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Bio-ecology of sorghum shoot fly, *Atherigona soccata* and stem borer *Chilo partellus*

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Abstract
Shoot fly and Stem borer are the key pests in most of sorghum growing area. In India nearly 150 insect species have been reported as pests on sorghum (Jotwani *et al*., 1980, Sharma, 1993), of which sorghum shoot fly (*Atherigona soccata*), and stem borers (*Chilo partellus,).* Are important pests. The shootfly is serious particularly in late sown crop. Stem borer, *Chilo partellus* Swinhoe is regularly causing economic losses during *kharif* and *Rabi* seasons. Looking the seriousness of these pests an attempt was made to gather information on seasonal incidence.

An experiment was conducted in the farmer's field during the *Rabi* and *Kharif* seasons 2016. In both the season once in a week time the population of Shootflies and Stem borers were recorded by identifying the symptoms such as dead heart. From the data it is evident that during September and October when the maximum temperature was between 28-30ºC the infestation was very high and causing 38% dead heart in sorghum. Further, Study on population dynamics of shoot fly revealed that the infestation of shoot fly on sorghum commenced in 1st week after germination. The pest infestation increased fast during second week and moved to the peak, However, the damage decreased from 3rd week after germination of the crop. In our study area Maize, Finger millet, several species of grasses are considered as alternate hosts.

The population of *C. Partellus* is high during November and December. Regarding Kharif season Shootfly attack was lower when compared to stem borer attack.

Keywords: *Atherigona soccata*, *Chilo partellus*, shootfly, sorghum bicolor, stem borer

Introduction

Sorghum [*Sorghum bicolor* (L.) Moench] is an important crop in Asia, Africa, Australia, and the Americas. And is the fifth major cereal crop after wheat, rice, corn, and barley. It is grown in about 86 countries covering an area of about 42 million ha with an annual production of 58.7 million tones (FAO, 2004) [3]. In India, sorghum is the third important cereal after rice and wheat, and is currently grown in 10.4 m ha with an annual production of 8 million tons (FAS, 2005) [4].

The shoot fly and stem borer are the key pests in most of sorghum growing area. In India nearly 150 insect species have been reported as pests on sorghum (Jotwani *et al*., 1980, Sharma, 1993) [5, 7], of which sorghum shoot fly (*Atherigona soccata*), and stem borers (*Chilo partellus,).* are important pests.

The adult is a grey-colored small fly, which deposits small, white cigar-shaped eggs singly on the abaxial leaf surface of the seedlings parallel to midrib. After hatching in 1-2 days, the maggot enters the seedling base through the whorl and cuts the growing point. The larval period lasts for 8 to 10 days. Grown up larva is yellowish and about 6 mm in length. Pupation takes place either at the plant base or in the soil and lasts for 8 days. The entire life cycle is completed in 17 to 21 days (Sharma and Nwanze, 1997) [8]. The shoot fly populations exhibit considerable variation, normally very low from April to June, tend to increase in July and reaches peak in August. From September onwards the population gradually declines and with slight increase there will be a small peak in October and thereafter remains at a moderate level till March (Balikai, 2000) [1]. Its activity is influenced by extreme temperatures (above 35ºC and below 18ºC), and also by continuous rains. Balikai and Venkatesh (2001) [2] reported that, rainfall received at one week after emergence and higher day temperature at two weeks after seedling emergence reduced shoot fly infestation, whereas lower afternoon relative humidity at 4 weeks after emergence increased shoot fly infestation.

Karibasavaraja *et al.* (2005) [6] reported that, the pest was active throughout the study period of four months starting from 27th to 44th standard week. Further, studies on the shootfly catches in fishmeal trap revealed that, highest peak catch of 488 flies per trap was recorded during 35th standard week. Effect of weather parameters on trap catches revealed that, the maximum and minimum temperature and rainfall had negative relationships. Maximum temperature at two and three weeks prior to trap catch had highly significant positive correlation, whereas the afternoon relative humidity at two weeks before trap catch had positive significant correlation.

The shoot fly population begins to increase in July, peaks in August-September, and declines thereafter. Infestations are high when sorghum plantings are staggered due to erratic rainfall. Shoot fly infestations are normally high in the postrainy season crop planted in September to October.

Temperatures above 35ºC and below 18ºC, and continuous rainfall reduces shoot fly survival. During the off-season, the insect survives on alternate hosts such as *Echinochloa colonum*. *procera*, *Cymbopogon* sp., *Paspalum scrobiculatum*, *Pennisetum glaucum,* and on volunteer/fodder sorghum.

Stem borer, *Chilo partellus* is common in Asia and East and Southern Africa.

The first indication of stem borer infestation is the appearance of small-elongated windows in whorl leaves where the young larvae have eaten the upper surface of the leaves. Later, the plant presents a ragged appearance as the severity of damage increases. The third-instar larvae migrate to the base of the

plant, bore into the shoot, and damage the growing point resulting in the production of a deadheart. Normally, two leaves dry up as a result of stem borer damage. Larvae continue to feed inside the stem throughout the crop growth. Extensive tunneling of the stem and peduncle leads to drying up of the panicle, production of a partially chaffy panicle or peduncle breakage.

Stem borer infestation starts about 20 days after seedling emergence, and deadhearts appear on 30 to 40 day old-crop. A female lays up to 500 eggs in batches of 10 to 80 near the midrib on the under surface of the leaves. Eggs hatch in 4 to 5 days. The larval development is completed in 19 to 27 days. Pupation takes place inside the stem and the adults emerge in 7 to 10 days. During the off-season, the larvae diapause in plant stalks and stubbles. With the onset of rainy season, the larvae pupate and the adults emerge in 7 days. In northern India, moth catch in light traps begins to increase during the last week of July and peaks during August to September, while in southern India, the peak in moth catches has been recorded during January to February.

The shootfly is serious particularly in late sown crop. *C. Partellus* Swinhoe is regularly causing economic losses during *kharif* and *Rabi* seasons. Looking the seriousness of these pests an attempt was made to gather information on seasonal incidence.

Materials and Method

An experiment was conducted in the farmer's field during the *Rabi* and *Kharif* seasons 2016. In both the seasons once in a week time the population of Shootflies and Stem borers were recorded by identifying the symptoms such as dead heart and dead heart and shot holes.

The field was marked as three plots and considered each as replication. Size of each plot was 30 x 30 sq. m. Meteorological data was obtained from the observatory situated at Annamalai Nagar. Correlation was worked out and compared.

Result and Discussion

From the data it is evident that during September and October when the maximum temperature was between 28-30^{o}C the infestation was very high and causing 38% dead heart in sorghum. Further, Study on population dynamics of shoot fly revealed that the infestation of shoot fly on sorghum commenced in 1st week after germination. The pest infestation increased fast during second week and moved to the peak, however, the damage decreased from 3rd week after germination of the crop. In our study area Maize, Finger millet, several species of grasses are considered as alternate hosts.

The population of *C. Partellus* is high during November and December. Regarding Kharif season Shootfly attack was lower when compared to Stem borer attack (Table 1).

Table 1: Incidence of *A. soccata and C. partellus*

S. No	Weekly	Max. Temp	Min. Temp	%	Rainfall mm	Rainy Day	Sun Shine	Wind velocity	Shoot fly	Stem borer
Season I										
1	Jan 1-7	29.5	21.5	89			8.6	3.9	0	0
2	8-14	29.5	20.5	87			9.2	3.0	0	0
3	15-21	30	21.3	86			9.0	2.3	6	0
4	22-28	29.1	22.1	90	7.0	1	6.9	2.7	6	0
5	29- Feb 4	30.5	20.4	86			8.3	2.0	18	0
6	5-11	30.8	21.7	88			9.4	2.0	27	0
7	12-18	31.5	21.7	87			9.7	2.6	36	6
8	19-25	32.4	22.1	88				2.5	53	28
9	26Mar 4	32.7	23.6	89			8.7	2.8	7	30
10	5-11	37.9	22.7	89			7.9	2.3	1	32
11	12-18	33.7	23.8	87			8.7	3.2	0	38
12	19-25	35.3	28.7	86			8.6	3.7	0	44
13	29-Apr 1	34.3	23.4	87			8.7	3.1	0	46
14	1-8	35.4	25.5	85			8.3	4.0	0	46
15	9-15	36.1	29.5	83			8.9	4.5	0	48
16	16-22	36.5	26.6	80			9.2	5.5	0	48
17	23-29	37.5	27	80			8.9	5.2	0	44
Season II										
23	4Jun-10	35.2	26.0	84	27.0	2	6.7	6.3	0	0
24	11-17	37.1	26.1	76			7.7	7.7	0	0
25	18-24	34.0	25.1	87	27.2	3	3.2	4.5	9	0
26	25-Jul 1	33.2	20.7	82	0.8		1.7	4.7	15	0
27	2-8	36.9	26.1	78			6.2	4.8	33	0
28	9-15	37.0	26.0	79	11.8	1	7.8	6.3	39	0
29	16-22	34.2	24.9	86	23.8	3	4.0	3.4	34	0
30	23-29	34.0	24.8	86	6.0	3	`5.8	3.7	30	0
31	30-Aug 5	35.1	25.1	81	0.6		5.2	6.1	0	14
32	6-12	36.6	24.9	82	15.2	1	7.1	5.6	0	21
33	13-19	36.9	25.2	82	17.4	2	8.5	5.4	0	27
34	20-26	35.5	25.0	88	67.0	2	6.3	3.7	0	29
35	27-Sep2	33.5	23.8	92	81.8	4	4.0	4.1	0	34
36	3-9	34.1	24.4	86	15.0	2	6.4	4.0	0	38
37	10-16	33.6	25.0	87	21.0	2	3.5	3.5	0	42
38	17-23	34.7	24.9	87	0.24		4.9	3.3	0	44
39	24-30	35.1	23.5	86	34.0	1	4.7	4.6	0	46

Table 2: Summary Output

Regression Statistics					
Multiple R	0.912539				
R Square	0.832728				
Adjusted R Square	0.693335				
Standard Error	21.52812				
Observations	12				
ANOVA					
	df	SS	MS	F	Significance F
Regression	5	13843.43	2768.686	5.973947	0.025132
Residual	6	2780.76	463.46		
Total	11	16624.19			

Table 3: Correlation

	Column 1	**Column 2**	**Column 3**	**Column 4**	**Column 5**	**Column 6**
Column 1	1					
Column 2	-0.75438	1				
Column 3	-0.21473	0.161712	1			
Column 4	0.418543	-0.19213	-0.51684	1		
Column 5	0.648896	-0.57749	-0.58731	0.621748	1	
Column 6	-0.52338	0.797829	0.497459	-0.36127	-0.69272	1

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