International J. Seed Spices 9(1), January 2019:79-84

Development of aphids *Hyadaphis coriandri* (Das), its natural enemies and pollinators on coriander (*Coriandrum sativum* L.)

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Abstract

Coriander (*Coriandrum sativum* L.) is an important seed spice crops belong to family Apiaceae. Rajasthan state cover maximum area and production of coriander in India. An experiment was conducted at NRC on Seed Spices on variety Ajmer Coriander-1 to study development of aphids, predators/parasitoides and pollinators complex at field level over the period of two year. Development of aphids, *Hyadaphis coriandri* (Das) population were recorded on crop form second week of December to March. Maximum population build up of aphids noticed during March month with highest average population (169.2 aphids umbel^{-1}) of both year was observed in 11th standard week.Among natural enemies complex predator Coccinella and aphid parasitoides *Aphidius* spp. was most prominent. There were five species of Coccinella found predating on aphids. Other predators were shryphid fly and *chrysoperla carnea* but their population was noticed at very low numbers. *Aphidius* species was important aphids parasitoides recorded on the crop. Honey bee species, *Aphis florea* constitute major pollinator of coriander crops.

Key words : *Coriandrum sativum* L, *coccinella, hyadaphis coriandri* (Das), natural enemies, pollinators.

Introduction

Coriander (*Coriandrum sativum* L.) occupies top place in term of area, production and export among all seed spice crops in India. The coriander crop attacked by number of insect-pests from vegetative stages to seed maturation in the field. Coriander crop also attracts large number of predators, parasitoides and pollinators due to presence of high quantity of nectar and volatile oil emitted from the plant. Among sucking pests, aphids are most important pests of all seed spice crops and are causing maximum crop losses at field condition and are also responsible for loss of extrinsic and intrinsic value of seed qualities. Globally there are seventy species of aphids has been reported, infesting coriander crop. Coriander is attacked by more than one species of aphids. *Hyandaphis coriandari* is main aphids of coriander and have worldwide distribution. (Jain and Yadava, 1986 and Hodjot and Mossadagh, 1979) *Aphis gossypii, Myzus persicae, Aphis spiraecola*, *Brevicornyne brassicea, Aphis fabae* and *Aphis critricola* has also been reported infesting coriander crops (Santos,1997, Dupas *et al.*,1985, Bostos, 1978). Aphids are major yield reducing factor in most of the seed spices crops. The population start developing on the crop during vegetative stage but heavy population develop during flowering and fruiting stages there by causes significant losses in yield at harvest of the crop. During flowering stage, a population of 55-70 aphids/5 plant could reduce the yield by 50% (Jain and Yadava, 1989). The population of *H. coriandri* in coriander crop at more than 200 aphids/plant can reduce the yield of 2.0 qt ha^{-1} (Jain and Yadava,1986). The maximum multiplication of aphid on coriander has found the temperature existed between 20-25°C (Maximum), 2-6°C (Minimum) and 60-65% relative humidity (Meena *et al.,* 2002).

Materials and methods

The observation on population dynamics of aphids, its natural enemies and pollinators were recorded at field levels during 2010-11 and 2011-12. The coriander variety Ajmer Coriander-1 was sown on 15th of October at NRCSS experimental farm. The coriander crop was given recommended fertilizers input and followed other agronomical practices to raise good crop. The all insects population were recorded since first appearance on crop till last presence. The average number of aphids population were recorded in fields by counting total number of population umbel^{-1} present on the plant. In case of natural enemies population were recorded by counting total number of coccinellieds, syrphid fly and chrysperla larva on plant. In case of parasitoides *Aphidius* sp. total numbers of mummified aphids umbel^{-1} were the plant. The mummified aphids umbel^{-1} were also kept in the laboratory

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for emergence and identification of species. Pollinators population were counted by counting average number of pollinators present umbel^{-1} at 8.00 to 9.00 am. All observation on insect species on the plant was recorded at weekly interval between 9.00 am to 10.00 am. The average number of population were recorded in fields by counting total number of population present on the plants from three location and thus average number was worked out. The selected plants were tagged and all observation were recorded on same plant till the last appearance of the insect. Data recorded on population were analyzed using randomized block design at weekly level for study of population dynamics of different insect pests on the crop.

Results and discussion

The data recorded on prevalence of insect–pests, predators/parasitoides and pollinators on coriander crop was given in Table 1&2. Coriander aphids, *Hyadaphis coriandri* (Das) was major aphid species found infesting on the crop from vegetative growth to early maturity stages on both the year of study. First record of aphid population were noticed during 3rd week of December (51th standard week) during both the year with average population was less than one aphids umbel^{-1}. Development of population on coriander crop was moderate during 1st year of study but heavy population build up observed during 2nd year of study. The population of aphids were raised gradually up to 3rd standard week with no significant difference was observed. However, after 4th standard week the population of aphid increased rapidly and having significant difference in aphid number were observed in each successive standard week till last appearance. The maximum population of aphid during 2010-11 noticed during 9th standard week (32.3 aphids umbel^{-1}) and 10th standard week during 2010-11 (238.7 aphids umbel^{-1}). Maximum population development of aphids on the crop was noticed during March months (Fig.1).

Pareek *et al.*, 2013 recorded maximum aphids population on coriander crop during February month. Aphid population and maximum temperature exhibit positive significant correlation whereas, minimum temperature, relative humidity and rainfall exhibited non–significant correlation. The heavy infestation of aphid on coriander occurred between December to March and causes the loss of more than 50% of yield in unprotected crop (Jain and Yadava, 1989). The crop sown on 30 October showed less aphids infestation and higher yield (9.88qt. ha^{-1}), while crop sown on 20th November attract maximum aphid population and lower yield of 6.33qt. ha^{-1} (Meena *et al.*, 2003). Every 15 days delay in sowing of coriander after 25 October resulted in reduction of yield of 1.75 to 2.01 qt ha^{-1}. (Jain and Yadava 1986).

Natural enemies complex of coriander aphids comprises predators Coccinellids, syrphids and chrysopids larvae, where as *Aphidius* sp. was main parasitoides recorded on the crop. Population build up of coccinellids was low in first year and higher on second year. The first appearance of predator Coccinella species on the crop were noticed in 3rd standard week with average population of less than one beetle plant^{-1}. The growth of beetle population increase with the population development of aphids on crop and reached its peak in 13th standard week with the average population of both year were 3.7 beetle plant^{-1} (Fig.2). Among coccinellids maximum population recorded were comprises of *Coccinella septumpunctata*. Other species recorded were *Hippodamia variegate, Menochelus sexmaculata, Brumoides Suturalis and* Scymnus sp. Other predators were noticed was shryphid fly larva (*Episyrphus* sp.) (Fig.3) and green lace wing (*Chrysoperla carnea*) (Fig.4). The population of theses preadators were very low and action for only three week from 6th to 12th standard week. Aphids parasitoids *Aphidius* sp. was noticed during peak period of aphids population from 7th to 12th standard week and maximum activity recorded during 12th standard week with 8.3 mummified aphids umbel^{-1} (Fig.5). Gupta and Yadav 1986 reported Coccinellieds consist of major predators found feeding on various sucking pests of seed spices. Major coccienellids found preyting on seed spice crops are *Coccinella septempunctata* L.,*Bromoides suturalis* F. *Menochilus sexmaculatus* and *Adonia sp*. Predatory bird myna (*Acridotheres tristis*) was also found feeding on the aphid. Pareek *et al*., (2014) recorded three coccinellid species, viz., *Coccinella septempunctata* L., *Menochilus sexmaculatus* (Fab.) and *Adonia variegata* (Geoze), prey upon *H. coriandri* on coriander crop in Rajasthan, India.

Pollinators population recorded on the crop showed that honey bee consist of major pollinator species visited on the crop (Table-6), another important pollinators were syrphid fly adult (Fig. 7). Other pollinators who also contribute in pollination were coccinellids adult, some dipterans and lepidopterons adult. Among honey bee small be *Apis florea* contribute maximum to the pollination fallowed by *Apis dorasata* and *Apis mellifera*. Bee activities observed from 2nd to 13th standard week with maximum activities of 5.7 bee/umbel/5min during 2011-12. Kant *et al*., 2013 found bee species *Apis florea* play very important role in pollination of different seed spice crop grown in ,arid area of Rajasthan, India.

Table 1. Aphid and its natural enemy complex of coriander crop.

Standard Week	Aphids umbel^{-1}			Coccinellids plant^{-1}			Sryphid fly Larva plant^{-1}			*Chrysoperla carnea Larva* plant^{-1}			Parasitized aphids umbel^{-1}		
	2010-11	2011-12	Average	2010-11	2011-12	Average	2010-11	2011-12	Average	2010-11	2011-12	Average	2010-11	2011-12	Average
49	0.0	0.0	0.0												
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
51	0.3	0.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.3	3.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.3	7.3	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.3	9.0	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.7	5.3	3.0	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	3.0	23.7	13.3	0.0	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	6.3	45.3	25.8	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00
6	13.7	38.3	26.0	0.3	1.0	0.7	0.3	0.0	0.2	0.0	0.3	0.2	0.00	0.00	0.00
7	10.3	67.0	38.6	0.3	1.7	1.0	0.3	0.3	0.3	0.0	1.3	0.7	2.00	0.00	1.00
8	18.7	102.7	60.7	0.7	0.3	0.5	1.0	0.3	0.7	0.3	0.9	0.6	4.00	2.00	3.00
9	32.3	180.7	106.5	0.7	2.7	1.7	1.0	0.7	0.8	0.3	0.9	0.6	4.00	2.66	3.33
10	25.0	238.7	131.8	0.7	2.7	1.7	1.0	0.7	0.8	0.3	0.0	0.2	5.30	5.33	5.32
11	20.0	318.3	169.2	0.3	4.0	2.0	0.0	0.0	0.0	1.0	0.0	0.5	4.60	7.00	5.80
12	11.0	101.3	56.2	0.3	6.3	3.2	0.0	0.0	0.0	0.7	0.0	0.3	1.30	8.33	4.82
13	0.0	56.7	28.3	0.0	7.3	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00
SEM	**0.50**	**2.27**	**1.37**	**0.02**	**0.12**	**0.08**	**0.03**	**0.02**	**0.02**	**0.01**	**0.02**	**0.01**	**0.16**	**0.18**	**0.17**
CD@5%	**1.43**	**6.45**	**3.88**	**0.06**	**0.34**	**0.22**	**0.09**	**0.06**	**0.04**	**0.04**	**0.05**	**0.03**	**0.46**	**0.51**	**0.47**

Table 2. Pollinators population on Coriander crop.

Standard Week	Honey bee Population/umbel/5 minute			Syrphid fly Adult/umbel/5 minute		
	2010-11	2011-12	Average	2010-11	2011-12	Average
49	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.00	0.0	0.0	0.0
51	0.0	0.0	0.00	0.0	0.0	0.0
52	0.0	0.0	0.00	0.0	0.0	0.0
1	0.0	0.0	0.00	0.0	0.0	0.0
2	0.0	2.0	1.00	0.0	0.0	0.0
3	0.0	5.7	2.83	0.0	0.0	0.0
4	0.3	6.0	3.16	0.0	0.0	0.0
5	0.3	4.0	2.17	0.0	0.0	0.0
6	0.3	3.7	2.00	0.3	0.0	0.2
7	0.3	4.7	2.50	0.3	0.3	0.3
8	0.7	5.3	3.00	1.0	0.3	0.7
9	0.7	5.7	3.17	1.0	0.7	0.8
10	0.3	4.0	2.17	3.0	2.0	2.5
11	0.3	2.3	1.33	2.0	3.0	2.5
12	0.0	1.7	0.83	1.0	3.0	2.0
13	0.0	1.0	0.50	0.0	0.0	0.0
SEM	0.01	0.14	0.09	0.09	0.07	0.08
CD@5%	0.04	0.41	0.25	0.25	0.19	0.22

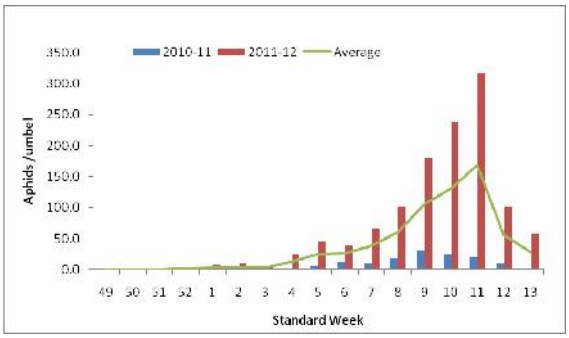

Fig. 1. Development of aphids population in Coriander crop

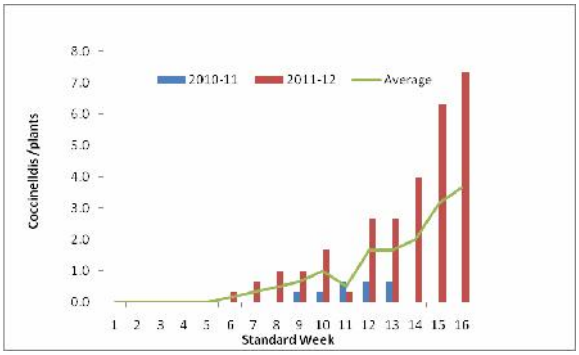

Fig. 2. Coccinellids population on coriander crop.

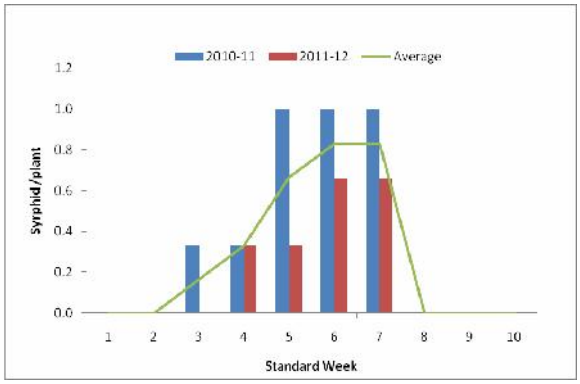

Fig. 3. Syrphid fly larva population on coriander plant.

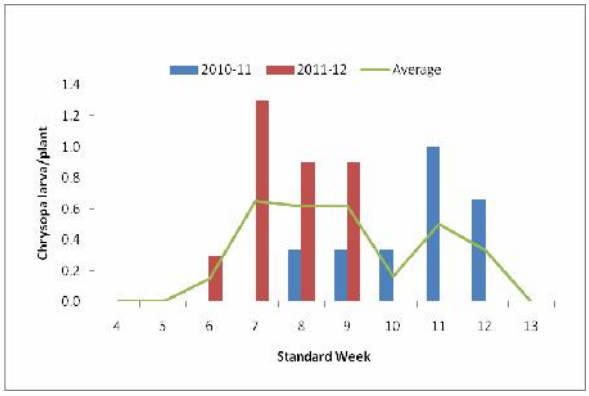

Fig. 4. Chrysoperla larva population on coriander plant.

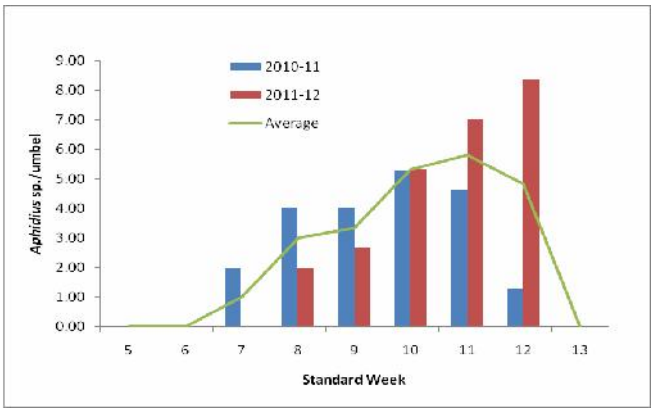

Fig. 5. Aphid Parasitoides (*Aphidius* sp.) population on coriander plant.

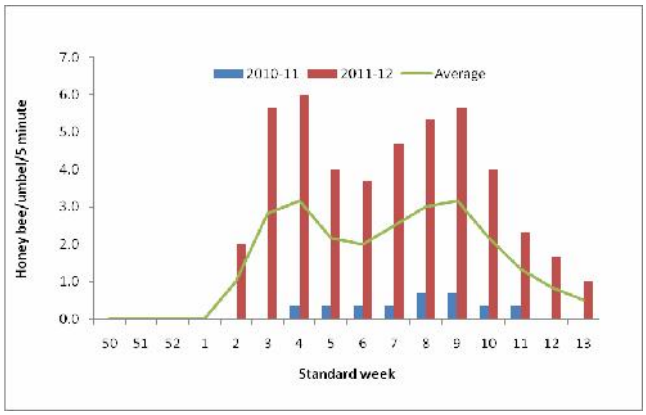

Fig. 6. Honey bee population on coriander plant.

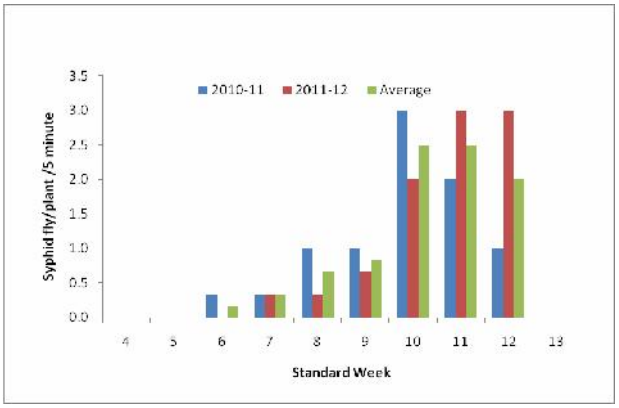

Fig. 7. Syrphid fly adult population on coriander plant.

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Received : November 2018; Revised : December 2018; Accepted : December 2018.