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Research Article

Effect of Larval Parasitoid, *Cotesia flavipes* on *Chilo partellus* Under Laboratory Conditions

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Abstract

Maize is third most important crop of Pakistan that attacked by many insect pests, among all these *Chilo partellus*is a notorious pest of crop. *Chilo partellus* is caused huge economic losses of crops in Pakistan. An experimental study was conducted in insect Bio Control Lab at the Department of Entomology, PMAS UAAR during 2018 to check the effect of *Cotesia flavipes* on *Chilo partellus* under control conditions. Adult duration of *Cotesia sp.* was 41.46 hours. Rate of parasitism was 76 percent in 4th instar larvae of *C. partellus.* Mean number of pupae per larvae were 41-46 pupae per larvae. The mean pupal duration of *Cotesia sp.* was 8 days. Rate of parasitism was 73 percent in 3rd instar larvae of *C. partellus.* From each parasitized larvae the mean adult emergence was 28 adults per larvae. The mean pupal duration of *Cotesia sp.* was 9 days.

Keywords: Maize; Cereal Crop; *Cotesia flavipes; Chilo partellus;* Pakistan

Introduction

Maize is third uppermost cereal crop after wheat and rice in Pakistan [1,2]. It belongs to the *Poaceae* family of grasses (Gramineae). It is recognized as the "Queen of Cereals" because of its uttermost production potential [3]. As the world's leading cereal crop in terms of area and production is a multi-purpose crop that provides fuel, food to mankind, animals and poultry. Maize was grown on an area of 1251.4 million hectares with annual production of 5901.6m tons in Pakistan during 2017 - 2018. Punjab is higher yielding province of maize that was 6527 kg per hectares than other provinces of Pakistan during 2017-2018 [4].

There are various biotic and abiotic factors involved in the reduction of maize yield like environmental factors (temperature, humidity, rain fall), diseases, weed sand many pathogens. Among all these factors, insect pests are the major one [5,6]. In Pakistan maize crop is affected by 140 different insect species with their different level of damage percentage [7].

The serious and major pests of maize are maize stem borer or spotted stem borer (*Chilo partellus* Swinhoe), pink stem borer (*Sesamia inference*), shoot fly (*Atherigona soccata*) and Asiatic corn borer (*Ostrinia furnacalis* Guenee). Among all these, *C. partellus* is the key and global pest in all corn-growing countries but consid-

ered as the national top priority entomological research problem in Pakistan [8] which causes 24 to 81% crop losses [9,10].

Maize stem borer inflicts multiple damages to corn crop which comprise tunneling within stalk, subsequent development of "dead hearts" by damage to the central growing shoot of young plant, leaf, stem, central shoot, tassels, grains and cobs feeding resulting in stunted growth and low yield and disruption of the flow of nutrients to the ear [3].

There are various strategies adopted for the management of *C. partellus* such as chemical, biological, host plant resistance and cultural methods. Among them biological control is ecofriendly and sustainable destruction of *C. partellus*. Bio control agent *Cotesia flavipes* (Hymenoptera: Braconidae) is playing an important role in the management of *C. partellus* at larval stage [11].

There is no systematic analysis to measure the effects of interaction between *C. partellus* and *C. flavipes*. Biological analysis of any pest is often necessary to explore the pest's know-how of survival and growth and ultimately to formulate an efficient and sustainable pest management strategy. Management of jawar stem borer through larval parasitoid *C. flavipes* is more significant from an ecological point of view for this locality. Taking these points under view, the purpose of the present investigation is to examine the impact of *C. flavipes* on *C. partellus* in maize crop.

Materials and Methods

An experimental study was conducted in insect Bio Control Lab at the Department of Entomology, PMAS UAAR during 2018 to check the impact of larval parasitoid *Cotesia flavipes* on *C. partellus.* The larvae were collected from university field and other areas of Rawalpindi, placed into vials and brought to laboratory for rearing purposes.

Maintenance of insect culture

Fifteen larvae were kept in each plastic jars with 5 maize stem pieces as food and the jars were covered with muslin cloth at top. After three days interval the old food was removed and provided fresh stem for feeding. The process was continued till all the larvae were entered into pupal stage. The pupae were collected and kept in another jars for adult emergence. Upon adult emergence, the adults were shifted to oviposition jars provided with leaves inside the jars for egg laying. The eggs were collected after each 24 hours and kept in another jars for hatching. Upon hatching, biological parameters were studies.

Potential of *Cotesia* sp on *C. partellus*

The potential of *Cotesia* sp on *C. partellus* was recorded. For this purposes, 10 3rd and 4th instar larvae of *C. partellus* were randomly selected from culture and released in jars containing about 40 - 50 *Cotesia* adults. On daily basis, larvae were observed till the development of *Cotesia* larvae and cocoon formation.

Biological parameters recorded

The following biological and morphological parameters of insect were recorded such as length of larvae, pupae, duration of different larval instars, pupae and adult longevity.

Statistical analysis

The means and standard deviation were calculated.

Results

3rd instar larvae of *C. partellus*

Developmental duration from parasitism to adult emergence of *Cotesia* was 15 - 19 days on 3rd instar of *C. partellus* (Table 1).

Parameters	Measurement
Developmental duration from parasitism till adult emergence (days)	15-19 days
Parasitism (%)	73%
Adult duration of *Cotesia*	40-45h
No of pupae per larvae	30-33
No of adult emergence	28
Pupal duration(days)	9

Table 1: Biological observations of *Cotesia sp.* reared on *C. partellus*3rd instar larvae under controlled condition.

Adult duration of *Cotesia sp.* was 40 - 45 hours. Rate of parasitism was 73 percent in 3rd instar larvae of *C. partellus.* Mean number of pupae per larvae were 30 - 33 pupae per larvae. From each parasitized larvae the mean adult emergence was 28 adults per larvae. The mean pupal duration of *Cotesia sp.* was 9 days.

4th instar larvae of *C. partellus*

Developmental duration of *Cotesia* from parasitism to adult emergence was 16 - 20 days on 4th instar larvae of *C. partellus* (Table 2). Adult duration of *Cotesia sp.* was 41.46 hours. Rate of parasitism was 76 percent in 4th instar larvae of *C. partellus.* Mean number of pupae per larvae were 41 - 46 pupae per larvae. From each parasitized larvae the mean adult emergence was 34 adults per larvae. The mean pupal duration of *Cotesia sp.* was 8 days.

Parameters	Measurement
Developmental duration from parasitism till adult emergence (days)	16-20
Parasitism (%)	76%
Adult duration of *Cotesia*	41-46h
No. of pupae per larvae	40
No. of adult emergence	34
Pupal duration(days)	8

Table 2: Biological observations of *Cotesia sp.* reared on *C. partellus* 4th instar larvae under controlled condition.

Discussion

The results of the present study indicate that the developmental duration was 15 - 19 and 16 - 20 days in 3rd and 4th instar larvae respectively. These results are in close agreement with some previous workers such as King., *et al.* (1975), who reported that the developmental duration was (15 - 18) days under laboratory condition. The duration under low temperature can increased significantly. Similarly Potting., *et al.* [12] had indicated that the rate of parasitism was 80% on4th instar larvae of *C. partellus.* Our findings are similar to previous study findings.

Some further investigations are needed for successful utilization of *Cotesia* against *C. partellus* and for quality mass rearing under laboratory conditions. On the basis of the present investigation it was concluded that out of 3rd and 4th instar larvae, *Cotesia* preferred 4th instar larvae. The early workers [13] have observed that third instar larvae of *C. partellus* were most suitable for parasitization by *C. flavipes*. The result of the present study and that of past worker may be different due to different environmental condition or may be due to different strain of *Cotesia* they used during their experiment. Our results are in conformity with Jiang., *et al*. [14] who reported significantly more number of *C. flavipes* cocoon emerging from 4th instar larvae than 3rd instar larvae.

Jiang., *et al*. [14] reported that there was no effect of host stage on progeny sex ratio of *C. flavipes* but might be a primary factor in determining effectiveness of a parasitoid. On the basis of the present finding it may be concluded that *Cotesia* can successfully parasitized *C. partellus* larvae under laboratory conditions and it can be successfully utilized against *C. partellus* in the field.

Conclusion

On the basis of the present study it was concluded that *Cotesia* sp. larval parasitoid can successfully utilized as a part of successful IPM for the management of *C. partellus* in maize crop. Further investigation on the biology and as well as ecology and identification is required for better understanding of the parasitoid and their host.

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