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Evaluation of different Doses of Nitrogen on the Incidence of *Hyadaphis coriandri* in Fennel

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ABSTRACT: The field experiments was carried out to study the effect of different doses of nitrogen on the incidence of *Hyadaphis coriandri* on fennel at the Research farm College of Agriculture, Swami Keshwanand Rajasthan Agricultural University Bikaner, (Rajasthan) during *Rabi* 2016-17 and 2017-18 by planting fennel variety RF-125. Five levels of Nitrogen, *i.e.* 50, 75, 100, 125 and 150% were applied. Sampling for aphid, *H. coriandari* (Das) was done weekly from last February to end of March. The significant increase in the incidence of aphid, *H. coriandari* has been recorded with increasing application of nitrogenous fertilizers. The maximum incidence of aphid on fennel was observed on 150 % of RDN, while it was minimum with 50 % of RDN and maximum yield was recorded with 100 % of RDN. Highest yield was observed in 100 % RDN whereas, it was minimum was in 50 % of RDN. So in future this could be interesting area for deep study to see the effect of different doses of nitrogen on the incidence of *H. coriandari* in fennel.

Keywords: Fennel, aphid, *Hyadaphis coriandri,* nitrogen and RDN.

INTRODUCTION

Fennel *Foeniculum vulgare* (Miller) is an important spice crop of the family Apiaceae, commonly known as 'saunf' and occupy prominent place among spices in India. In India, It is cultivated in an area of 239.0 thousand ha and having an annual production of 107.0 thousand tonnes with productivity of 2233 kg ha-1 (Anonymous, 2019a). The fennel growing states are Rajasthan, Uttar Pradesh, Madhya Pradesh, Punjab, Bihar and West Bengal. Rajasthan ranks second in both area (30.67 thousand ha) and production (32.29 thousand tonnes) with productivity of 1052 kg ha-1 in the country (Anonymous, 2019b) and contributed 33 % in India. In Rajasthan major fennel growing districts are Sirohi, Tonk, Jodhpur, Baran, Dausa, Pali, Bikaner, Alwar, Swaimadhopur and Jaipur etc.

The seed of fennel contain 9.5 % protein, 10.0 % fat, 18.5 % crude fiber, 42.3 % carbohydrates, 13.4 % minerals and also rich in vitamins and volatile oil ranged from 2.17 to 2.60 % (Pruthi, 1976). The leaves are reported to have diuretic properties, whereas, the root are purgative (ElAwadi and Hassan, 2011; Singh and Singh, 1996). In India, fennel seeds are chewed alone or in betel leaf or in 'paans'. The fennel leaves are use in fish sauces and for garnishing and the leaf stalks are used in salad or as vegetables. It is also used in cosmetic and medicinal preparations like in infantile colic and flatulence. It is considered as a good vermicide against hook- worm and it has insecticidal (Abramson *et al*., 2006; Abramson *et al*., 2007a; Abramson *et al*., 2007b; Hendawy and El- Din 2010; Singh and Singh, 1996) and fungicidal properties (Singh *et al*., 2006).

Insect-pests are one of the major limiting factors for higher production of fennel. Among the insect pests, aphid, *Hyadaphis coriandari* (Das) was reported as a major pest of fennel in Rajasthan and other parts of country.(Bhargava *et al*., 1971; Kanwat, 1988; Jat, 1993; Kumar and Sagar, 1994 and Choudhary, 2006).The brown wheat mite, *Petrobialatens* Muller; thrips, *Thripstabaci* Lindeman; whitefly, Bemisiatabaci (Genn.), Lucerne caterpillar, *Spodoptera exigua* (Hub.), pentatomid bug, *Agnoscalis nubile* F. (Nayer*et al*., 1982; Jain; 1984 and Kanwat,1988); chalcid fly, *Systole albipennis* Walker (Patel *et al*., 1986) thrips, *Thripsflavus* Schr and gram pod bores, *Helicoverpa armigera* Hub have been also reported on fennel crop and were categorized as minor pests.

The aphid, *H. coriandari* belong to the family aphididae of order Hemiptera and sub order Homoptera. Both nymph and adult cause damage 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, aphid 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.

The aphid population is also affected by applied nitrogen levels on fennel; therefore application of higher nitrogen is again problem to emergence of aphid. So the effect of different doses of nitrogen on the incidence of *H. coriandari* in fennel is proposed to be evaluated.

MATERIALS AND METHODS

The study was carried out at the Research Farm and Laboratory of Department of Entomology, College of Agriculture, Bikaner (Rajasthan) during *Rabi* season of 2016-17 and 2017-18. The experiment was laid out in a simple Randomized block design (RBD) with five treatments (50%, 75%, 100%, 125% and 150% of N). The plot size of 3 × 2.4 m^2 with row to row distance of 40 cm and plant to plant 20 cm was maintained. The fennel variety RF-125 was used for the study of incidence of fennel aphid. The recommended dose of nitrogenous fertilizers (90 kg/ha) and full dose of phosphorus (40 kg/ha) and 1/3 dose of nitrogen (30 kg) fertilizers were applied at the time of last ploughing and the rest of the nitrogenous fertilizer was applied through top dressing during first irrigation and second irrigation. Sowing was done in the last week of October, 2016 & 2017. Sprinkler irrigation (seven) irrigations were applied at an interval of 20 days. The first irrigation was applied just after sowing. Thinning was done at 25 days after sowing keeping the plant to plant distance of 20 cm. Number of fennel aphid (*H. coriandari*) was recorded after incidence of aphids, population of aphid was counted from three umbels (lower, middle and upper) each of 10 randomly selected and tagged plants during morning hours at weekly interval. Data were recorded weekly from last February till the end of March. Data were recorded weekly from last February till the end of March.

RESULTS AND DISCUSSION

RF-125 variety of fennel was sown to determine the effect *of different doses of nitrogen on the incidence of H. coriandari on fennel* during two years of *Rabi*, 2016-17 and 2017-18. The data presented in Table 1 & 2 revealed that less application of nitrogen in fennel crop resulted in less number of aphid, *H. coriandari*. The first observation on aphid population was recorded during 7th standard meteorological week (SMW) which was second week of Feb. of 2016-17 and 2017-18. The mean aphid populations were 15.10, 19.13, 24.35, 28.45 & 46.70/plant and 8.20, 10.18, 12.55, 15.10 & 22.85/plant at 50, 75, 100, 125 and 150 per cent of recommended doses of nitrogen (RDN) respectively. Among them the aphid population at 50 & 75 per cent of RDN were at par, 75 & 100 per cent of RDN were at par and 100 and 125 per cent of RDN were at par to each other during 2016-17 & 2017-18. However, aphid population at 150 per cent of RDN differed significantly from other treatments during both the years. The aphid population after first observation increased continuously and reached to its peak in 9th standard meteorological week of 2016-17 and 2017-18.

The mean aphid populations during peak were 47.90, 57.65, 72.70, 87.15 & 120.20/plant and 32.65, 39.53, 50.25, 58.55 & 80.00/plant at nitrogen dose of 50, 75, 100, 125 and 150 per cent of RDN during2016-17 & 2017-18, respectively. Among them the aphid population at 50 & 75 per cent of RDN was at par, 75 & 100 per cent of RDN were at par and 100 and 125 per cent of RDN were at par to each other during 2016-17 & 2017-18. However, aphid population at 150 per cent of RDN differed significantly from rest of the treatments during both the years.

The aphid population after peak started to decline and finally reached negligible at maturity of the crop. The last observation on aphid population was recorded during 13th SMW near maturity of the crop. The mean aphid populations were 4.48, 6.20, 7.70, 9.45 & 13.60/plant and 5.65, 7.00, 9.20, 11.35 & 17.75/plant at nitrogen dose of 50, 75, 100, 125 and 150 per cent of RDN respectively. Among them the aphid population at 50 & 75 per cent of RDN were at par, 75 & 100 per cent of RDN were at par and 100 and 125 per cent of RDN were at par to each other during 2016-17 & 2017-18. However, at 150 per cent of RDN aphid population significantly differed from other treatments during both the years.

Pooled. The pooled data of two years (2016-17 and 2017-18) presented in Table 3 indicated that the aphid population was 11.65, 14.65, 18.45, 21.78 and 34.78/plant in 7th SMW at 50, 75, 100, 125 and 150 per cent of RDN respectively. However, the aphid population at 50 & 75 per cent of RDN was at par, 75 & 100 per cent of RDN were at par and 100 & 125 per cent of RDN were at par to each other whereas, at 150 per cent of RDN, it was significantly differed from rest of the treatments.

The aphid population after 7th SMW increased continuously and reached at the peak in 9th SMW. At peak, the aphid population was 40.28, 48.59, 61.48, 72.85 and 100.10/plant at 50, 75, 100, 125 and 150 per cent of RDN respectively. Among them the aphid population at 50 & 75 per cent of RDN was at par, 75 & 100 per cent of RDN were at par and 100 & 125 per

cent of RDN were at par to each other whereas, at 150 per cent of RDN, it was significantly differed from other treatments. The aphid population after peak started to declined and finally reached negeligible at maturity of the crop. The last observation was recorded at maturity of crop (13th SMW). The mean aphid population was 5.06, 6.60, 8.45, 10.40 and 15.68/plant at 50, 75, 100, 125 and 150 per cent of RDN respectively. The aphid population were 50 & 75 per cent of RDN were at par, 75 & 100 per cent of RDN were at par and 100 & 125 per cent of RDN were at par to each other whereas, at 150 per cent of RDN, it was significantly differed from rest of the treatments. The present finding are in agreement with Khattak *et al*., (1996), Choudhary *et al*., (2001), Gaur and Sharma (2004); Kalra (2006); Fallahpour *et al*., (2015) who recorded the increase in the level of nitrogen application resulted in an increase in the infestation of fennel aphid *H. coriandari.* Tetarwal *et al*., (2012) recorded maximum population of aphid on coriander in plots treated with 150% of RDN followed by 125, 100, 75 and 50% RDN. Avoid excess use of nitrogenous fertilizer. Similar finding was also observed by Tuncturk, (2008) on medicinal and aromatic plants and Megaladevi *et al.,* (2018) on radish. An increase in the level of nitrogen application probably also increases the amino acids content in the plant which prefers more aphid infestation.

Effect of different doses of nitrogen on the seed yield of fennel. The data depicted that seed yield of fennel in different doses of nitrogen ranged from 6.50 to 8.55 and 5.45 to 8.12 q ha^{-1} during 2016-17 and 2017-18, respectively (Table 4). These results indicated that maximum yield 8.55 and 8.12 q ha^{-1} was recorded in the treatment of 100 % of RDN followed by 75 % of RDN recorded 7.60 and 6.82 q ha^{-1} during 2016-17 and 2017-18, respectively. The minimum seed yield of fennel 6.50 and 5.45q ha^{-1} was obtained in the treatment of 50 % of RDN followed 125 % of RDN which gave a seed yield of 7.20 and 6.15 q ha^{-1} during 2016-17 and 2017-18, respectively. The seed yield of fennel6.80 and 5.85 q ha^{-1} was recorded in the treatment of 150 % of RDN during both the years, respectively.

The pooled data of both the years (2016-17 & 2017-18) presented in Table 4 indicated the maximum seed yield of fennel was recorded in the treatment of 100 % of RDN (8.34 q ha^{-1}) and significantly superior over rest of the treatments. It was followed by 75 % of RDN (7.21 q ha^{-1}) and 125 % of RDN and both were at par. The minimum seed yield of fennel was recorded in the treatment of 50 % of RDN (5.98 q ha^{-1}) which were at par with 150 % of RDN (6.33 q ha^{-1}).

A significant positive correlation (r=0.973) was recorded between different nitrogen doses & aphid population which indicated that the aphid population increased with the increase nitrogen doses. The relationship between different doses of nitrogen and seed yield indicated *negeligible* positive correlation and non significant negative correlation (-0.127) between aphid population and seed yield.

Table 1: Effect of different doses of nitrogen on the incidence of *H. coriandari* on fennel during *Rabi,* 2016-17.

Doses of Nitrogen (% of RDN)	Aphid population /plant at different SMW						
	7th	8th	9th	10th	11th	12th	13th
50	15.10 (3.93)*	35.45 (5.96)	47.90 (6.91)	36.65 (6.01)	21.70 (4.70)	9.20 (3.07)	4.48 (2.20)
75	19.13 (4.41)	41.25 (6.46)	57.65 (7.62)	42.15 (6.53)	26.48 (5.19)	11.33 (3.43)	6.20 (2.57)
100	24.35 (4.97)	52.35 (7.26)	72.70 (8.49)	54.75 (7.41)	35.35 (5.94)	13.85 (3.78)	7.70 (2.86)
125	28.45 (5.34)	61.75 (7.84)	87.15 (9.34)	65.10 (8.08)	42.65 (6.55)	15.70 (4.02)	9.45 (3.15)
150	46.70 (6.86)	92.30 (9.63)	120.20 (10.97)	94.00 (9.71)	65.00 (8.07)	23.65 (4.91)	13.60 (3.75)
S.em.±	**0.28**	**0.36**	**0.43**	**0.35**	**0.31**	**0.20**	**0.13**
C.D.at 5 %	**0.87**	**1.10**	**1.32**	**1.09**	**0.94**	**0.62**	**0.39**
CV%	**11.03**	**9.65**	**9.91**	**9.35**	**10.03**	**10.53**	**8.69**

*Figures in parenthesis are √x+0.5 values

Table 2: Effect of different doses of nitrogen on the incidence of *H. coriandari* on fennel during *Rabi*, 2017-18.

Doses of Nitrogen (% of RDN)	Aphid population /plant at different SMW						
	7th	8th	9th	10th	11th	12th	13th
50	8.20 (2.93)*	15.45 (3.96)	32.65 (5.69)	20.25 (4.54)	13.15 (3.69)	9.80 (3.19)	5.65 (2.47)
75	10.18 (3.26)	17.60 (4.24)	39.53 (6.32)	25.45 (5.09)	16.20 (4.08)	12.48 (3.59)	7.00 (2.73)
100	12.55 (3.60)	22.80 (4.80)	50.25 (7.09)	32.10 (5.64)	21.25 (4.62)	15.25 (3.95)	9.20 (3.10)
125	15.10 (3.94)	28.15 (5.34)	58.55 (7.65)	40.65 (6.40)	24.65 (5.00)	18.55 (4.35)	11.35 (3.43)
150	22.85 (4.82)	42.25 (6.53)	80.00 (8.97)	57.25 (7.58)	41.00 (6.41)	28.10 (5.34)	17.75 (4.27)
S.em.±	**0.18**	**0.26**	**0.32**	**0.33**	**0.25**	**0.20**	**0.15**
C.D.at 5 %	**0.55**	**0.79**	**1.00**	**1.03**	**0.78**	**0.62**	**0.48**
CV %	**9.62**	**10.34**	**9.07**	**11.41**	**10.59**	**9.81**	**9.69**

*Figures in parenthesis are √x+0.5 values

Table 3: Effect of different doses of nitrogen on the incidence of *H. coriandari* on fennel during *Rabi*, 2016-17 & 2017-18 (Pooled).

Doses of Nitrogen (% of RDN)	Aphid population /plant at different SMW						
	7th	8th	9th	10th	11th	12th	13th
50	11.65 (3.47)*	25.45 (5.09)	40.28 (6.36)	28.45 (5.35)	17.43 (4.23)	9.50 (3.15)	5.06 (2.35)
75	14.65 (3.88)	29.43 (5.47)	48.59 (7.00)	33.80 (5.86)	21.34 (4.67)	11.90 (3.52)	6.60 (2.66)
100	18.45 (4.35)	37.58 (6.15)	61.48 (7.83)	43.43 (6.63)	28.30 (5.32)	14.55 (3.87)	8.45 (2.99)
125	21.78 (4.71)	44.95 (6.71)	72.85 (8.55)	52.88 (7.30)	33.65 (5.84)	17.13 (4.19)	10.40 (3.30)
150	34.78 (5.94)	67.28 (8.23)	100.10 (10.02)	75.63 (8.71)	53.00 (7.30)	25.88 (5.14)	15.68 (4.02)
S.em.±	**0.19**	**0.26**	**0.30**	**0.23**	**0.26**	**0.13**	**0.09**
C.D.at 5 %	**0.59**	**0.79**	**0.91**	**0.70**	**0.79**	**0.39**	**0.28**
CV%	**8.52**	**8.06**	**7.45**	**6.73**	**9.37**	**6.35**	**5.86**

*Figures in parenthesis are √x+0.5 values

Table 4: Effect of different doses of nitrogen on the seed yield of fennel.

Doses of Nitrogen (% of RDN)	Yield q ha^{-1}		
	2016-17	2017-18	Pooled
50	6.50	5.45	5.98
75	7.60	6.82	7.21
100	8.55	8.12	8.34
125	7.20	6.15	6.68
150	6.80	5.85	6.33
S.Em.±	**0.39**	**0.32**	**0.21**
C.D.at 5 %	**1.19**	**0.97**	**0.63**
CV%	**10.57**	**9.74**	**5.97**

Table 5: Correlation between different nitrogen doses & aphid population, different nitrogen doses & yield and aphid population & yield of fennel.

Sr. No.	Particulars	Correlation coefficient (r)		
		2016-17	2017-18	Pooled
1.	Different nitrogen doses & aphid population	0.972*	0.975*	0.973*
2.	Different nitrogen doses & yield	0.040	0.019	0.028
3.	Aphid population & yield	-0.116	-0.126	-0.127

*Indicated significant positive correlation at 5 % level

CONCLUSION

Five levels of Nitrogen, *i.e.* 50, 75, 100, 125 and 150% were applied. Sampling for aphid, *H. coriandari* (Das) was done weekly from last February to end of March. The significant increase in the incidence of aphid, *H. coriandari* has been recorded with increasing application of nitrogenous fertilizers. The maximum incidence of aphid on fennel was observed on 150 % of RDN, while it was minimum with 50 % of RDN and maximum yield was recorded with 100 % of RDN.

FUTURE SCOPE

The present study was conducted to know the aphid population is also affected by applied nitrogen levels on fennel; therefore application of higher nitrogen is again problem to emergence of aphid. So in future this could be interesting area for deep study to see the effect of different doses of nitrogen on the incidence of *H. coriandari* in fennel.

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Conflict of Interest. None.

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