

DETERMINATION OF LARVAL INSTARS OF *PIESMOPODA OBLIQUIFASCIELLA* HAMPS BY MEASURING HEAD CAPSULE WIDTH

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Abstract

Larvae of *P. obliquifasciella*, a consistent insect pest of Amaltas (*Cassia fistula*), were collected from field and their head capsule widths were measured under a binocular microscope (50X). Five larval instars were determined with maximum and minimum ratio of increase in head capsule width of 0.748 and 0.624 with an average 0.70 which conforms with Dyar's rule. The pest was found active in all larval instars from April to October except June and it overwintered in larval stage (2-5th instar) from November to February. Six to seven generations were found in a year.

Key words: Head capsule width, larval instars, *Piesmopoda obliquifasciella*

Introduction

Piesmopoda obliquifasciella Hamps, Lepidoptera, Pyralidae is a regular insect pest of Amaltas (*Cassia fistula* L.) as Khawaja *et al.* (1983) have reported more than 50% destruction of foliage per annum at the Pakistan Forest Institute, Peshawar campus. The pest larvae stitch 2-4 leaves together and feed among them by gnawing epidermis. Because of their hideous feeding behavior, it is not easy to record observations on post-embryonic development particularly number of larval instars.

The number of larval instars can be determined by measuring head capsule width. Dyar (1890), for the first time, determined number of

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larval instars of 28 lepidopterous species. The rule he described based on "the head capsule width of a larva which increases in geometrical progression in its successive stages, assuming that intra- stadium increases in head capsule width is zero." Following this rule, Nielsson & Bass (1967), Redfern (1967), Harman (1970), Frick & Wilson (1981) and Gul & Chaudhry (1983) have determined number of larval instars of different insect species by measuring head capsule width.

In the present study, larvae of *P. obliquifasciella* were collected from field and separated into statistically significant larval instars, *vis-a-vis* their seasonal occurrence was also worked out.

Materials and Methods

Larvae of *P. obliquifasciella* were collected from the foliage of Amaltas grown at the Pakistan Forest Institute, Peshawar during the whole year in 1993 except in June when leaf fall occurred. 25 pairs of stitched leaves were taken from five trees per month as sample for larval collection. 1223 larvae were collected and preserved month-wise in 70% alcohol at the normal laboratory temperature. The maximum head capsule width of each larva was measured under a binocular microscope (50X) with 0.02 mm degree of error.

The head capsule width data were separated into 5 statistically different groups. For each group, average observed and calculated head capsule width; their difference and ratio of increase were calculated. For conformity to Dyar's rule "t" test for the difference between observed and calculated head capsule width was implicated. The "t" value was calculated to find out difference between the values for observed and calculated head capsule width. Furthermore, one way analysis of variance test was applied on 160 larvae including all instars for finding significant differences among groups. The procedure was adopted after Harman and Berisford (1979).

Results and Discussion

A continuum in data was found from 0.16 mm to 1.02 mm. which agrees to the findings of Caltagirone *et al.* (1983) in *Amyelois transitella*. This may be ascribed to a considerably large number of larvae measured. Statistically separated groups, their average observed and calculated head capsule width and ratio of increase are presented in Table 1.

Average observed head capsule width for I, II, III, IV and V larval instars was found to be 0.252, 0.404, 0.572, 0.794 and 1.061 mm, respectively. The lowest ratio of increase was 0.624 and the highest was 0.748, with an average 0.70. The difference between ratio of increase in different groups was found statistically non-significant. Based on mean ratio of increase, calculated head capsule width worked out was 0.283, 0.400, 0.556 and 0.743 mm, for I, II, III and IV instars, respectively. For conformity to Dyar's rule the "*t*" value (for *t*-test) was calculated for the expression below:

$$t = \frac{\bar{d}}{S\sqrt{4}}$$

where \bar{d} was the average difference between average observed and calculated head capsule width and *S* for standard deviation of the differences. The "*t*" test yielded a value of 0.55, indicating that the difference between the average observed and calculated head capsule width did not differ significantly from zero. Therefore, the difference between average observed and calculated head capsule width found statistically non-significant ($P > 0.99$). Thus, the ratio of increase in head capsule width corroborates Dyar's rule. The overlapping of groups, if any, was confirmed by one Way analysis of variance test. The outcome of the test is shown in Table 2.

An F value of 711.083 indicates that the difference among the instar groups was highly significant thereby, showing no overlapping of groups. The means of 5 groups differed at 99% level of significance which means a larva with head capsule width falling within the limits of one of the

groups (Table 1) has 99% chances of being related to that group. The positive conformity test to Dyar's rule and highly significant analysis of variance test prove that *P. obliquifasciella* passes through 5-larval instars. Once the number of larval stages was determined, their seasonal occurrence was enumerated which is arrayed in Table 3.

Per month and overall percentage for each instar was calculated on the basis of total larvae found in that particular month and total larvae through out the year (1223), respectively. In April, May, July, August and September all five larval instars were recorded, while in November, December, January and February first larval instar was absent. Moreover, in March the first two and in October the fifth instar were absent. Overall 12.76, 21.34, 35.41, 18.89 and 11.61 percent of I, II, III, IV and V instar larvae were found in a year. Absence of 1st instar and constant presence of 2-5th larval instars (Table 3) in November, December, January and February, suggest that the pest overwinters in larval stage in these months. Population of the larvae was greatly reduced in March because of molting of overwintering larvae as well as pupation of full grown larvae. Thus the overwintering larvae became active in March and new generation started in April. On the basis of the times the first instar larvae found (six times), it is inferred that the pest has six generations in a year.

Table 1: Head capsule width limits with average observed and calculated head capsule widths and ratio of increase of *P. obliquifasciella*

GROUPS	LIMITS (mm)	AVG.OBS.HCW (mm) \pm SD	RATIO	AVG.CAL. HCW (mm)	OBS-CAL
I	0.165-0.295	0.252 \pm 0.039	0.624	0.283	-0.031
II	0.325-0.455	0.404 \pm 0.043	0.706	0.400	+0.004
III	0.485-0.675	0.572 \pm 0.0	0.720	0.556	+0.016
IV	0.705-0.915	0.794 \pm 0.077	0.748	0.743	+0.051
V	0.965-1.12	1.061 \pm 0.047			
		Average	0.70		

OBS. observed, CAL. calculated, HCW. head capsule width

Table 2: Analysis of variance of separation of head capsule width data in 5 groups

Source of variation	Sum of Squares	Degree of Freedom	Mean square	F.value
Between groups	8.533	4	2.133	711.083*
Within groups	0.527	155	0.003	-
Total	9.060	159	-	-

* significant at 99% level

Table 3: Month-wise occurrence of different larval stages of *P.obliquifasciella*

MONTHS	INSTARS	NO.	%	MONTHS	INSTARS	NO.	%
JANUARY	I	-	-	AUGUST	I	14	13.86
	II	7	8.43		II	30	29.70
	III	30	36.14		III	30	29.70
	IV	16	19.28		IV	15	14.85
	V	30	36.14		V	12	11.88
FEBRUARY	I	-	-	SEPTEMBER	I	2	1.68
	II	7	10		II	30	25.21
	III	29	41.42		III	69	57.98
	IV	32	45.71		IV	16	13.45
	V	12	2.86		V	2	1.68
MARCH	I	-	-	OCTOBER	I	25	18.66
	II	-	-		II	42	31.34
	III	6	20		III	49	36.57
	IV	4	13.33		IV	18	13.43
	V	20	66.67		V	-	-
APRIL	I	52	32.3	NOVEMBER	I	-	-
	II	34	21.12		II	5	10.42
	III	33	20.3		III	22	45.83
	IV	36	22.36		IV	13	27.08
	V	6	3.73		V	8	16.67
MAY	I	48	21.92	DECEMBER	I	-	-
	II	42	19.18		II	14	14.58
	III	61	27.85		III	39	40.63
	IV	37	16.89		IV	25	26.04
	V	31	14.16		V	18	18.75
JULY	I	15	9.26	OVERALL	I	156	12.76
	II	50	30.86		II	261	21.34
	III	65	40.12		III	433	35.41
	IV	19	11.73		IV	231	18.89
	V	13	8.02		V	142	11.61

Conclusion

From the results it is concluded that ratio of increase in head capsule width agrees with Dyar's rule and *P.obliquifasciella* has five larval instars. The pest overwinters (November-February) in larval stage and has six generations per year.

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