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DEVELOPMENT OF IMMATURE STAGES OF LEAF CUTTING WEEVIL, *Eugnamptus marginellus* UNDER DIFFERENT LEVELS OF CONSTANT TEMPERATURE

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ABSTRACT

The development and viability of the leaf cutting weevil, *Eugnamptus marginellus* Fst. was evaluated under laboratory condition at seven different constant temperatures, *viz.*, 14 ± 1°C, 15 ± 1°C, 20 ± 1°C, 25 ± 1°C, 30 ± 1°C, 35 ± 1°C and 36 ± 1°C. Freshly laid eggs were allowed to incubate separately at seven temperature regimes and allowed to develop till adult emergence. There was decrease in egg period with increase of temperature from 15 ± 1°C - 35 ± 1°C and with the increase of temperature from 15 ± 1°C - 35 ± 1°C there was increase in hatching percentage but the rate of hatching was lowered at 35 ± 1°C. None of the eggs hatched at lower temperature below 15 ± 1°C and upper temperatures above 35 ± 1°C indicating threshold level for egg development. The larval, prepupal and pupal period were found to decrease with the increase of temperature from 15 ± 1°C - 30 ± 1°C and 25 ± 1°C - 30 ± 1°C but none of the prepupal larvae transformed into pupae when exposed to 15 ± 1°C - 20 ± 1°C.

KEY WORDS : Leaf cutting weevil, *Eugnamptus marginellus*, constant temperature, development

Leaf cutting weevi *Eugnamptus marginellus* Fst. (Coleoptera: Cunculionidae) is one of the most serious pests of mango grafts in West Bengal. The pest has been reported from various mango growing tracts of India and abroad. The femal cuts the tender leaves after deposition of eggs on either side of midrib thus defoliates the grafts and the larvae develop on fallen cut leaf by passing through three instars. While temperature plays a decisive role in its population build-up, the impact of temperature on development of *E.marginellus* was studied to provide experimental evidence with the objective to assess the utility in application under field condition.

MATERIALS AND METHODS

Cut leaves with freshly deposited eggs were collected from the Horticultural Nurservy Farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani (22.5° N and 88.2°E) located on the Gangetic plains of West bengal. The leaves were then kept in petridishes (20 cm dia) with a layer of moist soil to keep the turgidity of leaves. The petridishes containing eggs were then exposed to different levels of constant temperature separately in BOD incubator. Seven temperature regimes *viz.*, 14 ± 1°C, 15 ± 1°C, 20 ± 1°C 25 ± 1°C, 30 ± 1°C, 35 ± 1°C and 36 ± 1°C were considered including control where the materials were kept constantly at room temperature ranging 27°C-29°C. Observations on developmental period of eggs and per cent egg hatched were recorded *vis-a-vis* the eggs failed to hatch at lower or at upper temperature, were also recorded. Observations on instarwise larval period were also recorded except at 35 ± 1°C where only egg period was recorded. Larva on hatching, mined and fed within leaf. At each observation, larval period was detected by shedding of head capsule observed under binocular microscope. Since pupation takes place in soil after completion of larval stage, the prepupal larvae came out by boring the mined leaves and were allowed to pupate in plastic containers (11 cm x 5 cm) provided with layer of 6 cm moist pulverised soil and the containers were exposed to different levels of temperature as mentioned earlier inside the BOD incubator separately till adult emergence. Simultaneously, observations on prepupal and pupal periods were recorded. For the above experiment, 50 leaves having four newly hatched out larvae in each leaf were taken and observation was recorded from 50 individuals at random for each constant temperature separately. (Fig.1).

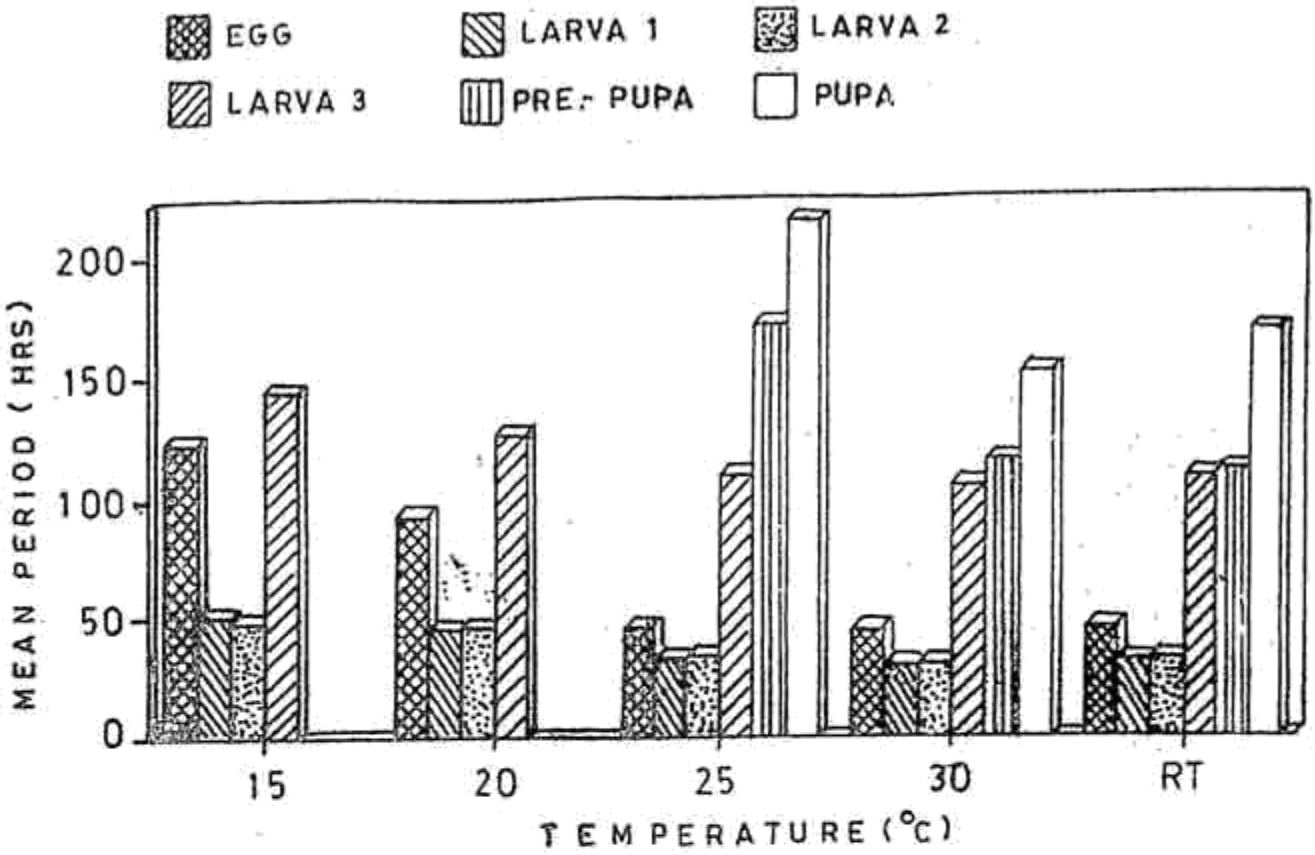

Fig. 1. Developmental period of immature stages of *E. marginellus* exposed to different constant temperatures

RESULTS AND DISCUSSION

Egg period

The egg stage seems to be sensitive to temperature fluctuations. There was a decrease in the incubation period with the increase of temperature from 15 ± 1°C - 35 ± 1°C indicating negative correlation between temperature and incubation period. It was also observed that with the increase of temperature from 15 ± 1°C - 30 ± 1°C there was increase in the hatching percentage but hatching percentage was found to decrease at 35 ± 1°C. From the observations carriet out, it was found that the development period of egg varied considerably with the prevailing temperature. The mean egg periods were observed to 123.12 hrs. (5.13 days), 93.36 hrs (3.89 days) 47.28 hrs (1.97days), 46.08 hrs (1.92 days) and 45.81 hrs (1.91 days) and the hatching percentages were 45.25, 69.39, 82.41, 80.66 and 41.22 respectively when the eggs were exposed constantly at 15 ± 1°C, 20 ± 1°C, 25 ± 1°C , 30 ± 1°C and 35 ± 1°C temperature respectively and in room temperature the mean egg period and hatching percentage were 46.80 hrs (1.95 days) and 80.71 respectively.

It is seen (Table 1, Fig. 1) that there was a significant variation in egg period and it was observed that the eggs exposed to 15 ± 1°C and 20 ± 1°C took more time than those eggs exposed to 25 ± 1°C - 35 ± 1°C and at room temperature. It was also noted that there was no significant variation in egg period when exposed to 25 ± 1°C - 35 ± 1°C as compared to room temperature.

Threshold of development

It was revealed (Table 1) that there was no hatching of eggs at 14 ± 1°C even after a lapse of more than two weeks. They were then shifted to room temperature to determine their viability and all the eggs were found dead. The findings indicate clearly that there is practically no development below 15 ± 1°C, which therefore marks that 14 ± 1°C temperature was the lower vital limit for the egg development.

From the experiments carried out to establish the index of development of eggs of *E. marginellus* it was noted that the growth period of eggs sharply decreased with the increase in temperature from threshold upto a temperature of 25 ± 1°C, there

after showed more or less straight and at 36 ± 1°C, no development took place (Table 1). To determine the viability of the eggs exposed at 36 ± 1°C, they were transferred to room temperature and were observed dead even after observing for seven days. The results as obtained from the experiment indicate that the condition for optimum development of eggs lies in the range of temperature from 25 ± 1°C to 35 ± 1°C and that the upper vital limit remains at 36 ± 1°C.

Larval period

There was a negative correlation between temperature and larval period of three instars (Table 1, Fig. 1) as observed earlier incase of egg period. The mean period of first, second and third instar larvae were 51.12, 48.48 and 144.48 hrs (2.13, 2.02 and 6.02 days) at 15 ± 1°C ; 45.84, 46.32 and 127.44 hrs (1.91, 1.93 and 5.31 days) at 20 ± 1°C ; 34.65, 34.95, and 110.35 hrs (1.44, 1.46 and 4.60 days) at 25 ± 1°C ; 31.25, 31.53 and 105.12 hrs (1.30, 1.31 and 4.38 days) at 30 ± 1°C and 32.66, 33.12 and 107.95 hrs (1.36, 1.38 and 4.50 days) at room temperature. At 35 ± 1°C, data on larval period were not recorded. The growth period of three different instars varied considerably when the data as obtained from effect of different temperatures were compared, in which case the growth period were retarded in the temperature range of 25 ± 1°C to 30 ± 1°C where as growth was prolonged at low temperature of 15 ± 1°C and 20 ± 1°C. It indicates that the optimum temperature for larval development also lies in the same range of temperature as in the case of egg development.

Prepupal period

Similar trend was noticed in the duration of prepupal instar also. With the increase of temperature from 15 ± 1°C to 30 ± 1°C, there was decrease in prepupal period. The mean period observed was 172.55 hrs (7.19 days) and 115.61 hrs (4.82 days) when they were exposed to 25 ± 1°C and 30 ± 1°C and was 110.85 hrs (4.62 days) at room temperature (Table 1).

It was interesting to note that the index of development showed uniform accelaration to temperature ranging from 25 ± 1°C to 30 ± 1°C. At lower this (15 ± 1°C - 20 ± 1°C) a change was noticed, which is however, not as marked as that in

Table 1. Effect of constant temperature on developmental period of immature stages of *E.marginellus*

Stage of insect	Developmental (h)																					
	14 ± 1°C			15 ± 1°C			20 ± 1°C			25 ± 1°C			30 ± 1°C			35 ± 1°C			36 ± 1°C			Room temperature (28-31°C)		
	Min.	Max.	$(\bar{X})^a$	Min.	Max.	$(\bar{X})^a$	Min.	Max.	$(\bar{X})^a$	Min.	Max.	$(\bar{X})^a$	Min.	Max.	$(\bar{X})^a$	Min.	Max.	$(\bar{X})^a$	Min.	Max.	$(\bar{X})^a$	Min.	Max.	$(\bar{X})^a$
Egg	-	-	-	121.00	125.00	123.12	92.00	94.00	93.36	46.00	48.00	47.28	45.00	47.00	46.08	45.00	46.00	45.81	-	-	-	45.00	48.00	46.80
% hatching																								
of egg					45.25			69.39			82.41			80.66				41.22			-			80.71
Larva																								
	-	-	-	50.00	53.00	51.12	45.00	47.00	45.84	26.00	36.00	34.65	26.00	32.00	31.25	NR	NR	NR	-	-	-	27.00	47.00	32.66
I	-	-	-	48.00	50.00	48.48	46.00	47.00	46.32	27.00	36.00	34.95	26.00	32.00	31.53	NR	NR	NR	-	-	-	25.00	47.00	33.12
II	-	-	-	144.00	146.00	144.48	125.00	1300	127.44	98.00	116.00	110.35	96.00	109.00	105.12	NR	NR	NR	-	-	-	102.00	120.00	107.95
Prepupa	-	-	-	-	-	-	-	-	-	144.00	186.00	172.55	110.00	118.00	115.61	NR	NR	NR	-	-	-	98.00	137.00	110.85
Pupa	-	-	-	-	-	-	-	-	-	204.00	240.00	215.45	132.00	190.00	152.25	NR	NR	NR	-	-	-	140.00	214.00	168.17

NR = Data not recorded ^{a} = Mean of 50 observations

the case of egg or larval development. The prepupating larvae were able to complete development at constant temperature of 25 ± 1°C and 30 ± 1°C respectively but were unable to do so at 15 ± 1°C and 20 ± 1°C. In this case, the prepupating larvae were kept at 15 ± 1°C and 20 ± 1°C for a period of about one month. All of them remained as such without reaching the pupal stage. They were then shifted to room temperature to determine their variability and withing a week, the prepupating larvae transformed into pupae to the tune of 95 per cent. This study interestingle gave an idea that during winter months (December - January) when temperature is low, *E. marginellus* hibernates in the prepupal stage under field condition.

Pupal period

Similarly there was a negative correlation between temperature and pupal period. The mean pupal period was prolonged i.e. 215.44 hrs (8.98 days) when prepupating larvae were exposed to 25 ± 1°C (Table 1). but it was significantly low i.e. 152.25 hrs (6.34 days) at 30 ± 1°C. The period when prepupal larvae kept at room temperature took more time and it was 168.17 hrs (7.00 days) than those exposed at 30 ± 1°C but it was less than those exposed at 25 ± 1°C.

Earlier studies by Tigvattnanont (1988), Bhole and Dumbre (1989), Hutson and Alwis (1934), Khanna (1952) and Hussain (1989) on the development of *E.marginellus* were made at ordinary temperature only. Studies on the development and viability of different insect species except *E. marginellus* in relation with meteorological parameters have been highlighted by several workers. Exposure of eggs to low temperature (10°C) for some Period was known to retard the development of eggs of Orthoptera (Bodine, 1925), *Tetranychus telarius* (Harrison and Smith, 1961), *Eurybrachys tomentosa* (Pugalenthi and Livingston, 1993), while Katiyar and Mukharji (1974) noted that the egg period of *Leucinodes orbonalis* was much prolonged at 15°C than at 27°C. Atwal and Verma (1972) observed acceleration in the rate of development in the egg of *L.orbonalis* owing to rise in temperature more between 20°C and 25°C than between 25°C and 30°C. The present study revealed that the eggs did not hatch below 15 ± 1°C and the rate of hatching of eggs was more at 25 ± 1°C and 30 ± 1°C. Ahmad and Ullah (1939) found that the eggs of *Earias fabia* did not hatch even at 13°C in twenty eight days and they were then transferred to 16°C to determine their viability and all the eggs were dead indicating lower threshold level *vis-a-via* failed to hatch at 40°C indicating upper threshold level for egg development. The present authors also noted similar trend and observed that the eggs of *E.marginellus* failed to hatch at 14 ± 1°C after keeping them more than two weeks and they were then shifted to room temperature and all the eggs were found dead and also the eggs did not hatch at 36 ± 1°C indicating lower and upper thresholod for egg development of *E.marginellus*.

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VAMBAN 1 A NEW COWPEA VARIETY FOR TAMIL NADU

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ABSTRACT

Vamban-1 cowpea is a pureline selection from IT85-F 2020. It matures in 55-65 days with high yield potential. It is an erect type with an average height of 25-30 cm. The average grain yield is 750 kg/ha under rainfed condition. Being white seeded, the variety has an edge over other varieties in market preference.

KEY WORDS : Vamban-1 cowpea, high yield, early maturity, rainfed, white seed

Cowpea (*Vigna unguiculata* (L.) Walp) is an important pulse crop in Tamil Nadu. Various types of cowpeas with differences in maturity, plant type, pod and seed variability are in cultivation depending upon the rainfall, ecology and cropping system. As it is drought tolerant, it is the predominant food begume in the drier regions of India. Earlier, breeding for improved cowpea varieties resulted in the release of many varieties with long duration (75-100 days) but lacked wider adaptability. Hence, an attempt was made at the National Pulses Research Centre (NPRC), Vamban to evolve a high yielding short duration variety possessing wide adaptability. This resulted in the identification of culture VCP 8 wich was released during 1997 as Vamban 1 for general cultivation in Tamil Nadu.

Table 1. Performance of VCP 8 in station trials (grain yield : kg/ha)

Season	VCP 8	Co 6	P 152
Kharif '89	761	-	474
Rabi 90-91	882	-	694
Kharif '91	534	-	476
Kharif '92	572	-	294
Rabi 92-93	1286	-	667
Kharif '93	644	-	629
Kharif '94	792	730	716
Rabi 94-95	529	502	392
Summer '95	469	383	303
Kharif '95	1192	926	909
Rabi 95-96	670	501	286
Summer '96	411	334	278
Kharif '96	811	771	757
Mean	735	612	529
% increase over CO 6	20.0	-	-
% increase over P 152	39.0	-	-

MATERIALS AND METHODS

The continued evaluation and screening of various cowpea genotypes at NPRC, Vamban has resulted in the identification of a high yielding culture VCP 8. It is a pure line selection from IT 85-F 2020 and forwarded as single plant progenies. After selections were made, the seeds were bulked, multiplied and evaluated from 1989 on wards alongwith check varieties P 152 and Co 6. This culture was evaluated in station trials (ST) at NPRC for eight years from 1989 to 1996 in multilocation trials (MLT), in different reseach stations from 1994 to 1995 and in adaptive research trials (ART), in farmer's holding of different districts from 1994 to 1995 and the results are presented in Tables 1 to 3 respectively.

RESULTS AND DISCUSSION

The culture VCP 8 has been tested from *kharif* 1989 onwards at NPRC, Vamban. It has recorded a

Table 2. Performance of VCP 8 in multilocation trials (grain yield : kg/ha) during 1994-95

Station	VCP 8	CO 6	P 152
Vamban	798	582	774
Coimbatore	265	386	299
Bhavanisagar	614	634	567
Virudhachalam	516	535	655
Tindivanam	650	525	402
Killikulam	973	745	688
Pattukkottai	712	454	553
Mean	647	537	563
% increase over CO 6	20.5		
% increase over P 152	15.1		