Journal of Biological Control, 33(2): 160-162,2019, DOI: 10.18311/jbc/2019/22828

Research Article

Survey and surveillance of natural enemies in mango ecosystem

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ABSTRACT: Abundance of natural enemies in mango ecosystem was studied through survey and surveillance. In order to record the natural enemies associated with mango ecosystem surveys were conducted in mango orchards in and around Malihabad block of Lucknow for two years. During the study period ten species of coccinellids and two species of chrysopid predators were recorded. The activity of lady bird beetles was noticed in mango orchard during first week of March to last week of March (10 to 13th Standard Meteorological Week (SMW) of 2016). Lady bird beetles, *Coccinella septempunctata, C. transversalis,* and *Menochilus sexmaculata*, were found in abundance and their population counts were taken. Peak populations of coccinellids were observed during 12th SMW with 3.3 adult beetles/panicle. Six species of parasitoids were collected from the mango ecosystem, among them; the most abundant parasitoid was *Brachymeria lasus*, parasitizing mango leaf webber. It was evident that wherever indiscriminate use of insecticides was undertaken, natural enemy population was very low. In unprotected orchards abundant natural enemies were recorded. In order to achieve natural control of the pest it is advised that the orchardists adopt minimal spray may be taken up.

KEY WORDS: Coccinellids, mango, natural enemies

(Article chronicle: Received: 17-08-2018; Revised: 22-03-2019; Accepted: 12-04-2019)

INTRODUCTION

Mango is grown throughout subtropics and tropics. Among the mango producing countries, India holds first rank with 45 per cent share (NHB, 2016). Key challenges for mango production in India are insect pests and diseases. The major insect pests of mango include hoppers, thrips, mealy bugs, midge, leaf webber, scale insects, stem borer and fruit fly (Reddy *et al*., 2018). Insect pest management is very important for the profitable cultivation of mango. Among the insect pest management methods, biological control play crucial role in checking the insect pests under detrimental levels by predators and parasitoids. Exploration of natural enemies in local or in the native region of the pest, or introduction of natural enemies from foreign countries and augmenting them for the pest management can be used as an effective strategy in biological control program (Barratt *et al.,* 2018). The value of biological control often becomes evident when predators and parasitoids are disturbed by spraying of insecticides or weather aberrations (Messing and Brodeur, 2018). Biological control plays an increasing role in the management of fruit pests. There are many ways to improve the biological control of pests of fruit. Decisions for pest spraying should be carefully weighed against the possible effects on predators and parasitoids. These decisions require a better understanding of the complex of natural enemies and the relative abundance of natural enemies.

MATERIALS AND METHODS

Twelve mango orchards of *cv*. Dashehari between 20 and 35 years of age were chosen to monitor natural enemies. Data on natural enemies were recorded weekly from five randomly selected trees in each orchard in four directions of the tree during the vegetative and reproductive phases. Abundance of predators and parasitoids were recorded in the orchards and major natural enemies were collected and brought to lab for the further processing. Parasitiods were identified by Dr. Balaji Rajkumar (trained taxonomist) and many are common natural enemies identified based on the literature and the experience of the authors.

RESULTS AND DISCUSSION

Abundance of natural enemies in mango ecosystem

During the survey and surveillance of the natural enemies in the mango ecosystem, 10 species of coccinellids and two

species of chrysopids were observed. Among the coccinellids most abundant species observed during the survey were *Cheilomenes sexmaculata* and *Coccinella septempunctata.* All the species of predators were found feeding on sucking insect pests of mango like hoppers, mealybugs and scales. Six species of parasitoids were collected from the mango ecosysytem, among them most abundant parasitoid was *Brachymeria lasus* which was parasitizing on the mango leaf webber (Table 1). The predation rate and species diversity of the coccinellid community has also been influenced by plant canopy and existing microclimate (Tooker and Hanks, 2000). This is because different ladybird species have a preference for specific vegetation types combined with adequate food in sufficient quantity.

Population dynamics of coccinellid predators in mango ecosystem

The coccinellide predator population was observed in mango orchard during the 10th to 13th SMW in 2016. Three species of coccinellids viz*., Coccinella septempunctata, C. transversalis,* and *Menochilus sexmaculata* were most frequently observed and their population was recorded. During the 12th SMW, a peak population of coccinellids was observed with 3.3 adult beets/panicle. *Coccinella septempunctata* was the most abundant species (Fig. 1). Inter-specific competition can also influence the relative abundance of coccinellid species. In mango ecosystem it was observed that peak activity of lady beetles coincides with the peak incidence of the insect pest (scale insect, mealy bugs, mango hoppers and thrips) (Choudhary *et al.,* 2014). The maximum incidence of soft bodied insect pests i.e. scales, mealybugs, hoppers and thrips occurs during the reproductive phase of the mango plant that is January to July (Suresh and Kavitha, 2007; Kaushik *et al*., 2012). Coccinellid habitat preference varies seasonally, as changes in microclimatic characteristics affect

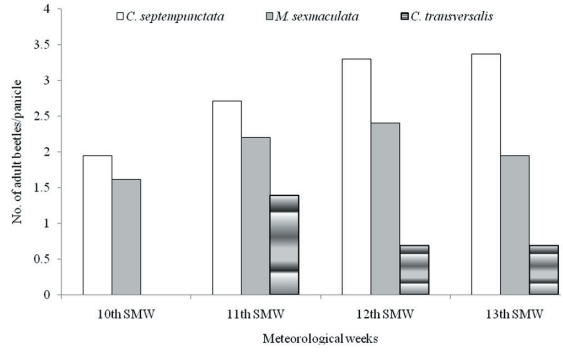

Fig 1. Population dynamics of coccinellids in mango ecosystem.

Table 1. Natural enemies observed in mango ecosystem

Natural enemies	Family	Target pest	Occurrence
Predators			
Brumoides suturalis	Coccinellidae	Hopper	+
Cheilomenes sexmaculata	Coccinellidae	Mealybugs	+++
Coccinella transversalis	Coccinellidae	Hopper	+++
Coccinella septempunctata	Coccinellidae	Hopper	+++
Cryprolaemus montrouzieri	Coccinellidae	Mealybugs and scales	+
Chilocorus nigrita	Coccinellidae	Scales	++
Menochilus sexmaculatus	Coccinellidae	Mealybugs, Hopper	+++
Rodolia fumida	Coccinellidae	Mealybugs	++
Sumnius renardi	Coccinellidae	Mealybugs	++
Scymnus coccivora	Coccinellidae	Scales	+
Chrysopa lacciperda	Chrysopidae	Hopper	++
Mallada boninensis	Chrysopidae	Hopper	++
Parasitoids			
Gonatocerus sp	Mymaridae	Hopper	++
Polynema sp	Mymaridae	Hopper	++
Tetrastichus sp	Eulophidae	Hopper	+
Leptomatix dactylopii	Encyrtidae	Mealybugs	++
Coccidoxenoides peregrines	Chalcidoidea	Mealybugs	++
Brachymaria lasus	Chalcidoidea	Leaf webber	+++

+++ - Abundant; ++ - Moderately abundant: + less abundant

the distribution of prey populations (Hawkeswood, 1987). The occurrence of predatory coccinellids in the ecosystem depends on the prey insect associated with it and in particular on the locality (Rekha *et al.,* 2007).

Abundance of coccinellid beetle population in fixed plots

The observations were recorded on the population of major coccinellids beetles viz., *Coccinella septempunctata, C. transversalis* and *Menochilus sexmaculata* in 12 fixed plots. Among the fixed plots highest numbers of adult coccinellid beetles (116) were recorded in the fixed plot located at Hafizkhera. Among the coccinellid beetles, a total of 360 *C. septempunctata* were captured (Table 2). The occurrence of coccinellid beetles varied according to the time and place. Temporal variation in the coccinellid population was also observed in terms of plant density and the availability of food resources (Thalji, 2005). The peak period of activity (second fortnight of February and first fortnight of March) often coincided with the peak abundance of their prey (scale insect, mealy bugs, mango hoppers and thrips) in mango plant. This links the temporal abundance of coccinellid fauna to the various phenological stages of mango with respect to insect pest's occurrence in the ecosystem (Santos *et al.,* 2010).

Table 2. Abundunce of coccinellid beetles captured across the fixed plots

Fixed plots	Coccinella septempunctata	Menochilus sexmaculata	C. transversalis	Total no. of adult beetles captured	Mean
Malihabad	12	45	23	80	26.7
Navipana	18	23	23	64	21.3
Methe Nagar	13	23	12	48	16.0
Hafizkhera	48	34	34	116	38.7
Mahmood Nagar	47	23	29	99	33.0
Kakori	28	11	21	60	20.0
Ulrapur	46	17	46	109	36.3
Kanar	23	17	21	61	20.3
Nayibasti Dhanewa	21	11	22	54	18.0
CISH BlockIII	25	23	35	83	27.7
CISH BlockII	45	18	12	75	25.0
Allupur	34	25	11	70	23.3
Total no.of adult beetles captured	360	270	289		
Mean	30	22.5	24.08		

Based on the surveys, most abundant species of predator and parasitoid in mango ecosystem were *Coccinella septempunctata* and *Brachymeria lasus*, respectively. It was evident that population was very low in orchards where indiscriminate use of insecticides was undertaken. In comparison to the protected orchards, natural enemies were abundant in unprotected orchards. In order to achieve natural control of the pest it is advised to the orchardists that minimal spray may be taken up.

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