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Seasonal Incidence of *Hyadaphis coriandari* Das Infesting Fennel and their Correlation with Biotic and Abiotic Factors

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ABSTRACT: The present study entitled "Seasonal Incidence of *Hyadaphis coriandari* Das Infesting Fennel and Their Correlation with Biotic and Abiotic Factors" was carried out under field conditions at the Instructional Farm and in the laboratory of the Department of Entomology, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during the Rabi season of 2021–22. Observations on the seasonal occurrence of *Hyadaphis coriandari* on fennel indicated that aphid infestation began in the third week of February and peaked in the first week of March. A significant positive correlation was found between aphid population and morning relative humidity. Likewise, a significant positive relationship was also observed between the aphid population and the presence of *Coccinella septempunctata.*

Keywords: Fennel, Aphid, *Hyadaphis coriandari*, Seasonal occurrence, *Coccinella septempunctata*.

INTRODUCTION

Fennel (*Foeniculum vulgare* Mill.), a member of the Apiaceae family, is native to Southern Europe, North America, and the coastal Mediterranean regions of India. It is popularly known as 'Variali' or 'Variari' in Gujarati and 'Saunf' in Hindi, and is regarded as an important spice crop. In India, fennel is predominantly cultivated in Gujarat and Rajasthan, with limited cultivation in Uttar Pradesh, Karnataka, Andhra Pradesh, Punjab, Madhya Pradesh, Bihar, Haryana, and Jammu & Kashmir. Gujarat is considered the leading state for fennel production.

As of 2020–21, fennel was cultivated over 80,000 hectares in India, yielding 129,000 metric tonnes annually, with a productivity of 1,687 kg/ha (Anonymous, 2021a). The crop thrives in cool, dry climates with well-drained loamy or sandy soils rich in organic matter. In Rajasthan, major fennel-growing districts include Sirohi, Tonk, Jodhpur, Baran, Pali, Bikaner, Dausa, Alwar, Sawai Madhopur, and Jaipur. The state covered 28.10 thousand hectares under fennel cultivation, producing 29.30 thousand metric tonnes with a productivity of 1,089 kg/ha during 2022–23 (Anonymous, 2022-23b). Fennel seeds are nutritionally rich, containing 9.5% protein, 10.0% fat, 18.5% crude fiber, 42.3% carbohydrates, 13.4% minerals, along with vitamins and volatile oil ranging from 2.17% to 2.60% (Pruthi, 1976).

Several insect pests affect fennel crops, especially sap-sucking insects such as aphids (*Hyadaphis coriandri* Das, *Aphis gossypii*), jassids (*Empoasca kerri*), thrips (*Thrips tabaci*, *Thrips flavus*, *Scirtothrips dorsalis*), Lygus bugs, seed midges (*Systole coriandri*, *Systole* spp.), pentatomid bugs (*Calcoris noregicus*), and fennel flower bugs (*Otinotus bipennis*). Among these, aphids, particularly *H. coriandri*, cause the most damage.

Hyadaphis coriandri, from the family Aphididae, order Hemiptera, and suborder Homoptera, damages the crop in both nymph and adult stages by sucking sap from tender stems, leaves, inflorescences, and developing seeds. They also excrete honeydew, which promotes fungal growth. Rapid population growth enables them to quickly infest apical shoots, leading to leaf yellowing, curling, drying, and the formation of shriveled seeds. According to Meena *et al.* (2011), aphid infestation can cause yield losses of up to 19%. Since aphid populations vary throughout the crop growth cycle, timely foliar sprays are crucial for management. In light of this, the seasonal incidence of aphids on fennel was studied.

MATERIALS AND METHODS

The study on the seasonal incidence of the aphid *Hyadaphis coriandari* was carried out on fennel at the Research Farm and Laboratory of the Department of Entomology, College of Agriculture, Bikaner (Rajasthan) during the Rabi season of 2021–22. The fennel variety RF-143 was sown on October 31, 2021, in a 10 × 10 m² plot with a spacing of 40 cm between rows and 20 cm between plants. All recommended agronomic practices for Zone IC were followed.

Aphid population data were collected from twenty randomly selected and tagged plants. Field observations were made weekly, early in the morning, to monitor aphid occurrence. Once aphids were observed, their numbers were counted from three umbels (lower, middle, and upper) of each plant. Additionally, the population of the coccinellid predator *Coccinella septempunctata* was recorded from the entire plant.

Simple correlation analyses were performed to examine the relationship between aphid population and environmental factors, including maximum and minimum temperatures (°C), average relative humidity (%), and rainfall (mm). The correlation between aphid population and *C. septempunctata* population was also calculated. Data on weather parameters were obtained from the meteorological observatory of the Agricultural Research Station, Swami Keshwanand Rajasthan Agricultural University, Bikaner.

RESULTS AND DISCUSSION

A. Infestation of aphids, H. Coriandrion fennel plants

1. According to the data presented in Table 1, the infestation of fennel aphid *Hyadaphis coriandari* began in the third week of February (8th Standard Meteorological Week, SMW) and remained active throughout the crop season until the first week of April during 2021–22. The initial aphid population was recorded at 9.3 aphids per plant. The population gradually increased week by week, peaking in the first week of March (10th SMW) at 74.4 aphids per plant. Throughout the season, the aphid population ranged between 10.5 and 74.4 aphids per plant. After reaching its peak, the population declined and reached low levels by the 14th SMW, near crop maturity.

2. As shown in Table 1 and Fig. 1, aphid activity commenced in the third week of February (8th SMW), under environmental conditions of 30.2°C maximum and 11.5°C minimum temperatures, along with morning and evening relative humidity of 70.7% and 20.7%, respectively.

Table 1: Seasonal incidence of *H. coriandari* on fennel during *Rabi*, 2021-22.

*SMW**	Period of observations		Temperature (°C)		Relative Humidity (%)		Total Rainfall (mm.)	Aphid population/plant	*C. septempunctata* population/plant
	From	To	Max.	Min.	Morning	Evening			
8	19-2-2022	25-2-2022	30.2	11.5	70.7	20.7	0	9.3	2.4
9	26-2-2022	04-3-2022	28.1	11.1	81.1	28.4	0	23.5	5.7
10	05-3-2022	11-3-2022	32.5	13.9	78.3	24.6	0	74.4	7.4
11	12-3-2022	18-3-2022	40.0	19.1	68.9	15.7	0	56.1	5.6
12	19-3-2022	25-3-2022	39.0	19.0	61.0	15.1	0	40.0	3.9
13	26-3-2022	01-4-2022	41.4	18.8	47.7	7.1	0	15.2	2.9
14	02-4-2022	08-4-2022	43.0	19.9	48.6	8.4	0	9.1	0.48

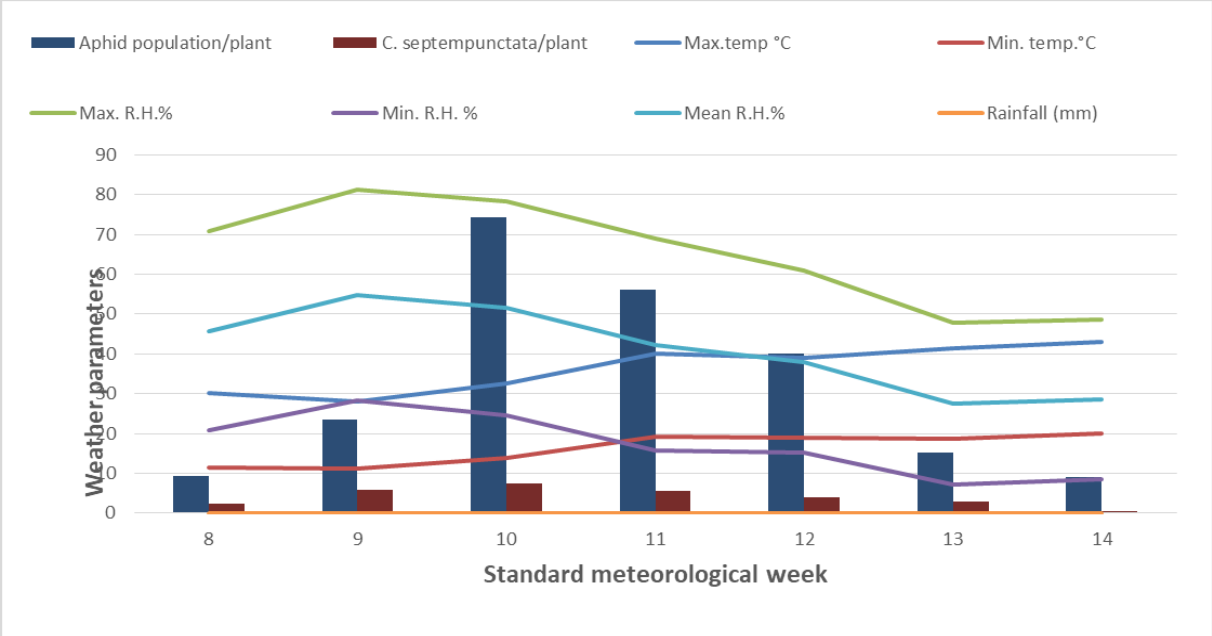

Fig. 1. Seasonal incidence of *H. coriandari* on fennel during *Rabi*, 2021-22.

3. The present findings align with those reported by Patel *et al.* (2011), Purti *et al*. (2017), and Kanjiya *et al.* (2018), who also observed the initial appearance of *H. coriandari* during different weeks of February. However, some studies, including those by Hirpara (2000), Meena *et al.* (2009), Pareek *et al.* (2013), and Swami *et al.* (2018), recorded the aphid's onset as early as January. Contrarily, Kumar and Sagar (1994) noted the presence of *H. coriandari* as early as December on coriander.

4. In the current study, the aphid population peaked during the first week of March, a pattern consistent with findings by Hirpara (2000), Aslam *et al.* (2007), Patel *et al*. (2011), Purti *et al.* (2017), Pareek *et al*. (2013), and Kant *et al*. (2018). Kanjiya *et al.* (2018) reported a broader peak from the second week of February to the third week of March, partially agreeing with the present observations.

5. Aphid populations declined sharply by the third week of March (12th SMW) in this study, similar to findings by Purti *et al*. (2017), who reported a significant drop in aphid numbers after the second week of March on coriander. However, other studies, such as those by Ansari *et al*. (2007) and Rashid *et al.* (2009), reported a much earlier disappearance of the pest—in early March and January, respectively.

B. Correlation between fennel aphids and abiotic factors

During the present investigation, the abiotic factors in the first week of March—namely maximum and minimum temperatures, morning and evening relative humidity, and rainfall—were analyzed for their correlation with *Hyadaphis coriandari* population. The maximum temperature exhibited a non-significant negative correlation with aphid population. This is partially supported by the findings of Singh *et al.* (2007), who reported a significant negative correlation between maximum temperature and aphid incidence.

Minimum temperature showed a non-significant positive correlation during 2021–22, aligning with the findings of Hirpara (2000), Ansari *et al.* (2007), Purti *et al*. (2017), and Swami *et al*. (2018), all of whom also reported non-significant correlations between minimum temperature and aphid populations.

Morning relative humidity showed a significant positive correlation with aphid population in the present study. These results are in agreement with the findings of Purti *et al*. (2017) and Kumawat and Singh (2008), who also observed a significant positive correlation between morning relative humidity and aphid population.

Evening relative humidity showed a non-significant positive correlation, consistent with the findings of Singh *et al.* (2007), Purti *et al*. (2017), and Swami *et al.* (2018), who similarly reported non-significant correlations with evening humidity.

C. Correlation Between Aphid Population and Biotic Factor (Coccinella septempunctata)

A significant positive correlation (r = 0.848) was observed between the population of the coccinellid predator *Coccinella septempunctata* and aphid population. This finding is supported by the work of Kumawat and Singh (2008), Patel *et al.* (2011), Swami *et al*. (2018), and Kanjiya *et al.* (2018), all of whom reported a significant positive relationship between *C. septempunctata* and aphid population in coriander and fennel crops. However, these findings contrast with those of Meena *et al*. (2009), who reported a significant negative correlation between adult coccinellids (and their grubs) and aphid population.

CONCLUSIONS

Peak infestation of *H. coriandari* on fennel was observed during the first week of March. The aphid population showed:

- A **non-significant negative correlation** with maximum temperature,
- A **non-significant positive correlation** with minimum temperature and evening relative humidity,
- A **significant positive correlation** with morning relative humidity,
- A **significant positive correlation** with the predator *C. septempunctata*.

FUTURE SCOPE

The presence of *H. coriandari* poses a significant threat to fennel crops. Therefore, understanding the population dynamics of this aphid species is essential for effective crop protection. Future efforts should focus on forecasting aphid abundance and developing expert systems to support farmers in making cost-effective, timely, and targeted pest management decisions. Forecasting-based approaches have consistently shown to outperform reactive or blanket preventive strategies, typically resulting in moderate to high crop yields.

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Conflict of Interest. None.

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