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Nema Ram

Department of Entomology,
College of Agriculture, Nagaur,
(Agriculture University,
Jodhpur, Rajasthan, India

Ashok Sharma

Department of Entomology,
SKN College of Agriculture,
Jobner, (SKN Agriculture
University, Jobner, Rajasthan,
India

Varietal screening of fennel against chalcid wasp, *Systole albipennis* Walker

Nema Ram and Ashok Sharma

Abstract

Seven fennel varieties were screened for their relative susceptibility against *S. albipennis*. The results of two years data (*Rabi* 2011-12 and 2012-13) indicated that none of the fennel varieties was found completely free from chalcid wasp infestation. The categorization of varieties indicated RF-145 as least susceptible (damage <13.58%), whereas, RF-125, RF-143, RF-178, RF-205 and local cultivar grouped as moderately susceptible (damage 13.58 to 16.92%) and the variety RF-101 as highly susceptible (damage >16.92). The morphological characters and oil content of different fennel varieties were observed to find out their relationship with chalcid wasp damage. The time taken for 50 per cent flowering was positively correlated, while plant height was negatively correlated with chalcid wasp damage. The maximum chalcid wasp damage was recorded in variety with yellow colour flowers and least damage in light yellow coloured flowers variety. The seeds per umbel were negatively correlated with chalcid wasp damage. The oil content in different fennel varieties had significant negative correlation with damage.

Keywords: *Systole albipennis*, fennel, varietal screening, morphological characters, oil content

Introduction

Spices occupy an important place in the lives of people since Vedic and Biblical times and have been considered indispensable in seasoning of food, flavouring of beverages, perfumery, cosmetics and medicines. The lure of spices prompted explorers like Columbus and Vasco de Gama to undertake hazardous sea journey to discover India "the land of spices" [1]. A wide variety of spices are grown in the country including seed spices. Fennel, *Foeniculum vulgare* Miller is an important seed spice crop, mainly grown in the states of Gujarat, Rajasthan and Uttar Pradesh. Fennel is mainly cultivated for its seeds (fruits) which have a pleasing fragrance and a pleasant aromatic taste. It is widely used in various Indian dishes for flavoring soups, sauces, pastries, confectioneries, bread rolls, liquors, meat dishes and in the seasoning of pickles. In India, fennel seeds are chewed alone or in betel leaf. It can be utilized as carminative, diuretic, expectorant and stimulant, antispasmodic and stomachic. It is also used in gastroenteritis, hernia indigestion and abdominal pain. Essential oil extracted from fennel seeds is used for manufacturing cordials and as a fragrant agent in toiletries such as soaps and shampoos [2]. Insect-pests are one of the major limiting factors for higher production of fennel. Among these chalcid or seed wasp, *Systole albipennis* Walker has been reported to occur as a regular pest in Rajasthan and other parts of the country [3-5]. Its damage cause both qualitative and quantitative losses in seed yield of fennel both in fields as well as in storage. A female chalcid wasp lay eggs in the embryo of grain and developing larva feed, pupate inside the grain and adult emerge from the grains by boring a hole, ultimately resulting in both qualitative and quantitative losses besides reducing the germination percentage. It is well known that certain varieties of crop are less attacked by a specific insect pest as compared to others, because of natural resistance. In the cultural practices, currently employed to minimize the losses caused by insect pests, growing of resistance varieties may be one of the most important tool in the management of pest without additional cost. With this view the present studies were carried out.

Materials and Methods

The crop was grown in a simple randomized block design. The seeds of seven fennel varieties were sown in the third week of October in both the years *i.e.*, *Rabi* 2011-12 and 2012-13, each replicated thrice. The plots size was 2 x 2.25 m²

Correspondence**Nema Ram**

Department of Entomology,
College of Agriculture, Nagaur,
(Agriculture University,
Jodhpur, Rajasthan, India

45 cm and 20 cm, respectively at S.K.N. College of Agriculture, Jobner (SKNAU, Jobner, Rajasthan). For this purpose, the crop was left for natural infestation of *S. albipennis*. Five plants were randomly selected from each plot and tagged when the crop was 40 days old. Further nine umbels (three umbels each from upper, middle and lower), from each of the same five tagged plants and were labeled to record the chalcid wasp damage. Total number of seeds/umbel and damaged seeds present on selected umbel were thoroughly checked and counted with the help of magnifying glass (10x). The appearances of black spot or insect exit hole on the seeds were considered as damaged seeds and percent infestation was calculated accordingly. The observations viz., morphological characters (days to 50% flowering, plant height, colour of flowers and seeds per umbel) were recorded during the crop growth from five randomly selected plants. Oil content was estimated after harvest of the crop by using essential oil distillation assembly i.e. Clevenger apparatus [6].

Results and Discussion

Effect of fennel varieties on the infestation of chalcid wasp

Seven fennel varieties were screened for their relative susceptibility against *S. albipennis* for two consecutive rabi seasons (2011-12 and 2012-13). The observations on chalcid wasp damage were recorded from five randomly selected plants just before harvesting of the crop (Table 1 and Fig. 1).

The observations recorded during rabi 2011-12 indicated that none of the fennel varieties was found immune from the attack of *S. albipennis*. The chalcid wasp damage ranged from 12.31 to 17.70 per cent. The maximum infestation of chalcid wasp damage was recorded on RF-101 (17.70%) followed by RF-125 (15.62%) and found to be non-significant. The minimum damage was recorded in RF-145 (12.31%). Varieties RF-178 (13.55%), RF-205 (13.97%), RF-143 (14.20%) and local cultivar (14.65%) had moderate damage and remained statistically at par.

The data revealed a similar trend of chalcid wasp damage in second year as observed in the first year. The highest infestation of wasp damage was recorded on RF-101 (18.53%) followed by RF-125 (17.62%). The minimum damage was recorded from RF-145 (13.84%) followed by RF-178 (14.86%), RF-205 (15.00%), RF-143 (15.50%) and local cultivar (16.14%) all these were proved to have non-significant difference. However, varieties RF-101, RF-125, local cultivar and RF-143; RF-125, RF-143, RF-178, RF-205 and local cultivar were statistically comparable.

The pooled data showed that the minimum chalcid wasp damage of 13.08 per cent was recorded in RF-145 followed by RF-178, RF-205, RF-143 and local cultivar which exhibited 14.21, 14.49, 14.85 and 15.39 per cent chalcid wasp damage, respectively and did not differ statistically. The maximum wasp damage of 18.12 per cent was observed in RF-101 followed by RF-125 (16.62%) and had non-significant difference. Similarly a non-significant difference existed among varieties RF-125, RF-143, RF-178, RF-205 and local cultivar. The variability of resistance in fennel varieties was in the order: RF-101 > RF-125 > local cultivar > RF-143 > RF-205 > RF-178 > RF-145.

The pooled per cent chalcid wasp damage on fennel varieties were categorized on the basis of following formula:

$$\bar{X} \pm \sigma$$

Where, \bar{X} = mean of cumulative per cent chalcid wasp damage (15.25),

σ = Standard deviation (1.67)

The varieties with per cent wasp damage below 13.58, 13.58 to 16.92 and above 16.92 per cent were regarded as less susceptible, moderately susceptible and highly susceptible. Taking the above criterion into consideration, the variety RF-145 was considered as less susceptible, varieties RF-125, RF-143, RF-178, RF-205 and local cultivar as moderately susceptible and the variety RF-101 as highly susceptible [7]. Screened 88 different coriander varieties/cultivars against the infestation of *S. albipennis* and reported that none of the variety/cultivar was found immune. They further revealed that the incidence ranged from 5.84 to 23.75 per cent (season's average), the highest being on JCO-32 and the minimum on DH-13 fully support the present findings. Likewise [8], screened different fennel cultivars/varieties against *S. albipennis* and reported entry JF-192 least susceptible with seven per cent seed damage. Similarly [9], observed fennel cultivar UF-178 as most susceptible whereas cv. HF-33 proved least susceptible. The present results are also tally with the earlier findings of [10], who screened 10 coriander variety/cultivars for their relative susceptibility against *S. albipennis* and found none of them immune.

Incidence of chalcid wasp vis - a - vis morphological characters and oil content in different fennel varieties

Morphological characters

The morphological characters (Table 2) of different fennel varieties viz., days to 50 per cent flowering, plant height, colour of flowers and seeds per umbel were recorded to find out their relationship with chalcid wasp damage. The time taken for 50 per cent flowering ($r = 0.068$) was positively correlated with chalcid wasp damage. The minimum wasp damage (12.31%) was harboured by variety RF-145 and took 111.20 days for 50 per cent flowering, whereas, RF-101 took 115.26 days for 50 per cent flowering and registered maximum 17.70 per cent damage.

The plant height ($r = -0.278$) was negatively correlated with chalcid wasp damage, and the mean plant height of different fennel varieties varied from 106.26 to 143.20 cm. The variety RF-145 had highest plant height (143.20 cm) and registered lowest seed damage (12.31%) whereas, RF-101 had a plant height of 130.10 cm with maximum chalcid wasp damage (17.70%).

The colour of flowers of different fennel varieties varied from yellow, light yellow and lemon yellow. The maximum chalcid wasp damage was recorded in variety with yellow colour flowers i.e. RF-101 and least damage in light yellow coloured flowers variety RF-145.

The seeds per umbel varied from 205.20 to 485.33 seeds and were negatively correlated ($r = -0.513$) with chalcid wasp damage. The highest number of seeds per umbel was recorded in variety RF-145 but had lowest damage. The lowest number of seeds per umbel was recorded in local cultivar with 14.65 per cent seed wasp damage.

Oil content

The oil content varied from 1.65 to 2.90 per cent in different fennel varieties and was significant negatively correlated ($r = -0.758$) with chalcid wasp damage. The highest oil content (2.90%) was recorded in variety RF-145 having lowest

damage (12.31%). The lowest oil content (1.65%) was recorded in variety RF-101 with highest seed wasp damage (17.70%). The result showed an inverse relationship between oil content and seed wasp infestation. However, no such

information on morphological characters and oil content of fennel crop infested by *S. albipennis* is presently available in literature, hence result could not be compared with the findings of the earlier workers.

Table 1: Screening of fennel varieties against *S. albipennis*

S. No.	Varieties	Per cent seed damage*		
		2011-12	2012-13	Pooled
1.	RF-101	17.70 (24.88)	18.53 (25.49)	18.12 (25.19)
2.	RF-125	15.62 (23.28)	17.62 (24.82)	16.62 (24.06)
3.	RF-143	14.20 (22.14)	15.50 (23.18)	14.85 (22.67)
4.	RF-145	12.31 (20.54)	13.84 (21.84)	13.08 (21.20)
5.	RF-178	13.55 (21.59)	14.86 (22.67)	14.21 (22.15)
6.	RF-205	13.97 (21.95)	15.00 (22.79)	14.49 (22.37)
7.	Local	14.65 (22.50)	16.14 (23.69)	15.39 (23.09)
	S. Em±	0.64	0.76	0.68
	C.D. at 5%	1.97	2.33	2.08

* Mean of three replications

Figures in parentheses are angular transformed values

Table 2: Morphological characters and oil content of different fennel varieties and their correlation with chalcid wasp damage

Varieties	Morphological characters				Oil content (%)	Per cent seed damage
	Days of 50% flowering	Plant height (cm)	Colour of flowers	Seeds/umbel		
RF-101	115.26	130.10	Yellow	280.33	1.65	17.70
RF-125	106.40	110.40	Lemon yellow	384.00	2.60	15.62
RF-143	116.50	106.26	Lemon Yellow	283.53	2.21	14.20
RF-145	111.20	143.20	Light yellow	485.33	2.90	12.31
RF-178	115.00	131.13	Light yellow	334.80	2.19	13.55
RF-205	110.33	123.80	Light Yellow	383.46	2.52	13.97
Local	118.00	136.00	Lemon yellow	205.20	2.30	14.65
Correlation coefficient (r) With chalcid wasp damage	0.068	-0.278	-	-0.513	-0.758*	-

Significant at 5% level

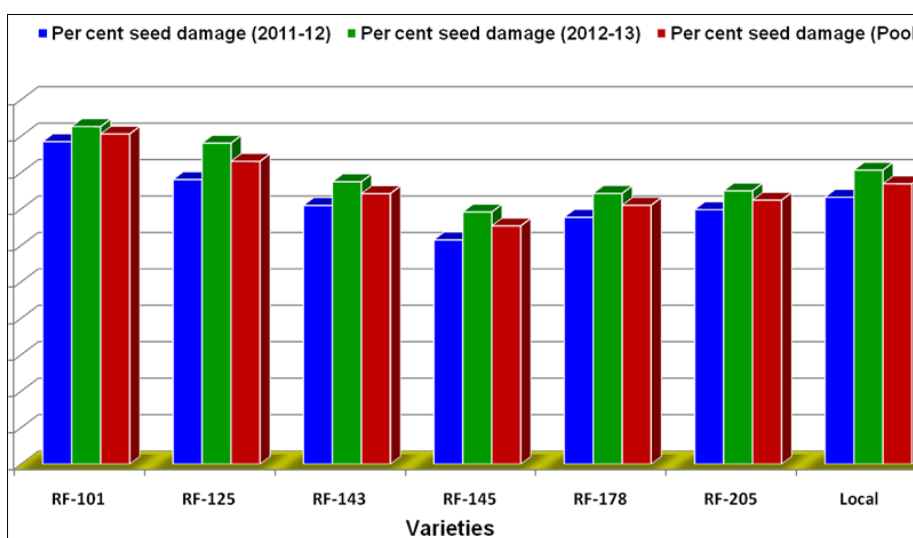


Fig 1: Screening of fennel varieties against *S. albipennis*

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