Eco. Env. & Cons. 30 (October Suppl. Issue) : 2024; pp. (S21-S24)

ISSN 0971–765X

DOI No. http://doi.org/10.53550/EEC.2024.v30i06s.003

Study the prevalence of predatory bugs of Southern Rajasthan in soybean crop

Vijay Kumar*, Hemant Swami, S. Ramesh Babu, B. Upadhayay, S.S. Lakhawat and Davendra Jain[2]

Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

(Received 20 March, 2024; Accepted 1 May, 2024)

ABSTRACT

The present investigation was carried out during *Kharif* season 2021-22 and 2022-23 in Udaipur district in Southern Rajasthan. The aim of the survey is to record the diversity of different species of prevailing predators on the soybean crops ecosystem. The survey on the diversity of predatory bugs was carried out under the agro-climatic conditions of Udaipur, Rajasthan. The predatory bugs of soybean crop during the *Kharif* seasons, 2021-22 and 2022-23 were found such as pentatomid, reduviid, mirid and anthocorid. The dominant predatory bugs of soybean crops were observed as Pentatomidae family bugs with the maximum mean and relative density from all surveyed locations. While the population of anthocorid bugs was found minimum.

Key words: *Survey, Prevalence, Abundance, Density, Hemipteran predators, Soybean ecosystem*

Introduction

Insects have been exceedingly successful with reference to both species richness and abundance. Insects are witnessed to be the bulkiest contributors to species richness (Stork *et al.*, 2015). Insects are responsible for nearly 66 percent of all recognized species, enveloping more than three-quarters of global biodiversity (Kim, 1993). In Animal Kingdom the operative role of predators is to attack, kill and eat their prey in the procedure of carrying over energy through different trophic levels. Hemipteran bugs are often massive and diverse, possessing a variety of fascinating specialized habits. The potency of the predatory bugs as biocontrol agents has been demonstrated and the field release generally achieved quick and constructive control of the target pests. Hence, predatory hemipterans insects can be used as an effective bio-control agents for the management of insect pests. The understanding on prevalence of predators for large-scale applications is required. For illustration, improving the intensity of colonization of introduced predators must be a major focus in biocontrol. Hence, taking into consideration of the potentiality of the natural predators from the Hemiptera order, the present investigation was carried out to study the prevalence of predatory bugs in the soybean crops.

Materials and Methods

The present investigation was carried out during *Kharif* season 2021-22 and 2022-23 in Udaipur district in Southern Rajasthan. The aim of the survey is to record the diversity of different species of prevailing predators on the soybean crops ecosystem. The observations on the prevalence of predatory bugs were taken from the 25 different locations of five villages in Udaipur. In each field, twenty plants were selected and observed for the number of

predatory bugs per plant by the visual-count-technique at 15 days interval and a record was maintained. The populations of predatory bugs recorded either from 6 to 8 am or 4 to 6 pm depending upon arrival at the location during survey.

Mathematical analyses: Analyses were done by using the below formulae.

a) Mean density

Mean density = Σ Xi/N

Where, *Xi* = *No*. of natural enemies in i^{th} sample

N = Total No. of plants sampled

b) Relative density

$$\text{Relative density (RD \%)} = \frac{\text{Number of individual of species}}{\text{Number of individuals of all species}} \times 100$$

c) Diversity indices

Suitable diversity indices used as per the recorded data:

Shannon index $$H' = -\sum_{i=1}^{s} p_i \ln p_i$$

Where,

S is the number of species. Also called species richness

p_i is the relative abundance of each species, calculated as the proportion of individuals of a given species to the total number of individuals in the community: n_i/N

n_i is the number of individuals in each species, the abundance of each species

N is the total number of all individuals

Simpson's index $$(D) = \frac{1}{\sum_{i=1}^{s}(p_i)^2}$$

Where,

S is the total number of species in a community (i.e., Species richness)

p_i is the relative abundance of each species, calculated as the proportion of individuals of a given species to the total number of individuals in the community: n_i/N

n_i is the number of individuals in each species, the abundance of each species

N is the total number of all individuals

Results and Discussion

The survey to study the abundance and prevalence of different predatory bugs in soybean crops ecosystems was carried out during *Kharif* season 2021-22 and 2022-23 in Udaipur district. Mean and relative density of predatory bug on soybean crop-ecosystem in Udaipur region during *Kharif* 2021-22 and 2022-23 was performed (Table 1). Twenty plants were randomly selected at five locations in five blocks of district for observing the prevalence of predatory bug species. Hundred plants were observed from each block for analyzing the data. A total of 25 blocks were surveyed in selected district of Udaipur. The predatory bug species were recorded from five blocks of district *viz.*, Kavita, RCA farm, Bhadgaon, Chikalwas and Vallabhnagar.

Table 1. Mean and relative density of predatory bug on Soybean crop-ecosystem in Udaipur region during *Kharif* 2021-22 and 2022-23

Predatory Bugs	Parameter	*Kharif* 2021-22	*Kharif* 2021-22
Pentatomidae Bug	Mean(x)	10.40	7.20
	SD (σ)	4.56	3.03
	Relative density	52.94	49.01
	Range	1-16	4-12
Reduviid Bug	Mean(x)	4.80	3.80
	SD (σ)	1.79	0.45
	Relative density	24.78	28.06
	Range	4-8	3-4
Mirid Bug	Mean(x)	3.40	2.60
	SD (σ)	2.41	1.34
	Relative density	17.22	17.82
	Range	1-6	1-4
Anthocorid Bug	Mean(x)	1.20	0.80
	SD (σ)	1.64	0.84
	Relative density	5.07	5.11
	Range	0-4	0-2

The result of the survey for the prevalence of hemipteran predatory bugs in soybean crop ecosystems in Udaipur district show that predominantly four species of hemipteran bugs viz., pentatomid, reduviid, mirid and anthocorid were recorded to exist during kharif season. The mean density of these four species of hemipteran bugs varied significantly from pentatomid bugs of 4.6 and 7.2 bugs, 4.8 and 3.8 of reduviid bugs, 3.4 and 2.6 of mirid bugs, 1.2 and 0.8 of anthocorid bugs in soybean crops during *Kharif* season 2021-22 and 2022-23 respectively.

The observation on predatory bugs species prevalence during *Kharif* crops season, 2021-22 and 2022-23 from Udaipur district revealed that the total mean density values for different predatory bugs observed 0-16 were range during both the year in the *Kharif*. The total mean relative density of different predatory bugs was ranged 5.07-52.94 percent. The predatory bugs prevailing in the region had high mean density 10.40 percent on soyabean field crops.

Generally, hemipteran predatory bugs feed on a wide variety of insect pests infesting various field and vegetables crops. There are some earlier observations in the similar line of present investigation who also recorded predatory hemipteran bugs *viz., Coranus spiniscutis* on cowpea and mustard (Bose, 1949), *Rhynocoris* sp. on soybean, okra, chilli and pumpkin (Singh and Sing, 1987; Joseph, 1959). Wheeler (2001) reported that mirid bugs is considered to prey upon thrips, aphids and other soft-bodied insects in okra, cauliflower, maize, brinjal and cucurbits crops. Sahayaraj (2014) observed that hemipteran predators have been distributed in various crops like soybean, groundnut, pigeon pea, cotton, castor, rice, cabbage, tobacco, pumpkin, bhindi, citrus, sugarcane, sesbania and apple and in secondary and tropical evergreen forests in many parts of the world. Anthocorid bug, *Orius* sp. predator habitat the cotton and soybean agroecosystems (Olson and Ruberson, 2012; Athey *et al*., 2019). Similarly, numerical trend has been observed in other studies in soybean (McPherson *et al.,* 1979).

Similarly, Thakare (2005) reported the occurrence of predatory fauna in various *Kharif* crop agro-ecosystem, *viz.,* Geocorid bug and pentatomid bug species in cotton, pigeon pea, soybean and green gram ecosystem of Akola region. Likewise, Naikwadi and Javalage (2010) studied the spatial distribution of hemipteran predatory fauna stink bug and assassin bug found in *Kharif* crop agro-ecosystem, in Akola district of Maharashtra. They recorded these predators from *Kharif* crops viz. cotton, cowpea, soybean, tur, jowar, sunflower and green gram.

Predominate pentatomid predator, *Eocanthecona furcellata* dwells in a diverse agroecosystem of India and noticed on various pests species *viz., Amsacta albistriga, Spodoptera exigua, Spodoptera litura, Athalia lugens proxima, Thosea cervina, Utethesia pulchella, Hyblaea puera, Semiothesia pervolgata, Eurema hecabe, Catopsilia pyranthe, Helicoverpa armigera, Thiacidas postica, Latoia lepida* (Cramer), *Diaphania pulverulentalis, Semiothisa pervolgeta, Terias hacabae, Spilosoma obliqua* (Bal and Biswas, 2013; Chakravarty *et al.,* 2016; Bhatnagar *et al.,* 2019). Mirid predator, *Cyrtorhynus lividipennis* (Reuter) was noticed to feed on white backed plant hoppers, leafhoppers, and brown plant hoppers in grass family plants in Andaman and Nicobar Island, Andhra Pradesh, Bihar, Madhya Pradesh and Karnataka (Bal and Biswas, 2013).

Conclusion

The present investigation was carried out during *Kharif* season 2021-22 and 2022-23 in Udaipur district in Southern Rajasthan. The aim of the survey is to record the diversity of different species of prevailing predators on the soybean crops ecosystem. The dominant predatory bugs of soybean crops were observed as Pentatomids and reduviids. These predators recognize them as potential biological control agents. Since predatory hemipteran bugs have not been increased swiftly under field condition, the best approach is to mass rear them through mass rearing and release them counter to the crop pests.

Acknowledgement

The authors express sincere thanks to the Head, Department of Entomology, College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, Udaipur for providing necessary facilities and encouragement for research.

Conflict of Interest

We declare that we have no conflict of interest.

References

Athey, K.J., Ruberson, J.R., Olson, D.M. and Harwood, J.D.

2019. Predation on stink bugs (Hemiptera: Pentatomidae) in cotton and soybean agroecosystems. *PLoS One.* 14: e0214325.

Bal, A. and Biswas, B. 2013. Handbook on Major Hemipteran Predators of India. *Zoological Survey of India. Kolkata,* pp. 1-44.

Bhatnagar, V.R., Maurya, R.P., Brijwal, L., Dobhal, P., Suyal, P. and Singh. N.K. 2019. Study on variability among predatory stink bug, *Eocanthecona furcellata* (Wolff) (Hemiptera: Pentatomidae) population thriving in different agro ecosystems of north-western Himalayas, India. *Journal of Entomology and Zoology Studies.* 7: 726-736.

Bose, M. 1949. On the biology of *Coranus spiniscutis* Reuter an assassin bug (Heteroptera: reduviidae). *Indian Journal of Entomology.* 11: 203-208.

Chakravarty, S., Meena, A. and Jaba, J. 2016. Seasonal abundance of predatory bugs, *Eocanthecona furcellata* (Wolff.) and *Rhynocoris fuscipes* (F.) and its olfactory responses towards plant and pest mediated semiochemical cues in Pigeon pea ecosystem. *Legume Research.* 40: 351-357.

Joseph, M.T. 1959. Biology bionomics and economic importance of some reduviids collected from Delhi. *Indian Journal of Entomology.* 21: 46-58.

Kim, K.C. 1993. Biodiversity, conservation and inventory: Why insects matter. *Biodiversity and Conservation*. 2: 191-214.

McPherson, R.M., Newsom, L.D. and Farthing, B.F. 1979. Evaluation of four stink bug species (Heteroptera: Pentatomidae) from 3 genera affecting soybean yield and quality in Louisiana. *Journal of Economic Entomology.* 72: 188-194.

Naikwadi, B.V. and Javalage, S. 2020. Study of spatial distribution of important predatory fauna found in Kharif agro-ecosystem from the region, Akola, Maharashtra, India. *Journal of Entomology and Zoology Studies.* 8: 790-794.

Olson, D.M. and Ruberson, J.R. 2012. Crop-specific mortality of southern green stink bug eggs in Bt- and non-Bt cotton, soybean and peanut. *Biocontrol Science and Technology.* 22: 1417-1428.

Sahayaraj, K. 2014. Reduviids and their merits in biological control. *Basic and Applied Aspects of Biopesticides,* DOI 10.1007/978-81-322-1877-7_10.

Singh, O.P. and Sing, K.J. 1987. Record of *Rhynocoris fuscipes* Fabricius as a predator of Green stink bug: *Nezara viridula* Linn. infesting soybean in India. *Journal of Biological Control.* 1: 143-146.

Stork, N.E., McBroom, J., Gely, C. and Hamilton, A.J. 2015. New approaches narrow global species estimates for beetles, insects, and terrestrial arthropods. *Proceedings of the National Academy of Sciences of the United States of America.* 112: 7519-7523.

Thakare, S.M. 2005. Report on training of facilitators (TOF) on cotton IPM programme. Annual Report of Plant Protection, 2006-07, *Department of Entomology, Dr. PDKV, Akola.* 2005.

Wheeler, A.G. 2001. Biology of the plant bugs (Hemiptera: Miridae): pests, predators, opportunists. Cornell University Press, New York.