

Biology of the Rice Leaf Roller, *Cnaphalocrocis medinalis* Gn. (Pyralidae: Lepidoptera)

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ABSTRACT

The biology of the Rice Leaf Roller, *Cnaphalocrocis medinalis* Gn. was studied. The average larval period ranged from 24.40 ± 3.96 to 28.63 ± 3.10 days. Under different temperature and humidity, larvae passed through five and six instars. Pupa measured on an average 9.48 ± 0.66 and 9.23 ± 0.58 mm in length in case of male and female respectively. Female moths laid 70 to 120 eggs with 2.15 ± 1.33 , 5.18 ± 2.19 and 0.45 ± 0.52 days as pre-oviposition, oviposition and post-oviposition periods. Total average life span from egg to egg was 29.55 ± 0.75 to 42.63 ± 1.59 days respectively for male and female under different weather conditions. *Sorghum Vulgare* Linn., wild rice plants and some weeds were found to play a role for its carry over.

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INTRODUCTION

Amongst the leaf folders, the rice leaf roller, *Cnaphalocrocis medinalis* Gn. is found to be occupying the major status in the Gujarat state with the introduction of high yielding varieties of rice (Upadhyay *et al.* 1975). The present contribution reports the biology of rice leaf roller.

MATERIALS AND METHODS

The rice leaf roller larvae were collected in August, 1975 from the rice crop grown on the Trial-cum-demonstration farm, Chikhali of district Bulsar. The larvae were reared in the laboratory on fresh rice leaves, confining them in one on litre battery jar (10 x 14.5 cm.) covered with perforated polythene sheet, to prevent the escape of the larvae as well as to maintain humid condition in the jar. The larvae were provided with fresh food daily till they pupated. The pupae

were sexed on the basis of distance between genital and anal apertures. The male and female moths developing from these pupae were paired and caged under a glass chimney (4.8 x 7.2 cm.) The temperature and relative humidity (maintained through the humidifier) were recorded throughout the study. Detailed observations were made on the eggs, duration of larval stages, duration of pupal period, site of pupation, nature of damage, longevity, fecundity and life span of the adult along with natural enemies, carryover and alternate hosts of this insect pest.

RESULTS AND DISCUSSION

Host plants and carry over: Observations were recorded during off seasons i.e. from November 1975 to February and May to June 1976, to know the stages through which the pest is carried over. For this study 740 rice stubbles

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were observed immediately after harvest of the crop in November 1975, at different locations; where in it was found that these stubbles had 1987 empty pupal cases and not a single viable pupa. Thus, the pest is not carried over in rice stubbles.

From July 1975 to July 1976, the rice fields and their surroundings were observed periodically to search for alternate hosts and it was found to be living upon wild rice plants, sprouted rice stubbles, *Sorghum vulgare* Linn., *Echinochloa colonum* (Linn.) Link; when regular rice crop was not existing. Gendana and Calora (1964) have reported the occurrence of this insect on sugarcane, maize, wheat and sorghum; while Yadav *et al* (1972) and Velusamy and Suburamaniam (1974) have reported the occurrence on water grass, *Brachiara mutica* Stapt. and *Echinochloa colonum* Link. Our findings are more or less in conformity with the same. Thus, there is a reason to believe that, the insect does not hibernate but it feeds on alternate hosts during off season and migrate to rice as soon as the crop is available.

Nature of damage : There larvae were found scraping green tissues containing chlorophyll and folding the blades longitudinally into tubes and remaining therein. The damaged leaves become whitish and dry up subsequently. The infested fields of rice thus appear scorched and feeble as compared to healthy.

The larvae right from the first instar, started spinning the silken threads. Younger larvae fasten the two edges of leaf from the tip downwards and prepare a small tube. This habit was found throughout the larval life. Sometimes in young crops, more than two adjacent leaves were webbed together to make

tubular shelter.. These two types of foldings of leaves into tubes observed in the area are in concurrence with those of Velusamy and Subarmaniam (1974) who reported four types of leaf rolling. As soon as food material has been exhausted in the shelter tube, the larvae migrated to other leaf and caused similar damage.

Life history and description of different stages:

Oviposition and fecundity: The pre-oviposition, oviposition and postoviposition periods remained 2.15 ± 1.33 , 5.18 ± 2.19 and 0.45 ± 0.52 days respectively at temperature ranging from 29.0°C to 30.0°C and 65 to 83 per cent relative humidity; with total number of eggs laid during entire period of oviposition being 69.73 ± 51.02 . These findings do not exactly tally to those of Velusamy and Subramaniam (1974) who reported on an average 1.5 days each for preoviposition and oviposition period with average number of eggs laid being 56.

Egg: The eggs of *C. medinalis* were flat, ellipse, having irregular margin and whitish in colour. Measurement of 100 eggs revealed that the average width and length were 0.41 ± 0.05 mm and 0.74 ± 0.11 mm respectively. Fertilised eggs turned black, reflecting the colour of the head of the developing larvae. Unfertilised eggs shrunk and dried without change in colour. The larvae upon hatching wriggled out cutting the transparent chorion with the help of mandibles. The average minimum incubation period was 4 days and percentage of hatching was 89.32 (Table 1) when the temperature ranged from $24.53 \pm 0.40^{\circ}\text{C}$ to $26.13 \pm 0.40^{\circ}\text{C}$ and relative humidity from 82.67 ± 0.65 to $93.00 \pm 1.73\%$.

The characteristics of colour, size of the eggs and hatching behaviour are in confirmation with those reported by Rajamma and Das, (1969) as well as Velusamy and Subramaniam (1974). Incubation period of eggs is similar to that reported by Otanes and Sison (1941), Rajamma and Das (1969), Anonymous (1971), Dorge *et al* (1971) and Yadav *et al* (1972) but not so with that reported by Velusamy and Subramaniam (1974).

Larva: The newly hatched larva measured on an average 1.53 ± 0.25 mm in length and 0.23 ± 0.02 mm in width. It is light cream in colour with conspicuous large black head having width of 0.25 ± 0.01 mm and with numbers of setae on the body. The body colour turned to green when the larva

started scraping green tissue from the leaves. The green colour of the food in the gut was seen through translucent integument of the body.

From second instar onwards, black spots were seen on abdominal segment on the dorsal and lateral sides. Eight pairs of spiracles were also visible. The larvae are eruciform with well developed three pairs of thoracic legs and four pairs of prolegs on third to sixth abdominal segments. Fully grown larvae measured on an average 17.90 ± 0.97 mm in length and 1.73 ± 0.20 mm in width. These observations are in concurrence with those of Otanes and Sison (1941), Rajamma and Das (1969), Pathak (1970), Dorge *et al* (1971), Lingappa (1972) and Velusamy and Subramaniam (1974).

TABLE 1

Duration and survival percentage of different stages of Rice leaf roller, *G. medinalis* Gn.

Stage	Number observed	Number found in second stage	Survival percentage	Average duration in days
1	2	3	4	5
Egg	253	226	89.32	4.00
Larval instar				
First	291	196	67.36	2.27 ± 1.14
Second	196	131	66.84	2.60 ± 1.78
Third	131	102	87.87	4.63 ± 2.77
Fourth	102	94	92.16	5.00 ± 2.52
Fifth	94	84*	89.36	7.19 ± 3.34
Sixth	76	69	90.79	4.26 ± 2.35
Pre-Pupal period	84	84	100.00	1.76 ± 0.44
Pupal period	84	83	98.80	11.20 ± 0.76
				(for 45 males)
				10.97 ± 3.46
				(for 38 females)

* 8 larvae undergone pupation after fifth instar of larval stage.

The total larval period lasted for 24.40 ± 3.96 days. There were six larval instars, the duration of which was 2.27 ± 1.14 , 2.60 ± 1.78 , 4.63 ± 2.77 , 5.00 ± 2.52 , 7.19 ± 3.34 and 4.26 ± 2.35 days for the first, second, third, fourth,

fifth and sixth instars respectively (Table 1) Rajamma and Das (1969) and Lingappa (1972) as well as Velusamy and Subramaniam (1974) reported six and five instars respectively for this pest. But in the present finding it

was found that out of total 291 larvae, observed under laboratory studies; only 8 passed through five larval instars while 69 passed through six instars. Thus, in the same brood there were five and six larval instars. This is in confirmation with the reports of others and also with the general behaviour found in Lepidoptera wherein the number of instars does vary in the same brood (Patel and Patel, 1973). They also found five and six larval instars of *Spodoptera exigua* (Hub.) at Anand in Gujarat.

Pre Pupa: When larvae attained their full development, they stopped feeding and started spinning the cocoon, of white silken threads, with the help of mandibles. The average prepupal period was found to be 1.76 ± 0.44 days to 1.90 ± 0.67 days under different levels of temperature and relative humidity.

Pupa: Freshly formed pupa was ob-
tect, light brown in colour and became dark brown on ageing. The fourth, fifth and sixth abdominal segments were free and movable. The genital aperture was situated on the ventral side of the eighth abdominal segment in case of females and on the ninth in case of males. The anal aperture was situated on the tenth abdominal segment in both the sexes. This character has been taken advantage for sex determination in pupal stage. The distance between anal and genital apertures was 0.15 ± 0.02 mm and 0.36 ± 0.03 mm in case of male and female pupae respectively. The length of male and female pupae were 9.48 ± 0.66 mm and 9.23 ± 0.58 mm, while the breadth were 1.96 ± 0.10 mm and 1.94 ± 0.11 mm respectively. Thus the pupae of male were slightly longer than those of the female. The sex ratio was calculated

from the observations taken for laboratory and found to be 1 female: 1.22 male. The duration of pupal periods of male and female *C. medinalis* was 11.20 ± 0.76 days and 10.97 ± 3.46 days respectively, under low temperature range of $22.13 \pm 0.56^\circ$ C to $23.60 \pm 0.44^\circ$ C, while it was 10.00 ± 0.75 days and 9.89 ± 0.54 days respectively at varying temperature of $23.64 \pm 1.24^\circ$ C to $24.70 \pm 1.45^\circ$ C. Thus, there was some effect of temperature on pupal period in both the sexes showing the increased duration of pupal period with lowering the temperature.

Field examination of more than 5000 plants revealed not a single pupa on rice leaf contradicting the findings of Velusamy and Subramaniam (1974) who reported the same to be on middle portion of the leaf. However their report of noticing pupae between the leaf sheath and stem is in confirmation with our observations where almost all the pupae were observed between two adjacent tillers or between the stem and the leaf sheath.

Adult: Earlier Hampson (1896) and Lefroy (1909) described the adults of *C. medinalis*. The small adults measured on an average 16.79 mm across the wings and 7.70 mm in length, with yellowish brown colour of the general body. On an average the females lived for 7.82 ± 2.52 days while the males lived for 8.64 ± 2.24 days.

Life span: Total life period for male moth from egg to death of the adult, during the period from 11-9-'75 to 25-10-'75, 11-11-1975 to 15-1-1976 was 35.25 ± 3.02 days and 54.13 ± 5.39 days respectively, whereas it was 35.40 ± 1.88 and 52.40 ± 4.50 days respectively in case of female moth. The egg to egg period was 29.55 ± 0.75 and 42.67 ± 1.59 days during the above two pe-

riods, when the temperature ranged from $29.18 \pm 0.76^{\circ}\text{C}$ to $30.18 \pm 0.77^{\circ}\text{C}$ and $22.73 \pm 1.10^{\circ}\text{C}$ to $24.24 \pm 1.08^{\circ}\text{C}$ respectively.

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