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Occurrence of Natural Enemies of Maize Stem Borer *Chilo partellus* (Swinhoe) in *Kharif* Maize Ecosystem

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A B S T R A C T

Field experiments were carried out at Maize field of AICRP on Maize, Central farm, OUAT, Bhubaneswar, Odisha during *Kharif* 2014 and *Kharif* 2015 to document the "Occurrence of natural enemies of maize stem borer *Chilo partellus* (Swinhoe) in *Kharif* maize ecosystem". The average seasonal coccinellid population in *Kharif* 2014 *and Kharif* 2015 was in between 1.10 to 1.20 per plant respectively from 30th SMW (19 DAS) to 40th SMW(89DAS) .Number of eggs/ plant laid by the green lacewings, *Chrysoperla carnea* recorded 0.07 to 0.43/ plant and 0.04 to 0.47/ plant in the same time period. Mixed population of two predominant spider population over two growing seasons reached maximum (1.56/ plant) and (1.55/ plant) at 39th SMW in maize ecosystem in both the seasons. Syrphid maggots reached the peak (1.26. and 0.80) / plant in maize at 40th SMW in these years ranged from 0.68 to 1.75/ plant. Pentatomid bug, *Eocanthecona. furcellata* was very negligible on maize crop. Reduviid bugs appeared from 31st to40th SMW however in growing seasons the population varied from 0.03 to 0.26/ plant.

Introduction

Maize (*Zea mays* L.) is the most important cereal crop after wheat and rice, grown virtually in every suitable agricultural region of the world. It belongs to the grasses family Poaceae (Gramineae). Maize is a fully domesticated plant which has lived with man and evolved since ancient times. It has been referred as the "Queen of cereals" due its highest yield potential among all the cereals (Ali *et al*., 2014). Maize is attacked by over 250 species of insect and pests [3]. Of those four species of tissue borers *viz*., maize stem borer or spotted stem borer (*Chilo partellus* Swinhoe), pink stem borer (*Sesamia*

inference), shoot fly (*Atherigona soccata*) and Asiatic corn borer (*Ostrinia furnacalis* Guenee) are regular and serious pests of maize. Among these, maize stem borer, *C. partellus,* is the principal pest in all maize growing countries. The yield losses caused by this ranges from 26.7 to 80.4% in different agro-climatic zones of India (Chatterji *et al.,* 1969). Further, Singh and Sajjan (1982) reported that the tune of losses caused by *C. partellus* in maize ranged from 57.70 to 79.40% in Punjab. Natural enemies plays important role in suppression of this target insects and also an important component of integrated pest management practice.

Materials and Methods

A field trial on Occurrence of Natural enemies of Maize stem borer *Chilo partellus* (Swinhoe) in *Kharif* maize ecosystem was conducted at the Central research farm, Odisha University of Agriculture and Technology during *Kharif* 2014 and *Kharif* 2015. The experiment comprised of fifteen numbers of popular cultivars of maize *viz.* MRM 3777, DMH 7705, DKC9117, VIVEK HYBRID-9, VIVEK QPM-9, NMH-1247, NK-30, BIO 9681, BIO 9637, CORN S 6217, ASMH 177, HM-4, HQPM-1, HQPM -5 and DKC 8101. The raising of maize crop was done by following AICRP on Maize recommendations (Annual report 2014). The experiment was laid out in Randomized Block Design (RBD)(Gomez and Gomez 1984) with fifteen treatments and replicated thrice with spacing of 60cmX25cm except the application of insecticides.

Sixteen plants were maintained in each row. The predatory population *viz.,* lady bird beetle (grubs and adults), green lace wings (eggs and grubs), syrphid grubs, predatory pentatomid bug and spider populations were recorded on whole plant basis at weekly intervals from the 25 randomly selected plants from 19 days after germination DAS onwards. Observations on insect pests and their natural enemies were taken from each experimental plot leaving the boarder rows

Results and Discussion

Lady bird beetle (Coccinellids)

Predominant lady bird beetle species (Table 1) were recorded from maize agro ecosystem. These major predatory coccinellid species were noticed in early vegetative stage of crop growth i.e., from 30th SMW (19 DAS) to 40th SMW with varying degree of population. The mixed population of both grubs and adults reached at their peak recording 1.75/ plant followed by 1.53/ plant which were observed during 39th SMW and 33rd SMW respectively in maize in the growing season *Kharif* 2014 and *Kharif* 2015. The grub and adult coccinellid population were at their plateau (1.86/ plant) during 39th SMW and (1.51/ plant) during 40th SMW in the year 2014. However, the average seasonal coccinellid population in *Kharif* 2014 *and Kharif* 2015 years was in between 1.10 to 1.20 per plant respectively. In general, there was no significant difference between preferences of lady bird beetle on maize crop.

Green lacewings *Chrysoperla carnea* Stephens

Observations recorded on the number of eggs/ plant laid by the green lacewings, *C.carnea* showed that (Table 1) there was no significant difference between preference of egg laying in maize during both the growing seasons. It was evident from the observations that majority egg laying by *C. carnea* recorded during 30th and 39th SMW of *Kharif* 2014and again during 38th to 40th SMW of *Kharif* 2015 in maize ecosystem . However, the seasonal weekly average egg numbers over the years varied from 0.07 to 0.43/ plant

and 0.04 to 0.47/ plant in maize in *Kharif* 2014 and *Kharif* 2015 respectively

Syrphid, *Ischiodon scutellaris* (Fabricius)

From the Table 2 it was revealed that the predatory dipteran syrphid fly, *I. scutellaris* appeared in the maize agro ecosystem during 30th SMW of the year 2014 and 2015 respectively.

The syrphid maggots fed on the larvae without any significant difference in their population abundance in maize. The combined weekly mean population of syrphid maggots reached the peak 1.26. and 0.81/ plant in maize at 39th SMW in the years *kharif* 2014 and *Kharif* 2015 respectively. The predator remained active up to 40th SMW i.e., 1st week of October. The mean seasonal population of syrphid maggots ranged from 0.16 to 1.01/ plant in maize over the two years.

Spiders

Mixed population of two predominant spider species (Table 2) were prevalent in maize agro ecosystem during the growing seasons of *Kharif* 2014 and *Kharif* 2015. They were the most dominant predators throughout the cropping season.

The observations recorded on mixed population/plant revealed that there was no significant difference between abundance of spiders in maize hybrids. The activities of spiders commenced from 30th SMW and it was continued till 40th SMW in both the growing seasons.

The weekly mean population of spiders over two growing seasons reached maximum (1.56/ plant) at 39th and (1.55/ plant) at 39th in maize ecosystem in both the seasons respectively.

Predatory Pentatomid bug, *Eocanthecona furcellata* Wolff.

The population of the predatory pentatomid bug, *E. furcellata* was very negligible on maizecrop (Table 3). However, they appeared on both the crops in both the years with a little bit variation in their population.

Reduviid bugs

The reduviid bugs appeared on maize only (Table 3). The population observed at 31st to40th SMW in the year *Kharif* 2014 and *Kharif* 2015 respectively. The population was high i.e., 0.25 and 0.27/ plant in the year *Kharif*2014 and *Kharif* 2015 respectively. However, the seasonal weekly mean parasitoid population over the two growing seasons varied from 0.03 to 0.26/ plant.

The mixed population of both grubs and adults of coccinellids reached at their peak recording 1.75/ plant followed by 1.53/ plant which were observed during 39th SMW and 33rd SMW in respectively in maize in the growing season *kharif* 2014 and *Kharif* 2015. The grub and adult coccinellid population were at their plateau (1.86/ plant) during 39th SMW and (1.51/ plant) during 40th SMW in the year 2014. However, the average seasonal coccinellid population in *Kharif 2014 and Kharif 2015* years was in between 1.10 to 1.20 per plant respectively. Aziz *et al.,* (2017) reported among the predators, the major insect groups included *Coccinellids, Chrysopa spp., Pheidole spp., Reduvid spp., Mantisreligiosa, Scolothrips*and *Euborellia spp., Coccinella septumpunctata* was having high relative abundance followed by *Chrysopa spp.* Rana (2004) conducted a three year experiment on rape seed and mustard crop to evaluate the response of *C. septempunctata* and *M. sexmaculatus* against *Lipaphis erysimi*.

Table.1 Seasonal incidence of lady bird beetle and *Chrysoperla* population under maize in unprotected conditions at Maize research farm, OUAT, Bhubaneswar during *kharif* 2014 and *kharif* 2015

SMW	Period	DAS	Ladybird beetle grub and adult (Nos./plant)			*Chrysoperla* sp. eggs (Nos./plant)		
			Kharif 2014	*Kharif* 2015	Pooled mean	*Kharif* 2014	*Kharif* 2015	Pooled mean
30	23th-29th July	19	1.13	1.16	1.15	0.25	0.04	0.14
31	30th July-5th Aug	26	0.80	0.55	0.68	0.08	0.15	0.11
32	6th-12th August	33	1.28	1.33	1.30	0.09	0.14	0.12
33	13th-19th August	40	1.40	1.65	1.53	0.07	0.16	0.11
34	20th-26th August	47	1.03	0.61	0.82	0.11	0.13	0.12
35	27th-02nd September	54	0.85	0.78	0.81	0.08	0.15	0.12
36	03rd-09th September	61	0.72	0.89	0.81	0.10	0.16	0.13
37	10th-16th September	68	1.45	0.73	1.09	0.16	0.18	0.17
38	17th-23rd September	75	1.19	1.41	1.30	0.08	0.19	0.14
39	24th-30th September	82	1.86	1.64	1.75	0.43	0.47	0.45
40	01st-07th October	89	1.51	1.39	1.45	0.12	0.24	0.18
	Range		0.72-1.86	0.55-1.64	0.68-1.75	0.07-0.43	0.04-0.47	0.12-0.45
	Mean±SD		1.20±0.35	1.10±0.42	1.15±0.35	0.14±0.11	0.18±0.10	0.16±0.09
			NS	NS	NS	NS	NS	NS

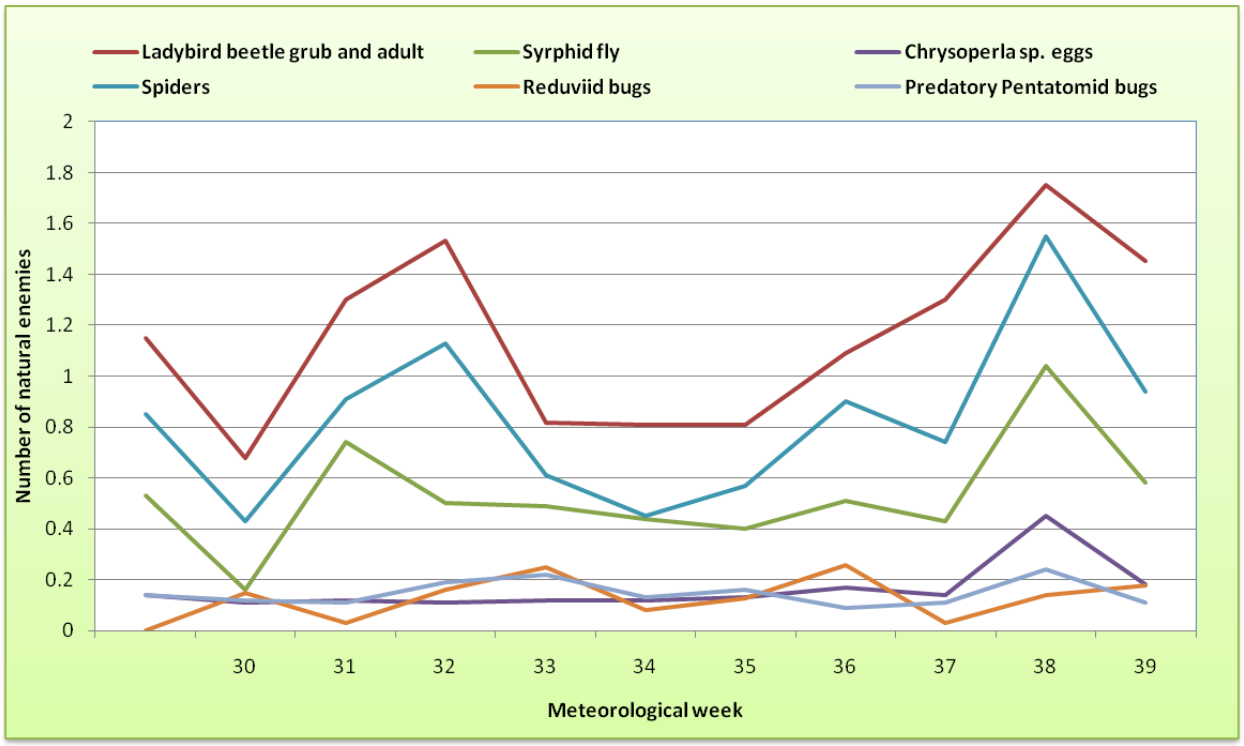
Table.2 Seasonal incidence of Syrphid fly and Spiders population in maize under unprotected conditions at Maize research farm, OUAT, Bhubaneswar during *Kharif* 2014 and *Kharif* 2015

SMW	Period	DAS	Syrphid fly(Nos./plant)			Spiders (Nos./plant)		
			Kharif 2014	*Kharif* 2015	Pooled mean	*Kharif* 2014	*Kharif* 2015	Pooled mean
30	23th-29th July	19	0.83	0.24	0.53	1.37	0.33	0.85
31	30th July-5th Aug	26	0.18	0.15	0.16	0.26	0.61	0.43
32	6th-12th August	33	1.20	0.29	0.74	1.09	0.73	0.91
33	13th-19th August	40	0.73	0.27	0.50	1.23	1.03	1.13
34	20th-26th August	47	0.78	0.19	0.49	0.86	0.35	0.61
35	27th-02nd September	54	0.12	0.75	0.44	0.13	0.77	0.45
36	03rd-09th September	61	0.36	0.43	0.40	0.41	0.72	0.57
37	10th-16th September	68	0.67	0.34	0.51	0.99	0.81	0.90
38	17th-23rd September	75	0.50	0.35	0.43	0.31	1.18	0.74
39	24th-30th September	82	1.26	0.81	1.04	1.56	1.55	1.55
40	01st-07th October	89	0.83	0.34	0.58	0.99	0.90	0.94
	Range		0.12-1.26	0.15-0.81	0.16-1.04	0.13-1.56	0.33-1.55	0.43-1.55
	Mean±SD		0.68±0.39	0.38±0.22	0.53±0.22	0.84±0.49	0.81±0.35	0.82±0.32
			NS	NS	NS	NS	S	NS

Table.3 Seasonal incidence of predatory pentatomid bugs and Reduviid bugs population in maize under unprotected condition at maize research farm, during *kharif* 2014 and *kharif* 2015

SMW	Period	DAS	Predatory Pentatomid bugs (Nos./plant)			Reduviid bugs (Nos./plant)		
			Kharif 2014	*Kharif* 2015	Pooled mean	*Kharif* 2014	*Kharif* 2015	Pooled mean
30	23th-29th July	19	0.16	0.11	0.14	0.05	0.00	0.00
31	30th July-5th Aug	26	0.19	0.05	0.12	0.18	0.13	0.15
32	6th-12th August	33	0.08	0.15	0.11	0.07	0.00	0.03
33	13th-19th August	40	0.18	0.19	0.19	0.15	0.17	0.16
34	20th-26th August	47	0.29	0.15	0.22	0.22	0.27	0.25
35	27th-02nd September	54	0.23	0.04	0.13	0.00	0.16	0.08
36	03rd-09th September	61	0.11	0.20	0.16	0.17	0.08	0.13
37	10th-16th September	68	0.15	0.03	0.09	0.25	0.26	0.26
38	17th-23rd September	75	0.10	0.13	0.11	0.06	0.00	0.03
39	24th-30th September	82	0.31	0.17	0.24	0.16	0.13	0.14
40	01st-07th October	89	0.15	0.07	0.11	0.21	0.15	0.18
	Range		0.10-0.31	0.04-0.19	0.11-0.24	0.00-0.25	0.00-0.26	0.00-0.26
	Mean±SD		0.18±0.08	0.12±0.07	0.15±0.04	0.14±0.08	0.12±0.09	0.13±0.08
			NS	NS	NS	NS	NS	NS

Fig.1 Graphical representation of population of natural enemies of maize stem borer from 30th SMW to 39th SMW during *kharif* -2014 and *kharif* -2015



C. septempunctata and *M. sexmaculatus* was dependent upon density and time of appearance of their prey. Spiders were found in large numbers along with less number of other Coccinelidae spp. Choudhury *et al.*, (2012) reported same observation on biocontrol agents of maize of relatively higher population of natural enemies such as spiders, coccinellids, *Paederus* sp. and *Cotesia sp.* were observed in the maize ecosystem and these contributed in controlling the pest population. Mixed population of three predominant spider species were prevalent in maize agro ecosystem during the growing seasons of *kharif* 2014 and *kharif* 2015. They were the most dominant predators throughout the cropping season. The observations recorded on mixed population/plant revealed that there was no significant difference between abundance of spiders in maize hybrids. The activities of spiders commenced from 30th SMW and it was continued till 40th SMW in both the growing seasons. The weekly mean population of spiders over two growing seasons reached maximum (1.56/ plant) at 39th and (1.55/ plant) at 39th in maize ecosystem over the years. It was evident from the observations that majority egg laying by *C. carnea* recorded during 30th and 39th SMW of *kharif* 2014and again during 38th to 40th SMW of *Kharif* 2015in maize ecosystem. However, the seasonal weekly average egg numbers over the years varied from 0.07 to 0.43/ plant and 0.04 to 0.47/ plant in maize in *kharif* 2014 and *kharif* 2015 respectively syrphid maggots reached the peak (1.26. and 0.81/ plant in maize at 40th SMW in the years *khari f*2014 and *kharif* 2015 respectively.. The predator remained active up to 40th SMW i.e., 1st week of October. The mean seasonal population of syrphid maggots ranged from 0.16 to 1.04/ plant in maize over the two years. Similarly the eggs of *Chilo patellus* procured from NBAIR hanged in the maize

field to see the parasitization in natural condition. It is recorded that over the year 10.4% eggs parasitized by *Trichogramma chilonis* present in nature and the larva of maize stem borer parasitized 2.68% by larval parasitoid *Cotesia flavipe*s.

Predominant lady bird beetle were noticed in early vegetative stage of crop growth. The average seasonal coccinellid population in *Kharif* 2014 *and Kharif* 2015 years was in between 1.10 to 1.20 per plant respectively from 30th SMW (19 DAG) to 40th SMW. Number of eggs/ plant laid by the green lacewings, *C.carnea* recorded during 30th and 39th SMW of *Kharif* 2014 and again during 38th to 40thSMW of *Kharif* 2015 in maize ecosystem . However, the seasonal weekly average egg numbers over the years varied from 0.07 to 0.43/ plant and 0.04 to 0.47/ plant. Swaminathan *et al.,* (2016) reported that the relatively more common aphidophagous predators on maize. Syrphid maggots reached the peak (1.26. and 0.80) / plant in maize at 40th SMW in the years ranged from 0.68 to 1.75/ plant. Pentatomid bug ,*Eocanthecona. furcellata* was very negligible on maize crop. Reduviid bugs appeared 31st to40th SMW however in growing seasons the population varied from 0.03 to 0.26/ plant. Mixed population of two predominant spider species were prevalent in maize agro ecosystem during the growing seasons The weekly mean population of spiders over two growing seasons reached maximum (1.56/ plant) at 39th and (1.55/ plant) at 39th in maize ecosystem in both the seasons (Fig. 1).

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