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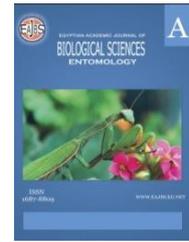
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Life Cycle of *Chilo partellus* (Crambidae: Lepidoptera) on Maize Under Laboratory Conditions

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ABSTRACT

Maize stem borer (*Chilo partellus*) is considered a major threat for agricultural crops especially sorghum and maize and a main entomological research problem in the globe, especially in Pakistan. A study was conducted to check the life cycle of maize stem borer, *C. partellus* on maize under controlled conditions in 2019. The complete metamorphosis (egg, larva, pupa and adult) was recorded. The embryonic period was 4-6 days. The results showed that 1st, 2nd, 3rd, 4th, 5th and 6th instar period was 3.98 ± 1.00 , 3.99 ± 2.76 , 4.35 ± 1.65 , 4.15 ± 2.94 , 5.23 ± 2.58 and 6.22 ± 2.37 days, respectively with 33.12 ± 9.25 days total larval period. Pupa was obtect and the fecundity was recorded 170-200 eggs per female. The pre-mating and mating period was lasted for 7-12 and 3-6 hours, respectively while the oviposition period lasted for 3-5 days. The total life cycle from egg to adult was 32-71 days. The current findings are very important in managing this pest on various crops around the globe especially in Pakistan.

INTRODUCTION

Maize, *Zea mays* belongs to family Gramineae is important third cereal crop after wheat and rice in the globe. It is commonly known as “Queen of Cereals”. Maize is not only consumed as human food but also use as animals feed and raw material in the form of various products such as starch, oil, maltodextrins and corn syrup. The production of maize is decreasing due to the attack of more than 150 insect species such as leafhopper; *Pyrilla perpusilla*, stem borer; *Chilo partellus*, pink borer; *Sesamia inferense*, stem fly; *Atherigona orientalis* and corn earworm; *Heliocoverpa zea*.

Among insect pests, maize stem borer is the main threat in maize production (Sharma *et al.*, 2010; Kfir *et al.*, 2002), attack from sowing to harvesting. The maize plant remained stunted and low in yield or grain production (Farid *et al.*, 2007). 15-60% losses have been reported, caused during a severe attack of maize stem borer (Khan, 1983). The female lays eggs on the leaves which causes lesions and early instar feed on the leaves

while later instars make a hole in the stem and caused dead heart even death of the plant. Management strategies should be adopted to control this destructive pest. Before the application of any management strategy, basic information like the life cycle of pests is very important. For this purpose, the current study was conducted to check the life cycle of pests on maize whose results will be helpful in managing this pest.

MATERIALS AND METHODS

The infested maize parts (leaves, stems) containing different instar larvae were collected from different fields used for developing a pure and mass culture of the *C. partellus* under laboratory conditions. The emerged male and female moths were shifted into adult rearing cages along with pieces of maize leaves for oviposition. The larvae hatched from these eggs were used for further biological studies (life cycle). Twenty-five (25) larvae were randomly selected from reared culture and released individually in petri dishes along with maize leaves. Maize leaves were given as food to larvae at an early stage while stem pieces at later stages. The old leaves and stem pieces were replaced with fresh ones on daily basis. The parameters such as embryonic, larval and pupal periods were recorded twice a day (12 hrs. interval). One pair of emerged adults (Male: Female) was released into an insect rearing cage for mating and egg-laying. The egg batches were collected, counted and the number of eggs per batch was also counted. After counting, one egg per petri dish was kept to record the biological parameters (morphological and biological characters) of each stage in the life cycle of *C. partellus*. The equal ratio of five pairs of adults was randomly selected from culture and released into an adult rearing cage. The adult longevity, oviposition, pre-mating, mating period, fecundity (total number of eggs laid by single female) and total life cycle (egg-adult) were recorded.

RESULTS

Maize is considered an economically important cereal crop and 80% of maize production is consumed in the household as human food. The data recorded in the present study were given in tables 1 and 2. The complete metamorphosis was observed in the maize stem borer, *C. partellus*. It was observed that oval and flat shape creamy white eggs were laid by the female on all parts of maize plants including leaf sheath, both sides of the leaf (dorsal and ventral) and in the whorl of the maize. The great variations in colour of eggs were recorded with respect to time during the study. Similar observations were recorded by early scientists (Siddalingappa *et al.*, 2010; Krishna *et al.*, 2018). They had reported that colour of eggs was yellow and yellow-brown after two and third days of egg lying, respectively. The incubation period was 4-6 days on maize leaves while Siddalingappa *et al.* (2010) reported 3-6 days. The average length of eggs was 0.95 ± 0.16 mm.

The fleshy hatched dirty white 1st and 2nd instar larvae were covered with small hairs with the dark brown head while 3rd instar larvae were dull white in colour with a brown head. The body length was increased with an increase in instar. The current results are similar to the previous study findings of Marulasiddesha (1999). The results showed that 1st, 2nd, 3rd, 4th, 5th and 6th instar period was 3.98 ± 1.00 , 3.99 ± 2.76 , 4.35 ± 1.65 , 4.15 ± 2.94 , 5.23 ± 2.58 and 6.22 ± 2.37 , respectively with 33.12 ± 9.25 total larval period (Table 1). It was observed that males were short lives as compared to female. Rauf *et al.* (2017) had reported 6th larval instars of maize stem borer, *C. partellus* which is in line with our findings.

The object pupa was seen. There were variations in the length of the male and female pupa. The average length of the male and female pupa was 14.23 ± 0.64 and 12.53

± 1.12 mm, respectively. The pupal period recorded in the current study was 8-14 days. The current findings are in line with many others researchers.

Adults (moths) were nocturnal and hides under leaves or crop residues during the daytime. The maximum adult emergence and mating occurred in the evening time. Moths are very active flyers. Neupane and Subedi (2019) had reported similar findings of the life cycle of maize stem borer. A single female can lay 150-160 eggs in her life period (Peddakasim *et al.*, 2018; Thippeswamy *et al.*, 2010). Peddakasim *et al.* (2018) investigated that 72% of eggs were laid on the lower leaves of the maize plant. The pre-mating and mating period was lasted for 7-12 and 3-6 hours, respectively while the oviposition period lasted for 3-5 days (Table 2).

Table 1. Biological parameters of *Chilo partellus* on maize

Stage	Mean \pm SE	Range (Days)
Incubation period	4.54 \pm 1.12	4-6
Larval period		
First instar	3.98 \pm 1.00	3-6
Second instar	3.99 \pm 2.76	3-6
Third instar	4.35 \pm 1.65	3-9
Fourth instar	4.15 \pm 2.94	3-7
Fifth instar	5.23 \pm 2.58	4-9
Sixth instar	6.22 \pm 2.37	3-9
Total larval period (1st-6th)	33.12 \pm 9.25	18-52
Pupa	7.76 \pm 2.39	8-14
Adult male longevity	6.01 \pm 1.65	3-7
Adult female longevity	7.47 \pm 1.87	3-9
Total life cycle (egg-adult)	44.79 \pm 15.23	32-71

Table 2. The reproductive potential of *Chilo partellus* on maize under laboratory conditions

Stage	Mean \pm SE	Range
Premating (hours)	7.68 \pm 1.33	7-12
Mating (hours)	3.89 \pm 0.65	3-6
Oviposition period (days)	3.91 \pm 0.47	3-5
Fecundity	180.00 \pm 131.23	170-200

Conclusion

The maize stem borer, *Chilo partellus* causes a dead heart which reduces maize crop. It is considered an important entomological research issue in Pakistan due to severe economic crop losses. The findings from the present study play a key role in management strategies applied against this destructive pest in all maize growing areas of the world, especially Pakistan. This study provides basic information such as the biology and morphology of pests on maize crops and proves fruitful in its management.

Conflict of interest

The authors declare no conflict of interest.

Author contribution

All authors have an equal contribution but MUS statistically analysed the data .

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