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**CPN Gautam**

Department of Entomology,  
A.N.D. University of Agriculture  
and Technology, Kumarganj,  
Ayodhya Uttar Pradesh, India

**Umesh Chandra**

Department of Entomology,  
A.N.D. University of Agriculture  
and Technology, Kumarganj,  
Ayodhya Uttar Pradesh, India

**Ram Veer**

Department of Entomology,  
A.N.D. University of Agriculture  
and Technology, Kumarganj,  
Ayodhya Uttar Pradesh, India

**Akshay Kumar**

Department of Entomology,  
A.N.D. University of Agriculture  
and Technology, Kumarganj,  
Ayodhya Uttar Pradesh, India

**SK Yadav**

Department of Entomology,  
A.N.D. University of Agriculture  
and Technology, Kumarganj,  
Ayodhya Uttar Pradesh, India

**Corresponding Author:****Ram Veer**

Department of Entomology,  
A.N.D. University of Agriculture  
and Technology, Kumarganj,  
Ayodhya Uttar Pradesh, India

## Study on biology of rice yellow stem borer

**CPN Gautam, Umesh Chandra, Ram Veer, Akshay Kumar and SK Yadav**

**Abstract**

The experiment was conducted at Students' Instructional Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya during *Kharif*, 2015 and 2016. The mean length (mm)  $2.0 \pm 0.12$  &  $1.8 \pm 0.10$  and mean head capsule width (mm)  $0.2 \pm 0.01$  &  $0.3 \pm 0.02$  were recorded during *Kharif*, 2015 and 2016, respectively. The mean incubation periods of  $6.2 \pm 0.36$  and  $6.5 \pm 0.38$  days were recorded in the year *Kharif*, 2015 and 2016, respectively. The mean total larval period was  $27.5 \pm 1.66$  and  $28.9 \pm 1.72$  days was recorded during *Kharif*, 2015 and 2016, respectively. The average pupal period was  $8.6 \pm 0.51$  days and  $8.9 \pm 0.53$  days was recorded. The mean duration of male adult  $2.6 \pm 0.15$  days and  $2.8 \pm 0.16$  days of female was recorded during *Kharif*, 2015, respectively. The mean duration of male adult  $2.7 \pm 0.22$  and female adult  $2.9 \pm 0.17$  days was recorded during *Kharif*, 2016, respectively. The pre-oviposition, oviposition and post oviposition period of  $1.0 \pm 0.06$ ,  $1.5 \pm 0.08$  and  $1.0 \pm 0.07$  was recorded in *Kharif*, 2015 and  $1.3 \pm 0.07$ ,  $1.7 \pm 0.09$  and  $1.2 \pm 0.05$  in *Kharif*, 2016. The average total life cycle of *Scirpophaga incertulas* was  $42.3 \pm 3.54$  days and  $44.3 \pm 3.61$  days in *Kharif*, 2015 and 2016, respectively.

**Keywords:** Egg, larvae, adult, temperature, day, rice and *Kharif*

**Introduction**

Rice (*Oryza sativa* L.), is the most important food crop of the global importance which is also the staple food for nearly half of the world population. India has the largest area under rice crop with about 45 million ha and second largest producer (104.32 million tonnes) in 2015-16 next to China. India and China together account for 56 per cent of the total production and 50 per cent of world area [2]. The various biotic and abiotic constraints encountered the rice production and productivity; among them insect-pests are major harmful biotic factors that caused 21-40 per cent losses in rice yield [9]. In India, approximately More than 100 species of insects are known to attack this crop, of which about 20 are of economic importance [8]. The five species of stem borers distributed throughout India. Among these, YSB is the most widespread, dominant and destructive pests. It causes damage to rice throughout the crop growth period. At tillering stage, the stem borer larva enters in the tiller and feeds inside resulting in dead heart. Where as in the central leaf whorl does not unfold, turns brownish and dries out although the lower leaves remain green and healthy. The affected tillers do not bear panicles. At reproductive stage, the damage is characterized by conspicuous whitish empty panicles which are called white earheads [6]. Among the major notorious insect pest, rice yellow stem borer, *Scirpophaga incertulas* Walker (Lepidoptera: Pyralidae) is one of them. So that it is necessities to studied on biology are needed to detect occurrence, early warning of the pest, identifying the peak occurrence to predetermine the time of infestation and estimating actual population density to decide insecticide applications. The adult female lays 100-150 eggs. The egg period is 5-8 days. The freshly hatched larvae bore into stem and feed internally causing death of central shoot 'dead hearts' in vegetative stage and 'white earheads' at milky stage, respectively. Larval period lasts for 33-41 days. It covers the exit hole with a thin web forms a white silken cocoon and pupates there. Pupa is dark brown in colour. The pupal period lasts for 6-10 day [3].

**2. Materials and Methods**

Studied on the biology of yellow Stem borer, *Scirpophaga incertulas* Walker was carried out at Department of Entomology, College of Agriculture, N. D. University of Agriculture & Technology Kumarganj, Ayodhya, on rice variety Pusa Basmati-1 during kharif, 2015 and 2016. With a view to obtained the fresh adults.

15 days old seedlings were uprooted and transplanted in earthen pots each of 20 or 25 cm diameter. The potted plants were covered with muslin cloth in the laboratory. Primary cultures were established by collecting the adults of *S. incertulas* from the paddy fields were released on potted plants, covered with muslin cloth. The female adults laid egg masses on the lower surface of the leaves, hatched egg masses, newly larvae come out and reared on cutting pieces of rice stem up to pupation. The experiment was replicated ten times in a Complete Randomized Design (C.R.D.). The newly hatched larvae were placed on cuttings piece of rice stem in the Petri disc and such Petri disc put in the BOD Incubator, these were exposed for larval and pupal development at temperature  $25 \pm 2$  °C with relative humidity 60-70 per cent. After the emergence, the male and female adults were allowed for mating and mated adults were released into the potted plants covered with muslin cloth. After oviposition, the rice leaves containing the egg masses were clipped off and their bases were wrapped in moist cotton to keep them fresh until hatching. The dates of hatching were recorded. On hatching, first instar larvae were detached from the egg masses with the help of hand lens and camel hairbrush. These larvae were placed on a moist filter paper in the Petri disc and exposed for larval development. The external characters of larvae at different instars, number of moults and total larval period using ocular stage micrometer and millimeter scale under stereoscopic binocular microscope were recorded. Pupal period was recorded as the time between formation of pupa and adult emergence. Emerged adults were separated as males and females and pairs of male and female were caged separately in cage containing 30 day old potted plants. Adults were provided with five per cent sugar solution in a cotton

swabs. Observations on pre-oviposition, oviposition and post-oviposition periods were recorded. The egg masses laid by the female were collected and reared to study the incubation period.

### 3. Results and Discussion

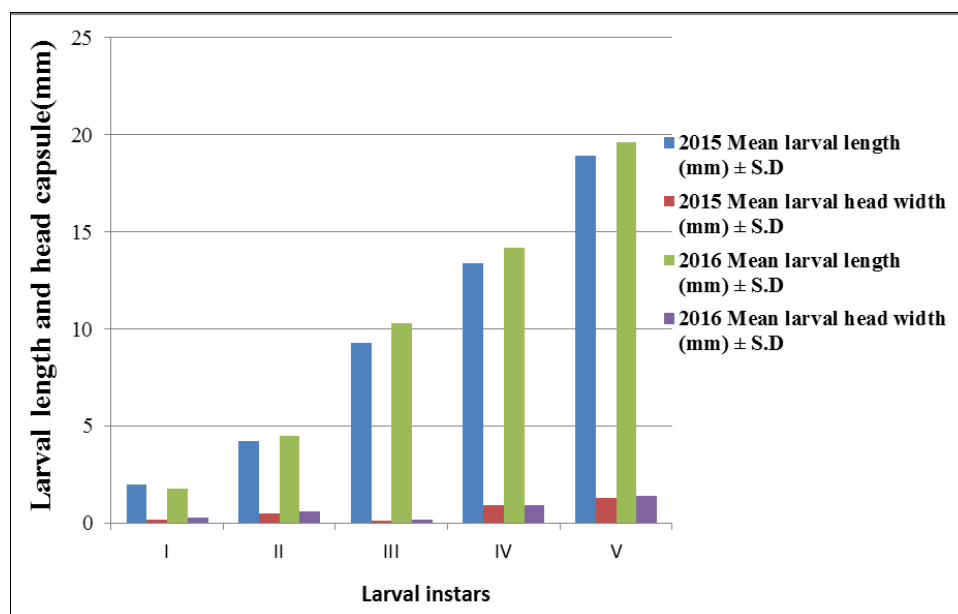
#### Measurement of different larval length and head capsule width of *Scirpophaga incertulas*, during, Kharif 2015 and 2016

The research work was carried out in the year Kharif, 2015 and 2016. The first instar larva was yellowish green with dark head and was non-gregarious in feeding habit. The mean length (mm) and mean head capsule width (mm) were recorded  $2.0 \pm 0.12$  and  $1.8 \pm 0.10$  and  $0.2 \pm 0.01$ , and  $0.3 \pm 0.02$  during Kharif, 2015 and 2016, respectively. The second, third and fourth instar larvae were creamy white with black head in colour with length of mean larval (mm)  $4.2 \pm 0.34$ ,  $9.3 \pm 0.52$  and  $13.4 \pm 0.67$  and  $4.5 \pm 0.36$ ,  $10.3 \pm 0.57$  and  $14.2 \pm 0.71$  in the year Kharif, 2015 and 2016, respectively. The mean larval head capsule width (mm) of second, third and fourth instar were recorded  $0.5 \pm 0.03$ ,  $0.1 \pm 0.01$  and  $0.9 \pm 0.05$  and  $0.6 \pm 0.04$ ,  $0.2 \pm 0.02$  and  $0.9 \pm 0.05$  during Kharif, 2015 and 2016 respectively.

Whereas, fifth instar was dirty white in colour. The mean larval length (mm) and mean larval head capsule width (mm)  $18.9 \pm 1.09$  and  $19.6 \pm 1.13$  mm and  $1.3 \pm 0.06$  and  $1.4 \pm 0.07$  (mm) were recorded in the year Kharif 2015 and 2016 are presented in Table-1 and Fig.1. The present findings are also in accordance with the findings of Hugar *et al.* (2010) [3] who found that the full grown larva was dirty white with the length of  $20.3 \pm 1.21$  mm on transplanted paddy and  $19.9 \pm 0.30$

**Table 1:** Measurement of different larval length and head capsule width of *Scirpophaga incertulas* during, Kharif 2015 and 2016.

Larval stage	Kharif, 2015		Kharif, 2016	
	Mean larval length (mm) $\pm$ S.D	Mean larval head width (mm) $\pm$ S.D	Mean larval length (mm) $\pm$ S.D	Mean larval head width (mm) $\pm$ S.D
I	$2.0 \pm 0.12$	$0.2 \pm 0.01$	$1.8 \pm 0.10$	$0.3 \pm 0.02$
II	$4.2 \pm 0.34$	$0.5 \pm 0.03$	$4.5 \pm 0.36$	$0.6 \pm 0.04$
III	$9.3 \pm 0.52$	$0.1 \pm 0.01$	$10.3 \pm 0.57$	$0.2 \pm 0.02$
IV	$13.4 \pm 0.67$	$0.9 \pm 0.05$	$14.2 \pm 0.71$	$0.9 \pm 0.05$
V	$18.9 \pm 1.09$	$1.3 \pm 0.06$	$19.6 \pm 1.13$	$1.4 \pm 0.07$



**Fig 1:** Measurement of different larval length and head capsule width of *Scirpophaga incertulas* Walker, during Kharif, 2015 and 2016

## 2. Duration of different stages of *Scirpophaga incertulas*, during *Kharif*, 2015 and 2016.

### 2.1. Egg period

The egg masses were covered with brownish hairs from the anal tufts of the female. Eggs were laid within the masses and were white, oval and flat in shape. The mean incubation periods were  $6.2 \pm 0.36$  and  $6.5 \pm 0.38$  days in the year *Kharif*, 2015 and 2016, respectively are presented in Table-2 and Fig.2. The slight variation in the present study may be due to change in weather and other ecological conditions. The present findings are also in accordance with the findings of Bora, D. K.; Saharia, D. and Hussain, S. (1994) [1] who reported that the females laid an average of  $133.4 \pm 24.9$  eggs which hatched within 6-8 days and male to female ratio was 1:1.75. The average longevity of adult females and males was  $4.25 \pm 0.84$  and  $2.5 \pm 0.49$  days respectively. The present investigations are also in accordance with the findings of Malhi, B. S. and Brar, D. S. (1998) [7] who found that the incubation period was 6.70 and 6.83 days during July and August, respectively.

### 2.2. Larval period

The mean duration of first instar larva  $5.3 \pm 0.43$  and  $5.7 \pm 0.46$  days was recorded during *Kharif*, 2015 and 2016. The mean duration of second; third; fourth and fifth instar larva was recorded during *Kharif*, 2015 i.e.  $4.2 \pm 0.24$ ;  $5.8 \pm 0.29$ ;  $5.3 \pm 0.31$  and  $6.9 \pm 0.51$  days, respectively. The mean duration of second; third; fourth and fifth instar larva was recorded in *Kharif*, 2016 i.e.  $4.4 \pm 0.25$ ;  $6.1 \pm 0.31$ ;  $5.6 \pm 0.33$  and  $7.1 \pm 0.52$  days, respectively. The mean total larval period was  $27.5 \pm 1.66$  and  $28.9 \pm 1.72$  days was recorded during *Kharif*, 2015 and 2016, respectively are presented in Table-2 and Fig.2. The present findings are also in partial agreement with the findings of Malhi, B. S. and Brar, D. S. (1998) [7] who found that the total larval duration of 28.85 and 32.96 days during July-August and August-September, was recorded respectively.

### 2.3. Pupal period

The average pupal period was  $8.6 \pm 0.51$  days and  $8.9 \pm 0.53$  days was recorded are presented in Table-2 and Fig.2 during *Kharif*, 2015 and 2016, respectively. The present findings are also in accordance with the findings of Malhi, B. S. and Brar,

D. S. (1998) [7] differed with the present study, according to them the period was 6.90 to 6.96 days during July-August and August-September, respectively.

### 2.4. Adult period

The mean duration of male adult  $2.6 \pm 0.15$  days and  $2.8 \pm 0.16$  days of female was recorded during *Kharif*, 2015 respectively. The mean duration of male adult  $2.7 \pm 0.22$  and female adult  $2.9 \pm 0.17$  days was recorded during *Kharif*, 2016 respectively. The pre-oviposition, oviposition and post oviposition period of  $1.0 \pm 0.06$ ,  $1.5 \pm 0.08$  and  $1.0 \pm 0.07$  was recorded in *Kharif*, 2015 and  $1.3 \pm 0.07$ ,  $1.7 \pm 0.09$  and  $1.2 \pm 0.05$  in *Kharif*, 2016, respectively are presented in Table-2 and Fig.2. The present findings are also in accordance with the findings of Jadhao, M. F. and Khurad, A. M. (2012) [5] reported that the pre-oviposition and ovi-position period lasted on an average for 1.0 and 1.5 days, respectively. The present findings are also in partial agreement with the findings of Malhi, B. S. and Brar, D. S. (1998) [7] who found that the the pre-oviposition, oviposition and post-oviposition periods 1.06, 0.92 and 0.85 days were recorded respectively.

### 2.5. Total life cycle (egg to adult emergence)

The average total life cycle of *S. incertulas* was  $42.3 \pm 3.54$  days and  $44.3 \pm 3.61$  days in *Kharif*, 2015 and in *Kharif*, 2016, respectively are presented in Table-2 and Fig.2. The study of the biology of *S. incertulas* during *Kharif*, 2015 and 2016. The biological attributes of *S. incertulas* was i.e. Egg period, Larval instars, Pupa, total life cycle, larval period, larval length and width of head capsule, total larval period, adult male duration, adult female duration, Pre oviposition period, oviposition period and post oviposition period were lower in the *Kharif*, 2015 as compare to *Kharif*, 2016 on the rice variety pusa Basmati-1 may be due to difference in microclimate of the rice plant under laboratory condition. The present findings are also in accordance with the findings of Hugar *et al.* (2010) [3] reported that the total life cycle of yellow stem borer was  $42.8 \pm 1.73$  and  $43.8 \pm 0.67$  days respectively on transplanted paddy and aerobic paddy. The present findings are also in accordance with the findings of Islam, Z. and Catling, H. D. (1991) [4] reported that the total life cycle of yellow stem borer 45.8 days was recorded.

**Table 2:** Duration of different stages of *Scirpophaga incertulas*, during *Kharif*, 2015 and 2016

Biological attributes	Mean duration of different stages (in days)±S.D. of stem borer, (N=10)	
	<i>Kharif</i> , 2015	<i>Kharif</i> , 2016
Egg period	$6.2 \pm 0.36$	$6.5 \pm 0.38$
Larval instars I	$5.3 \pm 0.43$	$5.7 \pm 0.46$
II	$4.2 \pm 0.24$	$4.4 \pm 0.25$
III	$5.8 \pm 0.29$	$6.1 \pm 0.31$
IV	$5.3 \pm 0.31$	$5.6 \pm 0.33$
V	$6.9 \pm 0.51$	$7.1 \pm 0.52$
Total larval period	$27.5 \pm 1.66$	$28.9 \pm 1.72$
Pupal period	$8.6 \pm 0.51$	$8.9 \pm 0.53$
Total life cycle	$42.3 \pm 3.54$	$44.3 \pm 3.61$
Adult male duration	$2.6 \pm 0.15$	$2.7 \pm 0.22$
Adult female duration	$2.8 \pm 0.16$	$2.9 \pm 0.17$
Pre oviposition period	$1.0 \pm 0.06$	$1.3 \pm 0.07$
Oviposition period	$1.5 \pm 0.08$	$1.7 \pm 0.09$
Post oviposition period	$1.0 \pm 0.07$	$1.2 \pm 0.09$

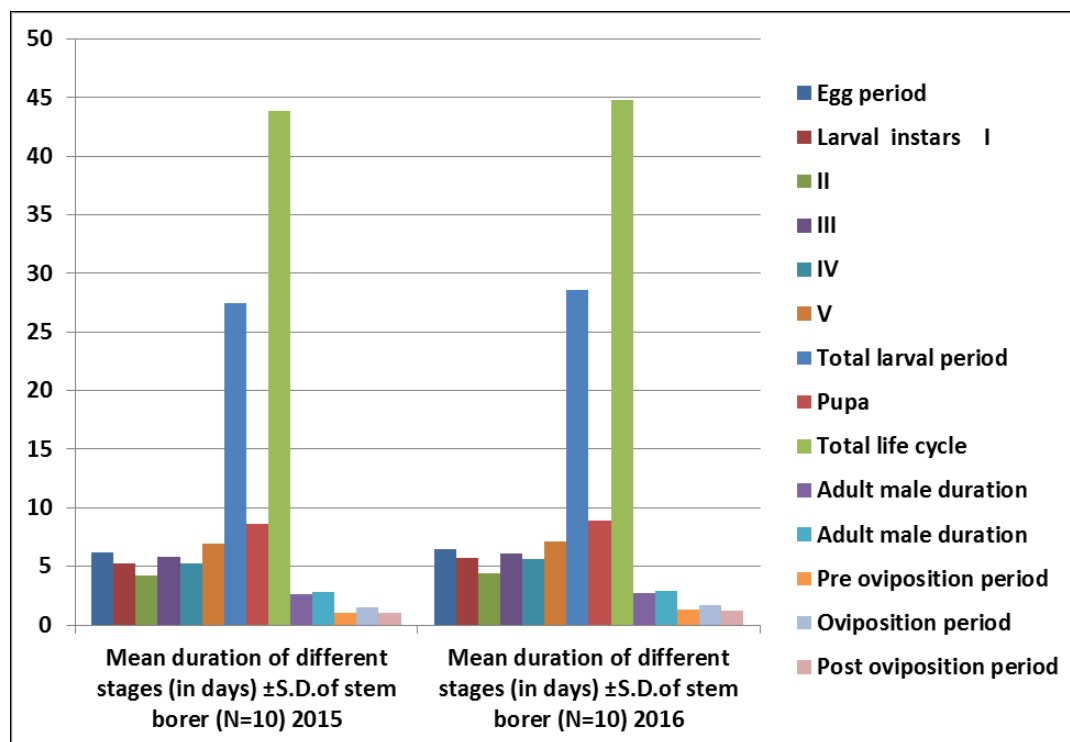


Fig 2: Duration of different stages of *Scirpophaga incertulas* Walker, during Kharif, 2015 and 2016

#### 4. Conclusion

The present investigation entitled “Study on Biology of Rice Yellow Stem Borer” The mean duration of male adult  $2.6 \pm 0.15$  days and  $2.8 \pm 0.16$  days of female was recorded during Kharif, 2015 respectively. The mean duration of male adult  $2.7 \pm 0.22$  and female adult  $2.9 \pm 0.17$  days was recorded during Kharif, 2016 respectively. The pre-oviposition, oviposition and post oviposition period of  $1.0 \pm 0.06$ ,  $1.5 \pm 0.08$  and  $1.0 \pm 0.07$  was recorded in Kharif, 2015 and  $1.3 \pm 0.07$ ,  $1.7 \pm 0.09$  and  $1.2 \pm 0.05$  in Kharif, 2016 respectively. The average total life cycle of *S. incertulas* was  $42.3 \pm 3.54$  days and  $44.3 \pm 3.61$  days in Kharif, 2015 and in Kharif, 2016 respectively.

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