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Effect of Cephalexin on Sex Expression, Fruit Development and Yield of Cucumber (*Cucumis sativus* L.)

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Abstract: Experiment was carried out to investigate the effect of cephalexin on sex expression, fruit setting, fruit development and yield of cucumber. Cucumber was grown in the field at natural condition and treated with cephalexin solutions of 0,12.5, 25, 50, 75 and 100 ppm at seedling stage (2-true leaf stage). Data were collected on number of male flowers/plant, number of female flowers/plant, number of fruits/plant, days to first male flowers, days to first female flowers, % fruit setting, fruit size, fruit weight and fruit yield/plant. The results revealed that foliar application of cephalexin changed the growth habit of cucumber reducing the vegetative phase and extending flowering phase of the plant. The lowest vegetative phase (30.3 days) and the highest reproductive phase (65 days) was found in the plants treated with 50 ppm cephalexin. It suppressed the production of male flowers but increased the number of female flowers thereby subsiding the ratio of male to female flowers. Cephalexin significantly increased the fruit setting over control with the highest (68.7%) in 50 ppm. It also increased the fruit length, girth, weight and ultimately total yield/plant by 48.0, 55.0, 52.6 and 172.2%, respectively, in 50 ppm treatment.

Key words: Cephalexin, sex expression, fruit setting, yield, cucumber

Introduction

Cucumber (*Cucumis sativus* L.) is one the most popular and extensively cultivated vegetables in Bangladesh as well as in other parts of the world. The fruits of cucumber are eaten both as salad and as cooked vegetables.

The cucumber is a monoecious cucurbit bearing male and female flowers on the same plant. This plant possesses four distinct phases in its life. The phases are long vegetative phase followed by a male phase when only male flowers are produced. Next phase is a long mixed phase when male and female flowers appear together. The last phase of growth is abortive phase when the female flowers become abortive. Fruits are formed from female flowers only in the mixed phase.

Different synthetic growth regulators have been proved to increase the yield in cucumber by manipulating its sex expression and fruit development (Sinha and Mandal, 2000; Rafeekher *et al*., 2001; Al-Masoum and Al-Masri, 1999; Ogawa *et al*., 1989). The antibiotic also can alter the sex expression and fruit development in cucurbits (Basu *et al*., 1996; Das *et al*., 1997; Das and Basu, 1997).

Cephalexin, a derivative of cephalosporin, is a β-lactum antibiotic which is used against bacterial infection. It modified the reproductive phase of *Momordica charantia* (Das *et al*., 1997) and of *Luffa acutangula* (Das and Basu, 1997) suppressing male flowering and promoting female flowering, fruit setting and development and ultimately led to higher yield. Therefore, this study was conducted to investigate the effects of exogenous application of cephalexin on sex expression, fruit setting, fruit development and yield of cucumber under Bangladesh conditions.

Materials and Methods

The experiment was conducted at the Field Laboratory of Department of Crop Botany, Bangladesh Agricultural University, Mymensingh, Bangladesh during the period from April to July, 2001. The experiment was laid out in a randomized complete block design (RCBD). Six concentrations of cephalexin solution viz., 0, 12.5, 25, 50, 75 and 100 ppm, were used in this experiment. Pits of 50 cm diameter were made providing a spacing of 1.5 x 1.5 m^2. Manures and fertilizers were applied as per recommendation (Anonymous, 1997). All the fertilizers and manures except urea were applied 10 days before seed sowing in the pit. Urea was top dressed twice, at 20 and 40 days after sowing. Five seeds were sown in each pit. Seeds were collected from Olericulture Division, Horticulture Research Centre, Bangladesh Agricultural Research Institute, Gazipur-1707, Bangladesh. When the cucumber seedlings were established, only one healthy seedling was allowed to grow in each pit. When it started spreading it was allowed to grow over trellis made of bamboo. Different intercultural operations like weeding, irrigation, drainage and plant protection measures were done as and when needed.

Cephalexin was procured from the market as alsporin 250 mg tablet (Renata Ltd., Bangladesh). Solutions of different concentrations were prepared with distilled water and were sprayed on the foliage with a hand sprayer to wet the leaves completely for three alternate days without dropping any solution on the ground. Spraying was done at 2-leaf stage of the plant because sex differentiation takes place at this stage in cucumber (El-Ghamriny *et al*., 1988). Dropping of solution on the ground was checked by spreading polythene sheet over the ground at base of the plant. Distilled water was sprayed on the control plants.

The number of male and female flowers produced both on main axis and on branches, number of fruits set were counted at alternate days up to 95 days of age of the plants. Fruits were harvested before attaining full maturity and turning dark green skin colour into brownish yellow and their weight was recorded. Data were analyzed statistically and the means of different parameters were adjusted with Duncan's multiple range test (DMRT) (Gomez and Gomez, 1984).

Results and Discussion

Application of cephalexin had significant ($P \leq 0.05$) influence on the growth phases of cucumber plant (Table 1). The plants treated with cephalexin solutions showed reduction in vegetative phase and extension in reproductive phase. The lowest vegetative phase (30.3 days) and the highest reproductive phase (65.0 days) was found in the plants treated with cephalexin of 50 ppm solution. In reproductive phase, cephalexin showed significant influence on male phase and mixed phase to shorten the male phase and to lengthen the mixed phase. The lowest male phase (15.3 days) and the highest mixed phase (43.8 days) was observed in the plants treated with 50 ppm cephalexin. Reduction in vegetative phase and extension in reproductive phase of growth has been reported earlier in *Luffa acutangula* (Das and Basu, 1997) and in *Momordica charantia* (Das *et al*., 1997) due to the foliar application with cephalexin.

Cephalexin had a significant ($P \leq 0.05$) effect on the number of flower production/plant (Table 2). Cephalexin performed as a male

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Table 1: Effect of cephalexin on different growth phases in cucumber

Concentration of cephalexin (ppm)	Vegetative phase (days)	Reproductive phase (days)			
		Male	Mixed	Abortive	Total
0	40.4a	23.3a	24.0e	7.0	54.7d
12.5	38.3b	21.2abc	28.2d	7.3	56.7c
25	34.0c	18.9c	36.2b	5.7	60.3b
50	30.3d	15.3d	43.8a	5.6	65.0a
75	34.4c	21.0bc	32.0c	6.7	60.7b
100	37.4b	23.0ab	27.0d	8.0	57.7c
LSD (P≤ 0.05)	1.32	2.27	2.18	NS	1.67
SE	0.42	0.72	0.69	0.74	0.53

Table 2: Effect of cephalexin on flower production in cucumber

Concentration of cephalexin (ppm)	No. of male flower/plant			No.of female flowers/plant			Ratio of male/ female flowers
	Main axis	Branches	Total	Main axis	Branches	Total	
0	133.3a	530.0a	663.4a	10.3b	20.0c	30.0c	22.2ab
12.5	120.0b	481.3b	601.3c	11.0b	22.1bc	32.3bc	18.6c
25	98.3c	438.0c	536.4d	11.7b	27.3ab	39.0ab	13.9d
50	70.0d	376.0d	444.0e	15.3a	32.3a	46.7a	9.6e
75	105.0c	490.7b	595.7c	9.3b	20.1c	30.0c	19.2bc
100	120.3b	520.3a	640.3b	8.7b	16.8c	26.0c	23.7a
LSD (P≤ 0.05)	9.78	19.02	21.73	3.15	5.92	7.99	3.64
SE	3.10	6.03	6.90	1.00	1.88	2.54	1.16

Table 3: Effect of cephalexin on fruit setting, fruit development and yield in cucumber

Concentration of cephalexin (ppm)	No. of female flower/ plant	No. of fruit/ plant	Percent fruit setting	Fruit size				Weight/ fruit (g)	Increase in weight (%)	Fruit yield/ plant (kg)	Increase in yield (%)
				Length (cm)	Increase in length (%)	Girth (cm)	Increase in girth (%)				
0	30.0c	15.1cd	50.3b	15.1c	-	11.1d	-	105.3d	-	1.8c	-
12.5	32.3bc	18.9c	55.7b	17.0bc	12.8	12.4cd	11.7	120.0c	15.0	2.3c	27.8
25	39.0ab	25.7b	57.9b	18.7b	23.9	14.2b	27.7	130.3b	23.7	3.2b	77.8
50	46.7a	32.0a	68.7a	22.3a	48.0	17.2a	55.0	160.7a	52.6	4.9a	172.2
75	30.0c	15.7cd	51.3b	16.3bc	8.1	13.2bc	18.9	121.3c	15.2	1.9c	5.6
100	26.0c	13.3d	51.5b	11.7d	-	9.2e	-	86.7e	-	1.2d	-
LSD (P≤ 0.05)	7.99	5.12	8.99	2.48	-	1.35	-	7.47	-	0.53	-
SE	2.54	1.63	2.85	0.79	-	0.43	-	2.37	-	0.17	-

Figures followed by different letter(s) in the same column differ significantly at P≤ 0.05.

suppressor and female promoter producing decreased number of male flowers and increased number of female flowers/plant. The lowest number of male flowers (444.0) and the highest number of female flowers/plant (46.7) were found in plants treated with 50 ppm cephalexin. Suppression of male flowers after cephalexin treatment was found in *Luffa acutangula* (Das and Basu, 1997) and in *Momordica charantia* (Das *et al.*, 1997). Similar suppression of male flowering and induction of female flowering was found by another β-lactum antibiotic, penicillin treatment (Basu *et al.*, 1996; Bose and Nitsch, 1970), by GA_3 treatment (Gosh and Basu, 1982), by ethephon treatment (Al-Masoum and Al-Masri, 1999) and by TIBA and ethrel treatment (Sinha and Mandal, 2000) in different cucurbits. The suppression of male flowering and induction of female flowering led to a decrease in the ratio of male to female flowers with the lowest (9.6) in 50 ppm treatment (Table 2).

Cephalexin also had significant ($P \leq 0.05$) influence on fruit setting in cucumber producing greater number of fruits/plant (Table 3). In the control plants 50.3% of the female flowers produced fruits whereas in cephalexin treated plants up to about 69% of female flowers produced fruits. The highest fruit setting was found in 50 ppm treatment.

The β-lactum antibiotic, cephalexin also increased the size (length and girth) and weight of the mature fruits. The cephalexin (50 ppm) increased the length, girth and weight of fruit up to 48.0, 55.0 and 52.6%, respectively over control (Table 3). Increased size and weight of fruit due to cephalexin treatment also reported in *Luffa acutangula* (Das and Basu, 1997) and in *Momordica charantia* (Das *et al.*, 1997). Thus cephalexin had a similarity with GA_3 which was reported to promote fruit development in cucumber (Rafeekher *et al.*, 2001; Ogawa *et al.*, 1989) and in *Momordica charantia* (Banerjee and Basu, 1992) and also with ethrel in cucumber (Sinha and Mondal, 2000).

Finally cephalexin also had significant ($P \leq 0.05$) influence on fruit yield/plant in cucumber as greater number of fruits of larger size and weight was produced in cephalexin treated plants over control. The highest fruit yield/plant (172.2% more over control) was found in plants treated with 50 ppm cephalexin. Similar increased yield was earlier reported in cucumber by ethrel (Sinha and Mandal, 2000; Rafeekher *et al.*, 2001; Al-Masoum and Al-Masri, 1999).

Cephalexin is an antibiotic but it is found to act as a plant growth regulator on cucumber increasing its femaleness and fruit setting. It also increased the size and weight of the fruit and ultimately the fruit yield/plant. The hormonal activity of cephalexin has much similarity with that of GA_3 and also that of ethrel (ethephon).

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