Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(1): 1148-1151

Received: 01-11-2018
Accepted: 05-12-2018

Jesu Rajan S
Assistant Scientific Officer, National Institute of Plant Health Management (NIPHM), Hyderabad, Telangana, India

Sree Latha E
Assistant Director, National Institute of Plant Health Management (NIPHM), Hyderabad, Telangana, India

K Sneha Madhuri
Senior Research Fellow, National Institute of Plant Health Management (NIPHM), Hyderabad, Telangana, India

Vijayaraghavendra R
Senior Research Fellow, National Institute of Plant Health Management (NIPHM), Hyderabad, Telangana, India

CH Sreenivasa Rao
Director, National Institute of Plant Health Management (NIPHM), Hyderabad, Telangana, India

Correspondence
Jesu Rajan S
Assistant Scientific Officer, National Institute of Plant Health Management (NIPHM), Hyderabad, Telangana, India

Predatory coccinellids diversity in organic vegetable farming systems: Conservation and mass production

Jesu Rajan S, Sree Latha E, K Sneha Madhuri, Vijayaraghavendra R and CH Sreenivasa Rao

Abstract
The predatory coccinellids are friends of farmers, help to manage plant-feeding insects from attaining their damaging population levels and could be effectively employed in bio intenssive pest management programmes. Farming practices that conserve biodiversity as ground fauna and pests' natural enemies might be a practical alternative to manage pests in agricultural systems.The present study gives information on diversity and crop preference in organic vegetable farming systems at NIPHM, Rajendranagr, Hyderabad. Data on diversity of these predatory coccinellids was obtained by trapping, hand picking and netting during 2016-17. Total nine species of coccinellids were recorded in vegetable crops *viz*., brinjal, bhendi, cauliflower, cabbage, radish, mustard, tomato, cucumber, watermelon, peas, cowpea ridge gourd and bottle gourd. Among the crops surveyed, *Coccinella transversalis* (Fab.) and *Menochilus sexmaculatus* (Fab.) were the most dominant species, followed by *Hippodamia variegata*. Host preference of coccinellids indicated that bhendi harboured largest number, nine species of coccinellids (*C. transversalis*, *Scymnus coccivora*, *M. sexmaculatus*, *Brumoides suturalis*, *Hippodamia variegata*, *Harmonia octomaculata*, *Stethorus sp.* and *Micraspis discolor*) followed by cowpea, cabbage, mustard, cucurbits, tomato and brinjal.

Keywords: Predators, coccinellids, diversity, host crop preference conservation biological control

Introduction
Coccinellids belong to the family Coccinellidae of the order Coleoptera and are commonly called as ladybird beetles. It is a well-known beetle family, distributed worldwide and divided into six subfamilies: Coccidulinae, Coccinellinae, Scymninae, Chilocorinae, Sticholotidinae and Epilachninae [1]. Coccinellids are the most attractive insects due to their bright shiny colours. There are about 5200 species reported across the world. Four hundred species under 79 genera of coccinellid beetles were recorded from Indian sub-continent [2]. Except for the mycophagous Coccinellinae (Halyziini and Tythaspis) and the phytophagous Epilachninae, all remaining coccinellids are predators of hemipteran insects mainly from the suborder Sternorrhyncha (e.g. aphids, scales, psyllids and whiteflies), mites and eventually other insect larvae [3].

These are oval to hemispherical in shape with clavate antennae, securiform maxillary palpi and pseudotrimerous tarsi and often brightly coloured with red, orange or yellow elytra frequently spotted black or yellow striped. The Coccinellids are extremely diverse in their feeding habits. The great number of the coccinellid species are predaceous and beneficial from the view point of biological control of pests, feeding during both larval and adult stages upon aphids, scale insects, psyllids, mites etc. Members of a relatively small sub-family Epilachninae are herbivorous and occur as serious pests of agricultural crops [3].

The lady bird beetles are distributed in many countries of Asia, including India [4]. The importance of coccinellid beetles in natural and applied biological control was recognized after spectacular success of vedalia beetle, *Rodolia cardinalis* (Muls.) in combating the cottony cushion scale, *Icerya purchase* (Mask) in California, USA. After that the beetle has been utilized all over the world including India.

Ladybird beetles prey upon many economically important pests, including aphids, mealy bugs, scale insects, thrips, leaf hoppers, mites and other soft bodied insects [3]. They have a wide range of acceptable food (polyphagy) including pollen, and cannibalistic, which allow them to survive in periods of food shortage.

Owing to their seasonal synchrony with specific preys, high foraging performance and high reproductive efficiency, the coccinellids have the potential to be effectively employed in integrated pest management programmes [5]. When insect food is insufficient, these coccinellids will feed on pollen and nectors. Both adults and larvae are voracious feders.

The composition of predacious Coccinellids vary widely among agro ecosystems and they play key role of keeping other phytophaous insects under control. These natural enemies can help keep plant-feeding insects from attaining damaging population levels. Some common predators in vegetable production systems are spiders, predatory mites, ground beetles, rove beetles, ladybird beetles, predatory bugs, lacewings, mantids, robber flies, and syrphid fly larvae. This paper communicates the diversity and host crop preference of predatory coccinellids in non-chemically grown vegetable crops.

Materials and methods

Studies on species complex of predatory coccinellids and their host preference were carried out in organically grown vegetable crops *viz*., brinjal, bhendi, cauliflower, cabbage, radish, mustard, tomato, cucumber, watermelon, ridge gourd, bottle gourd, peas and cowpea at National Institute of Plant Health Management (NIPHM), Hyderabad during 2016-17. NIPHM ecological engineering farm is maintained organically since ten years without using any sort of chemicals for crop production. The field was maintained with polyculture and different types of ecological engineering plants through out the year. Maize was sown as boarder crop and sunflower, marigold, different cosmos plants, chrysanthemum ect., flowering plants were grown in the field. Oscimum, mustard, basil, sunhemp, castor, mint ect., were grown on bunds along with cereals, vegetables, pulses and oil seed crops in polyculture field.

Data on coccinellids was obtained by trapping, hand picking and netting at fort nightly intervals in different vegetable crop ecosystems. In each crop, 10 plants were selected randomly to record species diversity of different lady bird predators. The egg mass, grubs, pupae of lady bird beetles were collected and reared in the laboratory till adult emergence and species of emerged adults were identified. The adult beetles observed in each crop were collected in insect collection vials and identified in the laboratory.

Mass rearing protocol for coccinellids under laboratory conditions

Massproduction technique was carried out in biological control lab, NIPHM, Hyderabad. Larvae and adult ladybird beetles were collected from the organic vegetable farming fields viz, bhendi, cow pea, cabbage, cucurbits, brinjal and tomato. Adults were released in pairs and confined inside plastic bowls (7 cm X 2.5 cm) at suitable temperature 26±0.5°C, 72±5% R. H and natural aphid diet was provided, Each bowl was covered with muslin cloth. Aphid infested twigs were kept in each bowl to serve as food for these predator coccinellids and endowed with water soaked cotton. Along with aphids diet, adults were provided with small droplets of glucose, honey and water on a piece of wet cotton wool for the continuous supply of food. Larval stages were provided with aphid diet until pupation to develop in to adult stages [6].

Male and female beetle pairs were selected from laboratory reared adults for the oviposition and polymate plastic boxes were used as egg laying cages. Ventilation pores were made on the lid of plastic box. The eggs laid were collected and egg masses glued on to the papers were removed and put into water to separate from glue. Eggs in an egg mass were separated using a small paint brush. The number of eggs laid were counted daily. Eggs were placed in the petriplates and covered using a polythene sheet. Soon after hatching, the grubs were fed with natual aphid diet till pupation and after pupation, each pupae was placed in a petri dish that had ventilation holes on the lid. Newly emerged pairs were transferred for separate rearing on natural aphid diet for oviposition.

Results and discussion

Nine species of Coccinellids were attracted to different crops in field during 2016-2017 viz., *Coccinella transversalis* (Fabricius), *Harmonia octomaculata* (Fabricius), *Micraspis discolor* (Fabricius), *Hippodamia variegate (*Goeze), *Batyle suturalis* (Say), *Scymnus coccivora*, *Illeis* cincta (Fabricius) and *Stethorus sp* (plate 1). The results obtained from these studies are presented in table 1.

Coccinella transversalis	*Cheilomenes sexmaculata*	*Hippodamia variegate*

Brumoides suturalis | *Scymnus coccivora* | *Illeis cincta*

Micraspis discolar | *Harmonia octomaculata* | *Stethorus sp.*

Plate 1: Predatory Coccinellid Species in Organic Vegetable Field, NIPHM, Rajendranagar 2016-17

Table 1: Predatory coccinellids in different vegetable crops at NIPHM, Rajendranagar 2016-17.

Crop	*C. Transversalis*	*C. sexmaculata*	*H. variegata*	*B. suturalis*	*M. discolor*	*S. coccivora*	*H. octomaculata*	*I. cinta*	*Stethorus sp.*
Bhendi	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cow pea	✓	✓	✓	✓	✓	✓	✓	✓	X
Groundnut	✓	✓	✓	✓	X	✓	✓	X	X
Mustard	✓	✓	✓	X	✓	X	X	X	X
Cabbage	✓	✓	✓	X	✓	X	X	X	X
Cucurbits	✓	✓	✓	X	X	✓	X	X	X
Greengram	✓	✓	X	X	X	X	X	✓	X
Paddy	X	X	X	X	✓	X	✓	X	X
Brinjal	✓	✓	X	X	X	X	X	X	X
Tomato	✓	✓	X	X	X	X	X	X	X

✓ - Present, X - Abscent

Diversity of predatory coccinellids in organic vegetable farming systems

Bhendi: Bhendi harboured maximum number i.e nine species of coccinellids *viz., Coccinella transversalis, Cheilomenes sexmaculata, Hippodamia variegate, Micraspis discolor, Harmonia octomaculata, Illeis cincta, Brumoides suturalis, Stethorus sp. and Scymnus coccivora*. The activity of *M. sexmaculata, Coccinella rependa and Micraspis sp* in bhendi field were reported [7].

Cow Pea: Coccinellid species found were *C. transversalis, C. sexmaculata, H. variegata, B. suturalis, M. discolor, S. coccivora, H. octomaculata* and *I. cinta.* The predatory activity of *C. transversalis* and *H. octomaculata* was also reported [8], *B. suturalis* [9], *M. discolor* [10], *S. cocciovora* [11] on cowpea. However, *I. cincta,* mycophagous lady bird beetle found feeding on mycelium and spores of powdery mildew infested leaves of cowpea.

Cabbage: In cabbage ecosystem predatory activity of *C. sexmaculata, C. transversalis, H. variegata* and *M. discolour* was observed. The activity of *C. sexmaculata* during November to Feburary was also reported [12].

Cucurbits: In Bottle gourd, Ridge gourd and Water melon *C. transversalis, C. sexmaculata, B. suturalis* and *H. variegate* were found to be feeding on aphids throughout the cropping period.

Brinjal and Tomato: Predatory activity of two species of cocinellids *viz., C. transversalis* and *C. sexmaculata* found feeding on white flies and aphids.

Conclusion

Biodiversity in agro-ecosystems has been reduced drastically in the last few decades due intensification of cereal based monocropping system. Empirical data showed that agro-ecosystems with an enhanced overall biodiversity have

relatively fewer pest problems. Present study revealed that the relative abundance of *Coccinella transversalis* (Fab.) and *Menochilus sexmaculatus* (Fab.) the two abundant species followed by *Hippodamia variegata* in the organically grown poly culture field with ecological engineering flowering plants. Ecological engineering plants like maize provide huge pollen as proten rich food to beneficial insects. Native flowering plants like sun flower, marigold ect., attracts and provides food and shelter to natural enemies and conserve them. Many beneficial insects like predators, parasitoids and pollinators take shelter on these plants throughout the year and flowering plants provide nectar and pollen as food to these beneficial insects.

Bhendi crop had harboured nine species of coccinellids (*C. transversalis, Scymnus coccivora, M. sexmaculatus, Brumoides suturalis, Hippodamia variegata, Harmonia octomaculata, Stethorus sp.* and *Micraspis discolor*), cowpea with eight species except *Stethorus* spp., followed by cabbage, mustard, cucurbits, tomato and brinjal. As a result of this observation it was stated that enhancement of biodiversity within agro-ecosystems by conserving the natural enemies will be an alternative for pesticides usage and to manage pests in agricultural systems.

Acknowledgement

We would like to thank Honourable Director general, NIPHM Smt. G. Jayalakshmi, IAS for financial support in conducting the research.

References

1. Vandenberg NJ, Coccinellidae Latreille RH, Arnett, Thomas MC. (eds.). American Beetles, Polyphaga: Scarabaeoidea through Curculionoidea. Boca Raton, CRC Press. 2002; 2:371-389, 861.
2. Poorani J. An annotated checklist of the Coccinellidae (Coleoptera) (excluding Epilachnae) of the Indian subregion. Oriental Insects. 2002; 36:307-383.
3. Dixon AFG. Insect predator–prey dynamics. Ladybirds beetles & biological control. London, Cambridge University Press, 2000, 257.
4. Singh J, Brar KS. Mass production and biological control potential of coccinellids in India. – In: Sahayaraj, K. (Ed) Indian Insect Predators in Biological Control, Daya Publishing House, New Delhi, 2004, 204-260.
5. Lanzoni A, Accineli G, Bazzocchia G, Burgio G. Biological traits and life table of the exotic Harmonia axyridis compared with Hippodamia variegata, and Adalia bipunctata (Col, Coccinellidae). Journal of Applied Entomology. 2004; 128:298-306.
6. Jesu Rajan S, Sree Latha E, Vijaya Raghavendra R, Sreenivasa Rao CH. Biology and feeding potential of *Coccinella transversalis* (Fab.) on cabbage aphid, *Brevicoryne brassicae* (Linn.). Journal of Entomology and Zoology Studies. 2018; 6(6):51-56.
7. Tank BD, Korat DM. Biology of Ladybird Beetle, *Cheilomenes sexmaculata* (Fab.) in Middle Gujarat Conditions. Karnataka J Agric. Sci. 2008; 20(3):634-636.
8. Chanmamla G. Taxonomic studies on predaceous coccinellidae of oder coleoptera. M.Sc. (Agri.) Thesis, Acharya N.G. Ranga Agril. Univ., Hyderabad, 2009.
9. Megha RR, Vastrad AS, Kamanna BC, Kulkarni NS. Species complex of coccinellids in different crops at Dharwad region. J Exp. Zool. India. 2015; 18(2):931-935.
10. Nghia, Poonam. Biodiversity of beneficial insects associated with cowpea at Pantnagar- Uttarakhand-India. Omon rice. 2015; 20:73-78.
11. Sunil Joshi, Venkatesan T, Rao NS. Host range and predatory fauna of *Aphis craccivora* Koch (Homoptera: Aphididiae) in Bangalore, Karnataka. J Biol. Control. 1997; 11:59-63.
12. Mandal SMA, Patnaik NC. Interspecific abundance and seasonal incidence of aphids and aphidophagous predators associated with cabbage. J Biol. Cont. 2008; 22(1):195-198.