Print ISSN : 0972-8813
e-ISSN : 2582-2780

[Vol. 20(1), January-April, 2022]

Pantnagar Journal of Research

(Formerly International Journal of Basic and Applied Agricultural Research ISSN : 2349-8765)

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PANTNAGAR JOURNAL OF RESEARCH

Vol. 20(1) January-April, 2022

CONTENTS

Population studies on various coccinellid beetles from different crop ecosystems of Pantnagar, Uttarakhand

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ABSTRACT: The study on the population of different predatory coccinellid beetles was carried out in three locations of Pantnagar. The predatory beetles were surveyed periodically from November, 2020 to February, 2021. A total of 10 species of predatory coccinellid beetles were observed from different crops of the region. Out of these recorded coccinellids, 9 species *viz., Anegleis cardoni* (Weise), *Cheilomenes sexmaculata* (Fabricius),*Coccinella septempunctata* (Linnaeus), *Coccinella transversalis* (Fabricius), *Harmonia dimidita* (Fabricius),*Propylea dissecta* (Mulsant), *Micraspis univittata* (Hope), *Micraspis discolor* (Fabricius) and *Harmonia variegate* (Fabricius) were identified under subfamily Coccinellinae, while the one species *i.e., Brumoides suturalis* (Fab.) belonged to subfamily Chilocorinae. Different field crops (Wheat, Rice, Chickpea, Mustard, Pigeon pea and Cotton), vegetable crops (Potato, Brinjal and Cabbage) and floricultural crops (Rose and Chrysanthemum) were observed during the period for occurrence of coccinellid beetles. Among all the crops, a maximum of six species of coccinellids were recorded in chrysanthemum crop followed by wheat (5 spp.), brinjal, potato, mustard (4 spp. respectively), pigeon pea, cotton (3 sps. respectively), chickpea, rose, cabbage (2 sps. respectively) and rice (1 sps.). Among all the species *C. septempunctata*, *C. sexmaculata*, and *C. transversalis* were found in all the cropping seasons of Pantnagar. Hence, due to their wide diversity, these predatory beetles could be utilized in an effective IPM module for the management of sucking pests in different crops.

Key words: Coccinellid beetles, diversity, management, predatory

In India, estimated annual production losses due to pests are as high as US$ 42.66 million (Sushil, 2016). Pesticides are most commonly used for pest control in agriculture. In India, there is significant increase in consumption of pesticide. Although chemical pesticides are very effective for controlling insect pests, but resistance development in pests against these chemicals and their detrimental effect on environment has become a serious issue in current prospective (Abrol and Shankar, 2014). Due to lack of technical information about the chemical content and increased number of sprays every time may enhance the pressure on farmer's pocket, and also on the health of people and soil.

The problem of insect pests in crops may be overcome by utilization of biological control technology. By virtue of wide host range and unique mode of attack on host by natural enemies, they will help in developing a sound framework of Integrated Pest Management (IPM) so that farmers can harness economic advantage from organic farming. Biological control is an integral part of IPM, which involves the use of predators, parasites and microorganisms for the control of pests. Among the biological control agents, coccinellid beetles (also known as lady birds or lady beetles) are an important group of predators which are predaceous on different agricultural pests *viz.,* aphids, scale insects, mealy bugs, mites, whiteflies, thrips, psyllids, plant hoppers, eggs and larvae of other insects (Omkar and Pervez, 2002).

The coccinellids belongs to the family Coccinellidae of order Coleoptera. The Coccinellidae is a well-known, abundant and diverse family and nearly 6000 species are known worldwide (Vandenberg, 2002). Sasaji (1967) reported that a total of 4800 species of coccinellids belonging to 490 genera have been described from different parts of the world. In Indian subcontinent there are 400 coccinellid species (including six subspecies) are reported (Poorani, 2012). Sathe and Bhosale (2001) described that more than 4500 species of coccinellids are predaceous in nature.

Although coccinellidae fauna of Indian subcontinent is rich and diverse, but it is poorly studied as

compared to the other geographical regions of the world. This is the major drawback with this predator in India for its successful utilization in biocontrol programmes (Kumar *et al*., 2017). Hence, species delimitation of coccinellidae predators is necessary for biodiversity, conservation and biological control program to understand their natural world. The host specificity of these predators and their eco-friendly nature encourages their use in insect pest management. Exploration and utilization of suitable native species and strains of coccinellid predators associated with different host insects in different crop ecosystems will help in maintaining normal equilibrium position of the environment. Thus, study of biodiversity of coccinellid predators will help in development and standardization of their mass production techniques and delivery system against sucking pests of different crops.Therefore, in this context, it becomes mandatory to explore the different species of these predatory beetles associated with different crops in the region. Keeping in view the above facts, an extensive study of different coccinellid species at Pantnagar were carried out.

MATERIALS AND METHODS

Field survey was undertaken at Govind Ballabh Pant University of Agriculture and Technology, Pantnagar from November, 2020 to February 2021. Three different sites were selected for the survey of Coccinellid beetles *viz.* Vegetable Research Centre (VRC), Crop Research Centre (CRC) and Model Floriculture Research Centre (MFRC). The collection of coccinellid beetles was carried out at different crop ecosystems *viz.,* field crops, vegetables and floriculture crop at weekly time interval. Different field crops (Wheat, Rice, Chickpea, Mustard, Pigeon pea and Cotton), vegetable crops (Potato, Brinjal and Cabbage) and floricultural crops (Rose and Chrysanthemum) were observed during the period for occurrence of coccinellid beetles. Collection was done generally in morning hours from 7:00 AM to 9:30 AM, when insect activity is least and can be easily spotted. Samples were collected from a crop by making 'W' shaped pattern within the field (Zehnder, 2014). Each corner of 'W' was considered as a spot for the collection. At a spot one meter square area was selected and each plant of square was observed for predators. All the life stages of predatory coccinellid beetles (eggs, grub, pupa and adult) were collected and brought to the Biological Control Laboratory, Department of Entomology, Pantnagar. Immature stages were reared up to the adult stage for the further study in the laboratory. Collection of adult coccinellid beetles were carried out continuously during the study period. The beetles were collected by hand picking method (Hemchandra *et al.*, 2010).Collected specimens were killed using chloroform in killing bottles and they were left for drying. The collected specimens were studied and identified using available keys (Omkar and Bind, 1993, 1995, 1996; Omkar and Pervez, 1999; Poorani, 2002b). The species which were not identified with the help of keys were sent to Entomology Division of IARI, New Delhi for identification by experts.

RESULTS AND DISCUSSION

A periodical survey was conducted from November, 2020 to February, 2021 in different crop ecosystems of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. A total of ten species of coccinellid predators belonging to two subfamilies; Chilocorinae Mulsant (1846) and Coccinellinea Latreille (1807) were reported from the surveyed regions. Nine species *viz., Anegleis cardoni* (Weise),*Cheilomenes sexmaculata* (Fabricius),*Coccinella septempunctata* (Linnaeus), *Coccinella transversalis* (Fabricius),*Harmonia dimidita* (Fabricius),*Propylea dissecta*

Table 1: Different species of coccinellid predators reported from different crop ecosystems of Pantnagar

Species reported	Sub family
Anegleis cardoni (Weise)	Coccinellinae
Cheilomenes sexmaculata (Fabricius)	Coccinellinae
Coccinella septempunctata (Linnaeus)	Coccinellinae
Coccinella transversalis (Fabricius)	Coccinellinae
Harmonia dimidita (Fabricius)	Coccinellinae
Propylea dissecta (Mulsant)	Coccinellinae
Micraspis univittata (Hope)	Coccinellinae
Micraspis discolor (Fabricius)	Coccinellinae
Harmonia variegate (Fabricius)	Coccinellinae
Brumoides suturalis (Fabricius)	Chilocorinae

Table 2: Coccinellid species reported from particular crop during 2020 and 2021 and along with their supporting findings

Crops	Month	Coccinellid species observed	Supporting evidence
Wheat	Mid December to starting February	*C. septempunctata* (L.), *C. sexmaculata* (Fab.), *C. transversalis* (Fab.) *P. dissecta* (Mul.) *H. dimidita*	Hossain *et al.* (2000)
Rice	Last November to starting December	*M. discolor* (Fab.).	Shanker *et al.* (2018)
Chickpea	Last November to starting February	*C. septempunctata* (L.), *C. sexmaculata* (Fab.)	Kumar *et al.* (2017); Megha *et al.* (2015)
Mustard	Starting November to starting February	*C. septempunctata* (L.), *C. sexmaculata* (Fab.), *C. transversalis* (Fab.), *H. variegate* (Goeze)	Pal and Bhatt (2018)
Rose	Starting November to starting February	*C. septempunctata* (L.), *C. sexmaculata* (Fab.),	Mahr *et al.* (2010)
Pigeon pea	Starting November to last February	*C. septempunctata* (L.), *C. sexmaculata* (Fab.), *H. dimidita* (Fab.)	Chakravarty *et al.* (2016)
Chrysanthemum	Starting November to last February	*C. septempunctata* (L.), *C. sexmaculata* (F.). *C. transversalis* (F.). *A. cardoni* (Weise), *M. discolor* (Fab.).	Mahr *et al.* (2010)
Cabbage	Mid November to mid-January	*C. septempunctata* (L.), *C. sexmaculata* (F.).	Ali and Rana (2011); Thakur *et al.* (1989); Megha *et al.* (2015)
Cotton	Mid November to mid-January	*C. septempunctata* (L.), *C. sexmaculata* (F.). *B. suturalis* (Fab.)	Khan *et al.* (2006)
Potato	Starting November to last January	*C. septempunctata* (L.), *C. sexmaculata* (F.). *B. suturalis* (Fab.) *H. dimidita* (Fab.)	Megha *et al.* (2015)
Brinjal	Starting November to last February	*C. septempunctata* (L.), *C. sexmaculata* (F.). *M. univittata* (Fab.). *P. dissecta* (M.).	Megha *et al.* (2015)

(Mulsant),*Micraspis univittata* (Hope),*Micraspis discolor* (Fabricius) and *Harmonia variegate* (Fabricius) were identified under subfamily Coccinellinae, while the one species *i.e., Brumoides suturalis* (Fab.) belonged to subfamily Chilocorinae. (Table 1). The wide diversity of coccinellids were found from the different crop ecosystems as wheat, rice, chickpea, mustard, rose, pigeonpea, cabbage, cotton, potato and brinjal (Table 2). Among all the crops, a maximum of six species of coccinellids were recorded in chrysanthemum crop followed by wheat (5 spp.), brinjal, potato, mustard (4 spp. respectively), pigeon pea, cotton (3 sps. respectively), chickpea, rose, cabbage (2 sps. respectively) and rice (1 sps.). Among all the species *C. septempunctata*, *C. sexmaculata*, and *C. transversalis* were found in all the cropping seasons of Pantnagar. They were found to be the dominating species from all the locations of Pantnagar and abundantly present in all the crop ecosystems. These coccinellid species were also recorded by Vinothkumar (2013) during their study in rainfed rice ecosystem of Tamil Nadu. In addition to that *M. discolor* (Fab.) and *C. transversalis* (Fab.) were

also found by Mondal *et al.* (2016) in rice ecosystem of West Bengal. Jat *et al.* (2009) and Megha *et al.* (2015) also reported the presence of *C. sexmaculata* (L) and *C. transversalis* (Fab.) in wheat crop. Chakravarty *et al.* (2016) reported the presence of two coccinellid species i.e., *C. septempunctata* (L.) and *M. sexmaculatus* (F.) from Pantnagar region of Uttarakhand. Mahr *et al.* (2010) also reported two predatory coccinellid beetles *i.e., C. septempunctata* (L.) and *A. bipunctata* (L.) on green house rose and chrysanthemum crop. Hence, due to their wide diversity, these predatory beetles could be utilized in an effective IPM module for the management of sucking pests in different crops.

CONCLUSION

In India, attack of sucking pests has been increased in the past few years in different agricultural crops. Main reasons of this outbreak are introduction of different GM crops and indiscriminate use of insecticides in crop ecosystems. This has led to the development of insect-pests resistance against various insecticides. To overcome their harmful effects, biological control methods are need of the hour. Coccinellid beetles are potential predators as they devour the sucking pests and thus control their population. Hence, these predators offer an environmentally safe alternative of pest management over chemical pesticides and therefore, the utilization of suitable strain of coccinellids for commercial biological control applications is mandatory. Hence, due to their wide diversity, these predatory beetles could be utilized in an effective IPM module for the management of sucking pests in different crops.

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Received: February 26, 2022
Accepted: April 25, 2022