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Laboratory Evaluation Of Coccinella Septempunctata Predation On Aphids And Mealybugs

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Abstract:
A study was done at SRM College of Agricultural Sciences (SRMCAS), Baburayanpettai, to find out if the ladybird beetle Coccinella septumpunctata could eat aphids and mealy bugs in Bhendi crops. In a free-choice test, results revealed that aphids were slightly more preferred (94.5%) than mealy bugs (84.82%), when both were exposed together to adults of Coccinella septumpunctata. In the no-choice test, we fed aphids and mealy bugs individually to Coccinella septumpunctata. The prevalence of mealy bugs was 71.33 percent after 24 hours; however, it increased to 92.00 percent after 96 hours. The overall mealy bug consumption varied from 21.4 ± 0.92 to 25.6 ± 0.67 per day. The mean number of aphids consumed by the predator varied from 24.4 ± 0.97 to 27.6 ± 1.16 per day, and the percent predation was 81.33 percent after 24 hours, and it increased to 92.00 percent after 96 hours.
Keywords: *Coccinella septumpunctata, lady bird beetle, aphid, mealy bug, Bhendi, Coccinellidae*

INTRODUCTION

Over the past thirty years, the insect pest complex of the Bhendi crop in and surrounding SRM College of Agricultural Sciences (SRMCAS) has experienced significant modification for a variety of reasons. Numerous insect species that were once thought to be minor pests are now the cause of many epidemic outbreaks. However, there has been a noticeable decrease in the frequency of certain insect species. Dhawan et al. (2008) assert that the emergence of new insect concerns in multiple locations has severely impacted the sustainability of Bhendi production in the state. In Punjab's Bathinda, F, and Muktsar districts, the mealy bug (Phenacoccus solenopsis (Tinsley)) first appeared on cotton crops in 2006. However, in 2007, the pest spread to other cotton-growing regions of the state and became seriously prevalent, resulting in 30–40% losses in cotton yield (Dhawan et al. 2007). Initially, several Punjabi regions identified this pest as affecting the cotton crop, but by 2007, it had spread to all main cotton-growing districts, causing a 30–40% reduction in cotton yield (Dhawan et al., 2007). Following that, there were reports of its severe occurrence in nine states in the country that grow cotton: Tamil Nadu, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Punjab, Haryana, Rajasthan, and Gujarat (Dhawan et al., 2008, 2007). Significant infestations of this mealybug are currently reported in a variety of weeds, various crops grown for agriculture, and vegetables, including solanaceous, malvaceous, and cucurbitaceous ones (Halder et al., 2013). Brinjal, okra, tomato, chilli, pumpkin, and pointed gourd have experienced significant infestations. Nymphs and adults inflict damage to the plants by sucking the sap from the growth points, depriving them of vigour and eventually leading to their dry out. Furthermore, the secretions of these plants develop black sooty mold, which prevents the plants from photosynthesizing. The seasonal frequency of P. solenopsis on different vegetables and the function of putative natural enemies are poorly understood. During surveys, we observed Gurbs and adults of Coccinella septumpunctata feeding on P. solenopsis. Predators such as Crysoperla carnea (Kaur et al. 2008), Aenasius sp. and Promuscidea unfasciati (Anonymous 2008), and Brumoides suturalis, Scymnus coccivora, and Cheilomenes sexmaculata (Ram et al. 2008) inhabit P. solenopsis in addition to C. septumpunctata. The current study's objective was to determine the relative abundance of several coccinellids that feed on mealy

bugs in the Bhendi environment. It also aimed to determine C. septumpunctata feeding preference and potential on mealy bugs and aphids in a lab setting.

MATERIALS AND METHODS

Relative abundance of Coccinellids on Bhendi:

We conducted weekly random sampling under field conditions to determine the relative abundance of various coccinellid species feeding on Bhendi mealy bugs. Each time, we collected fifty coccinellids from the mealy bug-infested Bhendi field between 9:00 AM and 10:00 AM. We calculated the relative abundance of each species using the proportion of total coccinellids collected.

The acceptance and preference of prey:

We conducted the current study in July 2024 at the Department of Entomology, SRM College of Agricultural Sciences, Baburayanpettai, under laboratory conditions of 25 °C and 70–75 per cent relative humidity. The goal was to ascertain the ladybird beetle's capacity for feeding preference on mealy bugs and aphids using both free choice test and no-choice tests. We removed the adult coccinellids from the field and subjected them to a 24-hour starving period. We simultaneously exposed the adult of C. septumpunctata to both prey species on Bhendi leaves in a petri dish (5 cm diameter) with damp filter paper, using a combination of 15 mealy bug nymphs and 15 aphid nymphs under a free choice test. We observed the variety of prey species that the adult beetle had eaten after 24, 48, 72, and 96 hours. Every 24 hours, we removed leftover mealy bugs and aphids and replaced them with fresh Bhendi leaves containing the same quantity of both prey species to determine the preferred feeding method. The experiment was replicated five times in total. We selected the life stages of the two prey species to be comparable in size, typically the second instar. We evaluated the ladybird beetle's feeding preference by counting the mean number of mealy bug and aphid nymphs ingested out of the total number of prey species (mealy bugs + aphids) presented for predation. We fed 30 aphid nymphs and 30 mealy bug nymphs separately to adults of C. septumpuctata on Bhendi leaves in separate petri dishes (5 cm diameter) with damp filter paper for a no-choice test. The experiment was repeated five times. We observed the adult beetles' eating behavior after 24, 48, 72, and 96 hours. Every 24 hours, we tallied, removed, and replaced the unconsumed aphids and mealy bugs with an equal amount. Based on the remaining aphids and mealy bugs in the petri dish from the total number supplied for the predation, the daily predation and percentage consumption of the ladybird beetle were computed.

RESULTS AND DISCUSSION

Relative abundance of Coccinellids in Bhendi ecosystem: The Figure 1 illustrates the relative abundance of different Coccinellid species. We discovered three distinct species feeding on mealy bugs infesting Bhendi crops: Coccinella septumpunctata, Cheilomenes sexmaculata, and Brumoides suturalis. The most common species among them was C. septumpunctata (83%), followed by C. sexmaculata (25%), and B. suturalis (6%). Ram et al., 2008 reported that these three species also consume mealy bugs in Haryana.

Feeding preference in the free choice test:

In a free-choice test, the adult C. septumpunctata showed a clear preference for aphids over mealy bugs when offered both types of insects simultaneously. Aphid predation ranged from 88.0 to 100%, and mealy bug predation ranged from 77.3 to 93.0%. After 24 hours, 13.20 ±0.66 aphids were devoured; however, C. septumpunctata consumed 11.60 ±0.50 mealy bugs. We observed a similar pattern up to 96 hours after the discharge. Aphids and mealy bugs consumed 14.00 ±0.66 and 12.00 ±0.31 calories per day after 48 hours; 14.60 ±0.40 and 13.40 ±0.50 calories per day after 72 hours; and 15.00 ± 0.44 and 14.00 ±0.70 calories per day after 96 hours, respectively. We have not found any pertinent material to confirm or refute the aforementioned statement regarding ladybird beetle species' preference for aphids and mealy bugs. Aphids may have a soft body, whereas mealy bug females, except for the crawlers, have a white waxy coating on their body surface. However, according to reports, Chrysoperla carnea larvae, a different predatory species, consume more mealy insect crawlers as prey than Corcyra cephalonica eggs (Kaur et al. 2008).

Feeding potential in no choice test:

Table 2 analysis revealed that mealy bug predation was 71.33% after 24 hours, but it rose to 85.33% 96 hours after release. After 96 hours, individuals consumed up to 28 mealy bugs per day, with a minimum of 20 consumed after 24 hours. After 24, 48, 72, and 96 hours, the average daily consumption of mealy bugs was 21.4 0 ± 0.92, 23.2 0 ± 0.66, 24.6 0 ± 0.81, and 25.6 ± 0.67, respectively. Under laboratory conditions in Punjab, Kaur et al. (2008) showed that the predator species Chrysoperla carnea consumed up to 30.79 P. solenopsis crawlers every day. The coccinellid species marginally preferred aphids as prey over mealy bugs, as previously mentioned in the free choice test. The no-choice exam also revealed a similar pattern (Table 2). After 24 hours, the percentage of predation was 81.33 percent, and after 96 hours, it rose to 92.00 percent. After 24 and 96 hours, respectively, the minimum and highest numbers of aphids consumed per day were 23 and 30. After 24 hours, the average amount of aphids eaten by the predator was 24.4 ±1.97 per day; after 48 hours, it was 25.6 ± 0.67 per day; after 72 hours, it was 26.6 ± 0.86 per day; and after 96 hours, it was 27.6 ± 1.16 per day. But the fact that C. septumpunctata eats aphids is in line with what Shera et al. (2010) found. They found that when mealy bugs and aphids were given to an adult Coccinella septumpunctata in a free choice test and no choice test, the aphids were slightly more preferred than the mealy bug.

CONCLUSION:

The current study's conclusion indicates that ladybird beetles are a more favored aphid host than mealy bugs. This study suggests that when a farmer grows Bhendi crop along with yellow flower crops like marigold and sunflower as a boader or intercrop, it attracts natural enemies such as ladybird beetles, Chrysoperla carnea, hoverflies, and numerous others. With ease, they can manage the sucking pest menace in the Bhendi field.

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Table 1. Consumption of mealy bug (Phenacoccus solenopsis) and aphid (Aphis gossypii) by lady bird beetle (Coccinella septumpunctata) in free choice test.

Time period (hrs)	Consumption of prey			
	Mean ± SE		Per cent consumed	
	Aphid	Mealybug	Aphid	Mealy bug
24	13.20 ± 0.66	11.60± 0.50	88.0 (69.70)	77.3 (61.56)
48	14.00 ±0.44	12.00 ± 0.31	93.0 (75.00)	80.0 (63.43)
72	14.60 ±0.40	13.40 ± 0.50	97.0 (80.60)	89.0 (70.93)

96	15.00 ±0.44	14.00 ± 0.70	100.0 (90.00)	93.0 (75.03)
Mean			94.5 (76.43)	84.82 (67.06)

Figures in parenthesis are arcsin transformed values

Table 2. Consumption of mealy bug (Phenacoccus solenopsis) and aphid (Aphis gossypii) by lady bird beetle (Coccinella septumpunctata) in no choice test.

Time period (hrs)	No. of aphid consumed			Per cent consumption	No. of mealybug consumed			Per cent consumption
	Min	Max	Mean ± SE		Min	Max	Mean ± SE	
24	23	28	24.4 ± 0.97	81.33	20	25	21.4±0.92	71.33
48	24	28	25.6 ± 0.67	85.33	21	25	23.2±0.66	77.33
72	25	30	26.6 ± 0.86	89.33	22	27	24.6±0.81	82.00
96	24	30	27.6 ± 1.16	92.00	24	28	25.6±0.67	85.33