Biological Forum – An International Journal **14(1): 1225-1229(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Studies on Infestation of Maize Stem Borer *Chilo partellus* (Swinhoe) (Lepidoptera: Crambidea) in North Kashmir

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(Received 18 November 2021, Accepted 25 January, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The survey was carried out at various locations of Kupwara district (North Kashmir) in Jammu and Kashmir, *viz.* high, mid and low altitude during the year 2019. The study revealed that leaf infestation commenced from 24th standard week and lasted up to 40th standard week reaching its peak infestation of 48.05% at 32nd standard week. Maximum leaf infestation was observed in low altitude (30.62%) followed by mid (23.99%) and high (13.56%). Deadheart were observed from 24th standard week till 30th standard week with its peak of 21.90% in 28th standard week. Highest dead heart formation was recorded in low altitude (10.44%) followed by mid (8.31%) and high altitude (5.2 %) respectively. Stem tunnelling caused by maize stem borer was observed from 34th standard week up to the crop maturity. Maximum mean tunnel length was found in low (5.57 cm) followed by mid (3.43 cm) and high (1.72 cm) altitudes, respectively. The maize stem borer is gaining status of key pest under temperate conditions of kashmir it is causing nuisance to maize growers of kashmir particularly in hilly areas of kashmir like kupwara district.

Keywords: Altitude, Deadhearts, Infestation, Stem tunnelling

INTRODUCTION

Maize (*Zea mays* L.) is the world's top ranking food crop followed by wheat and rice. It is one of the most versatile crops grown under a wide range of agro-ecological locations of the world. Maize crop has enomrous economic uses so is referred as 'a miracle crop' (Singh *et al*., 2012). It provides industrial raw material for production of glucose, starch, dextrin, corn flakes, corn oil, etc. along with nutritional needs (Bibi *et al*., 2010). Besides a large number of pharmaceutical products, alcoholic beverages are also commercially prepared from maize. The cobs are used for cleaning, brushing, polishing, abrasives for soaps, ceramics, glues and adhesives; as a carrier for pesticides, rubber compounds and tyres (Ashfaq and Ahmad 2002). In India, 28 per cent of maize produced is used for food purpose, about 11 per cent as livestock feed, 48 per cent as poultry feed, 12 per cent in wet milling industry (starch and oil production) and 1 per cent as seed. Maize is also known as 'Queen of cereals' because of its immense yield potential, the highest yielding cereal crop of world (Singh *et al.*, 2012) and is particularly important in countries like India where food security is most vulnerable due to ever increasing population that has outnumbered the available food resources.

In Kashmir valley, maize is usually cultivated at high altitude terrains and plains under rainfed conditions. The huge gap between attained and attainable yield under Kashmir conditions can be attributed to various biotic stresses. About 15.6 per cent of loss in yield due to biotic stress is caused by insect pests alone (Dhaliwal and Arora 2006). Maize is attacked by 140 different insect species with their different level of damage percentage. Out of 140 species of insect pests only 12 species are the serious pests of maize causing damage from sowing to the harvesting and also in the storage conditions (Siddiqui and Marwaha 1993). Maize crop is attacked by insects (army worm, stem borer, thrips, aphids, termites, white grub, seed corn maggots, root worms, Indian meal moth, grain borer and grain weevil) during their storage. Maize crop can be attacked at any stage of their life even after harvesting. The severity of pest attack depends upon the cultivars, cultivation practices, mode of storage and environmental conditions (Arabjafari and Jalai 2007). A wide variety of insect pests attack maize crop resulting in heavy losses annually. Among these pests, *Chilo partellus* is one of the most dangerous pests and causes tremendous damage to maize crop (Kavita *et al*., 2016; Yonow *et al*., 2017).

Chilo partellus is considered as principle pest in lowland areas (Yonow *et al*., 2017). It has been reported to cause damage to the extent of 42.29% (Dejen *et al*., 2014). In case of severe damage, it can cause yield reduction up to 75% (Sharma and Gautam, 2010). Maize stem borer (*Chilo partellus)* creates havoc especially when weather conditions are dry. The larvae of maize stem borer after hatching feeds on soft surface of the leaves and then enters the stem through whorls for feeding on the pith of the stem. The growth of the plants becomes stunted which results in dead hearts at their initial stages. The pest makes exit holes for emergence of adult prior to pupation which takes place inside the stem. A single stem borer has been reported to cause a loss of about 8 – 10 per cent of potential yield and the pest also has been reported as the most dominant one comprising 89.5 per cent of all stem borers (Songa *et al.*, 2001). A yield loss of 24-74 per cent has been reported alone by this pest in India (Kumar and Mihm, 1995, Kumar and Mihm, 1996 and Kumar, 2002). In Kashmir valley the maize stem borer has assumed the status of serious nature in recent years particularly with the introduction of hybrids. The study evaluates the damage of maize stem borer infesting maize crop in North Kashmir.

MATERIALS AND METHODS

The survey was carried out to know per cent leaf infestation, per cent dead heart and mean stem tunnelling by maize stem borer (*Chilo partellus*) at three altitudes *viz*., high (2250 AMSL), mid (1750 AMSL) and low (1550 AMSL) in district Kupwara during Kharif 2019. Ten plants were randomly selected from each selected location and the observations were taken fortnightly through entire cropping season by using the formula given below:

Per cent leaf infestation. Per cent leaf infestation was calculated by using the formula:

$$\text{Per cent leaf infestation} = \frac{\text{No. of infested leaves}}{\text{Total no. of leaves}} \times 100$$

Per cent dead heart. Per cent dead heart was calculated by using the formula:

$$\text{Per cent leaf infestation} = \frac{\text{No. of dead hearts}}{\text{Total no. of plants}} \times 100$$

Mean tunnel length. Five randomly selected plants were uprooted and split cut was made on each plant. Tunnel length was recorded with the help of measuring scale in centimeters.

Statistical analysis of data generated. The data generated was subjected to standard statistical procedure as per Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The data on per cent leaf infestation, per cent dead heart and Stem tunnelling by maize stem borer (*Chilo partellus*) in maize crop are presented in Table 1, 2 and 3 respectively. The data on leaf infestation by maize stem borer revealed commencement of maize stem borer (*Chilo partellus*) from 24th standard week till 40th standard week. The peak leaf infestation was observed in 32th standard week (48.05%) from where it started declining and reached to minimum in 40th standard week (13.05%). By comparing altitudes with each other, it was observed that maximum leaf infestation was found in low altitude (30.62%) followed by mid altitude (23.99%) and, minimum in high altitude (13.56%). The data are inline with Mallapur *et al*. (2012) who reported that the per cent infestation of stem borers varied during different months and observed highest infestation (19.22%) in the month of August followed by July (15.80%) and September (15.10%). Similarly the data on dead heart caused by maize stem borer revealed dead heart formation commenced from 24th standard week and lasted up to 30th standard week. The peak dead heart formation was observed in the 28th standard week (21.90%) from where it started declining and reached to minimum in 30th standard week (16.66%) in all selected locations of district Kupwara. Maximum dead heart formation was found in low altitude (10.44%) followed by mid altitude (8.31%) whereas, minimum dead heart formation was seen in high altitude (5.2%). These data agree with those of Kore *et al*. (2013) reported that the dead hearts due to stem borer, *Chilo partellus* occurred from third week of August (33rd Standard week) to third week of October (42nd Standard week). The data on stem tunnel formation by maize stem borer (*Chilo partellus*) revealed that stem tunnelling started from 34th standard week and continued till the crop was harvested at 40th standard week. Maximum stem tunnelling was observed in 40th standard week (9.33 cm) followed by 38th standard week (8.61 cm) and 36th standard week (7.62 cm) whereas, minimum in 34th standard week (6.52 cm). Highest tunnel length was observed in low altitude (5.57 cm) followed by mid altitude (3.43 cm) whereas, lowest in high altitude (1.72 cm). The data are in congruence with Mallapur *et al*. (2012) recorded maize stalk infestation by stem borers at the time of harvest in the farmer's fields and also noticed that more than 25 per cent of the stems were infested by the borers with maximum incidence in Davanageri (35.93%) followed by Haveri (35.71%) districts. They also recorded the tunnel length in these districts ranged from 2.83 to 12.55 cm.

Table 1: Per cent leaf infestation by *Chilo partellus* in maize at different altitudes of district Kupwara.

Locations			% infestation (Fortnight intervals)								
		24SW	26SW	28SW	30SW	32SW	34SW	36SW	38SW	40SW	Mean	Over all mean
Low altitude (1550 AMSL)	Langate	5.0* (1.93)	17.5 (4.14)	30.0 (5.43)	45.0 (6.65)	60.0 (7.73)	45.0 (6.69)	30.0 (5.43)	27.5 (5.22)	15.0(3.81)	**28.83 (5.22)**	30.62
	Panditpora	7.5 (2.54)	20.0 (4.39)	32.5 (5.68)	42.5 (6.51)	60 (7.73)	40.0 (6.11)	35.0 (5.78)	20.0 (4.32)	12.5 (3.94)	**30 (5.25)**	
	Chotipora	7.5 (2.26)	17.5 (4.14)	35.0 (5.65)	42.5 (6.48)	65.0 (8.05)	42.5 (6.69)	40.0 (6.30)	30.0 (5.32)	17.5 (4.06)	**33.05 (5.43)**	
Mid altitude (1750 AMSL)	Lach	2.5 (1.32)	10.0 (2.87)	15.0 (3.81)	32.5 (5.43)	55.0 (7.40)	35.0 (5.90)	27.5 (5.22)	22.5 (4.72)	15.0 (3.81)	**23.88 (4.49)**	23.99
	Batpora	5.0 (1.93)	20.0 (4.39)	32.5 (5.68)	37.5 (6.11)	52.5 (7.24)	32.5 (5.68)	27.5 (5.22)	17.5 (4.14)	12.5 (3.49)	**26.54 (4.89)**	
	Mawer bala	0.0 (0.70)	10.0 (2.87)	20.0 (4.39)	25.0 (4.97)	50.0 (7.05)	35.0 (5.86)	25.0 (4.97)	17.5 (4.14)	15 (3.81)	**21.55 (4.30)**	
High altitude (2250 AMSL)	Kheta cheak mohalla Nowgam	0.0 (0.70)	0.0 (0.70)	5.0 (1.93)	22.5 (4.72)	32.5 (5.68)	25.0 (4.97)	17.5 (4.14)	12.5 (3.49)	12.5 (3.49)	**14.59 (4.30)**	13.56
	Prongawari Nowgam	0.0 (0.70)	0.0 (0.70)	7.5 (2.54)	12.5 (3.49)	27.5 (5.22)	25.0 (4.85)	15.0 (3.81)	12.5 (3.49)	10.0 (3.16)	**12.22 (3.10)**	
	Reshwari Nowgam	0.0 (0.70)	0.0 (0.70)	5.0 (1.93)	15.0 (3.81)	30.0 (5.43)	22.5 (4.72)	15.0 (3.81)	12.5 (3.49)	10.0 (3.16)	**13.88 (3.08)**	
	Mean	3.05 (1.42)	10.55 (2.77)	20.27 (4.12)	30.55 (5.35)	48.05 (6.84)	33.61(5.72)	25.83 (4.97)	19.16 (4.25)	13.05 (3.59)	**32.94 (4.33)**	
	CD (P≤ 0.05)	**1.54**	**1.34**	**1.51**	**1.02.**	**0.61**	**0.99**	**0.98**	**1.41**	**0.96**		

SW= Standard week, *Mean of 4 replications. Figures in parentheses are square root transformed values
AMSL= Above mean sea level

Table 2: Per cent dead heart caused by *Chilo partellus* in maize at different altitudes of district Kupwara

Locations		% Dead heart (Fortnightly intervals)						
		24 SW	26 SW	28 SW	30 SW	32 SW	Mean	Over all mean
Low Altitude (1550 AMSL)	Langate	22.5* (4.84)	25.0 (5.09)	27.5 (5.33)	17.5 (4.29)	0.00 (0.70)	10.27	**10.44**
	Panditpora	20.0 (4.57)	25.0 (5.09)	27.0 (5.28)	22.5 (4.84)	0.00 (0.70)	10.55	
	Chotipora	20.5 (4.63)	27.5 (5.33)	30.0 (5.56)	22.5 (4.84)	0.00 (0.70)	10.52	
Mid Altitude (1750 AMSL)	Lach	15.0 (3.99)	17.5 (4.29)	22.0 (4.79)	20.0 (4.57)	0.00 (0.70)	8.61	**8.31**
	Batpora	15.5 (4.05)	17.0 (4.23)	20.5 (4.63)	17.5 (4.29)	0.00 (0.70)	8.55	
	Mawer bala	12.5 (3.66)	15.5 (4.05)	20.0 (4.57)	15.0 (3.99)	0.00 (0.70)	7.77	
High Altitude (2250 AMSL)	Kheta cheak Mohalla	10.0 (3.30)	12.5 (3.66)	17.5 (4.29)	12.5 (3.66)	0.00 (0.70)	5.83	**5.2**
	Prongawari Nowgam	7.5 (2.96)	10.5 (3.36)	15.0 (3.99)	12.5 (3.66)	0.00 (0.70)	5.05	
	Reshwari Nowgam	5.0 (2.42)	10.0 (3.30)	17.5 (4.27)	10.0 (3.07)	0.00 (0.70)	4.72	
	Mean	14.27 (3.50)	17.83 (4.05)	21.90 (5.12)	16.66 (3.98)	0.00 (0.70)	7.98 (2.87)	
	CD(P<0.05)	0.90	1.02	0.86	0.97	0.00		

SW=Standard week, *Mean of 4 replications
Figures in parentheses are square root transformed values
AMSL= Above mean sea level

Table 3: Stem tunnelling by *Chilo partellus* on maize at different altitudes of district Kupwara.

Locations		Stem tunnelling (Fortnight intervals)					
		34SW	36SW	38SW	40SW	Mean	Over all mean
Low Altitude (1550 AMSL*)	Langate	9.02*	10.56	12.24	13.06	4.98	5.57
	Panditpora	12.02	13.14	14	14.56	5.96	
	Chotipora	11.44	12.56	13.72	14.32	5.78	
Mid Altitude (1750 AMSL)	Lach	6.06	7.16	8.46	9.22	3.43	3.43
	Batpora	6.14	6.96	8.12	9.02	3.36	
	Mawer bala	6.02	7.2	8.24	9.24	3.41	
High Altitude (2250 AMSL)	Kheta cheak mohalla Nowgam	2.82	3.66	4.28	4.92	1.74	1.72
	Prongawari Nowgam	2.76	3.86	4.52	4.9	1.78	
	Reshwari Nowgam	2.44	3.5	4.04	4.8	1.64	
	Mean	6.52	7.62	8.62	9.33	3.56	
	CD	**1.21**	**1.76**	**1.04**	**0.79**		

SW= Standard week, *Mean of 5 replications, AMSL= Above mean sea level

SUMMARY AND CONCLUSION

Maize stem borer is serious pest of maize in north kashmir causing huge losses every year. The occurrence of multiple resistance system in association with low natural enemy population the pest is growing and expanding its range to every corner of the UT of Jammu and Kashmir. It is imperative to develop IPM strategies against the pest in order to avoid resistance and resurgence. It was seen that the low altitude areas are more prone to *Chilo partellus* attack among all the three altitudes of Kupwara district. The *Chilo partellus* sympotms *viz;* leaf infestation, dead hearts and stem tunnelling were observed more in low altitude followed by mid and High.

FUTURE SCOPE

This study will give evidence to support and suggest the use of resistant varieties of maize to prevent the damage caused by maize stem borer *Chilo partellus*.

Acknowledgment. The authors are thankful to Shere-e-Kashmir University of Agricultural Sciences and Technology kashmir (SKUAST-K), India
Conflict of Interest. None

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How to cite this article: Waseem Ahmad War*, Shafiq Ahmad Hakeem, Umer bin Farook, Jameela Rasool, Ishfaq Majeed Shah, Saima Bashir and Showkat Ahmad Sheikh (2022). Studies on Infestation of Maize Stem Borer Chilo partellus (Swinhoe) (Lepidoptera: Crambidea) in North Kashmir. *Biological Forum – An International Journal*, *14*(1): 1225-1229.