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EVALUATION OF THE CONSUMPTION RATES OF DOMINANT COCCINELLID PREDATORS ON APHIDS IN NORTH- EAST BIHAR

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ABSTRACT
The present paper records information on the consumption rate of coccinellid predators on aphids viz *Aphis craccivora, Aphis gossypii, Myzus persicae, and Lipaphis erysimi*. Male and Female *Coccinella septempunctata*, *Coccinella transversalis, Cheilomenes sexmaculata, Micraspis discolor* and *Pulus pyrochilus* have high consumption rate on *Aphis craccivora* (65.6 ± 3.01, 52 ± 4.2), on *Lipaphis erysimi* (57 ± 4.4, 41.25 ± 1.7), on *Aphis gossypii* (57 ± 2.26, 39.5 ± 0.55), on *Myzus persicae* (43.4 ± 0.51, 30.66 ± 0.62) and on *Lipaphis erysimi* (34.75 ± 1.4, 25.2 ± 0.65). It was observed that high consumption rate on nymphs of aphids in comparison to their adults was due to the fulfillment of dietary requirements of these predators from these prey species.

INTRODUCTION

Prey-predator association provides an idea for the understanding of the ecosystem functions. Coccinellid beetles (Coleoptera: Coccinellidae) are important predatory insects found in association with aphids (Hemiptera: Aphididae). Species of Ladybird beetles viz, *Coccinella septempuctata, Coccinella transversalis, Cheilomenes sexmaculata, Micraspis discolor* and *Pulus pyrochilus* collected from leaves and flowers of *Brassica compestris, Brassica juncea, Dolichos lablab, Phaseolus vulgaris* and *Abelmoschus esculentus* infested by *Lipaphis erysimi*, *Myzus persicae*, *Aphis craccivora* and *Aphis gossypii* in the field and considered most common and dominant coccinellid predators in north-east Bihar (Prabhakar and Roy, 2008, 2010). The prey consumption capacity is directly dependent upon their density in the natural habitat (Ramanand and Roy, 2008). The perusal of available literature revealed that the consumption rates by predators is a function of the quantitative and qualitative state of the prey in their ambient habitat. As the density of prey is higher, the predation is maximum. Several species of above mentioned beetles form an important component of biological control program involving scale insects and Aphids (Agarwala and Choudhuri, 1995; Agarwala *et al*., 1998) largely due to their high predatory efficiency (Hodek, 1973). Aphids are the largest phytophagous insect community causing a great economic loss to agricultural crops. It is essential to evolve some eco-friendly, ecologically safe control program for these injurious insects. Considering all these facts in mind the present study on the consumption rates of aphids by some dominant and abundant predators in the field has been undertaken.

MATERIALS AND METHODS

The interactions of Coccinellid predators with aphids of vegetable crops at first observed in natural environment in north Bihar, and then selected species of these predators and some important species of aphids of vegetables have been taken for the study of consumption rates in the laboratory during the period (2006 – 2008). Adult beetles (male and female separately) were reared on nymphs and adult aphids in glass troughs (diameter 8 cms and height 10 cms) containing 100 aphids along with the fresh leaves, and flowers of the respective host plants. The open end of glass troughs were covered with muslin cloth. Prey density (nymphs and adult aphids) was always maintained uniformly and renewed daily for the maintenance of predator population in the laboratory. For evaluating the coccinellids consumption rate, the daily consumption of nymphs and adult aphids by these predators was assessed by counting unconsumed prey population after 24 hrs to know the number of prey consumed. Laboratory observation was conducted at 24 ± 2°C and 67 ± 5% RH. The identification of Coccinellid predators were carried out according to Babu (1991); Omkar and Pervez (1999, 2000).

RESULTS AND DISCUSSION

The prey consumption rates of coccinellid predators have shown in Table 1. It was observed that a sort of differential consumption rates of aphids has been found in these predators. Since predators kill and destroy only moving prey voraciously, the prey (aphids) population were attacked both at nymphal and adult stages uniformly (Table 1). The data

Table 1: Prey consumption rates of different predators within 24 hr (value are expressed in mean ± SD)

S.N.	Name of predators (Female/Male)	Name of prey (aphids)	No. of Prey consumed / 24hrs Nymphs	Adults
1.	*Coccinella septempunctata*	*Aphis craccivora*	65.6±3.01, 52±4.2	58.42±2.1, 47.2±2.9
		Aphis gossypii	59.2±2.3, 46±4.50	47.3±1.21, 39±3.2
		Myzus persicae	61.4±0.85, 49.6±1.22	50.8±2, 41±1.26
		Lipaphis erysimi	63.7± 0.65, 51±2.8	56±2.2, 48.2±0.78
2.	*Coccinella transversalis.*	*Lipaphis erysymi*	57±4.4, 41.25±1.7	47±2.1, 39.3±0.65
		Myzus persicae	52±2.1, 43.4±1.66	42±1.2, 36.4±0.63
		Aphis craccivora	38.5±0.50; 31±1.20	33±2.3; 28.3±0.62
		Aphis gossypii	42±2.2, 33.6±0.8	37.2±0.70, 29±2.1
3.	*Cheilomenes sexmaculata*	*Aphis gossypii*	57±2.26, 39.5±0.55	45.0±1.3, 35.2±0.66
		Lipaphis erysimi	51±2, 37.3±0.71	41±1.60, 31.7±0.80
		Myzus persicae	53.31±0.70, 42.3±0.75	44.5±0.56, 34.0±1.56
		Aphis craccivora	48±1.20, 33.2±1.25	41.3±0.72, 30±2.0
4.	*Micraspis discolor*	*Myzus persicae*	43.4±0.51, 30.66±0.62	35±1.2, 27±1.0
		Lipaphis erysimi	40±1.6, 31±1.22	33.1±0.62, 27.2±0.61
		Aphis craccivora	39.2±1.28, 32±1	30.3±0.77, 25±1.0
		Aphis gossypii	37.4± 0.80, 31±1.56	31.3±0.70, 25.5±1.10
5.	*Pulus pyrochilus*	*Lipaphis erysimi*	34.75±1.4, 25.2±0.65	25.5±0.7, 20.2±2
		Aphis gossypii	26.5±2.4, 21.4±0.8	20.3±1.8, 17±1.0
		Myzus persicae	36.2±1.2, 28.6±0.55	28.3±2.1, 24.1±0.63
		Aphis craccivora	27.8±2.10, 20.5±1.4	23.7±1.1, 19.3±0.57

indicates that *Coccinella septempunctata* have high consumption rate on (Number of Prey/ 24 hr) on *Aphis craccivora* (65.6±3.01, 52±4.2 on nymph, 58.42±2.1, 47.2±2. on adults) in comparison to *Myzus persicae and Lipaphis erysimi* and low on *Aphis gossypi* (59.2±2.3, 46±4.50 on nymph, 47.3±1.21, 39±3.2 on adult). *Coccinella transversalis* have high consumption rate on *Lipaphis erysimi* (57±4.4, 41.25±1.7 on nymph, 47±2.1, 39.3±0.65 on adult) in comparison to *Myzus persicae and Aphis gossypii* and low on *Aphis craccivora* (38.5±0.50; 31±1.20 on nymph and 33±2.3; 28.3±0.62 on adult). *Cheilomenes sexmaculata* have high consumption rate on *Aphis gossypii* (57±2.26, 39.5±0.55 on nymph, 45.0±1.3, 35.2±0.66 on adult) in comparison to *Lipaphis erysimi, Myzus persicae* and low on *Aphis craccivora* (48±1.20, 33.2±1.25 on nymph and 41.3±0.72, 30±2.0 on adult). *Micraspis discolor* have high consumption rate on *Myzus persicae* (43.4±0.51, 30.66±0.62 on nymph, 35±1.2, 27±1.0 on adult) in comparison to *Lipaphis erysimi, Aphis craccivora and* low on *Aphis gossypii* (37.4± 0.80, 31±1.56 on nymph and 31.3±0.70, 25.5±1.10 on adult). *Pulus pyrochilus* have high consumption rate on *Lipaphis erysimi* (34.75±1.4, 25.2±0.65 on nymph, 25.5±0.7, 20.2±2 on adult) in comparison to *Myzus persicae, Aphis craccivora* and low on *Aphis gossypii* (26.5±2.4, 21.4±0.8 on nymph and 20.3±1.8, 17±1.0 on adult).

The aphids and their predators did not always exist concomitantly, predators also existed even in the absence of the aphids indicating that the predators is initially attracted to their prey in the habitat and later to prey proper (Prabhakar and Roy, 2010). Omkar and Bind (1993) recorded that *Coccinella septempunctata* and *Cheilomenes sexmaculata* were the most common and potential predators of aphids. Laboratory observation of present study suggested that consumption rate of coccinellid predators on species of aphids were different, both grubs and adults voraciously feed on aphids. Thus, the entire life cycle of these predators depends on the nymphal and adult stages of these aphid populations in the field.

Some similar observations on the consumption rate of aphids by predators have been reported by the various workers in the past. Rawat and Modi (1969) reported on the carnivorous coccinellid *Nephus regularis* feeding on the striped mealy bugs and it was consumed due to fulfillment of dietary requirement of the predator following consumption of less number of such large sized prey individuals possibly with superior nutritional value. Similarly, Babu (2001) recorded high consumption rate on nymphal stages of *Aphis gossypii* in comparison of adult by *Cheilomenes sexmaculata*. The present investigation were also showed high consumption rate on nymphs of aphids in comparison to their adults due to the fulfillment of dietary requirement of these predators and the consumption rate based on number of prey individuals consumed daily was far greater in female lady bird beetles than male(Roy and Sinha, 2002).

It was pointed out that the dietary requirement of predators has played a major role in the prey consumption rate and concluded that predatory efficiency of *Coccinella transversalis and Menocheilus sexmaculatus* were varied in relation to aphid prey quality (Babu, 1993), it confirms the predatory efficiency of different coccinellid predators of present study. The predatory efficiency depends on: (i) density of prey in the habitat, (ii) size of the prey, (iii) physiological state of the prey, (iv) mobility of the prey, (v) behavioral adjustment and adaptability of prey- predator in same habitat, and (vi) the lack of predator detection mechanisms in prey species. Mechanisms of predator detection by insects may involve tactile, visual or chemical clues and some chemically mediated avoidance in an adaptation used to prey to detect and evade from predators. Such chemicals are semi chemicals emitted from predators normally used by prey to detect a predators presence in the environment and the prey can thereby minimize such encounters (Kats and Dill, 1998).

Thus, depending upon the laboratory observations on the

consumption capacity of coccinellid predators on aphids the present study established a clear picture on their prey preference and high consumption rate on aphids by these predators. Thus it may be concluded that the agricultural fields of vegetable crops should be monitored regularly and should be manipulated for the release of coccinellid predators for minimizing the aphid infestations. The predatory insects are not so important in terms of the number and abundance but ecologically play a key role in the regulation of the animals occupying lower trophic levels of the food chain.

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