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Survey on Sorghum Pests, Their Natural Enemies and Alternative Hosts in Sorghum Growing Tracts under Rice Fallow Situation of Guntur district

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ABSTRACT

A survey was conducted in sorghum growing tracts under rice fallow situation of Guntur district during 2014-15. The data on incidence on sorghum pests, their natural enemies and alternative hosts was collected from randomly selected fields from each village. Among the popular private sorghum hybrids, cultivated Mahalaxmi 296 is mostly cultivated by farmers as it recorded higher yields (5200 to 7000 kg/ha) compared to others under zero tillage in rice fallows. Surveys were conducted at vegetative, grain formation and harvesting stages of sorghum. Among the sorghum pests, stem borer was observed predominant. At vegetative stage, the stem borer infestation was ranged from 1.0 to 2.0% dead hearts, 10.0 to 40.0 larvae/ plant, 9 to 21% leaf damage and 20.0 to 40.5% tiller damage. At grain formation stage the infestation was 4.5 to 9.5 larvae/plant were recorded but leaf damage and tiller damage were not recorded. At harvest stage recorded 3.8 to 8.0 larvae/plant, 1.31 to 3.26% stem tunneling and 2.5 to 6.4% chaffy grains. The data on carry over population of stem borer on sorghum stubbles after harvest ranged from 05 to 20 larvae and 3-15 pupae for 100 stubbles.The natural enemies on sorghum pests coccinellids and spiders. Among coccinellids, *Chilomenus sexmaculata*, *Cycloneda sanguinea* and among the spiders *Oxyopes* spp., *Argiope anasuja* (Thorell), *Chrysilla* sp. and *Oxyopes salticus* were predominant in sorghum ecosystem but, predatism was not noticed in the field conditions. In maize, the carry over population ranged from 0.0 to 4.0 larvae and 0.0 to 3.0 and pupae per stubble and in *Sorghum halopense* 0.0 to 3.0 larvae and 0.0 to 2.0 pupae per stubble were recorded under farmer's field conditions.

Key words : Alternative hosts, Natural enemies, Survey, Stem borer damage.

Sorghum [*Sorghum bicolor* (L.) Moench] is the fifth major cereal crop after wheat, rice, maize and barley. It is the most important crop of Asia, Africa, Australia and America cultivated as a major staple crop in the semi-arid tropics (SAT). Sorghum is attacked by more than 150 insect species contributing 32% crop loss due to insect pests (Borad and Mittal, 1983). Among the insect pests, shoot fly, *Atherigona soccata* (Rondani) and stem borer, *Chilo partellus* (Swinhoe) are the major threats with 75.6% and 24.3 to 36.3% yield losses respectively (Pawar *et al*., 1984). Insect pest situations are dynamic in nature and changes in climate, farming practices involving introduction of improved varieties have resulted in pest outbreaks or changes in pest status (Duale and Nwanze, 1999). As sorghum cultivation under zero tillage in rice fallows is popularizing in Guntur district, it is needed to conduct surveys to know about the sorghum pests along with their natural enemies and alternate hosts during off season cultivation. Divya *et al*. (2009) reported that the larval parasitoid, *Cotesia flavipes* was found to be very active in *kharif* season and maximum parasitization of 29% was recorded in November whereas *Sturmiopsis inferens* was prevalent during *rabi*-summer crop and maximum parasitization of 28% was recorded during February. Balikai (2006) and Sharma *et al*. (2008) reported that during the off-season, the shoot fly survives on alternate hosts such as *Echinochloa colonum*, *E. procera*, *Cymbopogon* sp., *Paspalum scrobiculatum*, *Pennisetum glaucum* and on volunteer/fodder sorghum.

MATERIAL AND METHODS

Surveys were conducted at vegetative, grain formation and harvesting stages of sorghum during 2014-15 in ten randomly selected zero tillage sorghum cultivating villages of Guntur district, viz., Appikatla, Bapatla, Chundurupalli, Yazali, Kollipara, Kunchavaram, Siripuram, Nandivelugu, Tenali and Nelapadu and recorded mandal wise area,

Table 1. Village wise survey on Sorghum pests, their natural enemies and alternative hosts in Guntur district during 2014-2015

S. No.	Name of the mandal	Name of the village	Variety or Hybrid	Area in acres under zero tillage	DOS/DOH	Date of survey	Shoot fly infestation			Natural enemies No/100 infested sorghum plants			Yield (Kg/ha)
							Maize	*Sorghum halopense*	Sorghum	Predators, Parasitoids, Pathogens	Coccinellids	Spiders	
1	Bapatla	Appikatla	Mahalakshmi	70	2/1/2015 30/4/2015	20/1/15 25/2/15 30/4/15	No	No	No	No	12.50	4.69	5200
2	Bapatla	Bapatla	Mahalakshmi	150	2/1/15 30/4/15	20/1/15 28/2/15 30/4/15	No	No	No	No	17.80	6.63	6000
3	Bapatla	Chundurupalli	Hytech-3210	10	5/1/15 1/5/15	24/1/15 20/2/15 1/5/15	No	No	No	No	14.60	5.47	6500
4	Karlapalem	Yazali	Mahalakshmi	1000	3/1/15 3/1/15	20/1/15 26/2/15 3/1/15	No	No	No	No	8.00	3.00	5000
5	Kollipara	Kollipara	Mahalakshmi	60	4/1/15 2/5/15	20/1/15 22/2/15 2/5/15	No	No	No	No	11.72	4.38	5800
6	Kollipara	Kunchavaram	Advanta	180	3/1/15 30/4/15	20/1/15 23/2/15 30/4/15	No	No	No	No	23.29	8.61	5600
7	Medikonduru	Siripuram	Advanta	70	2/1/15 28/4/15	20/1/15 21/2/15 28/4/15	No	No	No	No	13.32	4.97	6200
8	Tenali	Nandivelugu	Mahalakshmi	315	3/1/15 30/4/15	20/1/15 27/2/15 30/4/15	No	No	No	No	15.88	5.93	7000
9	Tenali	Tenali	Mahalakshmi	340	4/1/15 29/4/15	20/1/15 2/3/15 29/4/15	No	No	No	No	14.60	5.44	6200
10	Thullur	Nelapadu	Mahalakshmi	2527	3/1/15 1/5/15	20/1/15 4/3/15 1/5/15	No	No	No	No	10.76	4.01	5500

Note: DOS = Date of Sowing; DOH = Date of Harvest

Table 2. Village wise survey on Stem borer infestation in sorghum cultivating in Guntur district during 2014-2015.

S. No.	Name of the Village	Variety or Hybrid	% dead hearts	No of larvae per plant at vegetative stage	% damaged leaves	% Tiller damage	No of larvae/ plant at grain formation stage	No of larvae/ plant at harvest	Plant height (cm)	Stem tunneling (cm)	Stem tunneling Percent	No of white ears	% Chaffy grains	Larvae / 100 stubbles
1	Appikatla	Mahalakshmi	2.0	9.7	17	38.0	8.3	6.5	178.46	5.8	3.25	1.0	3.4	10
2	Bapatla	Mahalakshmi	1.0	11.0	10	26.0	9.5	4.0	211.42	3.7	1.75	1.0	2.5	20
3	Chundurupalli	Hytech-3210	1.0	9.5	18	36.5	7.6	8.0	200.00	5.2	2.60	0.0	2.6	15
4	Yazali	Mahalakshmi	1.0	10.4	12	40.5	8.3	7.5	230.06	7.5	3.26	2.0	2.5	5
5	Kollipara	Mahalakshmi	2.0	6.8	15	39.0	4.5	6.6	225.09	6.1	2.71	2.0	3.5	18
6	Kunchavaram	Advanta	2.0	5.6	12	35.0	5.0	5.4	225.22	5.0	2.22	1.0	2.6	13
7	Siripuram	Advanta	2.0	6.9	15	25.0	5.3	6.2	220.77	3.4	1.54	2.0	3.8	14
8	Nandivelugu	Mahalakshmi	1.0	7.3	21	32.0	6.4	3.8	204.44	4.6	2.25	3.0	6.4	17
9	Tenali	Mahalakshmi	1.0	6.6	9	20.0	5.6	6.4	190.83	2.0	1.31	2.0	3.0	12
10	Nelapadu	Mahalakshmi	1.0	8.9	20	30.0	6.2	7.0	190.04	4.2	2.21	2.0	2.8	8

production on incidence of major pests, their natural enemies and alternative hosts in sorghum under zero tillage condition in rice fallows. The data on pest incidence, their natural enemies and alternative hosts was recorded on selected 25 infested plants from randomly selected four fields from each village.

RESULTS AND DISCUSSION

The survey data revealed that under zero tillage sorghum was cultivated with the private hybrids *viz*., Mahalaxmi 296, Advanta and Hytech. hybrid was mostly choosen by the farmers which yielded comparatively higher than other varieties(5200 to 7000 kg/ha) under zero tillage condition (Table 1).

Survey on incidence of shoot fly, *Atherigona soccata*

The pooled data at vegetative stage of sorghum cultivated under zero tillage revealed that there is no incidence of shoot fly under farmer's field condition. The reason might be the chemical seed treatment adopted at the time of sowing and the influence of seasonal variations on the development of shoot fly. Karibasavaraj and Balikai (2006) and Matti *et al*. (2013) reported that combined weather parameters of maximum temperature with afternoon and morning RH were highly significant and negatively correlated with egg load and dead by shoot fly.

Survey on incidence of stem borer, *Chilo partellus*

The incidence of sorghum stem borer was observed from vegetative to harvesting stage under farmer's field conditions eventhough, control measures were taken us. At vegetative stage, the infestation due to stem borer in terms of dead hearts1.00 to 2.0% was 10.0 to 40.0 larvae/ plant, 9 to 21% leaf damage and 20.00 to 40.50% tiller damage. At grain formation stage incidence was 4.5 to 9.5 larvae/plant but leaf damage and tiller damage was not recorded. The survey at harvest stage recorded 3.8 to 8.0 larvae/plant, 178.46 cm to 230.06 cm plant height, 2.50 cm to 7.50 cm stem tunneling length, 1.31 to 3.26% stem tunneling and 2.5 to 6.4% chaffy grains. The data on carry over population of stem borer on sorghum stubbles after

Table 3 Village wise survey on Stem borer infestation in alternate hosts cultivating under zero tillage in rice fallows in Guntur district during 2014-2015.

S. No.	Name of the Village	Variety or Hybrid	Weeds present in Sorghum ecosystem	Stem borer larvae infestation (%)							
				Maize				*Sorghum halopense*			
				Mean stem tunnel length	Stem tunneling %	Larvae/ stubble	Pupae/ stubble	Mean stem tunnel length	Stem tunneling %	Larva/ stubble	Pupae/ stubble
1	Appikatla	Mahalakshmi 296	*Echinocloa colonum, Sorghum halopense, Echinochloa crussgalli*	6.5	3.61	2.5	1.0	1.00	1.02	3.0	1.0
2	Bapatla	Mahalakshmi 296	*Echinocloa colonum, Sorghum halopense, Cenchrus ciliaris*	4.0	2.01	3.0	1.0	0.00	0.00	0.0	0.0
3	Chundurupalli	Hytech-3210	*Echinocloa colonum, Sorghum halopense, Cenchrus ciliaris*	8.0	3.60	0.0	0.0	0.00	0.00	0.0	2.0
4	Yazali	Mahalakshmi 296	*Echinocloa colonum, Cenchrus ciliaris*	7.5	3.57	1.0	2.0	0.00	0.00	0.0	0.0
5	Kollipara	Mahalakshmi 296	*Echinocloa colonum, Cenchrus ciliaris Echinochloa crussgalli*	6.6	3.33	2.0	2.0	0.00	0.00	0.0	0.0
6	Kunchavaram	Advanta	*Echinocloa colonum, Sorghum halopense, Cenchrus ciliaris*	5.4	2.57	3.0	1.0	1.80	1.89	3.0	3.0
7	Siripuram	Advanta	*Echinocloa colonum, Cenchrus ciliaris Echinochloa crussgalli*	6.2	2.88	2.0	2.0	0.00	0.00	0.0	0.0
8	Nandivelugu	Mahalakshmi 296	*Echinocloa colonum, Sorghum halopense, Cenchrus ciliaris*	3.8	1.80	4.0	3.0	2.00	2.02	3.0	2.0
9	Tenali	Mahalakshmi 296	*Echinocloa colonum, Cenchrus ciliaris*	6.4	2.90	0.0	2.0	0.00	0.00	0.0	0.0
10	Nelapadu	Mahalakshmi 296	*Echinocloa colonum, Sorghum halopense, Cenchrus ciliarisEchinochloa crussgalli*	7.0	3.18	1.0	2.0	1.50	1.57	2.0	1.0

harvest ranged from 05 to 20 larvae and 3-15 pupae for 100 stubbles under farmer's field condition (Table 2).

Surveys of Mane and Rathod (2008) conducted survey at Akola invested that from randomly selected 25 plants the stem tunnel length was 9.98 cm, 3.28 larvae per plant and 78.48% tiller damage.

Survey on natural enemies

Among the predators, only coccinellids and spiders were observed. The data on number of coccinellids and spiders per 100 sorghum infested plants from farmer's fields ranged from 8.00-23.29 and 3.00-8.61 respectively. Among coccinellids, *Chilomenus sexmaculata*, *Cycloneda sanguinea* and among the spiders *Oxyopes* spp., *Argiope*

anasuja (Thorell), *Chrysilla* sp. and *Oxyopes salticus* were observed on sorghum stem borer infested plants.

Jalali and Singh (2002) reported the incidence of different spider species of Araneidae, Lycosidae, Oxyopidae, Salticidae, Tetragnathidae and Clubionidae families from the maize plants infested by *Chilo partellus.*

Larval or pupal parasitoids or entamopathogens were not observed from the stemborer infested sorghum plants.

Survey on Alternative hosts of sorghum pests

The monocot weeds *viz*., *Sorghum halopense, Echinocloa colonum*, *E. crusgalli* and *Setaria* were predominant in the sorghum and maize fields cultivated under zero tillage in rice fallows in the surveyed villages.

Chilo partellus infestation was noticed in the maize and among the weeds on *Sorghum halopense.* In maize, very low infestation in terms of mean stem tunnel length with 3.8 to 8.0 cm and 1.80 to 3.61% stem tunneling noticed. The carry over population ranged from 0.0 to 4.0 and 0.0 to 3.0 larvae and pupae per stubble respectively under farmers field condition. Among the weeds *Sorghum halopense* was found to be an alternative host for *Chilo partellus*. In *S. halopense*, the mean stem tunnel length ranged from 0.00 to 2.00 cm with stem tunneling 0.00 to 2.02%. The carry over population ranged from 0.0 to 3.0 larvae and 0.0 to 2.0 pupae per stubble (Table 3). The reason for the low incidence of *C. partellus* might be the influence of temperature on the distribution of *C. partellus*. Padmaja *et al.*, 2010 reported that bi cellular trichomes density were more in *S. halopense* and it was the close relative to *Sorghum bicolor* harbouring the sorghum pests. During off-season, in addition to the hibernating or diapausing pest populations in crop residues stem borers present on wild host plants and can infest the cereal crops. The present investigation strengthens the oligophagous nature of *C. partellus*.

CONCLUSION

Among the surveyed villages, mostly sorghum is cultivated with Mahalaxmi 296, a private hybrid with higher yields under zero tillage in rice fallows. Stem borer, *Chilo partellus* infestation was noticed upto crop end under farmer's field conditions. The stem borer infesting sorghum, maize and observed may continue its life cycle on alternative weed host, *Sorghum halopense*. Among coccinellids *Chilomenus sexmaculata*, *Cycloneda sanguinea* and among the spiders *Oxyopes* spp., *Argiope anasuja* (Thorell), *Chrysilla* sp. and *Oxyopes salticus* were predominant in sorghum ecosystem.

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