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Research Article

EFFICACY BIOLOGY OF CASTOR SEMILOOPER (*Achaea janata* L.) INFESTING CASTOR CROP

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Abstract- The present study was conducted at Chaudhary Charan Singh Haryana Agricultural University, Hisar, Regional Research Station, Bawal, Haryana (India) during the *Kharif* season of 2013-14. The average duration of eggs stage lasts for 2.32± 0.20 days. The larvae passed through five instars stages and mean duration of five instars stages were 1.5 ± 0.19, 1.7 ± 0.15, 2.1 ± 0.20, 2.3 ± 0.17 and 4.3 ± 0.21 days, respectively. Average larval and pupal period lasts 11.9 ± 0.54 and 8.95 ± 0.43 days. The average moth emergence was 95 per cent with the preponderance of males and their ratio was 1:0.85 (male: female). The pre-oviposition, oviposition, and post-oviposition periods ranged from 1-3, 4-7 and 3-6 days, respectively. The female lived slightly longer (11.2 days) than as compared to males (9.3 days). On an average, a female laid 351.2 ± 26.84 eggs during its life span.

Keywords- *Achaea janata* L., Biology, Castor.

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Introduction

Castor semi looper moth is pale reddish brown, which laid eggs singly mostly on the top second leaf which hatch out within 2 to 5 days. The larval period ranges from 11 to 15 days. The pupal period lasts for 10 to 14 days. The first instar larvae nibble only the outer tissues of the leaf, second instar damages the leaves by making holes and the third and later instars devour the green foliage completely leaving veins. During capsule formation stage they also found to feed on capsules. In the case of very severe attack, whole field of castor are completely defoliated and sometimes even the stems are attacked and destroyed [1]. 36.4 per cent reduction in castor leaves, 26.4 per cent branches per plant, 21.4 per cent capsules per bunch and 19.6 per cent loss in seed yield in unprotected plots over protected plots from insecticides recorded [2].

Materials and Methods

The various biological parameters of *A. janata* were studied in the laboratory conditions at average room temperature (33.79ºC max. and 23.61ºC min.) and per cent relative humidity (84.80 morning and 56.02 evening) on Castor (DCH-177) from 1st August to 15th September, 2013. The food for larvae was obtained from the hybrid of castor, which was sown in the research area, Bawal.

Pre-oviposition period

The observations on pre-oviposition period were taken on ten gravid females. The pre-oviposition period was recorded as the duration in days after the adult emergence till the start of oviposition. The paper strips and leaves of castor were replaced and examined daily with the help of hand lens for egg deposition and thus average pre-oviposition period for these females was calculated.

Oviposition period and fecundity

The oviposition period of a female was taken as the duration in days from the day it laid the first egg till egg laying was stopped. Observations on oviposition period were also made on gravid females which were used for pre- oviposition periods. For this purpose, paper strips and leaves of castor were replaced in battery jars after every 24 hours. The paper strips and leaves of castor were examined with the help of hand lens and eggs laid by a female every day were recorded during its oviposition period. The total fecundity of each female was recorded during its oviposition period and thus, average oviposition period and fecundity of these females were calculated.

Post-oviposition period

The duration in days when egg laying by a female was stopped till its death was taken as the post-oviposition period. Ten female moths were used for determining of post-oviposition period and thus, average post-oviposition period was calculated.

Adult longevity

The duration of adult life was recorded from the day of emergence of adults till their death. Five percent honey solution was provided as food. Ten moths of both the sexes were observed for recording their longevity and thus, average longevity for both the sexes was calculated.

Incubation period

The Incubation period was counted as the duration in days after egg laying till their hatching. For finding out the incubation period ten Peteri-dish, having 50 eggs each were observed and thus, average incubation period was calculated. The newly emerged larvae were transferred into jars for studying the larval instars and duration.

Larval period and numbers of instars

The larval duration was recorded as the duration in days from the hatching of eggs till the formation of pupae. The newly hatched larvae of *A. janata* were individually placed in separate jars having castor leaves as a source of food. The food was replaced daily. To find out duration of different larval instars, observations were

made on casting of exuivae daily and thus, the duration of different larval instars and total larval period were recorded.

Pupal period : The time taken from initiation and pupa formation till emergence of moths was considered as pupal period. For observing the pupal period we placed pupae in ten jars and each jars containing twenty pupae and average pupal periods were also calculated.

Sex ratio: The sex ratio was determined by examining the pupae and it was later confirmed by adult emergence. For observing sex ratio, puape were placed in ten jar and each jar containing twenty pupae and the sex of adult was later conformed after the adult emergence from these pupae.

Results and Discussion

[1] Pre-oviposition, oviposition, post-oviposition periods and fecundity per female of castor semilooper on castor

The data revealed that the pre-oviposition period of female moth of castor semi-looper varied from 1 to 3 days with an average of 2.3 days [Table-1]. The oviposition period of castor semi-looper varied from 4 to 7 days with an average of 5.1 days, while the post-oviposition period of *A. janata* varied from 3 to 6 days with an average of 3.7 days on castor. A single female of castor semi-looper laid maximum of 407 eggs with a minimum of 314 eggs with an average of 351.2 eggs per female during her life time. The freshly laid eggs were green in colour and round in shape. It was observed that most of the eggs were deposited during night or in dark places created by wrapping the rearing jars with paper. The eggs were laid singly on leaves, muslin cloth, as well as paper strips supplied for the purpose in the battery jars under laboratory conditions.[3] reported the pre-oviposition period of 3-4 days, which might be due to the different rearing conditions and quality of food fed to the moth during the present investigations. The findings of oviposition period are close conformity with, [4]. The present findings of post-oviposition period are in close proximity with [2, 3] who reported that the post-oviposition period of 3-6 days

Table-1 *Pre-oviposition, oviposition, post-oviposition and fecundity per female of A.janata on castor*

Number of female	Pre-oviposition period (days)	Oviposition period (days)	Post-oviposition period (days)	Fecundity per female
1	3	4	3	314
2	1	7	3	343
3	3	5	5	323
4	3	4	3	407
5	2	5	4	375
6	3	6	3	342
7	2	5	4	326
8	3	4	3	347
9	1	5	6	370
10	2	5	3	365
Mean ± S.D.	2.3 ±0.78	5.1± 0.89	3.7± 1.00	351.2±26.84
Range	1-3	4-7	3-6	314-407

[2] Adult longevity

The data revealed that longevity of male varied from 8.7 to 10.1 days on an average of 9.3 days while the female longevity varied from 10.1 to 12.6 days with an average of 11.2 days [Table-2]. Hence, the female lived slightly longer (11.2 days) than males (9.37 days). However, the present findings are in close proximity with [5, 4] whose reported that the males are short lived as compared to the females. The difference in adult longevity might be attributed to genetic make-up of the population.

[3] Incubation period

It is evident from the results that incubation period ranged from 2.1 to 2.7 days with an overall average of 2.32 days under laboratory conditions [Table-2]. The incubation period varied from 2.1 to 2.7 days with an average of 2.32± 0.20 days. These findings are in agreement with earlier researchers [6-8, 2] who reported the incubation period of castor semi-looper ranged from 2-3 days. However, [4] reported 3-5, 3-4 and 3-4 days, respectively as incubation period, which differed with the results of present investigations.

[4] Duration of larval instars and total larval period

The observations on numbers of larval instars, their durations and larval period are presented in the [Table-3]. It revealed that larval stages of *A. janata* passed through five instars, before transforming into pupal stage. The first larval instar took 1.2 to 1.8 days to become second instar with an average of 1.5 days on castor leaves. The second instars larvae moulted to third instar in 1.5- 2.0 days with an average of 1.7 days. Similarly, the duration of third instar was observed to be 1.8- 2.4 days with an average of 2.1 days. Fourth and fifth instar larvae took 2.1 to 2.6 and 4.0 to 4.7 days with an average of 2.3 and 4.3 days, respectively. The total larval period was ranged from 10.9 to 12.8 days with an average of 11.9 days.

Table-2 *Adult longevity and incubation period of A. janata on castor*

Replication	Adult longevity (Days)*		Incubation period(days)**
	Male	Female	
1	9.2	10.1	2.6
2	9.7	10.8	2.4
3	10.1	12.4	2.2
4	8.7	10.5	2.7
5	9.3	11.7	2.1
6	8.9	10.7	2.3
7	9.6	11.8	2.4
8	9.3	10.1	2.1
9	9.1	12.6	2.3
10	9.8	11.3	2.1
Mean ±S.D.	9.37± 0.40	11.2± 0.85	2.32± 0.20
Range	8.7-10.1	10.1-12.6	2.1-2.7
*** Based on 10 individuals observed per repeats, ** Based on 50 eggs observed per repeat.**			

Table-3 *Duration of different larval instars and total larval period of A. janata on castor*

Replication	Mean duration* of larval instars of *A. janata*(days)					Mean* larval period (days)
	I	II	III	IV	V	
1	1.5	1.8	2.0	2.1	4.1	11.5
2	1.4	1.6	2.2	2.3	4.2	11.7
3	1.2	1.9	2.3	2.6	4.4	12.4
4	1.8	1.7	2.2	2.2	4.7	12.6
5	1.6	1.5	2.1	2.3	4.1	11.6
6	1.4	1.6	1.8	2.1	4.0	10.9
7	1.8	1.7	2.3	2.4	4.6	12.8
8	1.4	2.0	1.8	2.1	4.4	11.7
9	1.3	1.5	2.4	2.5	4.3	12.0
10	1.6	1.7	1.9	2.4	4.2	11.8
Mean ±S.D.	1.5 ± 0.19	1.7 ± 0.15	2.1 ± 0.20	2.3 ± 0.17	4.3 ± 0.21	11.9 ± 0.54
Range	**1.2-1.8**	**1.5-2.0**	**1.8-2.4**	**2.1-2.6**	**4.0-4.7**	**10.9-12.8**
***Based on 10 larvae observed per repeat.**						

According to [7], there were four larval instars of *A. janata* whereas, [5] reported five larval instars. Similarly, [4, 8 and 6] reported five instars of *A. janata* on castor leaves. According to [5] reported the first instar last for 1 to 2 days, second and third lasts for 1 to 3 days, fourth larval instar for 2 to 5 days and the fifth instar lasts for 2 to 5 days. These results are in close proximity with [8] reported a period of 5.45 days for 5th larval instar. [6], reported duration of 1.54, 1.39, 1.60, 1. 55 and 4.40 days for I, II, III, IV and V instars, respectively.

5] Pupal period

The mean pupal period of *A. janata* ranged between 8.3 to 9.6 days with an overall average of 8.95 days [Table-4]. It was noticed that the larvae of *A. janata* pupated inside the castor leaves and also even on the muslin cloth. The pupa is brownish in colour and is covered with a whitish powdery substances.[6, 3] who reported that the pupal period varied from 8-10, 8.30 ± 1.12, and 9-11 days, respectively. In contrast to above findings, [7] reported that the pupal period of castor semi-looper varies from 11 to 27 days. This variation in the pupal period might be due to the variation in temperature and different food provided to the larvae.

(1) Sex ratio

The data showed that the number of male and female obtained indicated that the males were outnumbered the females [Table-4]. The male to female sex ratio was 1: 0.85. [5] who observed that the sex ratio was 1: 0.75 and reported that males slightly outnumbered than the female

Table-4 *Pupal period, sex ratio and percent adult emergence of A. janataon castor*

Replication	Mean pupal period (days)*	Sex ratio**		Per cent adult emergence**
		Number of male obtained	Number of female obtained	
1	9.1	12	8	100
2	8.5	11	9	95
3	9.3	13	7	95
4	8.6	10	10	100
5	8.3	12	8	90
6	9.4	8	12	100
7	8.5	11	8	90
8	9.6	10	10	95
9	9.3	10	11	95
10	8.9	11	9	90
Mean ±S.D.	8.95±0.43	10.8± 1.33	9.2± 1.47	95
Range	8.3-9.6	1.00	0.85	90-100
***Based on 20 pupae observed per repeat, ** Based on 20 individual observed**				

(2) Per cent adult emergence

Adult emergence data which showed that adult emergence ranged from 90-100 per cent with an average of 95 per cent adult emergence [Table-4].[6] Who reported per cent emergence ranged from 96.04 and 95.00 per cent, respectively.

Conclusions

The duration of egg stage varied from 2.1 to 2.7 days with an overall average of 2.32± 0.20 days. The larvae passed through five instars stages before transforming into pupal stage. The total larval period ranged between 10.9-12.8 days with an average of 11.9 ± 0.54 days. The pupal period ranged from 8.3 to 9.6 days with an overall average of 8.95 ± 0.43 days. The average moth emergence was 95 per cent with the pre-ponderance of males and their ratio was 1:0.85 (male: female). The pre-oviposition, oviposition, and post-oviposition periods ranged from 1-3 (2.3 ±0.78), 4-7(5.1± 0.89) and 3-6 (3.7± 1.00) days. The longevity of male varied from 8.7 to 10.1 days on an average of 9.37± 0.40 days while the female longevity varied from 10.1 to 12.6 days with an average of 11.2± 0.85 days.

Conflict of Interest: None declared

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