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Studies on Succession and Population Dynamics of various Insect Pests in Established Sorghum Varieties

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ABSTRACT: The present investigation entitled, "studies on succession and population dynamics of various insect pests in established sorghum varieties" was carried out in the experimental field of All India coordinated Sorghum Improvement Project, College of Agriculture, Indore, RVSKVV, Gwalior, M.P. during Kharif season established varieties (CSH-18, SPH-1653, Vidisha 60-1, JJ1041, JJ938, JJ1022 and RVJ1862) were sown in non-replicated manner. No insecticides were applied on the crop. Shoot fly (*Atherigona soccata*), stem borer (*Chilo partellus*), ear head bug (*Calocoris angustatus*), ear head worms (*Cryptoblabus* sp.) were recorded to be infesting the sorghum crop. The peak activity of shoot fly was recorded in SPH 1653 at 25 July (30th SMW) and the peak activity of stem borer was recorded in JJ 938 at 26 July (30th SMW) and the pick activity of ear head bug was recorded in JJ 1022 at 24 Sep (39th SMW) and the pick activity of ear head worm was recorded in JJ 938 at 24 Sep. (39th SMW).

Keywords: Sorghum, Shoot fly, Stem borer, Ear head bug, Ear head warm and Population dynamics.

INTRODUCTION

Sorghum**,** (*Sorghum bicolor*), also called great millet, Indian millet, milo, durra, or shallu**,** cereal grain plant of the grass family (Poaceae) and its edible starchy seeds. In India, the annual production for the year 2018 was 3.75 mmt under 4mha with a productivity of 1.83t/ha (Santosh, 2019). Maharashtra is the leading producer in the country (1.81 mmt), followed by Karnataka (1.13mmt) and Madhya Pradesh (0.57 MMT). These three states as a whole represent 60% of the country's sorghum production (APEDA, 2018). In Madhya Pradesh, sorghum is majorly grown as a *Kharif* crop, with an annual production of 0.57mmt cultivated under an area of 2.05 mha with a productivity of 1.95t/ha (Anonymous, 2019). India ranks fifth in total sorghum production with 4.23 million tonnes grown in an area of 3.90 million hectares in 2021-22, whereas in *Kharif* 2022-23, sorghum production was 1.69 million tonnes (1st advance estimates) in an area of 2.94 million hectares (agricoop.nic). The activity of the pests varies from season to season and region to region with the difference in their weather factor (Priyanka *et al.,* 2018; Anandhi *et al*., 2020). There was a higher incidence of this disease in late-planted crops during rainy and post-rainy seasons (rabi) due to the buildup of shoot fly populations on early- planted crops (Balikai and Bhagwat 2009). The worldwide yield loss due to shoot fly has been estimated to be over 274 million US$ (Sharma 2006). Among them shoot fly, Atherigona soccata Rondani (Diptera: Muscidae) is one of the most important insect pests of sorghum in India. The pest attacks the crop only in the early stage of the crop growth and lasts up to four weeks (Daware *et al.,* 2013). Feeding may kill small seedlings, cause reduced stand density and tiller sizes, and sometimes complete crop loss (Young and Teetes 1977; Young 1981; Patil and Bagde 2017). In India, the losses due to shoot fly damage have been estimated to reach as high as 90% of grain, and 45% of fodder yield. The major being sorghum shoot fly, *Atherigona soccata* Rondani, stem borer, *Chilo partellus* Swinhoe, sorghum shoot bug, earhed bug, army worm, sorghum aphid, Gram caterpillar, (Reddy and Davies 1979). The losses in grain yield due to stem borer *Chilo partellus* varies from 24.3 to 36.3 percent in different agro-climatic regions of India. Under natural infestation of shoot bug, it resulted into losses of 11.16 and 21.11 in grain and fodder yield respectively (Raju Anaji and Balikai 2005). The observations on population dynamics of head bugs on these varieties were reared at weekly intervals. The total number of earhead bugs per plant were recorded at interval of one week on 5 randomly selected plants in each replication of each variety. The first observation was recorded on 20th September at initiation of 50 per cent flowering and successive observations were recorded at one week interval on 27 September, 4 October, 11 October and 18 October in cropping season of 2020 (Kumar *et al.,* 2022).

MATERIAL AND METHODS

The materials used and methodology adopted during the course of investigation on "studies on succession and population dynamics of various insect pests in established sorghum varieties" was carried out in the

experimental field of All India coordinated Sorghum Improvement Project, College of Agriculture, Indore, RVSKVV, Gwalior, M.P. during *Kharif* season established varieties (CSH- 18, SPH 1653, Vidisha 60-1, JJ1041, JJ938, JJ1022 and RVJ1862) were sown in non-replicated manner. No insecticides were applied on the crop. The shoot fly incidence was recorded 21 and 28 days after emergence (DAE) of the crop plants. The total number of plants and total number of plants showing dead heart symptoms were recorded in each genotype and subjected to suitable transformations. Stem borer larvae also feed inside the stem and cause extensive tunneling. Observation was recorded at the time of harvesting on five randomly selected plants per plot. Population of ear head bug was counted on three cobs of each treatment randomly selected at milk stage of crop. And Population of ear head worm was counted on three ear heads of each treatment randomly selected at milk stage of crop.

RESULTS AND DISCUSSION

Shoot fly (*Atherigona soccata*), stem borer (*Chilo partellus*), ear head bug (*Calocoris angustatus*), ear head worms (*Cryptoblabus* sp.) were recorded to be infesting the sorghum crop. The peak activity of shoot fly was recorded in SPH 1653 at 25 July (30th SMW) and the peak activity of stem borer was recorded in JJ 938 at 26 July (30th SMW) and the pick activity of ear head bug was recorded in JJ 1022 at 24 Sept. (39th SMW) and the pick activity of ear head worm was recorded in JJ 938 at 24 Sept. (39th SMW). The first infestation of shoot was noticed during 29 SMW. The infestation of shoot fly varied from 10.0 to 80.6. The lowest dead heart percent by shoot fly was found in SPV JJ 938 (10.0) at 33 SMW, and peak activity was found in SPH 1653 (80.6) at 25 July (30th SMW), CSH-18 (72.1) at 22 July (30th SMW), JJ 1041 (69.6) at 26July (30th SMW), JJ938(67.5) at 24 July (30th SMW), Vidisha 60-1(67.4) at 12 August (33rd SMW), RVJ 1862 (65.9) at 23 July (30th SMW), JJ 1022 (64.4) at 26 July (30thSMW), per cent dead hearts in the session and gradually decreased in 33rd SMW. The data on population level of shoot fly (Table 1) revealed that the peak period of this pest was reported in 30 SMW and peak period of Vidisha 60-1 (67.4) in 33 SMW. The higher infestation of shoot fly reported in entry SPH 1653 during the all session. The present findings are parallel with the findings of earlier research worker like (SakShi Saxena *et al.,* 2022). The incidence of *A. soccata* was first observed during the 27th SMW (4.12% dead heart), and was observed till the vegetative stage up to 34th standard week (26 August 2019 i.e.) maximum dead hearts (55.43%) were found during 30th SMW (i.e. 23- 29, July); and this declined from 30th SMW to nil during 35th SMW (27th August- 2nd September 2019. The leaf injury due to stem borer reported in 30 SMW of its fixed DAE (4th week of July) and stem borer dead heart damage was reported in 34 SMW (3rd week of August). The peak period of stem borer was reported in JJ 938 (75.1) at 26 July (30th SMW), JJ 1022 (70.7) at 21 August (34th SMW), Vidisha 60-1 (67.1) at 15 sep. (38th SMW), RVJ 1862 (66.3) at 22 August (34th SMW), SPH 1653 (63.3) at 24 August (34th SMW), JJ 1041(62.4) at 23 August (34th SMW), CSH-18 (60.3) at 23 August (34th SMW). The dead hearts percentage ranged between 3.31 to 11.42 percent. The occurrence of stem borer dead hearts started from 31st MW (3.31 percent) and increased gradually to reach its peak in 43th MW (11.42 percent). The first appearance of ear head bug was noticed during 39 SMW. The minimum damage by Ear head bug in Vidisha 60-1 (3.7) at 41th SMW. The peak activity was reported at 24 Sept. (39th SMW) in JJ 1022(23.6), Vidisha60-1(21.7), JJ 938(20.8), JJ 1041 (19.8), SPH 1653 (18.5), RVJ 1862 (18.3), CSH-18 (10.0). The present findings are parallel with the findings of earlier research worker like (Kumar D *et al*.2022) The mean number of head bugs per 5 earhead were minimum (17.36) in 37 genotype ICSV 711 and were maximum (20.33) in genotype SPH 1352.The first appearance ear head worm was noticed during 39 SMW. The peak activity was reported at 24 Sep. (39th SMW) in JJ 938 (12.1), JJ 1022 (12.0), SPH 1653(9.1), JJ 1041 (9.0), RVJ 1862 (9.0), CSH-18 (8.0), Vidisha 60-1 (5.5). The lowest damage by ear head worm in SPH 1653 (2.5) at 41th SMW.

DISCUSSION

Population dynamics of seasonal pests in the established varieties (CSH-18, SPH1653, Vidisha 60-1, JJ1041, JJ938, JJ1022 and RVJ1862) was studied. The first infestation of shoot was noticed during 29 SMW. The infestation of shoot fly varied from 10.0 to 80.6. The lowest dead heart percent by shoot fly was found in SPV JJ 938 (10.0) at 33 SMW, and peak activity was found in SPH 1653 (80.6) at 25 July (30th SMW). The higher infestation of shoot fly reported in entry SPH 1653 during the all session. The observation recorded by (Patidar 2013). studied the population level of shoot fly revealed that the pick period of this pest was reported in 31 SMW (1stweek of August). The higher infestation of shoot fly reported in entry JJ1041 during the all session.

The leaf injury due to stem borer reported in 30 SMW of its fixed DAE (4th week of July) and stem borer dead heart damage was reported in 34 SMW (3rd week of August). The peak infestation level of stem borer was reported in JJ 938 (75.1) at 26 July (30th SMW). However this pest active in all session (30 SMW to 38 SMW of harvesting) in all entries. (Mohan *et al*. 1990) studied seasonal incidence of the *Chilo partellus* on the sorghum varieties. Larval and pupal populations were higher during *Kharif* than in summer up. The peak population occurred from the 3rd week of August to the 2ndweek of September. (Divya, *et al*., 2010) studied population dynamics of egg masses, larvae, pupae, number of plant damaged and parasitic interactions of natural enemies of *Chilo partellus*. Stem borer population was significantly higher in *Kharif* than in *Rabi*-summer crop. The first appearance of ear head bug and ear head worm was noticed during 39 SMW. in CSH-18, RVJ 1862, JJ1022 and JJ 1041, however in Vidisha 60-1, SPH 1653 and JJ938 ear head pests were noticed in 41 SMW. (Swathi, 2014), studied the

succession and population dynamics of seasonal pests in established varieties (CSH-18, SPH 1653, V60-1, JJ1041, JJ938, JJ1022 and spv1862) are sown in non-replicated manner. population level of ear head bug and worm were noticed during 44 SMW in CSH 18, SPV 1862, JJ1022 and JJ 1041, however in Vidisha 60-1, SPH 1653 and JJ 938 ear head pests were notice in 46 SMW.

Table 1: Peak activity of major sorghum pests during July 2015 to October 2015.

Date	SWM	Established Varieties of Cultivars								Remark
		Pest Name	CSH-18	SPH 1653	Vidisha 60-1	JJ 1041	JJ 938	JJ 1022	RVJ 1862	
(14th July-20th July)	29	Shootfly (*Atherigona Soccata*)	12.8	11.4	18.5	18.5	18.5	18.5	17.1	Dead hearts%
(21st July-27th July)	30		72.1	80.6	25.8	69.6	67.5	64.4	65.9	Dead hearts%
(28th July-3rd Aug)	31		36.1	40.3	30.5	33.6	24.8	32.5	26.2	Dead hearts%
(4th Aug-10th Aug)	32		55	58.6	17.1	53.4	51.2	55.4	53.4	Dead hearts%
(11th Aug-17th Aug)	33		7.2	10.5	67.4	13.1	10.0	17.2	13.7	Dead hearts%
(21st July-27th July)	30	Stem borer (*Chillo Partellus*)	4.1	2.1	2.8	5.5	75.1	10.5	8.0	Leaf injury damage% at 30DAE
(18th Aug-24th Aug)	34		60.3	63.3	4.7	62.4	58.2	70.7	66.3	Dead hearts damage % at 45 DAE
(15thsep-21stsep)	38		15.1	5.1	67.1	9.8	20.0	16.6	15.4	Stem tunneling % at harvest
(22ndsep-28thsep)	39	Ear head bug (*Calocoris Angustatus*)	10.0	18.5	21.7	19.8	20.0	23.6	18.3	Individuals/3 panicle
(6thoct-12thoct)	41		6.0	……..	3.7	……	7.0	4.5	……	Individuals/3 panicle
(22ndsep-28thsep)	39	Ear head warms (*Cryptoblabus* sp.)	8.0	9.1	5.5	9.0	12.1	12.0	9.0	Individuals/3 panicle
(6thoct-12thoct)	41		3.6	2.5	……..	4.4	3.1	5.6	……	Individuals/3 panicle

CONCLUSIONS

On the basis of overall performance in combating pests the following entries have been categories as resistant varieties, moderately resistant varieties and susceptible varieties. Under timely sown crop condition bug and worm count ranged between 3.33 and 12.60**,** 3.03 and 15.33 respectively**.** However, under late sown condition the population of bug and worm ranged from 1.67 to 6.67 and 2.33 to 7.67.

It can be concluded from present data that maximum infestation of shoot fly dead hearts observed in cultivars SPH 1653 as compared to rest of cultivars. However, the more infestation by stem borer (leaf injury and dead hearts) was reported in JJ 938. The maximum ear head bug individuals were found in JJ 1022 whereas the population of ear worm more in JJ938.

FUTURE SCOPE

The study on different aspects pertaining to biology and bionomics of these major pests (shoot fly and stem borer) is needed.

1. Need to study more date of sowing with less genotypes for the evaluation and occurrence of the sorghum pests, by conducting trials at different locations.
2. Physiological and biochemical assessment studies of genotypes should be conducted for antibiosis mechanism against sorghum pest.

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