



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(5): 1563-1570
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www.thepharmajournal.com
Received: 17-03-2022
Accepted: 22-04-2022

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Roving survey of major insect pests of finger millet (*Eleusine coracana* L.) in different blocks of Bastar district of Chhattisgarh state, India

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Abstract

Survey work was done on real pest problems of three blocks i.e., Tokapal, Lohandiguda and Bastar block of Bastar district (C.G.) was conducted during *Kharif* 2021-22. Two villages in each block were visited during the crop growth period. Pink stem borer (*Sesamia inferens*), Aphid (*Hysteroneura setariae*), Grasshopper (*Hieroglyphus banian*, *Cataloipus* sp.) and Ear head caterpillar (*Helicoverpa armigera*) was observed as major insect pests in the finger millet ecosystem in different blocks of Bastar district. The maximum seasonal mean activity of pink stem borer and aphid was recorded in Lohandiguda block with 7.25 per cent dead heart and 11.48 aphids per plant in which Baghanpal village of Lohandiguda block had maximum infestation of pink stem borer and aphid population with 8.14 per cent dead heart and 13.45 aphid per plant. Bastar block was earmarked for maximum block seasonal mean affected ear head of finger millet by ear head caterpillar having 9.37 per cent affected ear head. However, Bادهचकwa village of Bastar block received maximum damage of *H. armigera* (11.76% affected ear head). In the Lohandiguda block, the highest seasonal mean intensity of grasshopper was recorded with 10.57% damaged leaf. The highest levels of insect pest infestation was observed in Lohandiguda and Bastar blocks, while insect pest activity was found lowest in the Tokapal block.

Keywords: Survey, insect pests, finger millet

Introduction

Finger millet, *Eleusine coracana* (L.) is important climate-resilient small millet crop, forms staple nourishment for many African and Asian countries of the world including India, wherever it is cultivated. The Ethiopian and Ugandan highlands are the origin of finger millet (D'Andrea *et al.* 1999) [2]. It is also known as bird's foot, *mandiya*, *maruva*, *madua*, *nagli* and *nachni* in different regions of the country and as "Ragi" in south India and African millet and red millet in English (Rachie and Peter, 1977) [13] belongs to the family 'Poaceae'. *Eleusine*, the generic name, which is a Greek word meaning "Goddess of Cereals" (Chalam and Venkateshwaralu, 1965) [4] "*Eleusine*" while the common name of finger millet indicates "finger-like" branching of the panicle.

The presence of antioxidants reduces the risk of heart, kidney problems and cancer. Prevention of dyslipidemia and regulation of glucose homeostasis can be achieved by regular consumption of finger millet (Devi *et al.* 2010) [3]. Therefore, it is a staple food for a major section of people living in the region both rural and urban.

Over 57 insect species attack the crop (Sharma and Davies, 1988) [17]. The pink stem borer (*Sesamia inferens*) was an important insect pest of sugarcane and now shifted its infestation to rice and other crops (Cheng *et al.* 2011) [5]. *S. inferens* infests sorghum, bajra, finger millet, wheat, rice, oat, barley, sugarcane and some grasses (Sidar *et al.* 2017) [18]. In India pink stem borers regularly attack finger millet crops in parts of Odisha, Karnataka, Tamil Nadu and Andhra Pradesh (Jagdish *et al.* 2008) [6]. Pink stem borer causes extensive damage to the crop in peninsular India throughout the year and across the country (Santosh *et al.* 2012) [16].

Among all districts in Chhattisgarh, Bastar has more area and produces the highest finger millet. There are various challenges with finger millet agriculture in India and Chhattisgarh, as all phases of this crop are susceptible to insect problems. Many insects are attracted to the rich crop growth and soft, succulent foliage, which provides an endless supply of food, lodging, and habitat, because there is no or few systematic surveys has been conducted in the Bastar district of Chhattisgarh in the recent past, the current study was undertaken to obtain information regarding the incidence of finger millet crop pests in the area

so that effective management methods can be developed.

Material and Methods

The roving survey was conducted in the Bastar district of Chhattisgarh. Bastar district has 7 blocks in which 3 blocks was selected *i.e.*, Lohandiguda, Tokapal and Bastar. Bastar lies at 19°10' N latitude and 81°95' E longitude with an altitude of 552 meters above the mean sea level. To study the incidence of insect pests of finger millet, the roving survey was carried out in two villages of each block during the *Kharif* 2021. In each village, four farmer fields was surveyed. The survey was carried out thrice (vegetative, flowering and prematurity stage) during the cropping season. The observation were made on 10 randomly selected plants from each field using suitable techniques. The per cent dead heart caused by pink stem borer was calculated by using the following formula.

$$\text{Dead heart \%} = \frac{\text{Number of plants with dead heart}}{\text{Total number of plants}} \times 100$$

Per cent ear head damage by ear head caterpillar was determined using the following formula:

$$\text{Ear head damage \%} = \frac{\text{Number of damaged ear head}}{\text{Total number of ear head observed}} \times 100$$

The number of aphids was counted from 10 cm area from 10 randomly selected plants of each plot. Observations on the incidence of predators was recorded at three randomly selected spots of one-meter row length in each selected field leaving the border rows.

Results and Discussion

Two villages in each block were visited during the crop growth stages. During the course of the study, several insect pest species was noticed causing damage at various growth stages of finger millet. The findings revealed that four insect pest species was found to be associated with the finger millet ecosystem in the region.

A general account of the scenario of insect pest fauna associated with the finger millet ecosystem obtained from the field observation has been presented in Table: 2 and 4, which contains information on insect fauna (along with their Taxonomic position) of finger millet and their respective damaging stage (s). Table: 3 shows the incidence of major insect pests of finger millet in Bastar district during *Kharif* 2021.

Table: 3 revealed that the per cent dead hearts due to pink stem borer damage in finger millet crop ranged from 4.85 in Ransargipal to 5.57 in Sirisguda with an average of 5.21 for the Tokapal block, 6.37 per cent in Gadiya to 8.14 per cent in Baghanpal with an average of 7.25 for the Lohandiguda block and 6.23 per cent in Narayanpal to 7.11 per cent in Badechakwa with an average of 6.67 for Bastar block. Fig: 3 shows the infestation of pink stem borer in finger millet crop, highest at Lohandiguda block and lowest at Tokapal block of Bastar district.

The nymphs and adults of aphid usually congregated at the leaves of the finger millet and sucked the sap. The mean population/plant ranged from 9.23 in Sirisguda to 13.56 in Ransargipal with an average of 11.39 mean population/plant for the Tokapal block, 10.24 in Gadiya to 13.45 mean

population/plant in Baghanpal with an average of 11.48 mean population/plant for the Lohandiguda block and 8.42 mean population/plant in Badechakwa to 10.7 mean population/plant in Narayanpal with an average of 9.56 mean population/plant for Bastar block. The maximum infestation of aphids in finger millet crop was found at Lohandiguda block and lowest at Bastar block.

At the Lohandiguda block, the highest infestation of grasshopper, with an average damage per cent of 10.57 was recorded followed by Bastar and Tokapal block with the infestation per cent of 9.41 and 7.89 respectively, was recorded in finger millet field. The ear head damage ranged from 7.91 in Ransargipal to 10.79 in Sirisguda with an average of 9.35 per cent in the Tokapal block, 6.27 per cent in Gadiya to 11.52 per cent in Baghanpal with an average of 8.89 for the Lohandiguda block and 6.98 per cent in Narayanpal to 11.76 per cent in Badechakwa with an average of 9.37 for Bastar block. The damage per cent of ear head caterpillar was highest (9.37) in Bastar block and lowest (8.89) in Lohandiguda block of Bastar district.

The natural enemies, lady bird beetles were found associated with the aphid on the finger millet. Tokapal block had the highest mean population of *C. septempunctata* beetles per meter square (1.05/m²) and the lowest population found in the Lohandiguda block having 0.43 beetle/m². The mean population of Dragonfly per m² ranged from 0.24 in Tokapal to 0.46 in Bastar block. At the Bastar block, the highest mean population of green lacewing, *Chrysoperla carnea*, with an average of 0.44/m² was recorded followed by Lohandiguda and Tokapal block with an average of 0.38 and 0.20 respectively, was recorded in finger millet field (Table: 5).

In the present study, the major biotic threat to finger millet seems to be ear head caterpillar followed by the aphids in Bastar district and the results are in agreement with the results of previous workers. In the current study, grasshopper was found as the dominant pest, among the defoliators in finger millet and the results are in close concurrence with the results of Kalaisekar *et al.*, 2017; Jago *et al.*, 1993; Maiga *et al.*, 2008 [8, 7, 11]. The current results on the natural enemies feeding on the insect pests from small millets are corroborated with the findings of Sathish *et al.*, 2017; Sow *et al.*, 2018. Nwanze and Harris (1992) [14, 12, 15] recorded about 150 insect species feeding globally on millets whereas, in India Kishore and Soloman (1989) [9] have reported that around 100 insect pests devastating the millets crop and 116 insect pests associated with millet have been reported by Kishore (1996) [10]. Annon. (2019) [1] also recorded damage per cent and leaf affected by grasshopper ranged from 8.3 to 25.75 with an average 15.32 respectively at Berhampur centre. The incidence of shoot aphid was recorded in Bangalore and Berhampur. Per cent plant affected with aphid ranges from 6.53 to 10.03 with mean of 8.75.

Table 1: Details of places surveyed for recording major insect pests of finger millet in Bastar district

S. No.	Block	Villages
1.	Bastar	Narayanpal
		Badechakwa
2.	Tokapal	Ransargipal
		Sirisguda
3.	Lohandiguda	Baghanpal
		Gadahiya

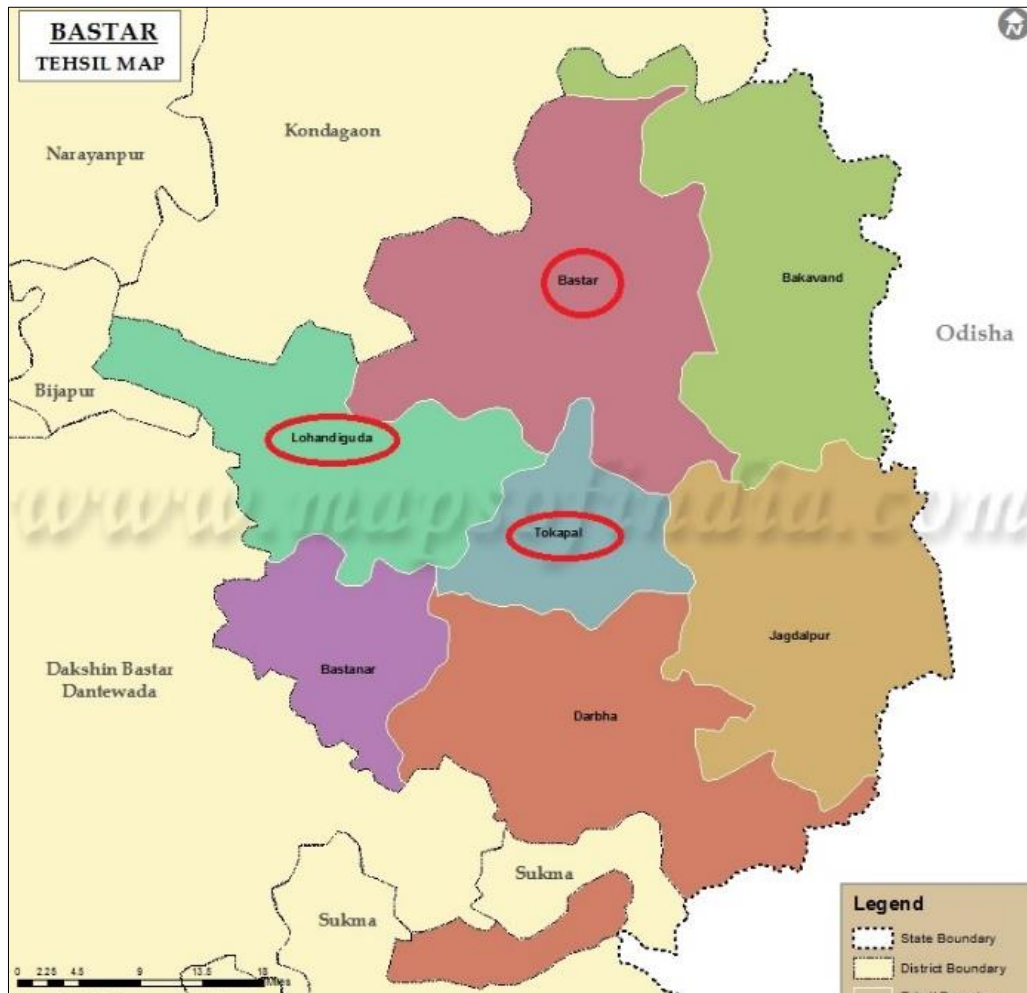


Fig 1: Map showing areas surveyed for insect pests of finger millet in Bastar district.

Table 2: Insect pests associated with finger millets growing area in Bastar district

Sl. No.	Common name	Scientific name	Family: Order	Occurrence	Damaging stage	Host part attacked
1.	Pink stem borer	<i>Sesamia inferens</i>	Noctuidae: Lepidoptera	Regular	Caterpillar	Stem
2.	Leaf aphid	<i>Hysteroneura setariae</i>	Aphididae: Hemiptera	Regular	Nymph and Adult	Leaf, stem and ear head
3.	Grasshopper	<i>Hieroglyphus banian Cataloipus</i> sp.	Acridae: Orthoptera	Regular	Nymph and Adult	Leaf
4.	Ear head caterpillar	<i>Helicoverpa armigera</i>	Noctuidae: Lepidoptera	Regular	Caterpillar	Ear head

Table 3: Roving survey for insect pests of finger millet

Block	Village	Pink stem borer	Aphid	Grasshopper	Ear head caterpillar
		Mean Dead heart (%)	Mean Population /plant	Mean Affected leaf (%)	Mean Affected ear head (%)
Tokapal	Ransargipal	4.85	13.56	9.74	7.91
	Sirisguda	5.57	9.23	6.04	10.79
Average		5.21	11.39	7.89	9.35
Lohandiguda	Baghanpal	8.14	13.45	8.23	11.52
	Gadahiya	6.37	10.24	12.91	6.27
Average		7.25	11.48	10.57	8.89
Bastar	Narayanpal	6.23	10.7	8.62	6.98
	Badechakwa	7.11	8.42	10.21	11.76
Average		6.67	9.56	9.41	9.37
Average mean		6.37	17.09	9.29	9.20

Table 4: The natural enemies observed in field of finger millet crop

Sl. No.	Common name	Scientific name	Family	Order
1.	Ladybird beetle	<i>Coccinella septempunctata</i>	Coccinellidae	Coleoptera
2.	Dragonfly	<i>Sympetrum flaveolum</i>	Libellulidae	Odonata
3.	Green lacewing	<i>Chrysoperla carnea</i>	Chrysopidae	Neuroptera

Table 5: Natural enemies encountered during the survey

Block	Village	Mean population of Lady bird beetle / m ²	Mean population of Dragonfly / m ²	Mean population of Lacewing / m ²
Tokapal	Ransargipal	0.87	0.48	0.40
	Sirisguda	1.24	0.00	0.00
Average		1.05	0.24	0.20
Lohandiguda	Baghanpal	0.87	0.23	0.56
	Gadahiya	0.00	0.41	0.20
Average		0.43	0.32	0.38
Bastar	Narayanpal	0.27	0.92	0.62
	Badechakwa	0.76	0.00	0.26
Average		0.51	0.46	0.44

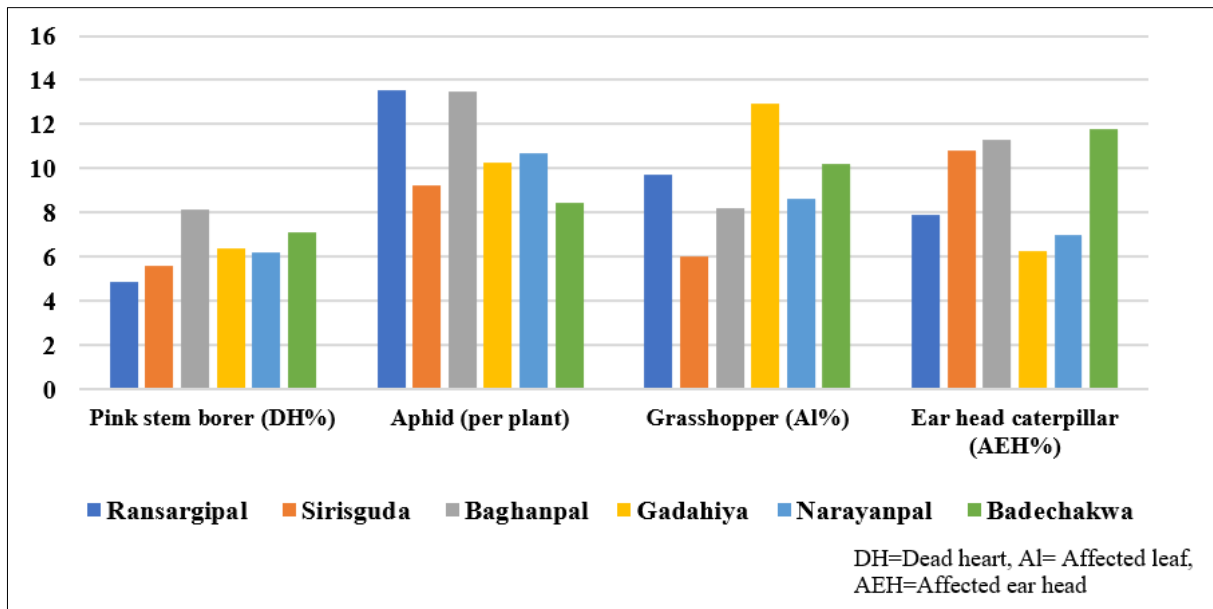


Fig 2: Insect pests of finger millet in different villages of Bastar district

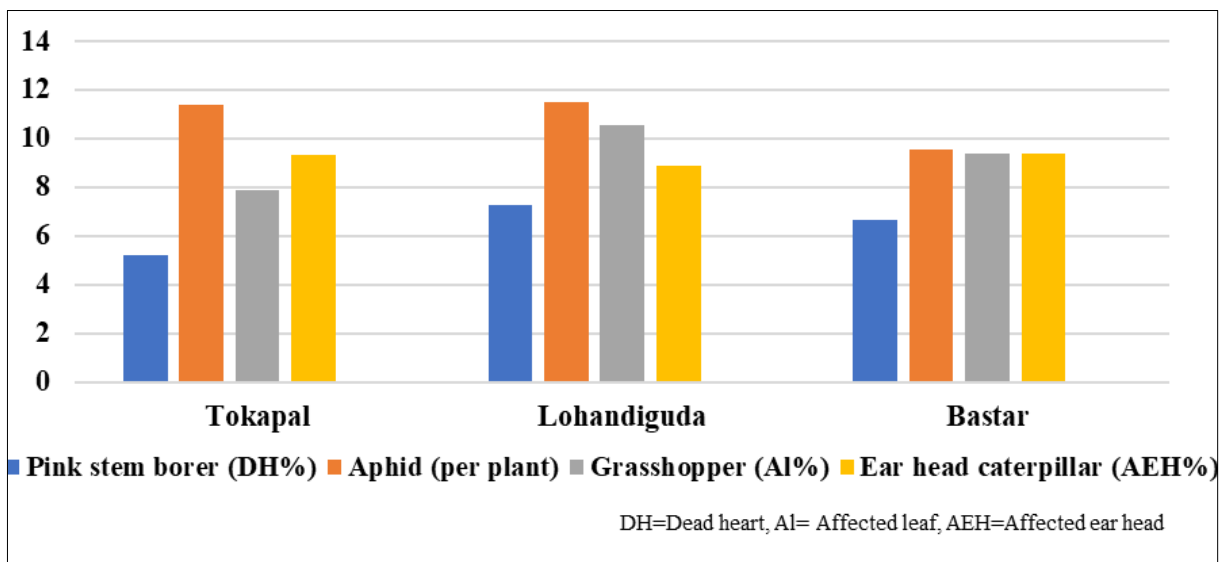


Fig 3: Block-wise average of insect pests in finger millet crop.

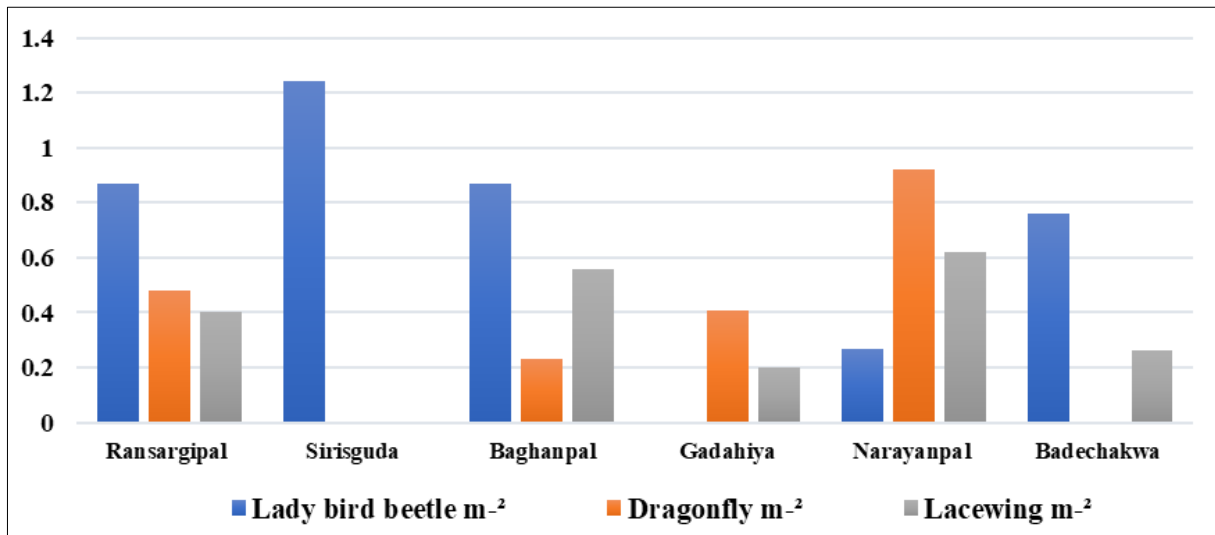


Fig 4: Natural enemies of insect pests in different villages of Bastar district

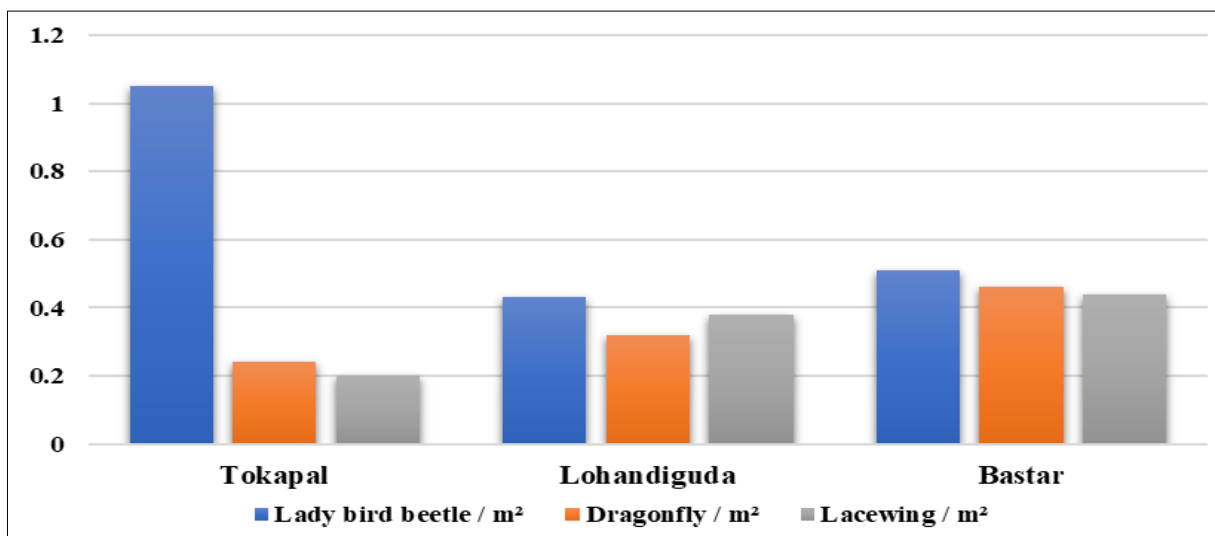


Fig 5: Block-wise average population of natural enemies

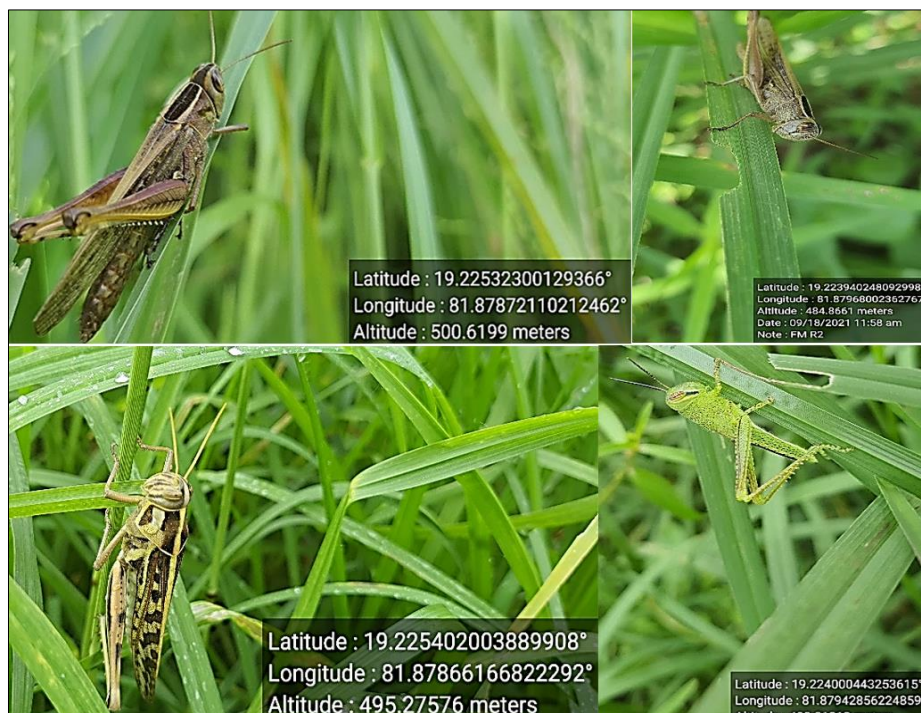


Fig 7: Different species of grasshopper



Fig 8: Dead heart symptom caused by pink stem borer

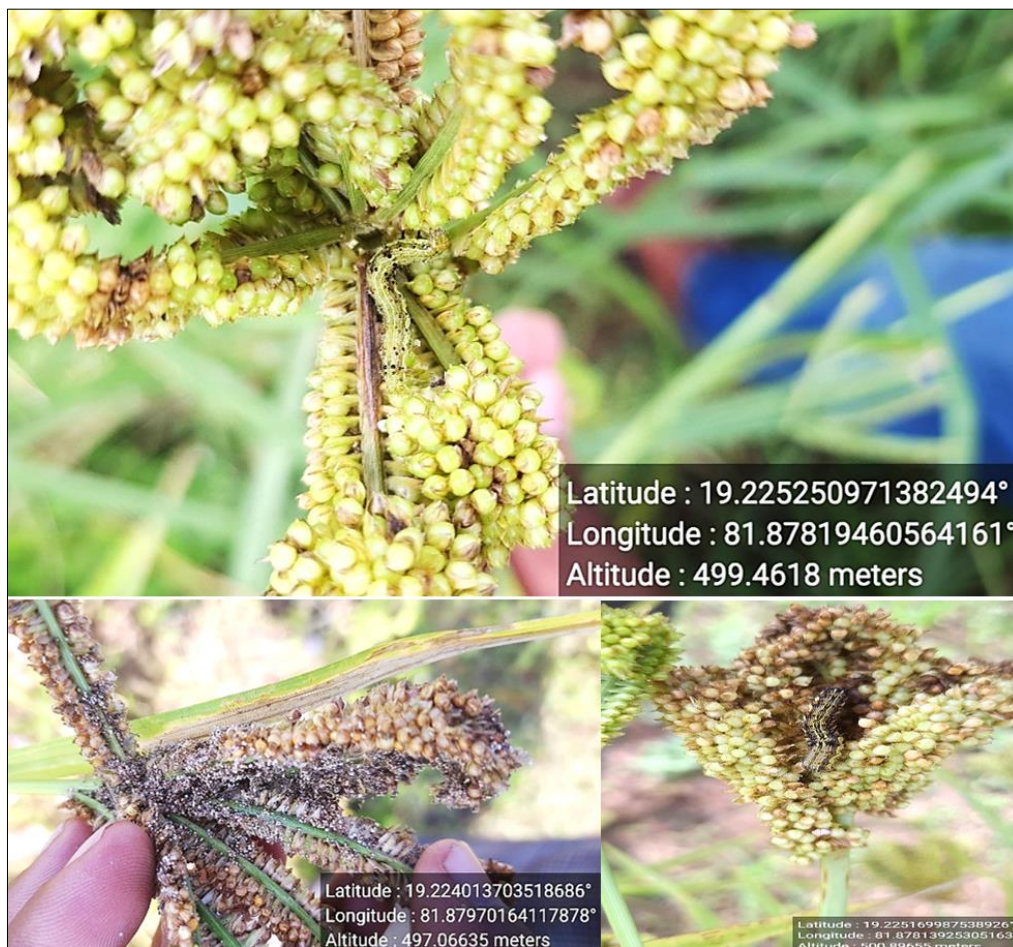


Fig 9: Ear head caterpillar infesting finger millet crop



Fig 10: Aphid associated with ants in finger millet crop

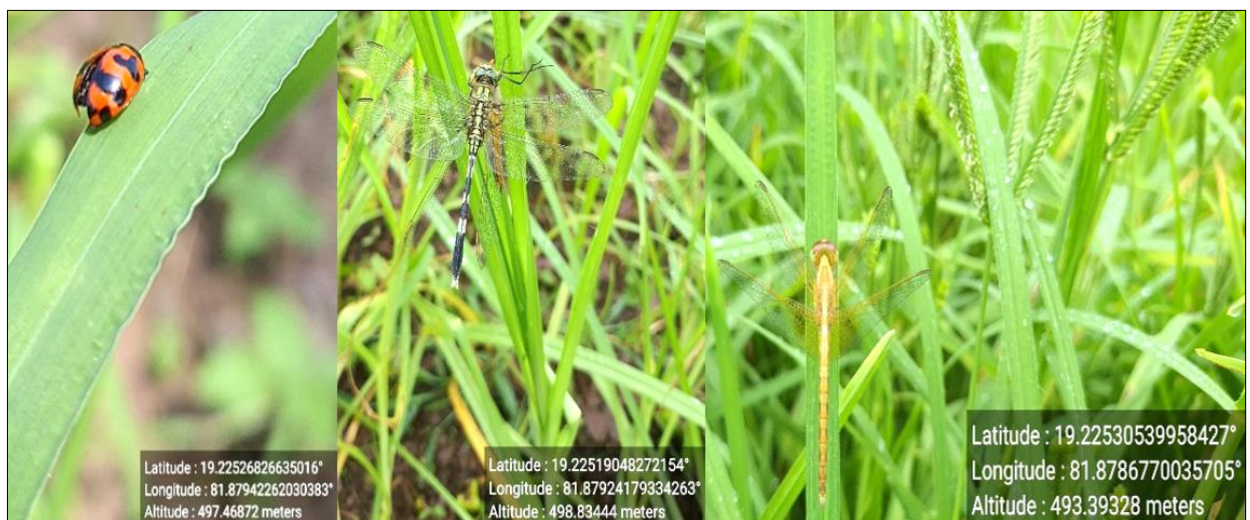


Fig 11: Different types of predators found in finger millet ecosystem

Conclusion

This seasonal activity of major insect pests of finger millet across the three different blocks of Bastar district showed the

differences in preference for different insect pests of finger millet. Lohandiguda block is more favourable for multiplication of pink stem borer, aphid, and grasshopper,

while Bastar block is more susceptible to ear head caterpillar. The Tokapal and Bastar blocks have the highest seasonal activity of predators. Overall, these all major insect pests cause damage to finger millet crops. Hence, management procedures apply to such kinds of major insect pests.

Acknowledgements

The author is grateful to Dr. N.C. Mandawi, Department of Entomology, Shaheed Gundadhoor College of Agriculture and Research Station, Kumhrawand, Jagdalpur (C.G.) for his guidance and facilities provided to carry out this research work.

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