STUDY OF REPRODUCTIVE BIOLOGY OF A MOTH *EUTECTONA MACHAERALIS WALKER*

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ABSTRACT:

*Eutectonamachaeralis Walker*Lepidopteran moth and is pest for *T. grandis.* Biology of the *Eutectonamachaeralis Walker*have been studied. In ten individuals, preoviposition period ranges from 2 to 3 days with an average of 2.6 ± 0.52 days. and post oviposition period ranged from 1.0 to 2.1 to 2 days with an average of 1.4 ± 0.52 days.Average egg hatching percentage was 75 78.5 ± 9.88. The developmental period of larval instars ranged from 15 to 18 days with an average of 17.0 ± 1.12 days. Instars of *Eutectonamachaeralis Walker*showed head capsule, body width and body length.

KEY WORDS: *Eutectonamachaeralis Walker,*preoviposition, oviposition and postoviposition.

INTRODUCTION:

Pachauri and Sridharan, 1998 reported that much damage is done to our natural resources and wealth.Beeson (1913) reported that *H. puera* and several species of Arctiids such as *Aularchesmiliaris*, *Teratodesmonticollis* Grey and *Spilosomaobliqua* defoliate teak forests. Garthwaite (1939) reported that *Calopeplaleayana* was a serious defoliator of *Gmelinaarborea* in Assam, Bengal, Mumbai and Chennai. *Celosternascabrator* was a most notorius pests of babul, *Acacia arabica* and teak plantations (Beeson, 1941). Khan *et al,*(1988) studied the seasonal activity and abundance of *H. purea*, *Euproctis* sp. and *E. machaeralis* in forest. listed various insect pests of teak, including lepidopterous such as *S.* Sensharma and Thakur (1988) *malabaricus*Moore, *H. puera,* and *E. machaeralis.* Beeson (1941) studied the biology of teak skeletoniser, *E. machaeralis.* David andKumarswami (1982) reported that female of *E. machaeralis* lays 250 to 500 eggs on leaves and as many as 10-12 generations were completed in a year.

Parthiban*et al.* (2016)described that*Ailanthus excelsa* species is extensively used foe making matchwood boxes. The wood extensively used in cottage industries for making wooden toys and cheap quality cricket bats. Also used for packing cases fishing floats, sword sheaths and in paper industry.Chembakassery*et al*. (2021) mentioned *Ailanthus excelsa* mothunder threatened taxa.Review of literature indicates that lepidopterous pests are not very widely attempted in previous days and there is need to concentrate on research on various disciplines of lepidopterous insect pests. Therefore present research work is designed to study the biology of *Eutectonamachaeralis Walker.*

MATERIAL AND METHODS:

*Eutectonamachaeralis Walker*was selected for its biology. The initial culture of the pests was obtained by collecting larval stages from the various forest/ plantations during the course of study and reared in the laboratory in 20 cm height and 10 cm diameter glass jars and other equipment. Leaves of *T. grandis*were provided as a food for the larval stages. Freshly emerged moths from the culture were sexed and released for mating in mating chamber. Healthy leaves of *T. grandis*were kept in conical flask containing water for oviposition. The conical flask was plugged with cotton. The flask was kept in glass jar. The top of the glass jar was covered with muslin cloth secured firmly with a rubber band and the outer side of the jar was covered with black carbon paper for providing darkness. Cotton swab soaked in five per cent sugar solution was kept suspended in the glass jar as a food for moth. Food material was changed periodically. Eggs laid by females were kept in 10 cm diameter petridishes containing the pieces of moist blotting paper at the bottom. After hatching, the larvae were reared in the glass jars on respective host plant leaves, Thus, mass culture was maintained in the laboratory and various aspects of biology were studied by using this culture.

Preoviposition period: The period required from the emergence of female moth from pupa to the commencement of egg laying was recorded for ten females. The average preoviposition period was worked out.

Oviposition period: The period during which the female moth laid eggs was recorded for ten females and the average oviposition period was worked out.

Postoviposition period: The average postovipositon period was worked out with ten female moths till its death.

Fecundity: Observations on egg laying were recorded every 24 hrs. The number of eggs laid by a female was counted every day till the death of female. The mean number of eggs laid by a female moth was worked out by ten females and the data were presented.

Morphometrics of eggs: The morphometrics of eggs were recorded by using ocular micrometer. The average was worked out, of twenty eggs.

Incubation period and hatching percentage: Eggs were observed daily for hatching and observations were continued for fifteen days. The average incubation period and hatching percentage were worked out from the data.

Larval rearing: Ten hatched larvae were transferred into apetridishes with tender leaves of host plants. Blotting paper was provided at its bottom. Fresh leaves were provided as food for the larval stages until pupation. Twenty such petridishes were maintained for study.

Larval instars: Larval stages were observed to study the instars.

Prepupal period: The average length and widths of prepupae were studied.

Pupal period: Twenty prepupae were kept under observation in jar till the adult emergence and the period required for pupal stage was recorded. The average pupal period was worked out. The mean length and widths of pupae were also taken by using millimeter scale.

Adult longevity: The longevity of adults was recorded by counting the duration between the emergence and the death of the adult. Twenty adults were considered for the average longevity of male and female adult and the data are presented.

Adult morphometrics: The measurements on body width, body length and wing expanse were recorded by using millimeter scale for twenty adult of both sexes separately.

Sex ratio: The adult emerged were separated for their sexes and the sex ratio was worked out on the basis of the number of male and female adult emerged from the total number of pupae.

RESULT:

Biology of *Eutectona machaeralis Walker*

During present studies *E. machaeralis* was found to be serious pest of *T. grandis* and therefore biology was undertaken in laboratory, at 25 ± 2^0C, 65± 5 % R.H. and 12 hrs photoperiod.

The initial culture of the pest was obtained by collecting larval stages from western Ghats of Maharashtra (Kolhapur and Satara district) and reared in the laboratory in jars. Healthy leaves of *T. grandis* were provided as a food for larval stages and it was changed periodically till the pupation. Emerged moths from the culture were sexed.

Mating : Newly emerged female and two male adults were released in glass jar covered with muslin cloth. The cotton swab soaked in five per cent sugar solution was kept suspended in jar as food. Ten such jars were kept under obserevations.

Site of oviposion :

A female laid eggs on the undersurface of the leaves of *T. grandis.*

Preoviposition, oviposition and postovipositionperiods :

Observation on ten females were recorded for preoviposition, oviposition and postoviposition periods. Result (Table.1) revealed that preovipositon period ranged from 2 to 3 days with an average of 2.6 ± 0.52 days. Oviposition period ranged from 4 to 6 days with an average of 4.7± 0.67 days. Postoviposition period ranged from 1 to 2 days with an average of 1.4 ± 0.52 days.

Fecundity :

Results indicated that the number of eggs laid by female ranged from 170 to 203 with an average of 187.4 ± 11.5 (Table -1) eggs.

Table : 1 Preoviposition, oviposition, postoviposition periods and fecundity of *E. machaeralis*

Female Number	Preoviposition period (days)	Oviposition period (days)	Postovipostion Period (days)	Fecundity
1	2	5	1	170
2	3	4	2	181
3	3	5	2	172
4	2	5	1	199
5	3	6	1	185

6	3	5	2	201
7	3	4	1	192
8	3	4	2	183
9	2	4	1	203
10	2	5	1	188
Mean	2.6 ± 0.52	4.7 ± 0.67	1.4 ± 0.52	187.4 ± 11.5
Range	2 to 3	4 to 6	1 to 2	170 to 203

Table : 2 Morphometrics of eggs of *E. machaeralis*

Sr. No.	Length (mm)	Breadth (mm)
1	0.69	0.60
2	0.67	0.58
3	0.65	0.55
4	0.70	0.54
5	0.71	0.59
6	0.67	0.54
7	0.66	0.58
8	0.71	0.57
9	0.69	0.55
10	0.70	0.59
11	0.72	0.57
12	0.69	0.60
13	0.70	0.61
14	0.72	0.58
15	0.69	0.60
16	0.70	0.57
17	0.68	0.58
18	0.72	0.58
19	0.71	0.55
20	0.69	0.59
Mean	0.69 ± 0.02	0.57 ± 0.022
Range	0.65 to 0.72	0.54 to 0.61

Morphometrics of eggs :

Eggs were spherical and pale yellow. In 20 individuals eggs averaged 0.69 mm ± 0.02 mm in length and 0.57 mm ± 0.022 mm in breadth (Table – 2).

Table : 3 Incubation period and hatching percentage of *E. machaeralis*

Sr. No.	Date of Egg laying	Eggs observed	Total hatch	Incubation period (days)	Per cent hatch
1	5.9.11	10	6	3.5	60
2	5.9.11	10	6	3.0	60
3	5.9.11	10	9	3.0	90
4	5.9.11	10	9	3.0	90
5	5.9.11	10	8	4.0	80
6	5.9.11	10	8	3.0	80
7	5.9.11	10	9	3.0	90
8	6.9.11	10	8	3.0	80
9	6.9.11	10	8	3.5	80
10	6.9.11	10	8	3.5	80
11	6.9.11	10	9	3.0	90
12	6.9.11	10	9	3.0	90
13	6.9.11	10	8	4.0	80
14	6.9.11	10	9	3.0	90
15	6.9.11	10	7	4.0	70
16	7.9.11	10	7	3.0	70
17	7.9.11	10	7	3.5	70
18	7.9.11	10	7	3.0	70
19	7.9.11	10	7	3.0	70

20	7.9.11	10	8	3.0	80
Mean		200	7.85 ± 0.99	3.25 ± 0.38	78.5 ± 9.88

Incubation period and hatching percentage :

The data on incubation period and hatching percentage of 20 individuals are given in Table – 3. Incubation period ranged from 3 to 4 days (mean 3.25 ±0.38 days). Average egg hatching percentage was 78.5± 9.88.

Larval development :

Observations on larval development are given in Table 15. The developmental period of larval instars ranged from 15 to 18 days with an average of 17.0 ± 1.12 days. During larval development, a larva moulted 4 times. The instarwise measurements on head width, body length and body width are presented in Table – 17.

First instar : Newly hatched larvaewere tiny active and greenish yellow. Head capsule ranged from 0.17 mm to 0.020 mm (mean 0.18 mm ± 0.011 mm) in width (Table -17). Five pairs of prolegs were on 3rd, 4^{th,} 5th, 6th and 10th abdominal segments. Larvae measured 1.70 mm to 2.00 mm long (mean 1.8 mm ± 0.11mm) and 0.30 mm to 0.40 mm broad (mean 0.40 mm ± 0.22 mm) (Table – 17). The instar lasted for 2 to 3 days (mean 2.65 ± 0.49 days) (Table - 15).

Second instar: Larvae were very active and greenish in colour. Head capsule ranged 0.38 mm to 0.41 mm (mean 0.40 mm ± 0.008 mm) in width. Larvae ranged from 3.50 mm to 3.90 mm (mean 3.7 mm ± 0.14 mm) in length and 1.0 mm to 1.2 mm, (mean 1.1 mm ± 0.069 mm) in width (Table – 17). This instar was lasted for 3 to 4 days (mean 3.6 ± 0.50 days) (Table -15).

Third instar : Third instar larvae were green with light brown head bearing whitish setae on the body. Two pairs of black dots were visible on either side of the middorsal line of segments.

The head capsule in 20 individuals measured from 0.60 mm to 0.63 mm (mean 0.62 mm ± 0.011 mm) in width. Larvae measured 10.9 mm to 11.4 mm (mean 11.2 mm ± 0.24 mm) in length and 2.0 mm to 2.2 mm (mean 2.09 mm ± 0.059 mm) in width (Table- 17). The instar lasted for 3 to 4 days (mean 3.3 ± 0.47 days) (Table -15).

Fourth instar : Larvae were greenish brown with well-developed head. The head capsule measured from 0.75 mm to 0.78 mm (mean 0.76 mm ± 0.009 mm) in width. Thoracic legs with claws at tip. The larvae were measured from 17.80 mm to 18.20 mm (mean 18 mm ± 0.13 mm) in length and 3.0 mm to 3.1 mm (mean 3.06 mm ± 0.051 mm) in width (Table -17). The instar lasted for 3 to 4 days (mean 3.65 ± 0.49 days) (Table - 15).

Fifth instar : The larvae changed from greenish to brown. Two longitudinal bands observed on lateral side of thoraracic and abdominal terga. Head was brown, prolegs were conspicuous. Mouth parts were well developed. Head capsules were 1.1mm to 1.4 mm (mean 1.25 mm ± 0.089 mm) in width (Table – 17). Larvae were 21.7 mm to 22.3 mm (mean 22 mm ± 0.21 mm) in length and 3.3 mm to 3.5 mm (mean 3.4 mm ± 0.079 mm) in width (Table -17). Instar lasted for 3 to 5 days (mean 3.9 ± 0.79 days) (Table – 15).

All instars of *E.machaeralis*showed increased head capsule, body width and body length. The instars and their size was tested by applying regression analysis and found positively correlated and represented in tables 18,19,20 and figs. 134,135,136.

Table :4 Development period required by larval instars of *E. machaeralis*

Sr. No.	Instars					Total period (days)
	I	**II**	**III**	**IV**	**V**	
1	3.0	4.0	4.0	4.0	3.0	18.0
2	3.0	3.0	3.0	3.0	4.0	16.0
3	2.0	4.0	4.0	4.0	4.0	18.0
4	3.0	3.0	3.0	4.0	3.0	15.0
5	3.0	4.0	3.0	3.0	3.0	16.0
6	3.0	3.0	3.0	4.0	5.0	18.0
7	3.0	4.0	3.0	4.0	3.0	17.0
8	2.0	4.0	3.0	3.0	3.0	15.0
9	3.0	3.0	3.0	4.0	5.0	18.0
10	2.0	4.0	4.0	4.0	3.0	17.0
11	3.0	4.0	3.0	4.0	5.0	18.0
12	3.0	4.0	4.0	3.0	4.0	18.0
13	2.0	3.0	3.0	3.0	4.0	15.0
14	3.0	4.0	3.0	4.0	4.0	18.0
15	3.0	3.0	3.0	3.0	4.0	16.0
16	3.0	4.0	4.0	3.0	3.0	17.0
17	2.0	3.0	3.0	4.0	5.0	17.0
18	3.0	4.0	3.0	4.0	4.0	18.0
19	2.0	3.0	4.0	4.0	5.0	18.0
20	2.0	4.0	3.0	4.0	4.0	17.0
Mean	2.65 ± 0.49	3.60 ± 0.50	3.30 ± 0.47	3.65 ± 0.49	3.90 ± 0.79	17.0 ± 1.12
Range	2 to 3	3.0 to 4.0	3.0 to 4.0	3.0 to 4.0	3.0 to 5.0	15.0 to 18.0

Table :5 Developmental period required for different stages of *E. machaeralis*

Sr. No.	Developmental period in days			Adult longevity in days	
	Larva	Prepupa	Pupa	Male	Female
1	18.0	2.0	6.0	--	8
2	16.0	2.0	6.0	5	--
3	18.0	1.0	5.0	--	9
4	15.0	1.0	6.0	6	--
5	16.0	2.0	5.0	--	10
6	18.0	1.0	5.0	--	8
7	17.0	1.0	6.0	--	10
8	17.0	2.0	6.0	6	--
9	18.0	2.0	6.0	--	10
10	17.0	1.0	5.0	6	--
11	18.0	2.0	6.0	5	--
12	18.0	1.0	6.0	5	--
13	15.0	1.0	6.0	--	9
14	18.0	2.0	5.0	5	--
15	16.0	1.0	6.0	--	9
16	17.0	1.0	6.0	4	--
17	17.0	2.0	6.0	--	7
18	18.0	2.0	6.0	--	8
19	18.0	1.0	6.0	--	9
20	17.0	1.0	5.0	--	8
Mean	17.0 ± 1.12	1.45 ± 0.51	5.70 ± 0.47	5.25 ± 0.75	8.75 ± 0.88
Range	15.0 to 18.0	1.0 to 2.0	5.0 to 6.0	4.0 to 6.0	7.0 to10.0

Table :6 Morphometrics of different stages of *E. machaeralis*

Sr. No.	Larval									
	Head width (mm)					Body width (mm)				
	I	**II**	**III**	**IV**	**V**	**I**	**II**	**III**	**IV**	**V**
1	0.17	0.41	0.60	0.75	1.1	0.4	1.0	2.0	3.0	3.3
2	0.18	0.40	0.61	0.76	1.3	0.4	1.1	2.1	3.1	3.4
3	0.20	0.39	0.62	0.77	1.4	0.4	1.1	2.1	3.1	3.5
4	0.17	0.40	0.63	0.77	1.3	0.4	1.0	2.0	3.0	3.3
5	0.18	0.40	0.62	0.76	1.2	0.4	1.1	2.1	3.1	3.4
6	0.20	0.39	0.62	0.76	1.2	0.4	1.2	2.1	3.1	3.5
7	0.20	0.41	0.63	0.78	1.3	0.4	1.2	2.1	3.1	3.5
8	0.18	0.38	0.61	0.76	1.3	0.4	1.2	2.1	3.1	3.4
9	0.17	0.41	0.62	0.75	1.1	0.3	1.1	2.0	3.0	3.3
10	0.19	0.40	0.63	0.78	1.3	0.4	1.2	2.2	3.1	3.5
11	0.18	0.40	0.61	0.76	1.3	0.4	1.2	2.1	3.0	3.3
12	0.20	0.41	0.63	0.76	1.2	0.4	1.1	2.2	3.1	3.5
13	0.18	0.40	0.61	0.76	1.3	0.4	1.1	2.1	3.0	3.3
14	0.17	0.41	0.62	0.76	1.1	0.4	1.0	2.0	3.0	3.3
15	0.20	0.39	0.62	0.77	1.4	0.4	1.0	2.0	3.0	3.4
16	0.18	0.40	0.62	0.76	1.2	0.4	1.1	2.1	3.0	3.4
17	0.20	0.41	0.63	0.78	1.3	0.4	1.1	2.1	3.1	3.5
18	0.18	0.40	0.62	0.76	1.2	0.4	1.1	2.1	3.0	3.4
19	0.18	0.40	0.62	0.76	1.2	0.4	1.1	2.1	3.1	3.4
20	0.18	0.40	0.63	0.77	1.3	0.4	1.1	2.1	3.1	3.4
Mean	0.18 ± 0.11	0.40 ± 0.008	0.62 ± 0.011	0.76 ± 0.009	1.25 ± 0.089	0.4 ± 0.022	1.1 ± 0.69	2.09 ± 0.059	3.06 ± 0.51	3.4 ± 0.79
Range	0.17 to 0.20	0.38 to 0.41	0.60 to 0.63	0.75 to 0.78	1.1 to 1.4	0.3 to 0.4	1.0 to 1.2	2.0 to 2.2	3.0 to 3.1	3.3 to 3.5

Table :6 (Continued) Morphometrics of different stages of *E. machaeralis*

Sr. No.	Instars					Prepupa		Pupa	
	Body length (mm)					Width	Length	Width	Length
	I	II	III	IV	V	(mm)	(mm)	(mm)	(mm)
1	1.9	3.7	11.1	18.0	22.0	4.5	17.1	2.3	11.9
2	1.8	3.6	11.0	18.1	21.8	4.4	17.0	2.2	11.8
3	1.7	3.7	11.1	18.0	22.0	4.5	17.3	2.2	11.8
4	1.9	3.7	11.2	18.2	22.0	4.5	17.3	2.2	11.9
5	1.8	3.6	11.0	17.9	21.8	4.4	17.0	2.2	11.8
6	1.7	3.5	11.1	17.8	22.2	4.3	16.9	2.1	11.7
7	1.9	3.7	11.2	18.0	22.0	4.5	17.1	2.2	12.0
8	1.7	3.9	11.4	18.2	22.3	4.6	17.3	2.1	12.2
9	1.7	3.5	11.0	17.8	21.7	4.6	17.0	2.1	11.7
10	1.7	3.9	11.4	17.8	21.7	4.6	11.3	2.1	11.7
11	1.8	3.6	11.2	18.0	22.3	4.5	17.1	2.2	12.0
12	1.9	3.8	11.3	18.1	22.1	4.6	17.2	2.3	12.1
13	1.7	3.9	11.4	18.2	22.3	4.6	17.3	2.4	12.2
14	1.7	3.9	11.4	17.8	22.2	4.6	16.9	2.1	11.7
15	1.8	3.6	11.0	17.9	21.8	4.5	17.0	2.2	11.8
16	1.8	3.6	11.0	17.9	21.8	4.4	17.0	2.2	11.8
17	1.7	3.5	10.4	18.0	21.7	4.3	16.9	2.1	11.7
18	1.9	3.7	11.2	18.0	22.0	4.5	17.1	2.2	12.0
19	2.0	3.9	11.4	18.2	22.3	4.6	17.3	2.4	12.2
20	1.9	3.7	11.2	18.0	22.0	4.5	17.1	2.2	12.0
Mean	1.8 ± 0.11	3.7 ± 0.14	11.2 ± 0.24	18.0 ± 0.13	22.0 ± 0.21	4.5 ± 0.11	17.0 ± 0.14	2.2 ± 0.99	11.9 ± 0.18
Range	1.7 to 2.0	3.5 to 3.9	10.9 to 11.4	17.8 to 18.2	21.7 to 22.3	4.3 to 4.6	16.9 to 17.3	2.1 to 2.4	11.7 to 12.2

Table :6 - (Continued) Morphometrics of different stages of *E. machaeralis*

Sr. No.	Adult					
	Male			Female		
	Body length (mm)	Body width (mm)	Wing Expansion (mm)	Body length (mm)	Body width (mm)	Wing Expansion (mm)
1	12.0	1.7	19.0	9.1	2.3	20.0
2	12.1	1.8	19.2	9.2	2.4	20.2
3	11.9	1.6	18.7	8.8	2.2	18.2
4	12.1	1.8	19.2	9.2	2.4	20.1
5	12.1	1.8	19.2	9.2	2.4	20.1
6	10.7	1.5	17.2	9.0	2.3	18.3
7	11.9	1.8	18.7	8.8	2.2	18.2
8	12.0	1.7	19.0	9.1	2.3	20.0
9	10.8	1.8	17.3	9.1	2.4	18.3
10	11.7	1.5	17.2	9.0	2.3	18.1
11	11.9	1.6	18.7	8.8	2.2	19.1
12	12.1	1.8	19.2	9.2	2.4	20.1
13	12.0	1.7	19.0	9.1	2.3	20.0
14	12.0	1.7	19.0	9.1	2.3	20.0
15	11.9	1.6	18.7	8.8	2.2	18.2
16	10.8	1.8	17.3	9.1	2.4	18.3
17	12.0	1.7	19.0	9.1	2.3	20.0
18	12.0	1.7	19.0	9.1	2.3	20.0
19	12.1	1.8	19.2	9.2	2.4	20.2
20	11.9	1.6	18.7	8.8	2.2	18.6
Mean	11.8 ± 0.52	1.7 ± 0.98	18.6 ± 0.73	9.04 ± 0.15	2.3 ± 0.79	19.3 ± 0.92
Range	10.7 to 12.1	1.5 to 1.8	17.2 to 19.2	8.8 to 9.2	2.2 to 2.4	18.1 to 20.2

Nature of damage and larval behaviour :

Newly hatched larvae were very active and fed on green matter under leaf. Second instar larva consumed tissues between the network of veins. Later instars migrated from one leaf to another and fed on green matter andskeletonising the leaf which turned brown. Tender leaves badly damaged than older leaves. Moulting took place under web of leaves.

Prepupa :

The full grown larvae were sluggish and stopped its feeding and changed from greenish brown to purple. The larva gradually shortened to the size of future pupa. A thick and opaque shelter web was spun by the larva. Prepupal period lasted for 1.0 to 2 days (mean 1.45 ± 0.51 days) (Table -5).

Pupa :

The larvae pupated on either lower or upper surface of leaf. The larva also pupated on glass surface beneath the blotting paper. Freshly formed pupa was reddish brown, gradually turned dark brown. In 10 individualspupal length ranged from 11.7 mm to 12. 2 mm (mean 11.9 mm ± 0.18 mm) and width ranged from 2.1 mm to 2.4 mm (mean 2.2 mm ± 0.099 mm) (Table – 6). Pupal stage lasted for 5 to 6 days (mean 5.7 ± 0.47days) (Table -5).

Adult :

Upon eclosion, wings expanded in about ten minutes and moth was ready to fly. Abdomen of female bigger than that of male. In both sexes fore wings were bright yellow in color with pink transverse zigzag marking while hind wings were pale yellow with reddish marginal lines and antennae were setaceous.

Female adult :

Female moths were medium sized and strongly built. Tarsal spurs on segment were pointed. Compound eyes were raddish brown. The abdomen of female was bulging. In selected 20 individuals, body length ranged from 8.8 mm to 9.2 mm (mean 9.04 mm ± 0.15 mm) whereas width ranged from 2.2 mm to 2.4 mm (mean 2.3 mm ± 0.079 mm). Wing expansion ranged from 18.1 mm to 20.2 mm (mean 19.3 mm ± 0.93 mm) (Table – 6). Adult longevity varied from 7 to 10 days (mean 8.75 ± 0.88 days) (Table – 5).

Male adult :

Moths were medium sized, stoutly built but smaller than females. In male abdomen was slender and pointed towards anal end. In 20 individuals body length ranged from 10.7 mm to 12. 1 mm (mean 11.8 mm ± 0.52mm) while the width ranged from 1.5 mm to 1.8 mm (mean 1.7 mm ± 0.098 mm). The wing expansion ranged from 17.2 mm to 19.2 mm (mean 18.6 mm ± 0.73 mm) (Table- 6). Adult longevity varied from 4 to 6 days (mean 5.25 ± 0.75 days) (Table -5).

Life cycle :

The duration of egg, larval, prepupal, pupal and adult stages varied from 3 to 4 days (mean 3.25 ± 0.38 days), 15 to 18 days (mean 17.0 ± 1.12 days), 1 to 2 days (mean 1.45 ± 0.51 days), 5 to 6 days (mean 5.7 ± 0.47 days) and 7 to 10 days (mean 8.75 mm ± 0.88 mm) respectively. Larva completed its development in 17.0 ± 1.12 days by passing through five instars, the duration of which lasted for 2.65 ± 0.49, 3.60 ± 0.50, 3.30 ±0.47, 3.65 ± 49 and 3.90 ± 0.79 days respectively. The life cycle from egg to adult varied from 24.00 to 30.00 (mean 27.40days). Required period for the completion of one generation varied from 31.00 to 40.00 (mean 36.15 ± 3.36 days).

Sex ratio:

Sex ratio, male to female averaged 1:1.5 (Table – 8).

Table – 7 Life cycle of *E. machaeralis*

Stages	Duration in days		
	Min.	Max.	Mean.
Egg	3.0	4.0	3.25 ± 0.38
Larval instars			
First instar	2.0	3.0	2.65 ± 0.49
Second instar	3.0	4.0	3.60 ± 0.50
Third instar	3.0	4.0	3.30 ± 0.47
Fourth instar	3.0	4.0	3.65 ± 0.59
Fifth instar	3.0	5.0	3.90 ± 0.79
Total larval period	15.0	18.0	17.0 ± 1.12
Pre pupal period	1.0	2.0	1.45 ± 0.51
Pupal period	5.0	6.0	5.70 ± 0.47
Male	4.0	6.0	5.25 ± 0.75
Female	7.0	10.0	8.75 ± 0.88
Life cycle	24.0	30.0	27.40 ± 2.48
Period of generation.	31.0	40.0	36.15 ± 3.36

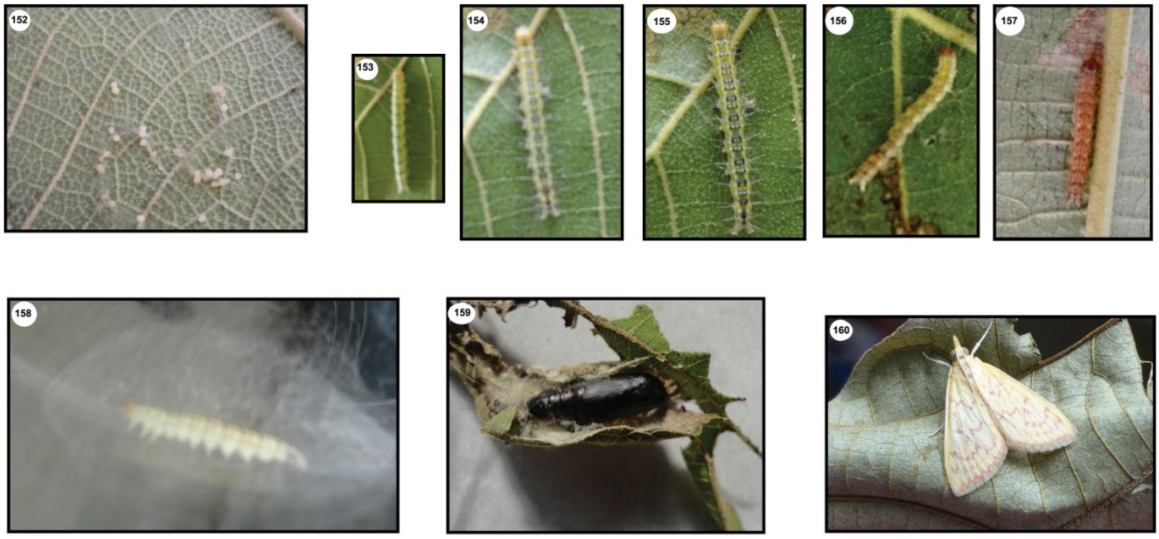
Table – 8 Sex ratio of *E. machaeralis*

Sr.No	Adult examined	Males	Females
1	10	4	6
2	10	5	5
3	10	4	6
4	10	3	7
5	10	4	6
6	10	5	5
7	10	4	6
8	10	3	7

9	10	4	6
10	10	4	6
Total	100	40	60

Sex ratio, male to female = 1:1 .5

PLATE.38



LIFE CYCLE– *EUTECTONA MACHAERALIS*

Fig-152-Eggs,Fig-153-First instar larva,Fig-154-Second instar larva,Fig-155-Third instar larva,Fig-156-Fourth instar larva, Fig-157-Fifth instar larva,Fig-158-Prepupa,Fig-159-Pupa,Fig-160-Adult

DISCUSSION:

Beeson (1941) reported that oviposition period in*E. macheralis* ranged from 7 to 14 days David andKumarswami (1982) reported 250 to 500 eggs laid by the females while according to Beeson (1941) eggs averaged 0.75 mm in length.

Stabbing (1903) studied incubation period in *E. machaeralis.* He reported 3 to 4 days as incubation period for the eggs. Maximum eggs were hatched on third day while, David andKumarswami (1982) recorded 2 to 3 days incubation period in *E. machaeralis* but, Patil &Thontadarya (1987) recorded 3 to 4 days as incubation period in the laboratory.

The larval development was completed from 12 to 20 days during which *E. machaernlis* passed through five instars (Beeson, 1941). David andKumarswami (1982) reported 18 to 27 days as larval period. While, Patil &Thontadarya (1987) reported 12.0 to 19.3 days as larval developmental period in the same species. The present findings were in agreement with those of Beeson (1941), who reported that the larval period was 12 to 20 days at Nilambur, Chennai and 12 to 19 days at Pyrimana, Myanmar. David andKumarswami (1982) reported 18 to 27 days as larval developemental period while, Patil &Thontadarya (1987) noticed five larval instars and the larval periods for first, second, third, fourth and fifth instars were 2.5 to 4.0, 3.0 to 4.0, 2.5 to 4.0, 3.0 to 4.0 and 4.0 to 5.0 days respectively.

According to Beeson (1941) pupal stage lasted for 6 to 7 days in *E. machaeralis*while, Patil &Thontadarya (1987) reported pupal period as 7 to 8 days during July – August, 8 to 9 days during December-January and 6 to 7 days during March – April, in the same species. Beeson (1941) studied wing expansion of male and female moths in *E. machaeralis* as 21 to 26 mm and 19 to 24 mm, respectively and adult longivity as 9 days, while Patil &Thontadarya (1987) reported longivity of *E. machaeralis* male and female moths as 8.80 to 15.45 days and 11.90 to 19.95 days respectively. In present study female moths of *E. machaeralis* survived for 6.9 days when fed with 5% sugar solution. According to Beeson (1941) the incubation, larval, prepupal, pupal and adult stage varied from 2 to 3 days, 8 to 27 days, 1 to 2 days, 4 to 11 days and 9 days respectively in *E. machaeralis*. He also reported that the life cycle was completed in 24 to 41 days. Beeson (1941) counted sex ratio (male:female) as 1:1.94 in *E. machaeralis* females outnumbered the males. He reported that female moths were often twice as much as male moths in number.

REFERENCES:

Beeson, C.F.C., 1913 Annual report of Forest Entomology. Scientific Advice for India: 8-11.

Beeson, C.F.C., 1941 Ecology and control of forest insects of India and the neighbouring countries Government of India (1961 Reprint): 767.

Chembakassery Jose Alex, KoladyparambilChinnanSoumya and ThavalathadathilVelayudhanSajeev, 2021 A report on the moth (Lepidoptera: Heterocera) diversity of Kavvai River basin in Kerala, India, Journal of Threatened Taxa 13(2): 12.

David, B.V. and T. Kumarswami, 1982 Insect pests of forest trees. Elements of Economic Entomology. Popular Book Depot, Madras:177- 187.

Garthwaite, D. F., 1939 Biology of CalopeplaleayanaLatr. (Chrysomelidae :Coleoptera) and the possibilities of control. Indian For. Rec., 5(2): 237-241.

Khan, H. R., Kumar, S. and L. Prasad, 1988 Studies on seasonal activity of some Agroforestry insect pests by light lamp. Indian J. For., 114(4): 215-229.

Parthiban, K. T., Jude Sudhagar, R., UmeshKhanna, S., Vennila S., Sekar I. and Baranidharan K., 2016 Forestry-A subjective guide for IFS aspirants, Competition tutor, Jodhpur:93.

Pachauri, R. K. and P. V. Shridharan, 1998. Green India -2047, Looking back to Think ahead. Green India, 31:1-346.

Sensarma, P.K. and M.L. Thakur, 1988.Insect factor in the management of forest resources. My Forest, 24 (2): 99-113.