



PREDATORY POTENTIAL OF *COCCINELLA SEPTEMPUNCTATA* L. AND *CHEILOMENES SEXMACULATA* FAB. ON *RHOPALOSIPHUM MAIDIS* FITCH

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ABSTRACT

The present investigation were conducted at Entomology department, Guru Kashi University during 2016-2018. The result revealed that the adult stage of both predatory beetles was voraciously feeding large numbers of nymphal and adults aphids. First nymphal stages of corn leaf aphids was most preferred stage as food. Although both predatory beetles was showing great potential as biocontrol agent against Corn leaf aphid, *Rhopalosiphum maidis*. But, *Coccinella septempunctata* was consuming more aphids when compared to *Cheilomenes sexmaculata*.

KEYWORDS: *Coccinella septempunctata*, *Cheilomenes sexmaculata*, *Rhopalosiphum maidis*, Feeding potential

INTRODUCTION

Corn leaf aphid (*Rhopalosiphum maidis* Fitch) belongs to family Aphididae, order Hemiptera was considered for research work. It is most common polyphagous pest known to infest various cereal crops like Maize, Sorghum, Barley and distributed worldwide (Ortega *et al.*, 1980; Carena and Glogoza 2004; Plewa and Panknin-Franczyk 1989; Razmjou and Golizadeh 2010). This Corn leaf aphid serves as a vector of two major viruses, Maize dwarf mosaic virus and Barley yellow dwarf virus (Dicke and Sehgal 1990). Yield losses of Corn due to this aphid infestation from 10-leaf stage to ripening stage were 14.66, 22.9, 35.28 and 36.03 % (Al-Eryan and El-Tabbakh 2004). For management of the aphids, many control methods are available such as cultural, physical, mechanical, biological and chemical control methods (Messelink *et al.*, 2013). Out of these methods, chemical control are most popular among farmers. But continuous usage of chemicals leads to several complications like development of pest resistance, environmental contamination, injurious for non-target organism and sometimes leads to secondary pest outbreak (Cork *et al.*, 2003; Jacobson *et al.*, 1978; Salem *et al.*, 2007; Sarwar 2015 a, 2015 b, 2015 c; Khalid *et al.*, 2015). Many aphids started showing resistance to different insecticides (Devonshire and Field 1991).

To avoid these negative effects, there is a need to use and conserve the non-toxic control measures like use of natural enemies or biocontrol agents (Bellows 2001). Hence, present study was conducted to study the predatory potential of *Coccinella septempunctata* and *Cheilomenes sexmaculata* on *Rhopalosiphum maidis* at Talwandi Sabo.

MATERIALS AND METHODS

The study was conducted during the period 2016 -2018 at Entomology Department, Guru Kashi University, Punjab. The biology and feeding potential of two Coccinellids were studied under laboratory condition on Corn leaf

aphids, *Rhopalosiphum maidis* (Homoptera: Aphidid).

Mass multiplication

a. Corn Leaf Aphid, *Rhopalosiphum maidis* Fab

Heavily infested Barley seedlings with *R. maidis* were collected from Agriculture field. Stock culture of this aphid species was reared under laboratory conditions at 24.3-31.2°C and 48.9-71.7% R.H. Further these aphids were used for feeding potential experiment using different feeding stages of two predatory beetles.

b. *Coccinella septempunctata* L. and *Cheilomenes sexmaculata* L.

Predator stock culture was obtained from agriculture field at Talwandi Sabo. The predatory larva was reared on *R. maidis* at 28±1 °C and 60 ± 5% RH, under a photoperiod of 16:8 (L: D). Ten pairs (males and females) of the each predators (*C. septempunctata* and *C. sexmaculata*) were placed in the container. Fresh twigs with aphids of cereal crops were kept inside the containers for their feeding and egg laying. Covered these containers with muslin cloth for preventing escape of predators. Further different stages of predatory beetles were used for experiment.

Feeding potential of *Coccinella septempunctata* and *Cheilomenes sexmaculata*

Newly emerged larva of each stage and adults of predators were taken individually in the containers. Feeding potential was studied by providing the counted number of aphids on fresh leaves and twigs of barley to individual larva of each predator. Counted number of different stages of *R. maidis* were transferred to the containers having predatory different larval stages or adults for recording their feeding potential. The number of aphids consumed in a day by each larval stage and adult predators was noted. Daily counted number of new aphids were provided. The feeding potential of different stages of predators was recorded as aphids consumed in a day and during the duration of an instar. 10 replications were made for each experiments. The raw data of all the experiment was

transferred in an electronic format on spreadsheet layout and further statistical analysis and graph was prepared using Microsoft excel, 2013.

RESULTS AND DISCUSSION

Studies on biology and feeding potential of *Coccinella septempunctata* and *Cheilomenes sexmaculata* against *Rhopalosiphum maidis*, were conducted at Entomology Laboratory, Guru Kashi University, Talwandi Sabo, Punjab during 2016-2018.

Feeding potential of larvae and adult of *C. septempunctata* on different stages of Corn Leaf Aphid, *Rhopalosiphum maidis*/ day

The result revealed that 1st instar of *C. septempunctata* consumed an average of 11.3±1.63, 11.1±1.72, 10.5±1.58, 8.9±1.19 and 5.1±0.87 (1st, 2nd, 3rd, 4th nymph and

adultstages) Corn leaf aphids/dayrespectively. 2nd instar of *C. septempunctata* consumed an average of 30.7±3.40, 29.7±3.30, 27.3±2.79, 26.6±3.86 and 17.6±1.50 (1st, 2nd, 3rd, 4th nymph and adultstages) Corn leaf aphids/dayrespectively. The 3rd instar of *C. septempunctata* capably consumed 40.8±2.97, 39.2±2.34, 37.9±2.84, 37.6±2.22 and 22.2±1.93 (1st, 2nd, 3rd, 4th nymph and adultstages) Corn leaf aphids/dayrespectively. The 4th instar of *C. septempunctata* capably consumed 55.7±7.58, 54.9±4.99, 54.1±6.43, 48.1±6.24 and 29.8±2.52 (1st, 2nd, 3rd, 4th nymph and adultstages) Corn leaf aphids/dayrespectively. Whereas Adult stage of *C. septempunctata* 75.9±7.38, 74.7±5.73, 73.2±8.31, 69.5±7.04 and 42.2±3.67 (1st, 2nd, 3rd, 4th nymph and adultstages) Corn leaf aphids/dayrespectively (Table 1).

TABLE 1: Feeding potential of larvae stages and adult of *Coccinella septempunctata* on different stages of Corn Leaf Aphid/ day

Different stages of <i>Coccinella septempunctata</i>	Different Stages of <i>Rhopalosiphum maidis</i> (Corn Leaf Aphid)				
	1 st nymph	2 nd nymph	3 rd nymph	4 th nymph	Adult
1 st Larval Stage	11.3±1.63	11.1±1.72	10.5±1.58	8.9±1.19	5.1±0.87
2 nd Larval Stage	30.7±3.40	29.7±3.30	27.3±2.79	26.6±3.86	17.6±1.50
3 rd Larval Stage	40.8±2.97	39.2±2.34	37.9±2.84	37.6±2.22	22.2±1.93
4 th Larval Stage	55.7±7.58	54.9±4.99	54.1±6.43	48.1±6.24	29.8±2.52
Adult	75.9±7.38	74.7±5.73	73.2±8.31	69.5±7.04	42.2±3.67

TABLE 2: Feeding potential of larvae stages and adult of *Cheilomenes sexmaculata* on different stages of Corn Leaf Aphid/ day

Different stages of <i>Cheilomenes sexmaculata</i>	Different Stages of <i>Rhopalosiphum maidis</i> (Corn Leaf Aphid)				
	1 st nymph	2 nd nymph	3 rd nymph	4 th nymph	Adult
1 st Larval Stage	9.4±1.64	8.6±2.6	7.4±1.34	6.7±1.63	4.5±1.08
2 nd Larval Stage	21.9±3.41	20.9±3.07	17.3±2.86	14.4±1.77	9.4±1.57
3 rd Larval Stage	32.6±4.01	27.1±5.54	22.2±2.20	17.5±2.36	11.6±1.83
4 th Larval Stage	44.3±7.27	38.3±3.56	30.5±3.10	24.2±3.82	15.4±1.71
Adult	49.8±7.75	41.2±4.34	33.4±3.13	25.8±3.96	19.3±2.21

TABLE 3: Total Feeding potential of *Coccinella septempunctata* on different stages of Corn Leaf Aphid

Different stages of <i>Coccinella septempunctata</i>	Different Stages of <i>Rhopalosiphum maidis</i> (Corn Leaf Aphid)				
	1 st nymph	2 nd nymph	3 rd nymph	4 th nymph	Adult
1 st Larval Stage	22.9±3.66	21.6±2.22	19.6±1.57	18.9±1.79	9.1±1.10
2 nd Larval Stage	84.1±5.93	83.7±5.45	80.5±4.71	79.5±5.91	48.9±2.80
3 rd Larval Stage	138.2±6.86	136.6±7.64	136.4±8.08	132.5±7.96	93.2±4.84
4 th Larval Stage	205.7±21.47	191.3±17.1	190.2±21.26	187.9±16.12	126.6±5.65
Adult	976.2±90.24	962.2±52.02	926.2±60.06	879.1±35.01	789.6±18.97

TABLE 4: Total Feeding potential of *Cheilomenes sexmaculata* on different stages of Corn Leaf Aphid

Different stages of <i>Cheilomenes sexmaculata</i>	Different Stages of <i>Rhopalosiphum maidis</i> (Corn Leaf Aphid)				
	1 st nymph	2 nd nymph	3 rd nymph	4 th nymph	Adult
1 st Larval Stage	19.1±2.02	18.9±1.91	16.6±1.64	15.4±2.06	8.7±1.25
2 nd Larval Stage	65.7±2.58	60.6±2.67	54.3±3.09	42.6±3.53	29.7±2.40
3 rd Larval Stage	118.6±9.04	103.9±6.98	95.4±5.81	87.2±4.44	57.6±4.11
4 th Larval Stage	177.9±14.73	144.3±7.57	121.9±5.66	105.2±7.84	83.1±4.14
Adult	781.4±17.24	754.9±7.93	733.6±10.45	718.8±12.54	681±17.68

Feeding potential of larvae and adult of *Cheilomenes sexmaculata* on different stages of Corn Leaf Aphid, *Rhopalosiphum maidis*/ day.

The result revealed that 1st instar of *C. sexmaculata* consumed an average of 9.4±1.64, 8.6±2.6, 7.4±1.34, 6.7±1.63 and 4.5±1.08 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids/day respectively (Table 2). 2nd instar of *C. sexmaculata* consumed an average of 21.9±3.41, 20.9±3.07, 17.3±2.86, 14.4±1.77 and 9.4±1.57 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids/day respectively.

The 3rd instar of *C. sexmaculata* capably consumed 32.6±4.01, 27.1±5.54, 22.2±2.20, 17.5±2.36 and 11.6±1.83 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids/day respectively. The 4th instar of *C. sexmaculata* capably consumed 44.3±7.27, 38.3±3.56, 30.5±3.10, 24.2±3.82 and 15.4±1.71 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids/day respectively. Whereas Adult stage of *C. sexmaculata* 49.8±7.75, 41.2±4.34, 33.4±3.13, 25.8±3.96 and 19.3±2.21 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids/day respectively (Table 2).

Total feeding potential of larvae and adult of *Coccinella septempunctata* on different stages of Corn Leaf Aphid, *Rhopalosiphum maidis*

The result revealed that 1st instar of *C. septempunctata* consumed a total average of 22.9±3.66, 21.6±2.22, 19.6±1.57, 18.9±1.79 and 9.1±1.10 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively. 2nd instar of *C. septempunctata* consumed a total average of 84.1±5.93, 83.7±5.45, 80.5±4.71, 79.5±5.91 and 48.9±2.80 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively. The 3rd instar of *C. septempunctata* capably consumed 138.2±6.86, 136.6±7.64, 136.4±8.08, 132.5±7.96 and 93.2±4.84 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively. The 4th instar of *C. septempunctata* capably consumed 205.7±21.47, 191.3±17.1, 190.2±21.26, 187.9±16.12 and 126.6±5.65 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively. Whereas Adult stage of *C. septempunctata* 976.2±90.24, 962.2±52.02, 926.2±60.06, 879.1±35.01 and 789.6±18.97 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively (Table 3).

Total feeding potential of larvae and adult of *Cheilomenes sexmaculata* on different stages of Corn Leaf Aphid, *Rhopalosiphum maidis*

The result revealed that 1st instar of *C. sexmaculata* consumed a total average of 19.1±2.02, 18.9±1.91, 16.6±1.64, 15.4±2.06 and 8.7±1.25 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively. 2nd instar of *C. sexmaculata* consumed a total average of 65.7±2.58, 60.6±2.67, 54.3±3.09, 42.6±3.53 and 29.7±2.40 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively (Table 4). The 3rd instar of *C. sexmaculata* capably consumed 177.9±14.73, 144.3±7.57, 121.9±5.66, 105.2±7.84 and 83.1±4.14 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively. The 4th instar of *C. sexmaculata* capably consumed 205.7±21.47, 191.3±17.1, 190.2±21.26, 187.9±16.12 and 126.6±5.65 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively. Whereas Adult

stage of *C. sexmaculata* 781.4±17.24, 754.9±7.93, 733.6±10.45, 718.8±12.54 and 681±17.68 (1st, 2nd, 3rd, 4th nymph and adult stages) Corn leaf aphids respectively (Table 4). The result also revealed that the adult stage of both predatory beetles was feeding large numbers of nymphal and adults aphids. 1st nymphal stages of aphids was most preferred stage as food. Although both predatory beetles was showing great potential as biocontrol agent against Corn leaf aphid. But, *C. septempunctata* was consuming more aphids when compared to *C. sexmaculata*. On the basis of overall preference of different corn leaf aphid stages by both predatory beetles was 1st nymphal Stages > 2nd nymphal Stages > 3rd nymphal Stages > 4th nymphal Stages > Adult Aphids. *C. septempunctata* grubs and adults of consume about 40-173 aphids daily (Akram *et al.*, 1996, Suhail *et al.*, 1999). Harjit and Deol (1999) observed the mean daily consumption of the aphid, *R. maidis* by adults and larvae of *C. septempunctata* to be 30.4 and 27.7 at 18.6°C and 71 per cent relative humidity. Swaminathan *et al.*, (2016) reported that *C. septempunctata* feeding 18.70 to 22.55 and *C. sexmaculata* feeding either 17.80 to 20.95 or 15.95 to 19.35 aphids. The voracity of *C. septempunctata* increased with the age and predate all stages of aphids (Jindal and Malik 2006, Bilashini and Singh 2009, Singh and Singh 2013). Adults of *C. septempunctata* consume more aphids than grubs (Ali and Rizvi, 2007, 2009). The mean feeding potential of *C. sexmaculata* grub and adult was 26.82±0.59 and 47.13±1.75 aphids per day per individual, respectively (Singh *et al.*, 2008). Choudhary *et al.*, (2017) reported that during whole larval period of *C. septempunctata* the 354.60±15.00 *R. maidis* aphids were consumed. Hence in future the mass production of both predators can be helpful in management of Corn leaf aphids in more ecofriendly ways.

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