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Studies on Seasonal Incidence of Sorghum Shoot Fly, *Atherigona soccata* (Rondani) and Stem Borer, *Chilo partellus* (Swinhoe), in Relation to Abiotic Factor

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A B S T R A C T

The field experiment was conducted during *Kharif*- 2012 at Crop Research Centre (Chirori farm) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) to characterize relationship of various meteorological parameters with sorghum shoot fly and stem borer incidence. In the experiment dead hearts of shoot fly start increasing observed first during in 16th to 22th July (29th standard weeks). And maximum dead hearts recorded during crop season from 13th to 19th August (33th standard week). In the experiment dead hearts of stem borer start increasing from 23th to 29th July (30th standard weeks) and maximum dead hearts of *Chilo partellus* (Rondani) were recorded during crop season from 20th to 26th August (34th standard weeks). The shoot fly and stem borer incidence in the form of dead hearts was correlated with the meteorological parameters corresponding to the period of observations.

Introduction

Sorghum, *Sorghum bicolour* (L. Moench) is a premier crop of the semi-arid tropics and a major staple food in several parts of the world. It is a dry land crop grown in *kharif* and *rabi* seasons for the utility as food, feed, forage and industrial raw material. Grown as human food (Africa and India) or animal feed and fodder on about 50 million hectares annually (Sharma *et al.*, 1992). Sorghum crop is being attacked by nearly 150 insect species causing an annual loss of over $1 billion in the Semi-Arid Tropics (ICRISAT, 1992) and the most damaging species are *Chilo partellus*, *Busseola fusa* and *Eldana saccharina* (Songa *et al.*, 2001). De Groote *et al.*, (2003) found that all stem borer species caused average annual losses of 13.5%, valued at US$ 80 million. In India, a number of stem borer species have been reported as serious pests of sorghum crop of which spotted stem borer, *Chilo partellus* (Swinhoe) (Lepidoptera: Pyralidae) is important (Jotwani *et al.*, 1971).

Host-plant resistance is one of the most effective means of pest management in sorghum. It is compatible with other methods of pest control, does not involve extra cost for the farmers, and is environment-friendly. There are over 36,700 germplasm accessions of sorghum in the gene bank at the

International Crops Research Institute for the Semi -Arid Tropics (ICRISAT), Patancheru, India, which serves as a global repository of the sorghum germplasm. The problems has become more acute with the introduction of shoot fly of exotic dwarf, which are highly susceptible to shoot fly (Rai and Jotwani, 1977) estimated the losses in grain yield of sorghum due to this pest to be 13-20%. Silica deposition and abundance of sclerenchymatous cells in the leaf sheath (Ponnaiya, 1951), trichomes on the abaxial surface (Maiti and Bidinger, 1979), glossy leaves (Agrawal and House, 1982) and early seedling vigour (Jain and Bhatnagar, 1962; Blum, 1969) are reported to be the factors responsible for primary mechanism of shoot fly resistance. The two key pest, *viz.*, shoot fly, *Atherigona soccata* (Rondani) and stem borer, *Chilo partellus* (Swinhoe), being internal feeders, most serious problems in achieving the targeted yield (Prem Kishore, 2001a) in northern part of the country. The role of environmental factors affecting these variations has also been described.

Materials and Methods

Screening of 27 germplasm of sorghum obtained from ICRISAT was undertaken field condition at Crop Research Centre (Chirori farm) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) during *Kharif*- 2012. Experiments were laid out in randomised block design with three replication, the row length being 3m. Row to row distance was 30cm and plant to distance 15cm. The healthy seeds of sorghum were sown manually at the depth of 3-4 cm. Recommended agronomic practices were followed for raising the fodder crop.

For the study of pest incidence observation were recorded on shoot infestation by sorghum shoot fly, *Ahherigona soccata* and stem borer, *Chilo partellus* at weekly interval throughout the growing season of the crop and randomly selected twenty plants in the field. The Dead shoots caused by this pest were counted in each entry from the first appearance, while damaged and healthy slant were counted at each observation (weekly). Damaged per cent on shoot fly and stem borer was calculated by recording the number of total and infested shoot. In general the early sowing crop escaped the shoot fly attack. *Interlard Fishmeal Technique* (Taneja and Leusschner, 1985) was used in addition to late sowing in *Kharif* season in order to ensure high shoot fly incidence. Kamatar *et al.*, (2001a) reported that shoot fly incidence varied with season and resistance was relative to shoot fly density. The averages of the observations new sources of resistance to shoot fly and stem borer displayed in tables 1 and 2.

Results and Discussion

Seasonal incidence of shoot fly

The data recorded on dead hearts of shoot fly during *Kharif*-2012 have been presented in the Table 1 and Figure 1. It is evident that the activity of pest population throughout the growing season. Pest population (2.29%) observed first during in 29th standard week (July, 16-22) when the maximum and minimum temperature 35.14 and 28.00^{0}C, respectively, relative humidity 55.99 per cent and rainfall 0.00 mm were recorded, when the age of the crop was 8 days.

The dead hearts increased and reached maximum (28%) in 33th standard week (Aug, 13-19) when the maximum and minimum temperature 31.57 and 26.50^{o}C respectively, relative humidity 67.24 per cent and rainfall 0.00 mm. Maggot feeds on the growing tip causing wilting of leaf and later drying of central leaf giving a typical symptom of "dead heart". The damaged plants produce side tillers which again are infested (Fig. 2).

Table.1 Seasonal incidence of shoot fly, *Atherigona soccata* (Rondani)

S.W.	Mean dead heart (%)	Temperature (^{0}C)		Relative humidity (%)	Rainfall (mm)
		Maximum	Minimum		
28	0.00	31.92	26.78	64.85	46.80
29	2.29	35.14	28.00	55.99	0.00
30	4.73	30.00	26.57	70.14	51.75
31	4.90	28.42	25.71	75.03	80.03
32	9.00	28.42	24.92	73.03	125.50
33	28.00	31.57	26.50	67.24	0.00
34	2.40	27.00	25.21	75.28	218.16
35	15.00	28.92	24.85	74.21	101.40
36	10.00	30.85	25.78	64.71	7.85
37	5.00	31.85	26.07	66.74	21.10
38	1.00	30.78	23.71	61.64	4.35
39	0.50	33.21	21.57	53.60	0.00
40	0.00	33.78	20.78	56.03	0.00
41	0.00	31.00	18.50	55.71	0.00
42	0.00	29.14	17.50	53.21	3.40
43	0.00	27.21	14.64	53.85	0.45
44	0.00	28.14	14.29	52.42	0.00
45	0.00	27.14	13.57	61.53	0.00

Table.2 Seasonal incidence of stem borer, *Chilo partellus* (Swinhoe)

S.W.	Mean dead heart (%)	Temperature (^{0}C)		Relative humidity (%)	Rainfall (mm)
		Maximum	Minimum		
28	0.00	31.92	26.78	64.85	46.80
29	0.00	35.14	28.00	55.99	0.00
30	5.00	30.00	26.57	70.14	51.75
31	11.67	28.42	25.71	75.03	80.30
32	15.34	28.42	24.92	73.06	125.50
33	21.00	31.57	26.50	67.24	0.00
34	30.50	27.00	25.11	75.28	218.60
35	25.25	28.92	24.85	74.21	101.40
36	22.00	30.85	25.78	64.71	7.85
37	18.29	31.85	26.07	66.74	21.10
38	15.50	30.78	23.71	61.64	4.35
39	10.38	33.21	21.57	53.60	0.00
40	6.78	33.78	20.78	56.03	0.00
41	5.00	31.00	18.50	55.71	0.00
42	3.33	29.14	17.50	53.21	3.40
43	1.50	27.21	14.64	53.85	0.45
44	0.00	28.14	14.29	52.42	0.00
45	0.00	27.14	13.57	61.53	0.00

Fig.1 Seasonal incidence of shoot fly during the crop season (July to November, 2012)

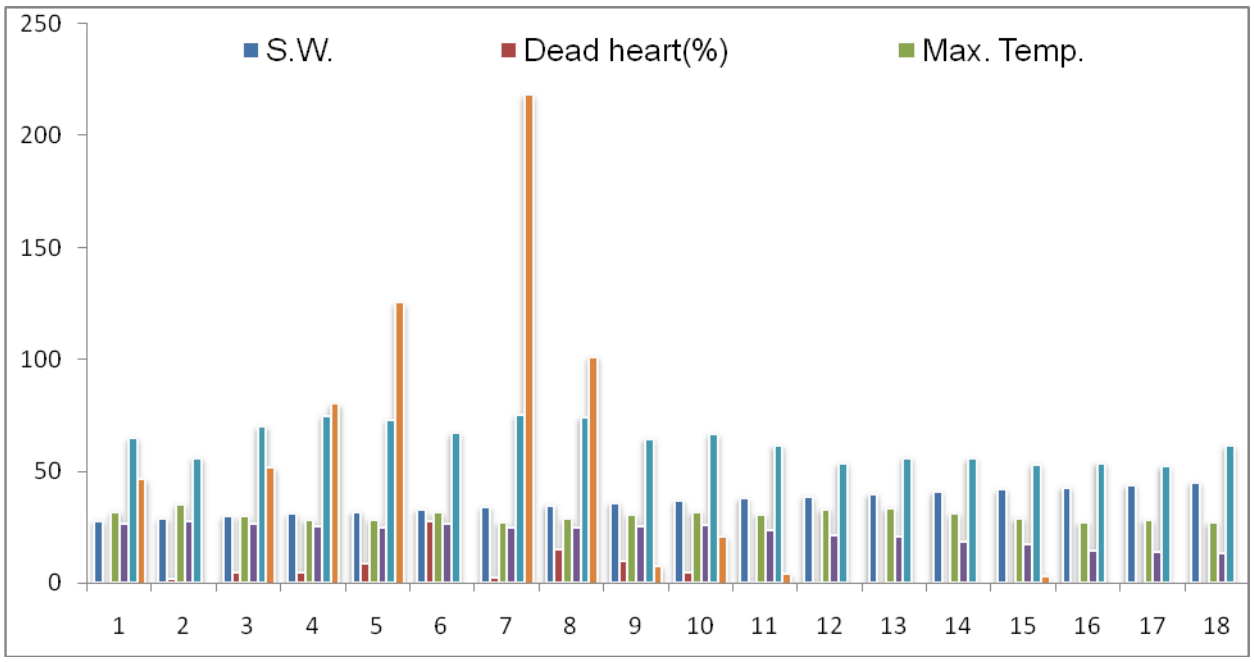
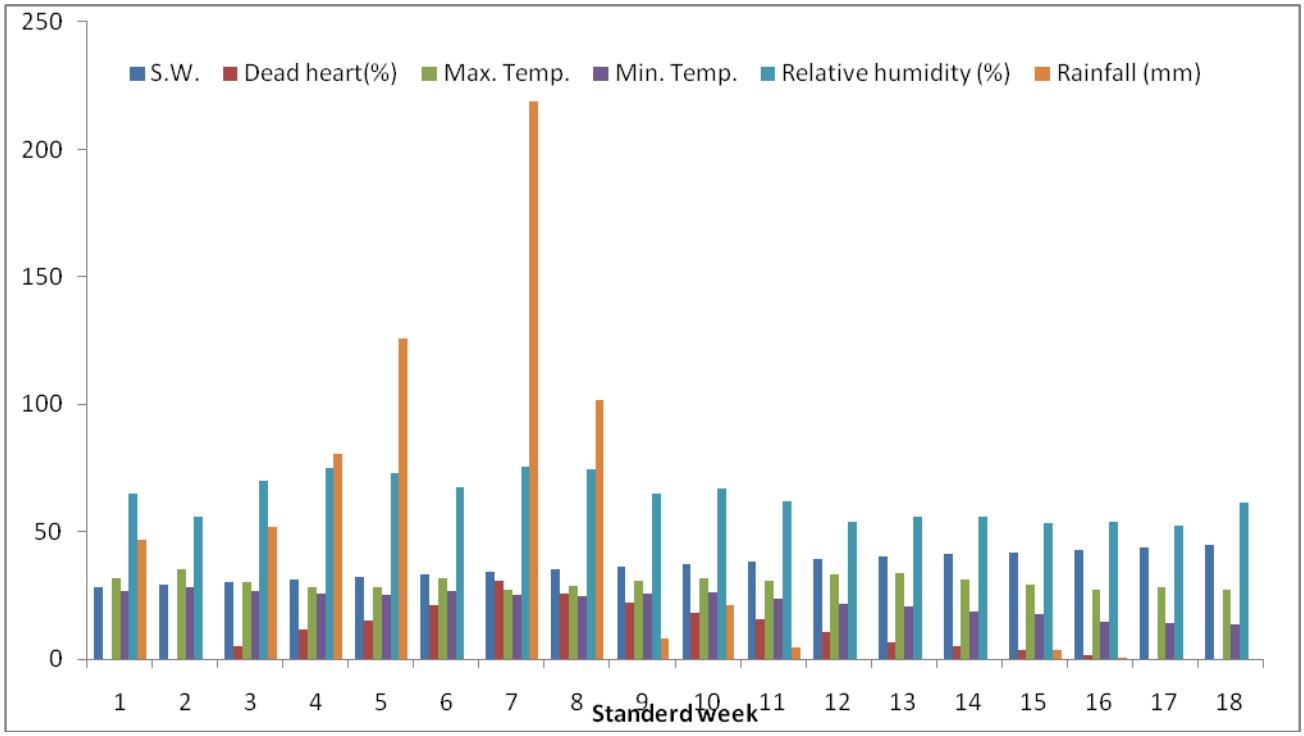


Fig.2 Seasonal incidence of stem borer during crop season (July to November, 2012)



Similarly, Sable *et al.*, (2009) the maximum shoot fly dead hearts recorded were 73.23% during the 32-37th meteorological week, where maximum and minimum temperature and relative humidity in the morning and evening were 30.00 and 21.8^{0}C, and 86 and

67%, respectively, with 244 mm rainfall. Karibasavaraja and Balikai (2006) the occurrence of dead heart in the crop was highest on 13-19 August (93.4%), corresponding to the occurrence of the highest mean number of eggs of the pest per plant (3.20).

Seasonal incidence of stem borer

Pest population (5%) observed first during in 30th standard week (July, 23-29) when the maximum and minimum temperature 30.00 and 26.57^{0}C, respectively, relative humidity 70.14 per cent and rainfall 51.75 mm were recorded, when the age of the crop was 10 days. The dead hearts increased and reached maximum (30.50%) in 34th standard week (Aug, 20-26) when the maximum and minimum temperature 27.00 and 25.21^{0}C respectively, relative humidity 75.28 per cent and rainfall 218.6 mm. Initially the larvae feed on the upper surface of whorl leaves leaving the lower surface intact. In Maharashtra, number of stem borer larvae were found to be high in winter sorghum than in *kharif* sorghum but the average number of pupae, percentage of stem tunnelling and inter nodes attacked were highest only in rainy (*kharif*) season (Anonymous, 1987). Singh and Sharma (1984) observed 4-45% infestation of *C. partellus* in sorghum and maize and maximum infestation was observed during August, which declined gradually in Sep. and Oct. Kandalkar (2002) only minimum temperature showed significant and negative correlation. Maximum temperature, morning and evening RH, and rainfall did not influence stem borer incidence significantly.

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