JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 01, 2020

STUDIES ON BIONOMICS AND MORPHOLOGY OF CORN PEST *CHILO PARTELLUS*

Bhawna Singh[1], Dr. Ramakant[2]

[1,2] Department of Zoology, Maharishi University of Information Technology, Lucknow, Uttar Pradesh.

Email: bhawnabhadauria06@gmail.com

ABSTRACT

Maize (*Zea mays* L.) is one of the most important cereals of the world and provides more human food than any other cereal. Maize is of American origin having been domesticated about 7000 years ago. It provides nutrients for human beings and animals and serves as a basic raw material for the production of starch, oil and protein, alcoholic beverages, food sweeteners and recently fuel. The moth group (which includes cutworms, armyworms, earworms, borers, and grain moths) is the most damaging to Maize worldwide, followed by the stemborers (rootworms, wireworms, grubs, grain borers, and weevils). Next in importance is the group of insects that serve as carriers (vectors) for disease agents (viruses, micoplasms, bacteria, and fungi), among which the sap-sucking bugs (leafhoppers and aphids) are the greatest problem.

INTRODUCTION

Maize is among the world's three most important cereal crops, the other two being Wheat and Rice. It possesses great genetic diversity and grown in a wide range of environments, from the equator to about 50 north latitude and 420 south latitude and as high as 3800 meters above sea level. U.S.A is the leading producer having the lion's share in total global Maize production accounting for 30% of the production. Other major Maize producers are China (15%), EU – 25 (14%), Brazil (4%) and India (3%). In India Maize is grown over an area of 5.7 million hectares with total production of about 6 million tons. Though, the maximum land and the productivity is in Uttar Pradesh, Karnataka gives the highest average yield per hectare (2995 kg) followed by Himachal Pradesh (1672 kg). The average Maize yield in India is only 1043 kg per hectare which is much lower than in most of the Maize growing countries of the world.

Maize is essentially a warm weather or *kharif* crop and as such is largely dependent upon the rains. There are three distinct seasons for the cultivation of Maize the main season is *kharif*; whereas its cultivation during *rabi* in Peninsular India and Bihar, and in spring in northern India is done. Higher yields have been recorded in the *rabi* and spring crops. The higher yields are primarily due to better water management and a lower incidence of disease and pests. During *kharif* it is sown with the break of monsoon in most parts of India. It is sown in early March in north-eastern hills, in April to early May in north-western hills, in May-June in Peninsular India, in the end of June to mid-July in the Indo-Gangetic Plains. During spring Maize is sown in late January to the end of *Rabi*, Maize is generally sown in Bihar, Andhra Pradesh, Tamil Nadu and Karnataka in the end of October to mid-November. Maize requires considerable moisture and warmth from germination to flowering period. The ideal temperature for germination is 21° C and for growth 32°C. 50-75 cms of well-distributed rainfall is conducive to growth. It can be successfully grown where the night temperature does not go below 15.6^{o} C. It cannot withstand frost at any stage of its growth. In India, its cultivation extends from the hot arid plains of Rajasthan and Gujarat to the wet hill of Assam and Bengal (receiving over 400 cm of rainfall). The states of Uttar Pradesh, Bihar, Madhya

ISSN- 2394-5125 VOL 7, ISSUE 01, 2020

Pradesh, Rajasthan and Punjab account for over 75 per cent of the area and production of this cereal in the country. Each of the districts of Bahraich, Gonda and Bulandshaher in Uttar Pradesh; Monger, Saran and Darbhanga in Bihar, Udaipur and Bhilwara in Rajasthan; and Panchmahal in Gujarat put annually over one lakh hectares under Maize. These nine districts account for a quarter of the national area and production of Maize in India.

MATERIALS AND METHODS

The scientific methodology is essential for accuracy and success of any investigation as it directly influences the validity and relevance of the finding. In this investigation these were therefore used thoughtfully. The idea of materials used and the method followed in this investigation during the course of study are described in this chapter.

EXPERIMENT SITE: The field experiments were conducted during July to October in the year 2018 and 2019 in the farmer's field at Etah district of western Uttar Pradesh. This Research site is within the semi arid zone of Uttar Pradesh and Rajasthan located at 26.2 North and 76.9 East latitude.

CLIMATE: Maize is essentially a warm weather or *kharif* crop and as such is largely dependent upon the rains. There are three distinct seasons for the cultivation of Maize: the main season is *kharif*; whereas its cultivation during *rabi* in Peninsular India and Bihar, and in spring in northern India is done. Higher yields have been recorded in the *rabi* and spring crops. The higher yields are primarily due to better water management and a lower incidence of disease and pests. In most parts of India, Maize during *kharif* is sown with the break of monsoon. It is sown in early March in north-eastern hills, in April to early May in north-western hills, in May-June in Peninsular India, in the end of June to mid-July in the Indo-Gangetic Plains.

Spring Maize is sown in late January to the end *Rabi* Maize is generally sown in Bihar, Andhra Pradesh, Tamil Nadu and Karnataka in the end of October to mid-November. Maize however, requires considerable moisture and warmth from germination to flowering. The ideal temperature for germination is 21° C and for growth 32°C. 50-75 cms of well-distributed rainfall is conducive to growth. It can be successfully grown where the night temperature does not go below 15.6^{o}C. It cannot withstand frost at any stage of its growth. In India, its cultivation extends from the hot arid plains of Rajasthan and Gujarat to the wet hill of Assam and Bengal (receiving over 400 cm of rainfall).

SOIL COMPOSITION: Maize requires fertile, deep and well-drained soils. Although, it can be grown on any type of soil, ranging from deep heavy clays to light-sandy ones, it is best adapted to well drain sandy loam to silty loam soils. It is, however, necessary that the pH of the soil does not deviate from the range 7.5 to 8.5. Over 85 per cent of the Maize acreage is sown under rain-fed conditions during the monsoon when over 80 per cent of the annual rainfall is received. The alluvial soils of Uttar Pradesh, Bihar and Punjab are very suitable for growing Maize crop. Maize is able to tolerate a wide range of soil reaction. It grows well in soil having pH range between 5.5 and 8.0 the Physiochemical characteristic of the soil samples were analyzed during experimental period.

DESIGN OF EXPERIMENT: For the study of the biology of the insect species pots were used which were covered by transparent cloth. On the other hand the control measure experiment was conducted in small plots on the field. Net plot size was 2m x 3m, number of rows per plot -10, number of dibbles per plot 200, spacing between row 20 cm, spacing within row 15 cm, number of treatment -2, number of replication-3.

ISSN- 2394-5125 VOL 7, ISSUE 01, 2020

MATERIAL FOR EXPERIMENT: For the purpose of the study of the stem borer, the cloth covered pots were used in which the Maize crop was planted for different observation in the laboratory. The observation were made by the help of hand lens and binocular microscope to identify the larvae of the insect, minimum and maximum temperature were recorded by using the thermometer and hygroscopic meter for humidity was also used. For the control of experiments, systemic insecticides were used in the experiment.

FIELD OPERATIONS

Sowing: The sowing was carried out in all five ploughed plots. It was done during the year 2018-2019 in the last week of August. The row spacing in plant was kept 20 cm in case of each experiment. Timely irrigation and weeding were done after sowing and also when it was necessary in this experiment.

RESULTS AND DISCUSSION

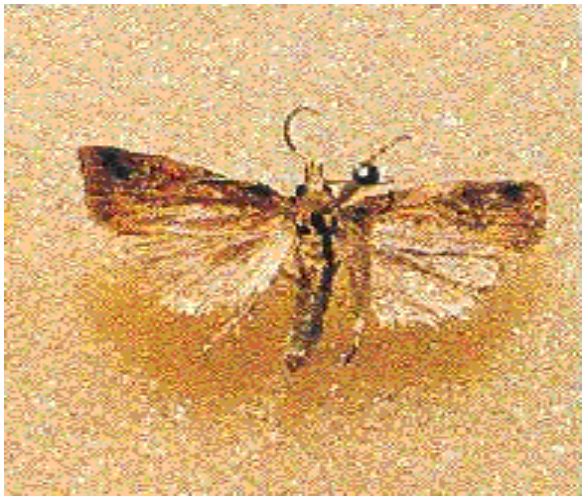
To study the life history, stem borers were collected from the fields, and were observed for their sex on the basis of the differences in antennae. Number of the female stem borers observed was more than male stem borers as is shown in (Table- 1,2) and (Fig. 1,2) maximum numbers of females were collected in October and November. *Chilo partellus,* (Swinhoe) shows complex type of life cycle, including all stages *viz.*, adult, pupa and larval stages. Copulation of the adults was closely observed in the laboratory. Adults were found mating immediately after emergence from pupae. In one case, mating took place immediately when the female was provided with the male and copulation continued for 14 minutes. During the period of copulation the female was found moving here and there easily carrying copulating male on its back. In second case, copulation continued for 11 minutes, while in the third case when the male was provided to the female, it reached to the female and rode on the back of the female from posterior side and mating took place.

Plate – 1 : Egg, larva and adult of *Chilo partellus,* (Swinhoe)

A. Egg

ISSN- 2394-5125 VOL 7, ISSUE 01, 2020

B. Larva



C. Adult

Table – 1: Percentage of male and female stem borer of *Chilo partellus* in total number of adults during monthly collections.

Serial Number	**Months of stemborer collection**	**Total adults**	**Percentages of male Stem borer**	**Percentage of female stem borer**
1	July	100	44	50
2	August	100	48	52
3	September	100	50	56
4	October	100	46	58
5	November	100	42	50
6	December	100	40	48
7	January	100	36	45
8	February	100	38	42
9	March	100	36	45
10	April	100	40	52
12	May	100	42	49

ISSN- 2394-5125 VOL 7, ISSUE 01, 2020

Fig. – 1: Percentage of Male and Female stem borer of *Chilo partellus* (Swinhoe.) total number of adults during monthly collection.

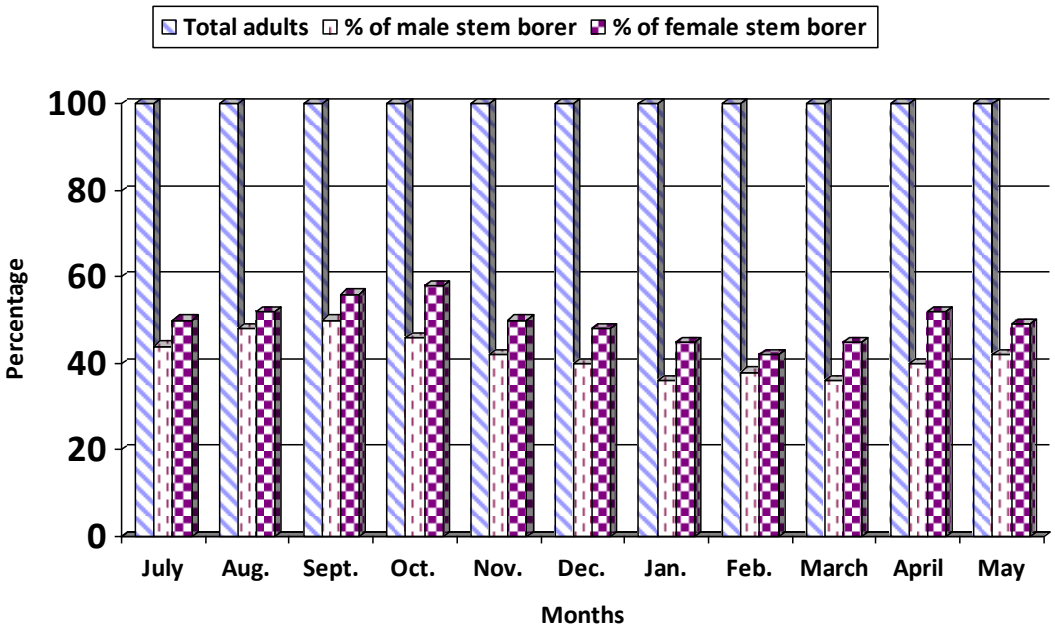


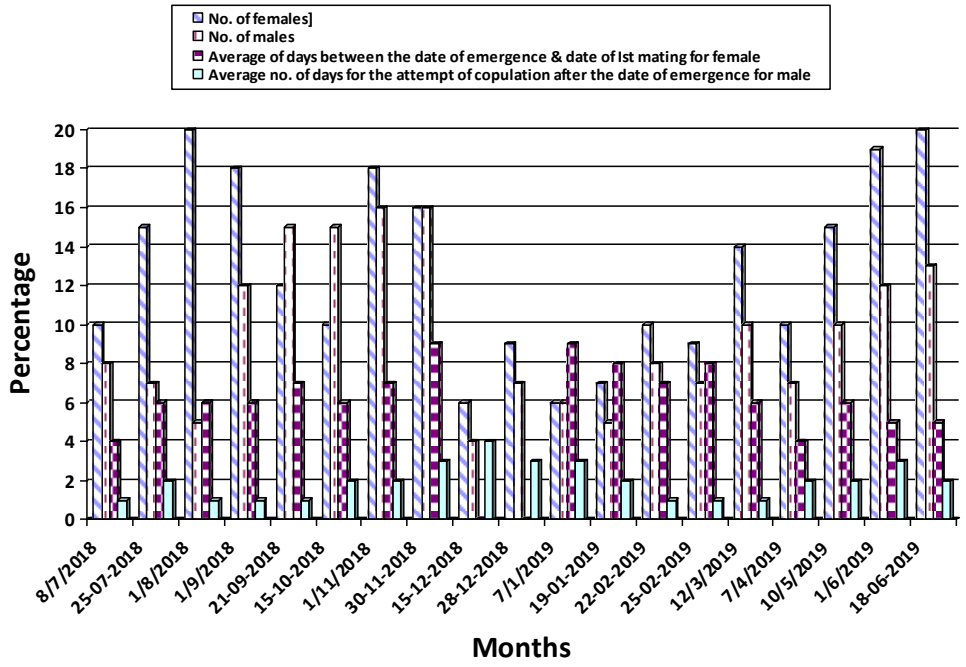
Table – 2: Maturation period of the male and female of *Chilo partellus* (Swinhoe) for the act of copulation in different months.

Date of Emergence	**No. of Females**	**No. of Male**	**Average of days between the date of emergence & date of Ist mating**	**Average No. of days for the attempt of copulation after the date of Emergence for male**
08-07-2018	10	8	4	1
25-07-2018	15	7	6	2
01-08-2018	20	5	6	1
01-09-2018	18	12	6	1
21-09-2018	12	15	7	1
15-10-2018	10	15	6	2
01-11-2018	18	16	9	3
30-11-2018	16	16	9	3
15-12-2018	6	4	-	4
28-12-2018	9	7	-	3
07-01-2019	6	6	9	3
19-01-2019	7	5	8	2

ISSN- 2394-5125 VOL 7, ISSUE 01, 2020

22-02-2019	10	8	7	1
25-02-2019	9	7	8	1
12-03-2019	14	10	6	1
07-04-2019	10	7	4	2
10-05-2019	15	10	6	2
01-06-2019	19	12	5	3
18-06-2019	20	13	5	2

Fig. – 2 : Maturation period of the male and female of *Chilo partellus* (Swinhoe) Maize stem borer for the act of copulation in different months.



Regarding the general description the newly emerged adult was completely white in colour and after sometime colour of wings was observed to be deep copper or brown and that of abdomen to be black. In contrast to the present finding (Woodhead *et al.* 1980) reported the colour of the adult as dark greenish blue. Body of the stemborer was divisible into three distinct regions viz., the head, the thorax and the abdomen. The general morphology described gains support of (Ferdu *et al.* 2002). Observations made on the general morphology are also in accordance to Hamid and (Bleszynski 1970). However, present study revealed the difference between the antennae of male and female which can be taken as an advantage for sex differentiation in the laboratory rearing of insects.

Copulatory act and mating behaviour of the adults was closely observed and mating started immediately after copulation was found to be lasted for eight to fourteen minutes and sometimes frequent mating during day and night was observed and gains support of (Atwal and Singh 1974). It has also been found that males become sexually mature in short period in comparison to the female. Oviposition rate was recorded to be maximum in November and

ISSN- 2394-5125 VOL 7, ISSUE 01, 2020

duration of oviposition was maximum in July. Eggs were laid mainly during night and increased number was recorded in September 2018 and in February 2019 (De Groote 2002).
The eggs were smooth, pale yellow or pale green in colour somewhat elliptical in shape and remained glued to the surface of the leaf. Incubation period shows usual kind of relationship with the temperature expressed as the average daily maximum, minimum and mean temperature during monthly period from July 2018 to June 2019 and varied from 3 to 12 days. Hatching was at constant temperature ranging from 20°C to 30°C and no hatching was observed at a temperature of 35"C. The immediate mating act after emergence from the pupal case can be attributed to its sound hormonal physiology thus, making the stemborer ready to start mating which reflects the maturity stage immediately after emergence.
Tolstava *et al.* (1982) reported that the fecundity of *C. partellus* was reported to be approximately equal to a mean of 300 eggs laid by a stem borer but in present study the stem borer laid cluster of eggs whose number was much more than that of the workers concerned. Decrease in hatchability in field conditions after insecticide sprays shows ovicidal action of the compounds, thus resulting in egg mortality.
There were three larval instars and from the general observations taken in fields it was revealed that all the instars of *Chilo partellus*, (Swinhoe) remained feeding on the same plant during the larval period. (Harris 1990) stated that the larvae live on the leaves and makes holes inside the stem of the plant during the whole development. (Siddiqui and Marwaha, 1994) found that the larvae of *Chilo partellus* fed on green material of Maize leaves and remain concealed over leaves due to their feeding habit and is in contrast to (Varma and Saxena 1989) who found these larvae to feed on leaves forming linear patches along the veins.

REFERENCES

1. Atwal, A. S. and Singh, B. (1974). Ecological studies on the European corn borer and *Chilo partellus* in India. *Punjab Agricultural University*, Ludhiana, pp. 84.
2. Bleszynski, S. (1970). A revision of the world species of *Chilo Zincken* (Lepidoptera: Pyralidae) *Bull. British Mus.* (Nat. Hist.) *Entomol*., 25: 195.
3. De Groote H. (2002). Maize yield losses from stem borer in Kenya. *Insect Sci*. *App*., 22 (2): 89-96.
4. Ferdu, A. Demissew, K. and Birhane, A. (2002). Major Insect Pest of Maize and their Management: A Review In: Enhancing the contribution of Maize to food security in Ethopia. *Proc. 2nd national Maize Workshop*, Addis Ababa, Ethiopia, 12-16.
5. Harris, K. M. (1990). Bioecology of *Chilo* species. *Insect Sci. Applic.*, 11: 467-477.
6. Siddiqui, K. H. Marwaha, K. K. (1994). Distribution, life cycle and nature of damage of some key / important insect pests of Maize. The vistas of Maize entomology in India. *Kalyani Publishers*, New Delhi, India. pp. 17–19.
7. Songa, J. M. Mugo, S. Mulaa, M. Taracha, C. Bergvinson, D. Hoisington, D. and DeGroote, H. (2002). Towards development of environmentally safe, insect resistant Maize varities for food security, *Syngenta Symposium*, Washington D.C. USA.
8. Tolstava, Yu. S. and Atanov, N. M. (1982). Action of chemical substances for plant protection on the arthropod fauna of pesticides in agrocoenosis. *Entomol. Review.*, 61: 1-14.
9. Varma, A. and Saxena, H. (1989). Field recovery of an exotic parasite *Allorhogas pyralophagus* Marsh against sorghum borer *Chilo partellus* Swinhoe. *Indian J. Plant Prot*., 17: 101-102.
10. Woodhead, S. Padgham, D. E. and Bernays, E. A. (1980). Insect feeding on different sorghum cultivars in relation to cyanide and phenolic acid content. *Annals of Applied Biology*, 95: 151-157.