



Studies on sex modification with silver nitrate in Kakrol (*Momordica dioica* Roxb)

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ABSTRACT

The present investigation was carried out during kharif season of 2011 to study the effect of different concentrations of silver nitrate on sex modification in Kakrol (*Momordica dioica* Roxb) at College of Horticulture, Venkataramannagudem, A.P. The soil of the experimental plot was medium in available N, low in available phosphorus and fairly high in available potassium. The field experiment was laid out in randomized block design with seven treatments replicated thrice. The treatments comprised of 100, 200, 300, 400 500, 600 ppm silver nitrate and control. Silver nitrate was sprayed on female plants at pre floral stage. Results revealed that spraying of silver nitrate resulted in development of hermaphrodite flowers at 20 to 25 days after spraying. Spraying of silver nitrate at the rate of 600 ppm significantly affected the stamen length and stigma length over other treatments. The lowest stamen and stigma length were recorded with 100 ppm silver nitrate. The yield characters like fruit diameter, fruit stalk length, individual fruit weight, number of seeds per fruit and fruit yield were found to be significant at 500 ppm silver nitrate application.

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INTRODUCTION

Kakrol (spine gourd or teasel gourd) belongs to family Cucurbitaceae having a botanical name *Momordica dioica* Roxb. (2n=28) grows naturally in bushes and jungles. It is one of the popular and delicious summer vegetable grown widely in Bangladesh. Now it has become major vegetable because of high export potential and internal demand in the local market and it is available in the period of April and October. It is dioecious plant where male flower is solitary upto 2.8 cm long and yellow coloured and female flower is solitary, small bract below the middle of the peduncle. It is protein rich vegetable and it costs more than any other vegetables. Though it is having immense export potential, its cultivation is not so common because of its dioecious nature, difficulty in identifying male and female plants before flowering and need to allot 10 % male plants for natural pollination. Several researchers have worked on sex expression of cucumbers and reported that it was genetically determined but could be modified by growth substance application and also environmental factors. An application of plant growth regulators like NAA, GA₃, Silver nitrate, ethrel, cytokinin and ABA played an important role in sex expression, sex ratio and yield. Hence, the present investigation was conducted to study the effect of different concentrations of silver nitrate on sex modification in Kakrol.

MATERIAL AND METHODS

The present investigation was conducted at college farm, college of Horticulture, Venkataramannagudem, West Godavari Dist. during kharif season 2011. The field experiment was laid out in randomized block design with 7 treatments replicated thrice. The treatments comprised of 100, 200, 300, 400 500, 600 ppm silver nitrate and control. The soil was of red sandy loam with good drainage and moderate water holding capacity. The experiment plot was ploughed 2-3 times, harrowed with disc to bring fine tilth. Tubers were sown at a spacing of 2X2 m. A recommended dose of 54:250:83 kg NPK /ha was applied in the form of urea, SSP and MOP along with FYM @ 20 tha⁻¹ as basal dose. Another split dose of 54 kg of nitrogen was applied as top dressing at flowering stage. The crop was irrigated immediately after sowing and

subsequent irrigations were given based on soil moisture condition to maintain optimum soil moisture throughout the crop growth period. The spraying of silver nitrate was done at pre floral (bud initiation) stage. The data on sex modification, vegetative and reproductive characters was recorded and subjected to statistical analysis.

RESULTS AND DISCUSSION

Days to hermaphrodite flower development:

Pre floral application of silver nitrate at different concentrations resulted in modification of female flowers on female plant into a hermaphrodite flower. Data presented in Table 1 revealed that more number of days for hermaphrodite flower development (21.70) was observed with the application of silver nitrate at 600 ppm and was found to be on par with the other treatments. This may be due to inhibitory action of silver nitrate on endogenous level of ethylene results in inducing the male sex in genetically female plant. This is in accordance with the findings of (1) and (3). No hermaphrodite flower was observed in control.

Effect of silver nitrate on calyx, stamen and stigma length

Perusal of data presented in table 1 revealed that calyx length, stigma length and stamen length at 8th and 10th day after spraying were significantly influenced by different concentrations of silver nitrate. Gradual decrease in calyx length was noticed from 8th day to 10th day after spray. The calyx length was increased with increasing concentration of silver nitrate. The highest calyx length of 1.47 cm and 1.27 cm was recorded with the application of silver nitrate at 500 ppm at 8th and 10th day respectively. Among different concentration of silver nitrate, minimum calyx length was observed with silver nitrate at 100 ppm. Higher concentrations of silver nitrate also exhibited senescence and wilting of vines so that at 600 ppm of silver nitrate, the calyx length was less when compared to 500 and 400 ppm silver nitrate applied plants. These findings are in conformity with findings of (2) in pointed gourd. Prefloral application of silver nitrate induced stamens in female flowers. The stamen length and stigma length of hermaphrodite flowers were varied with different concentrations of silver nitrate. The stamen and stigma length of hermaphrodite flower was more than that of normal male and female flowers. The length of stamen and stigma at 300 ppm silver nitrate application was on par with normal flowers. This may be due to the action of silver ions on internal ethylene levels is negligible at this concentration. However, highest stamen (7.80 mm) and stigma lengths (8.20 mm) were recorded at 8th day after spraying of 600 ppm silver nitrate. Spraying of silver nitrate at 100 ppm recorded lowest stamen length and no stamen was observed in control treatment (Table 1). These results were in accordance with the work done by Hoque *et al.* [2] in pointed gourd.

Effect of silver nitrate on fruit characters

The data presented in Table 2 revealed that fruit characters *viz.*, fruit diameter, stalk length, number of seeds per fruit and fruit yield were significantly influenced by different silver nitrate concentrations.

Fruit diameter:

The maximum fruit diameter of 4.76 cm was recorded with the application of silver nitrate at 500 ppm followed by silver nitrate 400 ppm and silver nitrate 300 ppm. Minimum fruit diameter of 5.83 cm was recorded with 100 ppm silver nitrate application.

Fruit stalk length:

Application of silver nitrate at 500 ppm registered maximum fruit stalk length of 7.47 cm followed by 400 ppm and 300 ppm. The minimum fruit stalk length (5.83 cm) was recorded at 600 ppm silver nitrate.

Individual fruit weight:

Data presented in Table 2 revealed that the individual fruit weight (32.90 g) was highest with the application of silver nitrate at 500 ppm followed by silver nitrate 400 ppm and silver nitrate 300 ppm. Minimum fruit weight of 20.50 g was recorded with 100 ppm silver nitrate application. Highest fruit weight at 500 ppm was due to the availability of pollen grain just beside the stigma and it was noticed that the stamen and stigma were at equal length. In normal female flower, the pollen grain availability was obviously poor and fruit set depends upon the pollinating agents. The similar findings were observed in *Momordica cochinchinensis* by [5].

Number of seeds per fruit:

Highest number of seeds per fruit (32.60) was recorded with 500 ppm silver nitrate application followed by 400 ppm and control. The minimum number of seeds (26.46) was recorded at 100 ppm silver nitrate application. The seeds were increased as the concentration was increased, this may be due to that pollen might fertilize maximum number of ovules in the 500 ppm and 400 ppm concentrations. Similar findings were reported by [6] in borage.

Fruit yield:

Application of silver nitrate at 500 ppm recorded highest fruit yield per hectare (32.90 kg ha⁻¹) followed by 400 ppm (29.66 kg ha⁻¹) and 300 ppm (26.86 kg ha⁻¹) the lowest yield of 20.50 kg ha⁻¹ was obtained with 100 ppm silver nitrate application. As the maximum flowers were modified into hermaphrodite, highest yield was recorded with 500 ppm silver nitrate. The proportion of induced hermaphrodite flowers on female plants was highest when treated with 500 ppm silver nitrate while the minimum was recorded with 100 ppm silver nitrate. The results were in accordance with the findings of (1) and (4).

Table 1: Effect of different concentrations of silver nitrate on sex modification in Kakrol

Treatments	Hermaphrodite flower development (DAS)	Calyx length (cm)		Stamen length (cm)		Stigma length (cm)	
		8 th DAS	10 th DAS	8 th DAS	10 th DAS	8 th DAS	10 th DAS
100 ppm AgNO ₃	21.51	0.90	0.84	4.20	5.40	5.33	6.20
200 ppm AgNO ₃	21.64	1.12	0.98	5.46	6.26	5.80	6.80
300 ppm AgNO ₃	21.58	1.25	1.10	5.93	6.53	6.53	8.00
400 ppm AgNO ₃	21.68	1.33	1.15	6.60	7.20	7.06	8.60
500 ppm AgNO ₃	21.67	1.47	1.27	7.20	8.20	7.73	9.13
600 ppm AgNO ₃	21.70	1.03	0.90	7.80	8.60	8.20	9.73
Control	0.00	0.16	0.16	0.00	0.00	6.27	7.86
SEm.±	0.298	0.018	0.015	0.102	0.100	0.091	0.132
C. D at 5 %	0.927	0.050	0.040	0.317	0.310	0.280	0.410

DAS: Days after spraying

Table 2: Effect of different concentrations of silver nitrate on fruit characters and yield of Kakrol

Treatments	Fruit diameter (cm)	Fruit stalk length (cm)	Individual fruit weight (g)	Number of seeds per fruit	Fruit yield (kg ha ⁻¹)
100 ppm AgNO ₃	3.43	6.07	20.50	26.46	20.50
200 ppm AgNO ₃	3.83	6.32	23.50	27.80	23.40
300 ppm AgNO ₃	4.09	6.52	27.03	28.80	26.86
400 ppm AgNO ₃	4.46	6.93	29.66	30.46	29.66
500 ppm AgNO ₃	4.76	7.47	32.90	32.60	32.90
600 ppm AgNO ₃	3.91	5.83	23.33	27.46	23.33
Control	4.08	6.51	27.00	28.93	26.66
SEm.±	0.085	0.061	0.36	0.260	0.329
C. D at 5 %	0.26	0.18	1.14	0.81	1.024

CONCLUSION

Pre floral application of silver nitrate induced hermaphrodite flowers in Kakrol. Silver nitrate applied at 600 ppm registered maximum length of stamen and stigma. But other fruit characters like individual fruit weight, fruit stalk length and fruit diameter were recorded highest at 500 ppm silver nitrate application. This was mainly due to wilting and scorching effect of vegetative parts at higher concentrations of silver nitrate. Highest fruit yield was also recorded at silver nitrate 500 ppm concentration.

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