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Monitoring of major insect pests, correlation and yield loss in pearl millet

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Abstract

Investigations were carried out at Main Pearl Millet Research Station, Junagadh Agricultural University, Jamnagar (Gujarat) during *kharif* 2021 revealed that shoot fly, *Atherigona soccata,* stem borer, *Chilo partellus,* and ear head worm, *Helicoverpa armigera* were the major insect-pests in pearl millet. Significant correlation was found of shoot fly, stem borerand *Helicoverpa armigera* with different weather parameters. There was a considerable loss in yield due to insect-pest complex in pearl millet.

Key Word: Shoot fly, stem borer, *Helicoverpa armigera*, correlation, yield loss.

Introduction

In India, pearl millet, *Pennisetum typhoides* (Burm.) or *bajra* is grown in Rajasthan, Maharashtra, Gujarat, Uttar Pradesh, Andhra Pradesh, Haryana, Tamil Nadu and Karnataka (Prem Kishore and Solomon, 1989). It occupies an area of 6.93 million ha with an average production of 8.61 million tones and productivity of 1243 kg/ha (Anonymous, 2020). Pearl millet is generally preferred in low rainfall areas and on light soils. This crop has wide spectrum adaptability in respect of rainfall, temperature and soil. It is generally believed that pearl millet either grown as mono crop or mixed crop or in relay cropping system has hardly had any serious problems. However, perusal of literature on insect pest of this crop gives quite a different picture. Twenty six insects and two non-insect pests were found feeding on pearl millet (Balikai, 2010). Out of these, shoot fly, *Atherigona soccata,* stem borer, *Chilo partellus* Swinhoe and ear head worm, *Helicoverpa armigera* are comparatively more serious pests attacking the crop. The need to study the effect of different weather parameters on insect-pest incidence has also arised in present situation of climate change. Hence, study was under taken.

Material and methods

The experiment was taken during *kharif* 2021 at Pearl Millet Research Station, Junagadh Agricultural University, Jamnagar (Latitude:22.46816, Longitude:70.02855, Altitude:64 ft). Sowing of released pearl millet variety (GHB 558) was done over an area of 200 m^2 which was kept free from insecticidal

application during crop season. During, *kharif*-2021, monsoon commenced in the third week of June. Total rainfall *i.e.* 800 mm was received in 28 rainy days. Sowing for entomological trials was done on 20th July, 2021. After sowing there was long dry spell and hence irrigation was given. All the agronomical package of practices was followed from time to time. Incidence (%) and population of various insect pests observed during the crop period was recorded at weekly interval from 20 randomly selected plants seven days after germination (DAG) of the crop till maturity. The presence of bio agents was also recorded simultaneously. Weather data was also recorded on weekly basis (Meteorological Standard Weather Week) for correlation. The correlation of major insect pest was worked out. Simultaneously, one treated plot was maintained and kept insect-pest free by taking recommended package of practices for insect pest management to get the information for losses. The following treatments were adopted for treated plot.

1. Seed treatment imidacloprid 600 FS @ 8.75 ml/kg seed was given for protection against shoot fly, stem borer & white grub at early crop stage. For later stage crop protection (Shoot fly & stem borer) foliar spray of fipronil 5 SC @ 0.01%, at 35 days after germination of the crop was given.
2. Spray of Novaluron 10 EC 0.01%, at ear head stage at pest appearance of the *Helicoverpa armigera* was given.
3. For leaf binder, grass hopper, grey weevil and hairy cater pillar spray of neem seed kernel extract 5% was done.

Results and discussion

(A) Insect-pest incidence:

Shoot fly: The initiation of shoot fly incidence was found in 31st SWW (5.0%). The highest shoot fly incidence (25.0%) was observed during 40th SWW. The average incidence was 13.18% during the crop period. Stem borer: The initiation of stem borer was found from 32nd SSW (5.0%). However, its incidence was found highest (25.0%) during 36th week with an average incidence of 12.73% during the crop period. The overall range of other insect pests *viz.* White grub (0.0-10.0%), leaf roller (0.85-2.50 damage score), grass hopper (0.0-5.0%), grey weevil (0.0-1.85 damage score), hairy cater pillar (0.0-10.0/20 ear heads), chaffer beetles (0.0-7.0/20 ear heads), blister beetle (0.0-6.0/20 ear heads), *Helicoverpa* (0.0-12.0 larvae/20 ear heads). The incidence of fall army worm was not observed during the study period. The natural enemy lady bird beetle population initiated during 32nd SWW (2 adults/20 plants) and was observed till the end of the season ranging from 0.0 to 25.0 adults/ 20 plants. The average population was 11.73 adults/20 plants. C*hrysopa* population was population initiated during 33rd SWW (1 adult/20 plants) and was observed till 36th SWW i.e. during med crop stage. The overall range was 0.0 to 2.0/ 20 plants with an average of 0.55 adults/20 plants, table-1.0.

(B) Correlation

The correlation of shoot fly with temperature minimum (-0.671*) was found negatively significant and highly and negatively significant with wind speed (-0.832**). The correlation of stem borer was again negatively significant with temperature minimum (-0.629*) and highly and negatively significant with wind speed (-0.809**). As far as *Helicoverpa armigera* was concerned its correlation was found negatively significant with wind speed (-0.608*) and negatively highly significant with evaporation rate (-0.725**), table 1.1. Raghvani *et al.,* 2008 reported that none of the weather parameters showed significant correlation with incidence of shoot fly. However, maximum temperature and difference of minimum and maximum temperature exhibited negative correlations with stem borer. While significant positive association of minimum temperature was observed with larval population of *Helicoverpa* and correlation with rainy days was found significantly negative.

(C) Losses

The treated plot recorded 2343 kg/ha grain and 4566 kg/ha fodder yield (Table-1.2). The losses in grain and fodder yield were 16.41% and 20.01%, respectively. Prem Kishore, 1996 reported that, shoot fly causes 23.3 to 36.5 percent grain losses and 37.5 per cent fodder loss. Whereas, borers indicated losses varied from 20 to 60 per cent. Juneja and Raghvani (2000) reported that on an average 10 to 15 per cent reduction in yield was observed due to *Helicoverpa armigera*.

Conclusions

The above study on monitoring of major insect pests in pearl millet during *kharif* 2021 revealed that there is huge difference in the intensity of different insec -pests. These insec -pests are collectively responsible for loss in yield. Moreover, weather played an important role in the pest incidence.

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Table-1.0: Incidence/population of insect-pests and natural enemies in pearl millet during *kharif*,2021

No.	SWW	Date of Observation	Days After Germi. nation	Shoot fly % incidene	Stem borer % incidece	White grub % Inci.	leaf roller damage score (0-10)	Grass hopper % damage	FAW % damage	Mean Grey weevil damage score (0-10)	Hairy cater pillar /20 pl.	Blister beetles/ 20 EH	Chaffer beetle 20 / EH	Helicoverpa larvae/ 20 EH	Lady bird beetle/ 20 pl.	Chrysopa/ 20 pl.
1	30	26.07.21	7 DAG	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0	0	0	0	0	0
2	31	02.08.21	14 DAG	5.00	0.00	0.00	1.00	0.00	0.00	0.00	0	0	0	0	0	0
3	32	09.08.21	21 DAG	5.00	5.00	5.00	1.10	5.00	0.00	0.40	0	0	0	0	2	0
4	33	16.08.21	28 DAG	10.00	10.00	10.00	1.45	5.00	0.00	0.60	0	0	0	0	5	1
5	34	23.08.21	35 DAG	15.00	15.00	10.00	1.62	5.00	0.00	0.80	0	0	0	0	10	1
6	35	30.08.21	42 DAG	20.00	20.00	10.00	1.80	5.00	0.00	0.85	0	0	0	0	12	2
7	36	06.09.21	49 DAG	10.00	25.00	10.00	1.95	5.00	0.00	1.00	0	0	0	0	15	1
8	37	13.09.21	56 DAG	15.00	10.00	10.00	2.10	5.00	0.00	1.20	4	3	0	0	18	1
9	38	20.09.21	63 DAG	20.00	15.00	10.00	2.20	0.00	0.00	1.65	7	5	4	5	20	0
10	39	27.09.21	70 DAG	20.00	20.00	10.00	2.25	0.00	0.00	1.75	8	5	6	8	22	0
11	40	04.10.21	77 DAG	25.00	20.00	10.00	2.50	0.00	0.00	1.85	10	6.00	7	12	25	0.00
			Mean	**13.18**	**12.73**	**7.73**	**1.71**	**2.73**	**0.00**	**0.92**	**2.64**	**1.73**	**1.55**	**2.27**	**11.73**	**0.55**
N.B.: Date of sowing: 20.07.2021, Harvesting: 15.10.2021, Variety: GHB 558																

Table-1.1: Correlation of major insect-pests of pearl millet with different weather parameters

No.	SWW	Date of Observation	Days After Germi. nation	Temp. C Maxi.	Temp. C Mini.	R.H. Morn.	R.H. Even.	Wind speed km/hr	BSS (hrs)	Eo (mm)	Rainfall (mm)	Rainy Days
1	30	26.07.21	7 DAG	32.0	27.1	93	76	15.2	1.4	5.6	30.0	2
2	31	02.08.21	14 DAG	32.1	26.5	85	67	16.2	1.6	5.6	4.5	1
3	32	09.08.21	21 DAG	33.0	25.8	85	66	9.3	5.8	6.6	0.5	0
4	33	16.08.21	28 DAG	33.0	25.4	84	65	10.1	7.0	6.8	0.0	0
5	34	23.08.21	35 DAG	32.7	25.9	86	65	9.8	6.1	6.9	2.0	0
6	35	30.08.21	42 DAG	33.1	25.5	89	72	8.0	5.0	7.2	68.5	2
7	36	06.09.21	49 DAG	31.4	25.6	93	83	8.2	2.7	5.4	91.0	4
8	37	13.09.21	56 DAG	30.3	24.8	95	83	7.2	1.1	4.7	204.0	5
9	38	20.09.21	63 DAG	32.5	26.1	91	76	7.8	6.5	4.8	6.5	1
10	39	27.09.21	70 DAG	31.4	24.8	94	86	4.9	3.3	4.2	244.0	4
11	40	04.10.20	77 DAG	32.6	25.2	90	73	5.1	8.1	4.1	7.0	1
		Correlation	Shoot fly%	0.027^{NS}	**-0.671^{*}**	0.258^{NS}	0.276^{NS}	**-0.832^{**}**	0.512^{NS}	-0.372^{NS}	0.280^{NS}	0.153^{NS}
			Stem Borer%	-0.051^{NS}	**-0.629^{*}**	0.349^{NS}	0.437^{NS}	**-0.809^{**}**	0.360^{NS}	-0.205^{NS}	0.334^{NS}	0.335^{NS}
			Helicoverpa /5 EH	0.003^{NS}	-0.384^{NS}	0.287^{NS}	0.305^{NS}	**-0.608^{*}**	0.437^{NS}	**-0.725^{**}**	0.157^{NS}	0.047^{NS}

Table-1.2: Yield losses in grain & fodder due to insect-pest complex in pearl millet.

Parameters	Yield kg/ha in treated plot	Yield kg/ha in Un-treated plot	% losses
1. Grain	2343	1959	16.41
2. Fodder	4566	3652	20.01

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