5.60 ± 0.60 days). The third instar larval period was ranged from 3.5 to 5.5 days (av. 4.50 ± 0.73 days). The fourth instar larval period was ranged from 3.0 to 5.0 days (av. 4.08 ± 0.71 days). The fifth instar larval period of *C. dispar* was ranged from 4.5 to 6.5 days (av. 5.08 ± 0.54 days). Total grub period of *C. dispar* revealed that it was varied from 21.0 to 27.5 days (av. 25.40 ± 2.00 days) when reared at average temperature of 28.14 ± 1.44 ^{0}C and relative humidity of 72.15 ± 14.12 per cent. Grub feed on immature groundnut kernels by making small markings and small pits and on immature groundnut pods by making small hole (Fig.2)

The fully fed grub prepared a tough earthen cell and remained inside with occasional movement (Fig.3)

Fig 3: Matured grub in earthen cell

Pupa was exarate type. Pre-pupa was completely white in color. With passage of time, it turned to darker. The wings in fully developed pupae could be seen attached to the thorax. It is observed that the pupal period of leaf weevil was varied from 2.5 to 3.5 days (av. 3.08 ± 0.41 days)

The adult leaf weevil of *C. dispar* was dark brown to black in color with whitish stripe on both the lateral side of thorax and abdomen. The head was freely articulated with prothorax with dense light brown scales. Rostrum was stout and little curved at anterior. Antennae were straight, geniculate and inserted at the distal end of the rostrum. Mandibles were highly sclerotinized. Adult has two pair of wings but not used for flying. In present study, it was found that the adult was very active and moved quickly. If disturbed, it remains motionless called feigns death. The male and female was distinguished by the end of abdomen which is narrower in width in male while little broad and roundish in female. The adult leaf weevils feed on young leaves of groundnut and cause notching on the margin of the leaflets and eating away of small patches of leaf lamina. In severe cases of feeding, leaf weevils eat almost the entire leaflet, leaving the midrib (Fig.4).

Fig 4: Typical feeding pattern of adult

The adult period of female leaf weevil was varied from 17.0 to 25.5 days (av. 21.85 ± 3.13 days) and adult period Male leaf weevil was varied from 14.0 to 20.5 days (av. 17.70 ± 2.67 days) (Fig. 1) Thus, the result on adult longevity clearly indicated that the life span of female leaf weevil was longer than Male leaf weevil.

The pre-oviposition period of *C. dispar* was ranged from 6.0 to 8.0 days (av. 6.80 ± 1.03 days). The oviposition period was varied from 10.0 to 14.5 days (av. 11.10 ± 1.47 days). While, the post-oviposition period was varied from 3.5 to 5.5 days (av. 4.30 ± 0.54 days).

The egg laying capacity of female leaf weevil was varied from 174 to 419 eggs with an average of 314.00 ± 62.36 eggs per female during its life span. The sex ratio of male: female was founds to be 1:1.29. The present observations are almost similar to the reports of Bhalani (1977) [2].

Table 1: Period of different stages of leaf weevil, *C. dispar*

Sr. No.	Particulars		Period (Days)		
			Min.	Max.	Av. ± S.D.
1.	Egg period		4.0	6.0	5.03 ± 0.77
2.	Grub period	1st instar	5.0	7.5	6.15 ± 0.89
		2nd instar	5.0	6.5	5.60 ± 0.60
		3rd instar	3.5	5.5	4.50 ± 0.73
		4th instar	3.0	5.0	4.08 ± 0.71
		5th instar	4.5	6.5	5.08 ± 0.54
3.	Total grub period		21.0	27.5	25.40 ± 2.00
4.	Pupal period		2.5	3.5	3.08 ± 0.41
5.	Adult period	Male	14.0	20.5	17.70 ± 2.67
		Female	17.0	25.5	21.85 ± 3.13
6.	Total life period	Male	46.0	54.0	51.23 ± 3.21
		Female	45.5	59.0	55.35 ± 4.40
7.	Temperature (ºC)		25.65	31.30	28.14 ± 1.44
8.	Relative humidity (%)		37.50	94.50	72.15 ± 14.12

Table 2: Per cent hatching of egg, Pre-oviposition, oviposition, post-oviposition period and fecundity of leaf weevil, *C. dispar*

Sr. No.	Particulars	Min.	Max.	Av. ± S.D.
1.	Per cent hatching of eggs (%)	83.33	97.44	92.94 ± 3.91
2.	Pre-oviposition period (days)	6.0	8.0	6.80 ± 1.03
3.	Oviposition period (days)	10.0	14.5	11.10 ± 1.47
4.	Post-oviposition period (days)	3.5	5.5	4.30 ± 0.54
5.	Fecundity (Eggs laid/ female)	174	419	314.00 ± 62.36
6.	Temperature (^{0}C)	25.65	30.50	28.14 ± 1.44
7.	Relative humidity (%)	37.50	94.50	72.15 ± 14.12

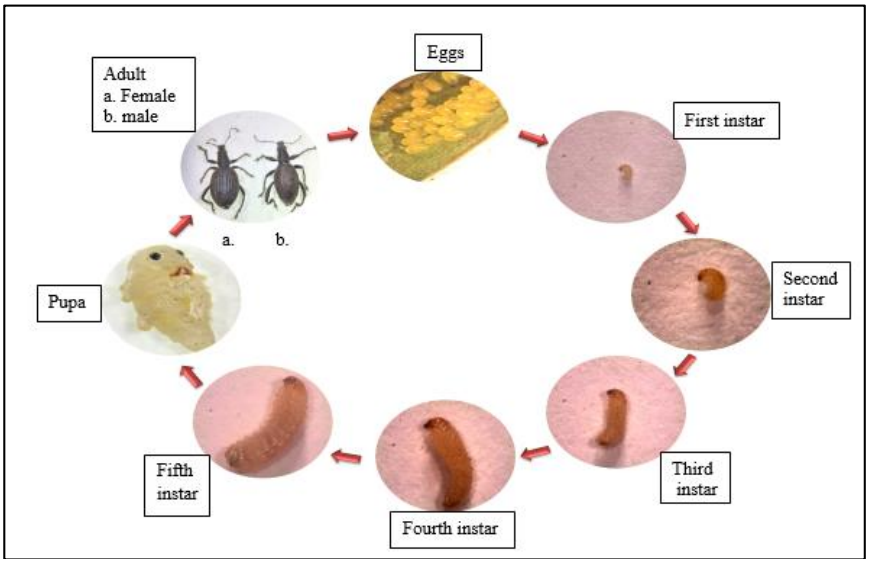

Fig 5: Life cycle of *C. dispar*

Conclusion

The average incubation period, hatching percentage, first instar, second instar, third instar, fourth instar, fifth instar, total grub period and pupal period of *C. dispar* were 5.03 ± 0.77, 92.94 ± 3.91, 6.15 ± 0.89, 5.60 ± 0.60, 4.50 ± 0.73, 4.08 ± 0.71, 5.08 ± 0.54, 25.40± 2.00 and 3.08 ± 0.41 days, respectively. The longevity of adult male and female leaf weevil was 17.70 ± 2.67 and 21.85 ± 3.13 days, respectively. The pre-oviposition, oviposition and post-oviposition periods of the insect were 6.80 ± 1.03, 11.10 ± 1.47 and 4.30 ± 0.54 days, respectively. The fecundity was observed to be 314.00 ± 62.36 eggs /female. Sex ratio to male: female was found to be 1:1.29. The total life period of female was 55.35 ± 4.40. While, in male it was 51.23 ± 3.21 days.

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