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## Studies on the duration of different stages, survival percentage, sex ratio and longevity of *Agrotis ypsilon* Rott. under laboratory condition

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**Abstract-** Winter is generally a lean season for insect pest activity. The Cutworms, belonging to that comparatively small group of pest, the destructive activity of which is more marked in rabi crops. They are known as cutworms because they cut and fell to the ground either the whole plants of low crops like gram or their twigs. They are also referred to as surface caterpillars because their activities are mostly confined to a few centimeters of the surface layer of the soil. Their collective names apply to a number of species of Noctuid moths, particularly those belonging to the genera *Agrotis*. Amongst them *Agrotis ypsilon* Rottenberg, is the commonest and widely distributed. It is commonly known as greasy, black potato or gram cutworm is a cosmopolitan pest of great economic importance since it causes a great economic damage to the vegetables, gram and rabi crops annually. In India its occurrence has been found in all the regions of Northern area in the Gangatic belt. In Bihar, it is a limiting factor in the cultivation of rabi crops in the 'Chaur', 'Diara' and 'Tal' areas of different districts. Flood areas are most affected by this pest. The main aim and objectives of the present investigation is the application of research findings specially biological control of this pest in the field of crops for the benefits of poor farmers of Bihar and India as well as the way of safe guard of ecosystem and health hazards.

**Key words:** *Agrotis ypsilon* Rottenberg, rabi crops, caterpillars

### INTRODUCTION

*Agrotis ypsilon* Rottenberg is a polyphagous pest and its most favorite host is gram. But it also feeds on pea, wheat, potato, mustard, litchi, khesari, linseed, cabbage, cauliflower during crop season.<sup>1</sup> The cultivators of low land regions sustained losses every year on account of their noticed moth of this pest. Out of the total cultivated area of 2,363,000 hectares in Bihar 15,65,000 hectares

are under rabi crops cultivation which sustains a loss of 10 to 15 percent annually on an average due to cutworms.

Dutt (1917)<sup>2</sup> reported incubation period varied from 6 to 9 days during December and the same was 13 days in January and also reported longest life of female moth to be 16 days, whereas according to Franssen (1935)<sup>3</sup>, the maximum life span of male was 12 days and that of female was 20 days. Wesley (1958)<sup>4</sup> reported that the larval period lasted for about 4 weeks largely depending upon the temperature. The total life cycle as 68 days during December and January and 40 days during February and March.<sup>5</sup>

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**MATERIALS AND METHODS**

**Duration of different stages of life cycle and their survival under laboratory conditions**

With a view to know the incubation period forty freshly laid eggs are isolated by means of slightly moist brush and kept in petridishes (10 cm. diameter). The bottom of the petridish was provided with a filter paper to facilitate counting. The eggs were remained regularly with hand lens for studying the hatching of larvae. For studying the duration of larval period twenty five newly hatched larvae were isolated each month and kept in five petridishes with a layer of sand in the bottom. The larvae were provided with fresh gram twigs every morning and the older one were taken out. Pupation occurred on various dates and fifteen pupae of different dates were kept in the labeled earthen dishes separately. After emergence of adults, they were confined in the breeding cages as mentioned above. The duration of different stages of cutworm were then estimated. Similarly the percentages of survival of the different stages were found out on the basis of their number which completed successfully next progressive stage of growth. The observations on the emergence of male and female adult moths were recorded daily and their sex ratio was determined in percentage.

**RESULT AND DISCUSSION**

For finding out of incubation period, forty freshly laid eggs are isolated every month and kept in petridishes. The bottom of the petridish was provided with a filter paper to facilitate counting. The eggs were examined regularly with hand lens for their hatchability. For study of larval duration, twenty five newly hatched larvae were isolated in each month and kept in five petridishes. These larvae were reared on gram twigs as indicated earlier. The

dates and number of larvae pupated were recorded to estimate the duration of larval period as well as survival percentage of the larvae. Similarly, altogether fifteen pupae were kept under observation each month to estimate the length of pupal period and survival percentage of pupae. When the moths emerged, the number of male and female moths were counted and their longevity was recorded which have been presented in table I. The data presented in table I reveal that the moderate high humidity increased the duration of different stages and their survival also. It was observed that the duration of different stages was the longest and the survival percentage was maximum during January when there was lowest temperature and high humidity. With the rise in temperature and fall in humidity, the duration of different stages of *Agrotis* as well as the survival percentage was declined during December and February onwards. The duration of eggs, larval and pupal period were 9.6, 33.4, 10.5 days respectively in January when the average temperature was maximum 21°C. The maximum survival also took place in the same month which was 95.0, 88.0 and 100 percent respectively. The minimum generation and survival percentage was noted in June when the temperature is maximum i.e., 32.2°C. Further, it was also observed that the dominated over the male population except during the month of April and June. The longest life span of the male and female moths was found to be 9.5 and 12.0 days respectively in the month of January when the temperature was lowest (21.8°C) and relative humidity was 95%. But the life span of both male and female moths declined gradually with the rise in temperature. The data also reveals that the life span of female was invariably longer as compared to male. Life span of male ranged from 3.0 to 10.0 days while in case of female it was 5.0 to 13.0 days.

**Table I- Shows the duration of different stages, survival percentage, sex ratio and longevity of *Agrotis ypsilon* Rott.**

Months	Eggs		Larvae		Pupae		Sex ratio		Longevity	
	Duration (in days)	% of eggs hatched	Duration (in days)	Survival %	Duration (in days)	Survival %	No.of Male	No.of Female	Average longevity of male (in days)	Average longevity of female (in days)
Dec.2020	9.6	93.5	33.4	73.0	10.5	94.5	7	9	9.5	12.0
Jan.2021	11.0	96.5	34.8	89.0	11.5	101.0	8	9	10.5	13.0
Feb.2021	9.0	88.5	31.5	69.0	10.5	87.6	7	8	9.5	11.5
Mar.2021	7.0	76.0	27.2	57.0	9.0	67.6	6	6	7.5	8.0
Apr.2021	6.0	68.5	24.5	49.0	7.5	61.0	6	5	5.0	7.0
May,2021	5.0	60.0	23.0	33.0	6.5	54.5	4	6	4.5	6.0
June,2021	4.5	51.0	19.5	25.0	6.1	47.6	5	4	4.0	5.0

**Table II- Effect of different humidity conditions on the duration and survival of different immature stages of *Agrotis ypsilon* at a constant temperature of 20°C**

Humidity %	Average Incubation period (in days)	Average Viability of eggs (in %)	Average Larval period (in days)	Average Survival % of larvae	Average Pupal period (in days)	Average Survival % of Pupae
60	7.0	66.6	32.0	55.0	7.5	57.4
70	7.5	80.0	35.0	67.7	9.0	75.0
80	8.0	86.5	37.0	77.0	11.0	89.9
90	10.5	93.2	40.0	85.8	12.5	91.6

According to Dutt (1917)<sup>2</sup> incubation periods varied from 6 to 9 days during December and the same was 13 days in January, whereas in the above study it was found to be 9.6 days during December and 11.0 days during January. Jonescu *et.al.*, (1971)<sup>6</sup> found the incubation period to be 1 to 9 days at 10-30° C while in this study it ranged from 4.5 to 11.0 days at 21.8 to 35.2°C. Wesley (1958)<sup>4</sup> reported that the larval period lasted for about 4 weeks largely dependent upon the temperature. Nokolova (1961)<sup>7</sup> found the larval period as 24 to 42 days at 18.5 to 25.3°C and 16 to 18 days at 20°C. The larval period in the present study was found to be 19.5 to 34.2 days at 21.8°C to 34.2°C under Bihar condition.

According to Wesley (1958)<sup>4</sup> the pupal period lasted from 10 to 30 days, whereas Dutt (1917 & 20)<sup>2,8,9</sup> had earlier reported this duration to 9 to 30 days. The same period of 6.5 to 11.5 days have been observed by the present workers also.

Dutt (1917)<sup>2</sup> reported longest life of female moths to be 16 days whereas, according to Franssen (1935)<sup>3</sup> the maximum life span of male was 12 days and that of female 20 days. Studies made at Muzaffarpur revealed the maximum life of male and female as 10.5 and 13.0 days respectively.

Lefroy and Ghosh (1907)<sup>5</sup> reported the duration of the total life cycle as 68 days during December and January and 40 days during February and March, Whereas Dutt (1917)<sup>2</sup> reported the duration of total life cycle ranged from 30 to 68 days. In the present study the total life cycle was found to be 32.5 to 67.3 days.

## CONCLUSION

Considering the great importance of *Agrotis ypsilon* Rott. in significantly reducing the yields of gram and many other rabi crops, it was thought expedient to carry out investigation in respect of some of the important aspects

such as biology of the pest, growth behavior of larvae etc. and also the biological control of this pest.

The gravity of the pest evokes concern to farmers for a suitable and lasting relief from this problem. Efforts are being made since 1950 to control this pest by insecticidal applications but till now, in spite of the best efforts of the entomologists no satisfactory control has been achieved in the protection of crops. Further tremendous health hazards involved with transitory and catastrophe effects on ecosystem. The biological methods of control offers a quite promising and economical approach in controlling this serious pests by the application of *Bacillus thuringiensis* Berlinger, an insect pathogen.

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