Influence of management practices on the incidence of *Systole albipennis* Walker in fennel (*Foeniculum vulgare* Mill.) seeds

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ABSTRACT

The chalcid wasp *Systole albipennis* Walker (Hymenoptera : Eurytomidae) was observed as the most important pest of fennel (*Foeniculum vulgare* Mill.) seeds under field conditions in Haryana State, India. Studies on influence of management practices on pest infestation indicated that sowing the crop in December-January resulted in maximum seed infestation (up to 17 per cent) and minimum yields (1.1 q/ha) as against October sown crop which resulted in minimum (4 per cent) seed infestation and higher yields (32 q/ha). Plant population per unit area did not affect wasp infestation, though total yield was significantly affected. The loss of seed weight due to wasp infestation was higher in October sown crop, as seeds from this sowing are well developed and infestation of even a single seed amounts to increased loss of seed weight.

Key words: fennel, *Foeniculum vulgare*, management practices, *Systole albipennis*, yield.

Introduction

Crop plants belonging to Umbelliferae are reported to be damaged by *Systole* species (Hymenoptera: Eurytomidae) from Hungary (Nagy & Tetenyi 1986), Chile (Lamborot Gueriero & Arretz 1986), Iraq (Abdul-Rassoul 1980), Bulgaria (Popov 1979), USSR (Zerova 1970), USA (Roberts 1963; Scott 1972) and India (Verma 1986; Patel *et al.* 1986). In Gujarat State (India) up to 20.7 per cent of fennel seeds were reported to be damaged by *S. albipennis* (Patel *et al.* 1986). In Bulgaria, up to 17 per cent seed infestation was recorded which reduced the value of the seed by 40 per cent (Popov 1979). During agronomic trials with fennel (*Foeniculum vulgare* Mill.) at Hisar (Haryana State, India), seeds of the crop were observed to be infested by larvae of *S. albipennis* (Walker). Since fennel is generally consumed raw, residues of insecticides used for control of this wasp could cause health hazards to the consumer, besides causing environmental pollution. Hence field trials for the management of this

eurytomid was attempted through cultural manipulations.

Materials and methods

The studies were conducted at Vegetable Research Station, Haryana Agricultural University, Hisar (Haryana, India) (29.10°N latitude; 75.46°E longitude; 215 m above MSL) in sandy loam soils. The study was conducted on the promising fennel cultivar 'Hisar Selection I' for two years. During the first year, sowings were started on 10th October and the subsequent five sowings were done at 20 day intervals (D_2 to D_7). The first year's results revealed higher yields on first date of sowing and hence during the subsequent year, the first sowing was advanced to 30th September with four subsequent sowings at 20 day intervals (D_2 to D_5). The last two sowings done during the first year were not repeated in the second year since the yields were greatly reduced on these dates. Three 'row to row' spacings (20, 30 and 40 cm) (S_1 to S_3) were maintained while plant to plant distance was maintained at 20 cm in a plot of 7.2 m^2 (3.0m× 2.4 m). The experiment was laid in a RBD design with four replicates. The main field was fertilized uniformly with 40 kg N and 25 kg P_2O_5 per ha before incorporating sub-plots.

To asses the wasp infestation (per cent) in a plot, a random sample of 25 g was drawn from the total raw seed yield of each plot. The seeds were separated based on presence or absence of exit holes with the help of a multifocus lens (×3) and per cent damage on weight basis was worked out. The weight of unifested (healthy) and infested seeds was recorded and per cent loss of weight per seed calculated. The overall seed yield was also recorded. Based on the per cent seed infestation by the wasp in a 25 g sample, healthy and infested yield was calculated from total yield. The data were subjected to ANOVA test and significance tested at 5 per cent level.

Results and discussion

The incidence of *S. albipennis* in fennel seed (on weight basis) was significantly influenced by date of planting and its interaction with spacing during the first year (Table 1). Minimum infestation (4.4 per cent) was observed on 10th December sowing, though it was at par with all the earlier sown crops viz., 20th November (5.9 per cent), 30th October (5.3 per cent) and 10th October (5.3 per cent). The infestation was maximum (16.5 per cent) in the crop sown on 10th January. Spacing did not affect wasp infestation during both the years. During the second year, neither spacing (range: 4.9 to 5.8 per cent) nor date of sowing (range: 5.2 to 5.9 per cent) had a significant effect on wasp infestation. However, their interaction showed significant effects. Minimum infestation (4.1 per cent) was observed when the crop was sown on D_5 S_1 followed by D_4S_3 (4.2 per cent) during the first year. However, during the second year, D_1S_1 resulted in minimum (3.9 per cent) infestation followed by D_2 S_1 (4.2 per cent). It is evident from the data that higher infestation at D_6 and D_7 during first year were responsible for the significant effects obtained with regard to date of sowing. When the infestation data is examined by excluding D_6 and D_7, the trend in infestation appears similar during both the years. Though there seems to be lack of other such reports on fennel, Popov (1979) reported 17 per cent seed infestation by *S. albipennis* in coriander. Lamborot Gueriero & Arretz (1986) also reported

Table 1. Infestation of fennel seeds by *Systole albipennis* as affected by date of sowing and spacing

Date of planting	Infestation (%)*							
	I Year				II Year			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
30th September	--	--	--	--	3.9(11.0)	6.6(14.2)	5.4(13.5)	5.3(12.8)
10th October	4.4(11.8)	6.3(13.9)	5.1(12.8)	5.3(12.9)	4.2(11.5)	6.5(14.0)	5.0(12.8)	5.9(12.8)
30th October	5.7(13.7)	4.3(11.4)	5.8(13.8)	5.3(13.2)	4.9(12.7)	5.4(13.4)	5.4(13.3)	5.2(13.1)
20th November	6.8(14.9)	6.7(14.4)	4.2(11.6)	5.9(13.7)	5.4(13.5)	4.4(12.0)	5.7(13.7)	5.2(13.0)
10th December	4.1(11.6)	4.3(11.9)	4.8(12.6)	4.4(12.1)	6.3(14.9)	6.1(13.6)	5.3(13.3)	5.9(13.9)
30th December	10.8(18.9)	10.2(18.6)	9.0(18.2)	9.9(18.3)	--	--	--	--
10th January	16.9(23.9)	17.1(24.4)	15.5(22.8)	16.5(27.3)	--	--	--	--
C D at 5 %		(4.07)		(2.35)		(1.57)		(NS)
Mean	8.1(15.7)	8.2(15.8)	7.4(15.3)	7.9(16.3)	4.9(12.7)	5.8(13.4)	5.3(13.3)	5.5(13.1)
C D at 5 %		NS				NS		

* Weight basis

Figures in parentheses are transformed values

Row spacing : S_1 = 20 cm × 20 cm; S_2 = 30 cm × 20 cm; S_3 = 40 cm × 20 cm

that 75 per cent of coriander seeds were infested with a related species, *S. coriandri*.

The total yield was affected significantly ($P<0.05$) by date of sowing as well as spacing during both the years (Table 2). Maximum yields (29.0 q/ha) were recorded from 30th October sowing which was not significantly different from 10th October (27.8 q/ha) sowing during first year. During the second year, 20th November sowing (28.6 q/ha) yielded more than all other treatments, though it was at par with sowings done on 10th (27.2 q/ha) and 30th October (28.5 q/ha), respectively. Drastic reduction in yields were observed in December and January sown crop during the first year. Yields of 20th November and 10th December sowings during first year were adversely affected due to unfavourable climatic conditions just at the beginning of the reproductive phase of the crop. During both the years highest yields were recorded from D_3S_2 sown crop. Increased activity of adult wasps was observed during November and December, which coincided with the early part of flowering period of the crop. Higher infestation was recorded in October sown crop as the crop reaches reproductive phase 90 to 100 days after sowings. Thus, at this sowing, a synchronization between flowering and wasp activity was observed. In the present study, each fennel seed contained a single larva, though in coriander 1-2 individuals were reported by Lamborot Gueriero & Arretz (1986), probably bacause of increased seed size.

Seed weight (per cent reduction) was affected by date of planting and spacing (Table 3). The per cent loss in seed weight was greater in those sowing dates where the yields were higher i.e., October sowing. In December and Janu-

Table 2. Influence of date of planting and row spacing on yield of fennel

Date of planting	Seed yield (q/ha)							
	I Year				II Year			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
30th September	--	--	--	--	24.3	25.2	20.1	23.2
10th October	29.9	28.9	24.6	27.3	28.9	29.1	23.6	27.2
30th October	29.2	35.1	23.4	29.2	29.4	32.0	23.8	28.4
20th November	15.1	14.8	8.4	12.8	30.7	31.8	23.9	28.6
10th. December	9.3	8.2	6.4	8.0	17.6	19.3	15.3	17.4
30th December	1.2	1.2	0.9	1.1	--	--	--	--
10th January	0.8	0.6	0.7	0.8	--	--	--	--
C D at 5 %		5.3		4.9		7.2		6.2
Mean	14.2	14.8	10.7	13.2	26.2	7.4	21.3	24.9
C D at 5 %		2.3				3.3		

Row spacing : S_1 = 20 cm × 20 cm; S_2 = 30 cm × 20 cm; S_3 = 40 cm × 20 cm

Table 3. Effect of management practices on loss of weight in fennel seeds

Date of planting	Loss in seed weight (%)*							
	I Year				II Year			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
10th September	--	--	--	--	62.0(51.9)	69.9(56.7)	63.4(52.8)	65.1(53.8)
10th October	70.4(57.2)	69.0(56.5)	78.8(63.0)	72.3(58.9)	68.2(55.6)	9.2(56.2)	72.1(58.1)	71.3(57.8)
30th October	73.5(59.1)	73.9(60.0)	66.3(54.5)	71.2(57.9)	70.6(57.2)	70.6(57.2)	70.1(56.4)	70.8(57.4)
20th November	66.7(54.4)	66.5(54.0)	67.2(55.1)	66.8(54.5)	72.4(58.3)	73.1(58.8)	65.3(52.2)	68.6(55.8)
10th December	61.0(51.4)	64.4(63.4)	71.3(57.6)	65.6(54.2)	78.3(62.2)	79.1(62.8)	76.9(61.2)	71.8(58.1)
30th December	53.5(47.5)	55.0(47.9)	57.0(49.0)	55.2(48.1)	--	--	--	--
10th January	55.6(48.2)	56.4(48.7)	60.0(50.8)	57.3(49.2)	--	--	--	--
C D at 5 %		(4.60)		(2.6)		(3.9)		(2.1)
Mean	63.4(52.9)	64.2(55.1)	66.8(50.0)	64.7(53.8)	70.3(57.0)	72.3(58.2)	69.5(56.1)	69.5(56.6)
C D at 5 %		(1.7)				(1.3)		

Figures in parentheses are transformed values
Row spacing : S_1 = 20 cm × 20 cm; S_2 = 30 cm × 20 cm; S_3 = 40 cm × 20 cm

ary sown crops, though the infestation was higher (Table 1), the per cent loss was less. The seeds formed in October sowings were fully developed and not shrivelled having less weight as observed in December and January sowings. Thus, infestation of even a single seed in October sown crop amounted to increased loss of seed weight. Patel *et al* . (1986) also reported that grain weight and germinability of infested fennel seed was affected to a great extent by chalcid infestation.

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