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Study on the population densities of grass hopper and armyworm on different maize cultivars at Peshawar

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Abstract
The present study aimed to record Population densities of Grass hopper and Armyworm on different maize cultivars at Peshawar was conducted at Agronomy Research Farm (ARF), The University of Agriculture, Peshawar (UAP), Pakistan during 2015. Seven maize cultivars, namely Azam, Jalal, Babar, Pahari, Iqbal, Climax 3055 and Climax 30M62 were tested. The overall mean density of grass hopper and armyworm were found statistically non-significant on the seven tested maize cultivars. However, highest overall mean density of grasshoppers of 0.48 grass hoppers plant^{-1} was found on Azam while lower of 0.42 grass hoppers plant^{-1} on each of C-3055 and C-30M62. Overall mean density of worms was recorded higher of 0.77 worms plant^{-1} on Pahari while lower of 0.66 worms plant^{-1} on C-30M62. On the basis of lower incidence of insect pests, all of the seven tested maize cultivars are recommended for cultivation during spring season at Peshawar.

Keywords: Maize cultivars, Grass hopper, Armyworm, Population densities.

1. Introduction

Corn, usually called "maize" (*Zea mays* L.) (family Poaceae) is an annual, cross pollinated, Kharif crop. Zea, makai, corn, jovar and silk corn, etc. are other synonyms used to recognize maize. Corn provides food for humans, feed for animals particularly poultry and livestock and raw materials for various industries, hence it is a multipurpose crop [1]. Maize is worldwide distributed crop [2]. It is the fourth largest grown crop in Pakistan after wheat, cotton and rice. After wheat and rice, maize occupies third position among the world's most important cereal crops, but second after wheat in Khyber Pakhtunkhwa province [3]. Classification of maize occurs on the basis of grains structure. Popcorn, flint, pod, dent, sweet and flour are major types of maize [4].

In Pakistan, the total area under maize cultivation in 2013-14 was more than one million hectares and it yielded 3.5 million metric tons. The total area contribution of Khyber Pakhtunkhwa province under maize was 56 percent which contributed 63 percent of the total production [5]. Maize is mostly grown in Haripur, Swabi, Mardan, Malakand, Charsadda, Peshawar, D.I. Khan, Kohat and Bannu districts of Khyber Pakhtunkhwa [6]. In Pakistan, the most dependable, profitable and staple crop after potato is maize [7].

There are many factors which are responsible for low yield of maize [8] among which insect pests are major ones. During the initial growth phase, corn crop is more susceptible to the insect damage particularly up to 30 percent losses can be caused by the soil insects which may necessitate the replanting of the crop. Maize germinating seeds and seedlings are damaged by other insect pests such as cutworms, wireworm, false wireworms, black field earwigs, maize stem borer and beetles such as African black beetle. Traditional methods such as spraying in furrows and various other agronomic practices at the time of sowing are also very effective [9]. Invertebrate insect pests that attack the maize crop at the development and maturity stages include corn aphid, green vegetable bug, corn earworm, red shouldered leaf beetle, common army worm, maize leaf hopper, two-spotted spider mite, maize weevil and thrips [10]. To control specific pests, selective pesticides have been developed [11].

2. Materials and methods

The research was conducted at the Agronomy Research Farm of The University of Agriculture Peshawar, during 2015. RCB design was used to carry out the experiment. There were three replications and each replication had seven treatments (Climax 30M62, Climax 3055, Babar, Iqbal, Azam, Jalal and Pahari). Separate experimental units were used to sow each maize cultivar. During March 2015, these maize cultivars were sown in lines. Buffer zone of one meter was kept between the replications and a half meter between the treatments for isolation. Size of the whole experimental field was 24 m × 11 m which was divided into 21 sub-plots each with an area of 3 m × 3 m. Row to row and plant to plant distance were kept 75 cm and 25 cm, respectively. Standard agronomic practices were adopted in the field throughout the maize growing season. The experimental field was left open for natural infestation of insect pests. Data was recorded on weekly basis from germination till the maturity of cultivars. The details of the experiments were as following:

Insect pest data collection for maize cultivars screening:

To check the comparatively resistant and susceptible responses of maize cultivars, the experimental field was observed thoroughly at weekly intervals for insect pests infestation on upper, middle and lower portion of the plant. Grass hopper and Armyworm data were recorded as number plant^{-1} on randomly selected 6 plants per treatment. The collected specimens Grass hoppers were killed with the help of killing jar and then properly pinned in the insect collection box while Army worm specimens were preserved in 70% alcohol and were deposited at the Insect Museum, Department of Entomology, UAP.

Statistical analysis

Each recorded data was analyzed statistically by using Statistix 8.1 Software and Fisher Protected Least Significance Difference Test was used for the separation of means at 5% level of significance [12].

Table 1: Experimental Layout

R1		R2		R3
Azam (OPV)		Climax 3055 (hybrid)		Iqbal (OPV)
Babar (hybrid)		Jalal (OPV)		Pahari (OPV)
Pahari (OPV)		Climax 30M62 (hybrid)		Babar (hybrid)
Climax 3055 (hybrid)		Azam (OPV)		Jalal (OPV)
Iqbal (OPV)		Babar (hybrid)		Climax 3055 (hybrid)
Climax 30M62 (hybrid)		Pahari (OPV)		Azam (OPV)
Jalal (OPV)		Iqbal (OPV)		Climax 30M62 (hybrid)

OPV: Open Pollinated Varieties

3. Results

3.1. Population density of Grass hopper

The results in Table 2 showed that mean density of grass hopper was non-significantly different on the seven maize cultivars in week 1-8. In week 9 mean density of the grass hopper was significantly higher of 0.66, 0.57, 0.56 and 0.53 grass hoppers plant^{-1} on Azam, Pahari, Babar and Iqbal while lower of 0.50, 0.51 and 0.52 grass hoppers plant^{-1} on C-30-M62, C-3055 and Jalal, respectively. Moreover, mean density of the grasshopper in week 10-12 was non-significantly different on the maize cultivars. Also, overall mean density of the grasshopper was non-significantly different on the seven maize cultivars, where it was higher of 0.48 grass hoppers plant^{-1} on Azam and 0.47 grass hoppers plant^{-1} each on Babar and Pahari while lower of 0.42 grass hoppers plant^{-1} on each of C-3055 and C-30M62 respectively.

3.2. Population density of Armyworm

The results in Table 3 showed that mean density of armyworm was non-significantly different on the seven maize cultivars in week 1 and 2. In week 3 mean density of the army worm was significantly higher (1.05 worms plant^{-1}) on Pahari and Babar (1.01 worms plant^{-1}) and lower (0.87 worms plant^{-1}) on C-30M62 and C-3055 (0.90 worms plant^{-1}). Mean density of the army worm in week 4 was non-significantly different on the maize cultivars. In week 5 mean density of the army worm was significantly higher of 0.71, 0.68 and 0.66 worms plant^{-1} on Pahari, Babar and Azam while lower of 1.57 and 1.59 worms plant^{-1} on C-3055 and C-30M62 respectively. Mean density of the army worm was non-significantly different on the seven maize cultivars in week 6. Mean density of the army worm in week 7 was significantly higher (0.99 worms plant^{-1}) on Pahari and lower (0.81 plant^{-1}) on C-30M-62. In week 8 mean density of the army worm was significantly higher of 0.69 and 0.66 worms plant^{-1} on Babar and Pahari and lower of 0.36, 0.38 and 0.42 worms plant^{-1} on C-30M62, C-3055 and Jalal respectively. Mean density of the army worm was non-significantly different on the seven maize cultivars in week 9-11. Also, overall mean density of the army worm was non-significantly different on the seven maize cultivars, where it was higher of 0.77 and 0.74 worms plant^{-1} on Pahari and Babar while lower of 0.66 and 0.67 worms plant^{-1} on C-30M62 and C-3055 respectively.

Table 2: Mean weekly density of grass hopper plant^{-1} on seven maize cultivars during 2015.

Treatment	Mean density of grass hopper in week no.												Overall Mean
	1 14-April	2 21-April	3 28-April	4 5-May	5 12-May	6 19-May	7 26-May	8 2-Jun	9 9-Jun	10 16-Jun	11 23-Jun	12 30-Jun	
Azam	0.17	0.22	0.33	0.42	0.51	0.64	0.59	0.68	0.66 a	0.6	0.48	0.41	0.48
Babar	0.2	0.24	0.31	0.43	0.52	0.68	0.65	0.62	0.56 b	0.51	0.49	0.38	0.47
Pahari	0.19	0.26	0.39	0.46	0.49	0.67	0.63	0.59	0.57 b	0.52	0.5	0.39	0.47
C-3055	0.13	0.21	0.29	0.4	0.5	0.61	0.64	0.56	0.51 b	0.47	0.42	0.33	0.42
Iqbal	0.16	0.2	0.3	0.45	0.53	0.65	0.67	0.6	0.53 b	0.46	0.44	0.36	0.46
C-30M62	0.11	0.19	0.27	0.44	0.48	0.63	0.62	0.58	0.5 b	0.49	0.41	0.34	0.42
Jalal	0.14	0.23	0.32	0.41	0.54	0.69	0.6	0.57	0.52 b	0.48	0.43	0.35	0.44
LSD value	ns	ns	ns	ns	ns	ns	ns	ns	0.0856	ns	ns	ns	ns

Means in rows and columns followed by different letters are significantly different at 5% level of significance (LSD test).
ns = Non-significant.

Table 3: Mean weekly density of armyworm plant^{-1} on seven maize cultivars during 2015.

Treatment	Mean density of army worm in week no.											Overall Mean
	1 21-April	2 28-April	3 5-May	4 12-May	5 19-May	6 26-May	7 2-Jun	8 9-Jun	9 16-Jun	10 23-Jun	11 30-Jun	
Azam	0.32	0.7	0.97 abc	1.43	1.66 abc	1.28	0.94 abc	0.64 abc	0.47	0.29	0.18	0.74
Babar	0.3	0.69	1.01 ab	1.46	1.68 ab	1.3	0.96 ab	0.69 a	0.48	0.31	0.21	0.76
Pahari	0.38	0.67	1.05 a	1.47	1.71 a	1.31	0.99 a	0.66 ab	0.49	0.33	0.2	0.77
C-3055	0.28	0.62	0.9 c	1.33	1.57 d	1.22	0.87 cd	0.51 e	0.38	0.23	0.12	0.67
Iqbal	0.3	0.66	0.92 bc	1.42	1.64 abcd	1.26	0.89 bc	0.57 cde	0.43	0.25	0.14	0.71
C-30M62	0.26	0.63	0.87 d	1.37	1.59 cd	1.2	0.81 d	0.55 de	0.36	0.2	0.11	0.66
Jalal	0.31	0.65	0.94 bc	1.4	1.61 bcd	1.24	0.92 abc	0.6 bcd	0.42	0.28	0.16	0.71
LSD value	ns	ns	0.0900	ns	0.0889	ns	0.0775	0.0738	ns	ns	ns	ns

Means in rows and columns followed by different letters are significantly different at 5% level of significance (LSD test).
ns = Non-significant

4. Discussion

The differences in the present and earlier results might be due to variations in the time of sowing maize and agro-climatic differences. Sparks and Yates [13] stated that the change in the climatic conditions has greatly affected the agricultural systems along with the insect pests. In the present results densities of insect pests on the seven maize cultivars were lower than that reported by some earlier researchers like Sparks and Yates [13]; Mensah and Madden [14]; Dhillon *et al.* [15], which might be due to the fact that host plant resistance has played its role in suppressing insect pests populations.

4. Conclusion and Recommendations

The overall mean density of Grass hopper and Armyworm were found statistically non-significant on the seven tested maize cultivars. However, highest overall mean density of grasshoppers of 0.48 grass hoppers plant^{-1} was found on Azam while lower of 0.42 grass hoppers plant^{-1} on each of C-3055 and C-30M62. Overall mean density of worms was recorded higher of 0.77 worms plant^{-1} on Pahari while lower of 0.66 worms plant^{-1} on C-30M62. On the basis of above stated information, all of the seven tested maize cultivars are recommended for cultivation during spring season. Maize should be cultivated earlier in spring for lower incidence of insect pests. It is necessary to diversify new resistance basis in maize. Further parameters at different locations need to be studied.

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