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Effect of mepiquat chloride on sex expression of pumpkin (*Cucurbita moschata* L.) variety Arka Suryamukhi

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Abstract
A field experiment was carried out during kharif season 2019-2020 Department of Horticulture, College of Agriculture, University of Agricultural Sciences, GKVK, Bengaluru to study the effect of mepiquat chloride on sex expression of Pumpkin (*Cucurbita moschata* L.) variety Arka Suryamukhi. Three concentrations of mepiquat chloride (50, 75 and 100 g a.i. ha-1) containing ten treatments were replicated thrice and spray was taken at three growth stages of the crop (at initiation of shooting, at initiation of flowering and 15 days after initiation of flowering) of the crop. Reproductive parameters, observations were recorded and significant results were obtained in T3 by comparing to other treatments and control. Reduction in variety of days taken for initial male and feminine flowers, look of male and female flowers at lowest node, increase in number of male and female flowers and low male: female quantitative relation were recorded in treatment T_3 compare to different treatments

Keywords: Pumpkin, Arka Suryamukhi, Mepiquat chloride, reproductive parameters

Introduction
Pumpkin (*Cucurbita moschata* L.) is one amongst the foremost widespread and vital vegetables among cucurbits and native to Central America (Ahmad and Khan, 2019) [11]. It is one annual plant that climbs or drops. The leaves have three-5 simple lobules, rounded or obtuse, the central one above the lateral ones. With 3 to five forked tendrils, the stem is slightly angulated. The flowers are pentamerous, solitary and axillary. The fruit varies greatly in form and size and is soft and customarily not fibrous. The flesh is nice with countless seeds. (Ntui *et al*., 2017) [8].

It is known for its fruits and edible seeds. The foremost important half is fruit and second most vital part is its low-fat and supermolecule made seeds. The fruit flesh contains 559 K Cal of energy, 28% of water, 4 g Fat, 2 g fibre and 2.4 mg Ca, 475 mg P, 175 mg Fe, 1 mg Na, 340 mg K, 7 g total carbohydrate, 2.8 g Sugar, 1 g Protein, and it's cholesterin free vegetable (Devi *et al*., 2018) [5].

The major pumpkin producing countries are China, India, Russia, Ukraine, United States of America and Mexico. In India area and production of pumpkin was 94,000 ha and 2030,000 MT respectively. it's for the most part cultivated in states like Orissa, Uttar Pradesh, Madya Pradesh, Chhattisgarh, Karnataka, Haryana, Kerala and Tamil Nadu. the best production recorded in Orissa of 459.83,000 ton and in Karnataka it is 64.87,000 ton (Anon., 2019) [1].

Pumpkin is taken into account as a high price vegetable crop attributable to its high nutritional content, market value, storability and long period of availableness with higher transport potentialities. Therefore, there's a requirement to extend the yield. The exogenous application of plant growth retardent might be potential in controlling each morphology and physiology of the plants while not changing any biological process (developmental) pattern or induce phytotoxic effects on plant (Naz, 2016) [7].

Mepiquat chloride is an anti-gibberellin compound, it checks vegetative growth and hastens the development of reproductive parts by reducing the vine length and plant spread, thereby decreasing the gap between the supply and sink to impact higher translocation of photosynthates into developing fruits (Rademacher, 2000) [9].

Therefore, the objective of the experiment was

1. To study the effect of mepiquat chloride on sex expression of pumpkin

Materials and Method

The field experiment was carried out during *kharif* season (June to November) 2019 at Department of Horticulture, College of Agriculture, UAS, GKVK Bengaluru. The area lies on 12º 58' North latitude and 77º 35' East longitude with an altitude of 830 m above Mean Sea Level (MSL). The nutrient status of the experimental site was 325.46 kg ha^{-1}, 142.3 kg ha^{-1} and 34.4 kg ha^{-1} nitrogen, phosphorus and potassium respectively with pH of 6.4 to 6.8

Land preparation/ Experimental design

The total experimental (478.5m^2) area was thoroughly ploughed to a depth of 30 and the soil was brought to a fine tilth. Farm Yard Manure (FYM) at the rate of 25 tons per hectare applied 2-3 weeks before sowing. Raised beds of 30 cm height, 23 m length and 100 cm width were prepared leaving a space of 45 cm between two beds as path to enable easy cultural operations. Drip irrigation laterals were laid after the field preparation while in the preparation of beds, a basal dose of 30 kg each of nitrogen and phosphorus and 60 kg of potash per hectare was added and mixed well in the soil. After the preparation of beds, a bicolored polythene sheet of 30-micron size used as mulching sheet to control weeds. Arka Suryamukhi seeds were procured from Indian Institute of Horticulture Research, Bengaluru (IIHR) and sowed at 2.2 m x 1.2 m spacing and the experimental was laid out in Randomized Complete Block Design (RCBD) with 10 treatments and 3 replications.

Treatment details of experiment

Experiment consisted of 10 treatments replicated 3 thrice. We have taken mepiquat chloride (MC) at three concentrations *viz* 50, 75 and 100 g a.i. ha^{-1} which applied at three growth stages of the crop namely at initiation of shooting (T_1, T_2 and T_3), at initiation of flowering (T_4, T_5 and T_6) and at 15 days after initiation of flowering (T_7, T_8 and T_9)and T_{10} taken as control.

Data collected

The data pertaining to various reproductive parameters from five randomly selected and labelled plants in each replication of the treatment.

1. Number of days taken to first male flower

Days taken for bloom of first male flower from date of sowing was recorded for each treatment periodically as and when first male flower bloomed in tagged plants.

2. Number of days taken to first female flower

Days taken for bloom of first female flower from date of sowing was recorded for each treatment periodically as and when first female flower bloomed in tagged plants.

3. Node at which first male flower appeared

Observations were made to record at which node first male flower appeared in each treatment of selected plants, when first male flower appeared and calculated the mean.

4. Node at which first female flower appeared

Observations were made to record at which node first female flower appeared in each treatment of selected plants, when first female flower appeared and calculated the mean.

5. Number of male flowers

The total number of male flowers produced in selected plants of each treatment were recorded and mean were calculated.

6. Number of female flowers

The total number of female flowers produced in selected plants of each treatments were recorded and mean was calculated.

7. Sex ratio (%)

Sex ratio was calculated by dividing number of male flowers to number of female flowers of selected plants in each treatments and mean was calculated.

$$\text{Sex ratio (\%)} = \frac{\text{Number of male flowers}}{\text{Number of female flowers}} \text{ X } 100$$

Results and Discussion

The data on number of days taken first male and female flower were outfitted in Table 1. Among the distinctive treatments, the early appearance of male (38.11 days) and female (42.56 days) blossom was taken note in T_3 (application of 100 g a.i. MC at start of shooting) compare to other treatments and control (41.33 and 46.22 days). The reason for early appearance of male flowers is due to shortening vegetative growth and that leads to early reproductive growth. Similar observations were done by Saimbhi and Thakur (1973) [12] in squash melon, Sadiq *et al.* (1992) [10] in cucumber and Devaraju *et al.* (2002) [4] in gherkin. Influence of MC on node at which first male and female flower appeared was furnished in Table 2 and noticed that in treatment T_3 flowers were appeared at earliest first node (male: 1.89, female: 8.00) compare to control (2.44 and 9.78). Application of growth retardant leads to reduction in internodal length there by male flowers appeared at lowest first node compares to other growth regulators which enhances internodal length. A similar result was recorded by Arora *et al.* (1982) [2] in bottle gourd and Choudhary and Phatak (2005) [3] in cucumber. The data on number of male flowers, number of female flowers and sex ratioare presented in Fig 1 and noticed significant difference among the treatments. Highest number of male (64.11), female (7.22) flowers and sex ratio (%) (8.87 %) were noticed in treatment T_3 with the application of 100 g a.i. MC at initiation of shooting

Table 1: Effect of mepiquatchloride on number of days taken for appearance of first male and first female flower in pumpkin variety Arka Suryamukhi

Treatments	Number of days taken for appearance of first male flower	Number of days taken for appearance of first female flower
T_1-50 g a.i. ha^{-1} MC at initiation of shooting	39.11	43.78
T_2-75 g a.i. ha^{-1} MC at initiation of shooting	39.00	43.33
T_3-100 g a.i. ha^{-1} MC at initiation of shooting	38.11	42.56
T_4-50 g a.i. ha^{-1} MC at initiation of flowering	40.67	45.33
T_5-75 g a.i. ha^{-1} MC at initiation of flowering	40.00	44.44
T_6-100 g a.i. ha^{-1} MC at initiation of flowering	39.78	44.00
T_7-50 g a.i. ha^{-1} MC at 15 days after initiation of flowering	40.89	45.67
T_8-75 g a.i. ha^{-1} MC at 15 days after initiation of flowering	40.56	45.44
T_9-100 g a.i. ha^{-1} MC at 15 days after initiation of flowering	40.44	45.44
T_{10}-Control	41.33	46.22
T_{10}-Control	41.33	46.22
F test	*	*
Mean	39.99	44.62
S.Em±	0.18	0.22
CD at 5%	0.53	0.65

a.i. – Active ingredient *Significant @ 5% level, MC – Mepiquat chloride

Compare to control (48.89, 3.22 and 15.18 %) and other treatments. Application of growth retardant acted as anti-gibberellin compound by inhibiting vegetative growth, nucleic acid synthesis and protein metabolism thereby enhanced male flower bud initiation and the increase in number of female flowers by application of growth retardant due to increase in endogenous ethylene level which induces more.

Table 2: Effect of mepiquat chloride on number of node at which first male and female flower appeared in pumpkin variety Arka Suryamukhi

Treatments	Node at which first male flower appeared	Node at which first female flower appeared
T_1-50 g a.i. ha^{-1} MC at initiation of shooting	2.00	8.67
T_2-75 g a.i. ha^{-1} MC at initiation of shooting	2.00	8.67
T_3-100 g a.i. ha^{-1} MC at initiation of shooting	1.89	8.00
T_4-50 g a.i. ha^{-1} MC at initiation of flowering	2.00	8.89
T_5-75 g a.i. ha^{-1} MC at initiation of flowering	2.00	8.67
T_6-100 g a.i. ha^{-1} MC at initiation of flowering	2.00	8.89
T_7-50 g a.i. ha^{-1} MC at 15 days after initiation of flowering	2.00	9.33
T_8-75 g a.i. ha^{-1} MC at 15 days after initiation of flowering	2.00	9.33
T_9-100 g a.i. ha^{-1} MC at 15 days after initiation of flowering	2.00	9.33
T_{10}-Control	2.44	9.78
F test	*	*
Mean	2.03	8.96
S. Em±	0.04	0.11
CD at 5%	0.14	0.35

a.i. – Active ingredient *Significant @ 5% level, MC – Mepiquat chloride

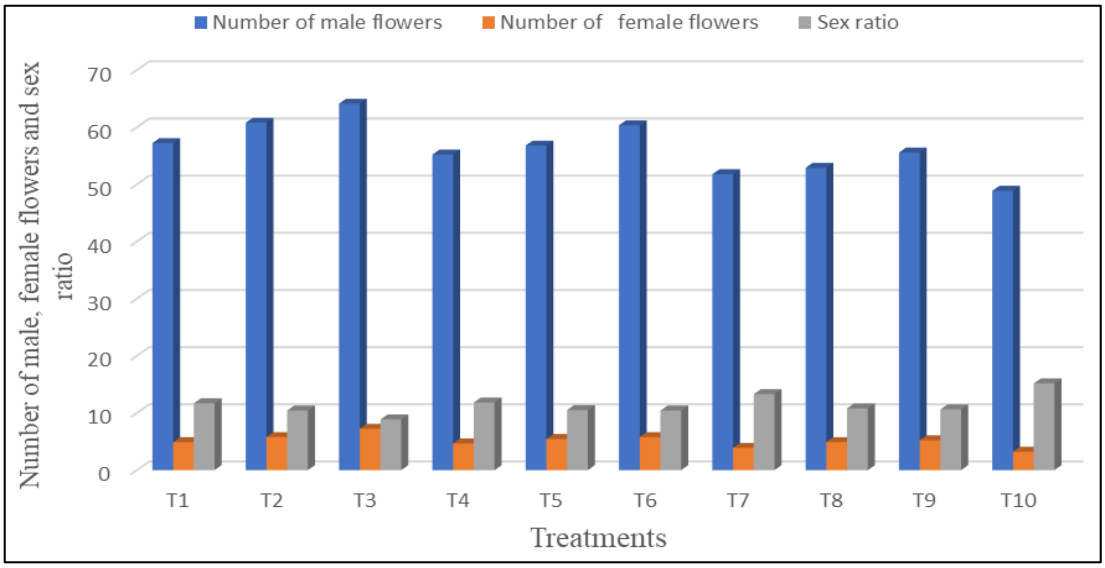

Fig 1: Effect of mepiquat chloride on number of male, female flowers and sex ratio percentage in pumpkin variety Arka Suryamukhi

A comparable study was done by Devaraju *et al.* (2002) [4] in gherkin and Hidayatullah *et al.* (2009) [6] in cucumber. The sex ratio was differed significantly due to different treatments. The narrow male: female sex ratio percentage was noticed with the spray of growth retardant, which produces more number of branches on which male and female flowers are appeared in great number. A similar result recorded by Arora *et al.* (1982) [2] in bottle gourd.

Conclusion

Pumpkin has spreading habit of producing long vines with less reproductive growth and more vegetative growth. Thus, optimization of vegetative growth and enhancement of reproductive growth of pumpkin can be done through the application of growth retardant like mepiquat chloride. In the present study to determine the effect of growth retardant mepiquat chloride on pumpkin revealed that all treatments are superior than control. Although it could be concluded that optimum concentration of mepiquat chloride at 100 g a.i. hectare applied at early vegetative growth stage of the crop resulted in enhancement of reproductive growth of the crop.

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