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

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Abstract

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.

Keywords
Maize, Chilo partellus, Natural enemies and Standard Meteorological Week
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 30\(^{th}\) 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 39\(^{th}\) SMW in the years kharif 2014 and Kharif 2015 respectively. The predator remained active up to 40\(^{th}\) 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 30\(^{th}\) SMW and it was continued till 40\(^{th}\) SMW in both the growing seasons.

The weekly mean population of spiders over two growing seasons reached maximum (1.56/ plant) at 39\(^{th}\) and (1.55/ plant) at 39\(^{th}\) 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 maize crop (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 31\(^{st}\) to40\(^{th}\) 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 Kharif2014 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 39\(^{th}\) SMW and 33\(^{rd}\) 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 39\(^{th}\) SMW and (1.51/ plant) during 40\(^{th}\) 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., Mantis religiosa, 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                | DA S | 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: Not Significant
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                  | DA S | 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         | S          | NS         | 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 |

*NS* indicates no significant difference.
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 Coccinellidae 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 30\textsuperscript{th} SMW and it was continued till 40\textsuperscript{th} SMW in both the growing seasons. The weekly mean population of spiders over two growing seasons reached maximum (1.56/plant) at 39\textsuperscript{th} and (1.55/plant) at 39\textsuperscript{th} in maize ecosystem over the years. It was evident from the observations that majority egg laying by C. carnea recorded during 30\textsuperscript{th} and 39\textsuperscript{th} SMW of kharif 2014 and again during 38\textsuperscript{th} to 40\textsuperscript{th} 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 maggots reached the peak (1.26. and 0.81/plant in maize at 40\textsuperscript{th} SMW in the years kharif 2014 and kharif 2015 respectively. The predator remained active up to 40\textsuperscript{th} 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 flavipes*.

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 30<sup>th</sup> SMW (19 DAG) to 40<sup>th</sup> SMW. Number of eggs/ plant laid by the green lacewings, *C.carnea* recorded during 30<sup>th</sup> and 39<sup>th</sup> SMW of *Kharif* 2014 and again during 38<sup>th</sup> to 40<sup>th</sup>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. 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 40<sup>th</sup> 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 31<sup>st</sup> to40<sup>th</sup> 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 39<sup>th</sup> and (1.55/ plant) at 39<sup>th</sup> in maize ecosystem in both the seasons (Fig. 1).

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References

Aziz R U, Gaherwal S and Sameena 2017. An assessment of the occurrence of natural enemies(predators) against maize stem borer, *Chilo partellus*, *International journal of current advance research* 10: 6464-6466

Anonymous, 2014. Annual Report, AICRP on Maize

Chatterji SM., Young WR., Sharma GC. Sayi IV, Chahal BS., Khare B P, Rathore,Y., Panwar VPS and Siddiqui KH. 1969. Estimation of loss in yield of maize due to insect pests with special reference to borers. *Indian Journal of Entomology*, 31: 109-15.

Chaudhury N, Saharawat YS, and Kumar P, 2012 IPM: a Technology to Conserve Biological Control Agents in maize. *Indian journal of Entomology*,74 :(4) 348-354.

Gomez KA and Gomez AA (1984) *Statistical Procedures for Agricultural Research*, 2<sup>nd</sup>edn. Pp. 653

Rana JS 2006, Response of *Coccinella septempunctata, Menochilus sexmaculatus* (Coleoptera: Coccinellidae to their aphid prey , *Lipaphis erysimi* (Hemiptera: Aphididae) in Rapeseed mustard. *Journal of Entomology* 103(1): 81-84.

Singh J, Sajjan SS. 1982. Losses in maize yield due to different grades (1 to 9 scale) caused by the maize borer, *Chilo partellus* (Swinhoe). *Ind J Ent*. 44:41–48.

Swaminathan R, Meena A, Meena BM, 2016. Diversity and predation potential of major aphidophagous predators in maize. *Applied ecology and environmental Research* 13(4): 1069-1084.
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