

A Review on Impact of Biotic and Abiotic components on Aphid species infesting in Seed spices

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ABSTRACT: The seed spices constitute an important group of agriculture commodities and play a significant role in our national economy. Several insect pests associated with seed spice crops. Among these pests sucking pests are the largest group and cause maximum damage to the crops in field conditions. Aphids are the major yield limiting factor, as they cause more damage than any other pest on seed spice crop. Aphids populations are govern by many biotic and abiotic factors *i.e.* temperature, rainfall, humidity and natural enemies.

Keywords: Seed spices, Aphids, biotic and abiotic factors.

INTRODUCTION

Spices are important group of horticultural crops in India with its vast geographical area has varied an agro-climatic region which supports the growth of around 63 different spices. Out of which around 21 have commercial importance. They are black pepper, ginger, turmeric, chilli, garlic, small cardamom, large cardamom, coriander, cumin, fennel, fenugreek, ajwain, celery, dill seed, nutmeg, clove, cinnamon, tamarind, saffron, vanilla, curry leaf, mint etc. India is the largest producer of Spices with a production of 106.79 lakh tones from an estimated area of 45.28 lakh ha (Anonymous, 2021). Seed spice crops are grown in arid and semiarid parts of the India. Rajasthan and Gujarat contribute more than 80% of total seed spices production. These states are known as seed spices bowl of India. Seed spices also sown in some other states on considerable areas such as Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Orissa, Punjab, Karnataka and Tamil Nadu. Major seed spices are cumin, coriander, fennel, fenugreek, ajwain, anise, caraway, celery, dill and nigella. Among seed spices, maximum area is under cumin followed by coriander, fennel fenugreek, ajwain, celery, nigella, dill, anise etc. India is the world's largest seed spice producer. It is also the largest consumer and exporter of seed spices. Seed spices contribute about 51.79 % of total area and 19.06 % of production of total spices in the country. The area under seed spices is about 2.07 million hectare and production is about 1.97 million tons (Anonymous, 2021). India is consistent source of seed spices for importing countries worldwide. There has been ever increasing demand of seed spices and importing countries look at India for quality produce of seed spices.

Seed spice crops have been infested large number of insect pests that cause significant losses *viz.*, aphid, *Myzus persicae* (Joshi and Mathur 1967; Araujo *et al.*, 1986); *Orthops compestris* (L.) and *Lygus compestris* (L.) (Korez, 1977); Gram pod borer, *Heliothis armigera* (Judal and Upadhyay 1989), brown wheat mite, *Petrobia latens* (Gupta, 1990), thrips (*Thrips tabaci*, and *Thrips flavus*, (Kanjiya *et al.* 2018). Aphids are the major yield reducing biotic factor because aphids cause more damage than any other pest on seed spice crops.

INCIDENCE OF APHID IN SEED SPICE CROP

More than one species of aphids are found attacking on many seed spice crops. A total number of 5109 species under aphid group has been reported globally out of which 794 species are known to presently in India (Singh & Singh, 2019). Among which *Myzus persicae* (Kant *et al.* 2010), *Hydaphis coriandri* (Hameed *et al.*, 1975; Hodjot and Mossadagh, 1979; Jain, 1984), *Aphis gossypii*, *Brevicornyne brassicea*, *Aphis fabae* are majorly infest seed spices crop as per the various records. *Aphis craccivora* had also been reported infesting in seed spice crop (Bostos, 1978; Dupas *et al.*, 1985; Santos, 1997). Aphid belongs to the family Aphididae of order Hemiptera and suborder Homoptera. Both nymph as well as adult cause's damage to the crop by sucking the cell sap from tender stem, leaves, inflorescence and developing grains and secreting honey dew. Due to their fast multiplication within few days, aphids cover the entire surface of apical shoots and as a result of continuous feeding by such a large population yellowing, curling and subsequent drying of leaves takes place resulting in poor and shriveled seed formation.

Aphid causes serious damage at flowering stage of the crop and decreased the crop yield (Gupta and Yadava

1986). It was also stated that higher losses in yield could be caused by a small number of aphids infesting the crop at the beginning of flowering (Gupta and Yadava 1990) than by large number of aphids at the grain filling stage. Joshi and Mathur, 1967; Kumar, 1976; Lal, 1976; Manohar 1988; Bhadauria *et al.*, 1998; Kumar and Paul 2017; Yadav *et al.*, 2018(a) reported

that the aphid was active from last week of December to harvesting of the crop. Initially population was low but population increased gradually and reached to its peak in last week of February (Bhadauria *et al.*, 1998; Samota *et al.* 2015, Kumar *et al.* 2016) to mid March (Saljoqi, 2009; Sarwar, 2013; Kant, 2019).

Table 1: Major aphid species infesting on seed spices.

Sr. No.	Crop	Major Aphid species	Reference
1.	Cumin, <i>Cuminum cyminum</i>	<i>Myzus persicae</i> (Sulzer)	Yadav <i>et al.</i> (2018)
2.	Coriander, <i>Coriandrum sativum</i>	<i>Hyadaphis coriandri</i> (Das) <i>Myzus persicae</i> (Sulzer) <i>Aphis gossypii</i> Glover	Meena <i>et al.</i> (2017)
3.	Fennel, <i>Foeniculum vulgare</i>	<i>Hyadaphis coriandri</i>	Kanjiya <i>et al.</i> (2018)
4.	Fenugreek, <i>Trigonella foenumgraecum</i>	<i>Aphis craccivora</i>	Kant <i>et al.</i> (2017); Bindhani <i>et al.</i> (2021); Mishra and Pandey (2023)

Populations of aphid are varying according to biotic and abiotic factors and also date of sowing of crop. These are the some biotic and abiotic factors which affect the aphid population in seed spice crop:

1. Effect of date of sowing
2. Temperature
3. Relative humidity and Rainfall
4. Natural enemies

1. Effect of date of sowing on the incidence of aphid:

Aphid populations were highly significant and positive correlated with dates of sowing. Aphid populations were lower in early sown crop than late sown crop (Gupta and Yadava, 1989a; Jain and Yadava 1986; Meena, 1999; Meena *et al.*, 2002; Lekha, 2002; Kumari and Yadav 2004; Bana, 2007; Choudhary *et al.*, 2007; Mishra and Shukla; 2007; Siddqui *et al.*, 2009; Saeed and Razaq 2014; Yadav *et al.* 2018a; Hake *et al.* 2018). Seed yield also increased in early sown crop compared to late sown crop. A negative correlation was recorded between aphid population and seed yield (Singh and Singh 1985; Jain and Yadava 1989; Meena *et al.*, 2002; Bana, 2007; Choudhary *et al.*, 2007; Yadav *et al.*, 2018a; Hake *et al.*, 2018).

2. Effect of temperature: There was a significant negative correlation between maximum temperature and population of aphid (Sarangdevot and Kumar, 2005; Hagag and Hafiz, 1999, Kumawat and Singh, 2008; Pawar *et al.* 2010; Meena *et al.* 2009, Rashid *et al.*, 2009; Melesse and Singh, 2012; Sarwar, 2013; Pareek *et al.* 2013, Samota *et al.*, 2015; Kumar and Paul, 2017; Purti *et al.*, 2017; Yadav *et al.* 2018b; and Swami *et al.*, 2018). Whereas minimum temperature exhibited non-significant negative correlation with aphid population (Hirpara, 2000; Ansari *et al.*, 2007;

Kumawat and Singh 2008; Purti *et al.*, 2017 and Swami *et al.*, 2018).

3. Effect of Relative humidity and Rainfall: Aphid population exhibited significant positive correlation with morning relative humidity. (Hagag and Hafiz 1999; Kumawat and Singh 2008; Purti *et al.*, 2017). The aphid population was negatively correlated with mean relative humidity (Meena *et al.*, 2009). Whereas mean relative humidity showed non-significant negative correlation with aphid population (Naga 2012, Kumar *et al.* 2016).

Rainfall showed non-significant positive correlation with aphid population (Pareek *et al.*, 2013; Kumar *et al.*, 2016; Swami *et al.*, 2018).

4. Effects of Natural Enemies: Many natural enemies (Gopal, 2018) feed on aphid in seed spice crop *i.e.* predator *Coccinella* and aphid parasitoids *Aphidius* spp. was most prominent. There were five species of *Coccinella* found predated on aphids (Kant *et al.* 2019). Major coccinellid found predated on aphids were, *Coccinella septempunctata* L. (Omkar *et al.*, 1997; Meena, 1999; Gupta and Yadava 1989b; Singh *et al.*, 2023), *Bromoides suturalis* F., *Menocephalus sexmaculatus* and *Adoniasp.* Predatory bird myna (*Acridotheres tristis*) was also found feeding on the aphid (Mittal and Butani 1994; Singh, 2007). Other predators were shryphid fly and *chrysoperla carnea* but their population was noticed at very low numbers. These natural enemies were significantly positive correlated with aphid population (Saljoqi, 2009; Varmora *et al.*, 2009; Patel *et al.*, 2011; Samota *et al.*, 2015; Kumar and Paul 2017; Swami *et al.*, 2018; Kanjiya *et al.*, 2018).

Table 2: Different natural enemies on aphids in seed spices.

Sr. No.	Natural Enemies	Types of natural enemies	Order & Family	References
1.	<i>Coccinella septempunctata</i> <i>Coccinella transversalis</i> <i>Cheilomenes sexmaculatus</i> <i>Hippodamia convergens</i>	Predator	Coleoptera: Coccinellidae	Meena <i>et al.</i> (2002); Meena <i>et al.</i> (2009); Kanjiya <i>et al.</i> (2018)
2.	<i>Chrysoperla carnea</i>	Predator	Neuroptera: Chrysopidae	Kant <i>et al.</i> (2019)
3.	Syrphid fly	Predator	Diptera: Syrphidae	Kant <i>et al.</i> (2019)
4.	<i>Aphidius</i> spp.	Parasitoid	Hymenoptera: Braconidae	Kant <i>et al.</i> (2019)

CONCLUSIONS

Seed spices were infested by many insect pests but aphids (*Hyadaphis coriandri* *Myzus persicae*, *Aphis craccivora*, *Aphis gossypii*) were the major insect pest of seed spices and population of these aphid species are governed by many biotic and abiotic components of environment. The biotic component includes natural enemies whereas abiotic component includes temperature, relative humidity and rainfall etc.

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