Effect of growth retardants on growth, flowering and bulb yield of Asiatic Lilium

K.M.Malik[1], A.H.Wani-[2]and I.T.Nazki[3]

[1&2] Division of Horticulture, Faculty of Agriculture Wadura, Sopore,
[3]Division of Floriculture & Landscape Architecture, Faculty of Horticulture, Shalimar,
Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir,
Srinagar - 190 025 (Jammu & Kashmir)

DOI: 10.29322/IJSRP.11.04.2021.p11260
http://dx.doi.org/10.29322/IJSRP.11.04.2021.p11260

Abstract- The main focus in lily cultivation has been on cut flower production and other attributes like pot culture and garden display have not been addressed so seriously resulting in damage to the flowers during medium and high wind storms particularly to the cultivars which have long stems. The present investigation on effect of growth retardants on growth, flowering and bulb yield of Asiatic Lilium was carried out at the Experimental field of faculty of agriculture Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Wadura campus. The results obtained revealed that growth retardants (paclobutrazol and cycocel) had significant effects on growth, flowering and bulb characteristics of Asiatic lilium. The treatment combination paclobutrazol (60ppm) and cycocel (200ppm) took minimum days to bulb sprouting(17.66 days), produced shortest plant(45.18cm),less number of leaves (35.00),lesser number of days to colour break(48.00 days),minimum number of days to anthesis (52days),maximum number of bulbs plant^{-1} (3.91) and diameter of bulb (6.33cm) with highest propagation coefficient (3.91) whereas maximum flower diamete r (15.27cm),weight of bulb (98.10 g) and maximum scale size (2.03)was obtained under T_7 (cycocel@ 200ppm). On the other hand number of daughter bulbs produced bulb-^{1}was observed under T_4 i.e., paclobutrazol @ 60ppm. However there were no significant effects of growth retardants on number of flowers plant^{-1}.

Index Terms- Growth retardants, growth attributes, flowering, bulb yield, Lilium.

I. Introduction

With the advancement in the human civilization the taste and the vision of people have changed and farmers have inclined towards flower farming because of high demand during festivals and marriage seasons and further more flowers have comparatively more B:C ratio than other traditional crops. Cut-flower cultivation is an important component of flower farming and Asiatic lilium finds a pivotal place among cut-flowers in India and abroad. Asiatic lilium is an important ornamental bulbous plant used as cut flower because of its large size, attractive colour, and good keeping quality. In Kashmir, the agro-ecological conditions are very conducive for the survival and culture of Asiatic lilium. It has great potential for local as well as export market.

Lilium besides being a very good cut flower finds a very important place in gardens and pot culture. Its height sometimes is a limiting factor for pot culture and garden display. Due to mild or high wind storms whole plant gets lodged and uprooted along with the growing bulb resulting in a greater economic loss and gives the garden a shabby look.

Asiatic lilium responds well to the use of growth retardants like paclobutrazol and cycocel for modifying its developmental processes. The major areas where growth retardants have successfully played their roles in ornamental bulbous crops are plant height, regulation of flowering, bulb yield and propagation coefficient Therefore, keeping in view the need and importance of growth retardants, the present investigation was conducted with the objective of studying the effect of growth retardants on vegetative growth, flowering and bulb production in lilium.

II. Material and Methods

The present investigation entitled "Effect of growth retardants on Growth, Flowering and bulb yield of Asiatic Lilium**.**" was conducted during 2018 and 2019 at experimental field of division of horticulture FOA Wadura. (SKUAST-K). The experiment was laid out in Randomized Complete Block Design with 16 treatment combinations, replicated thrice.

Treatment details are as under:

T_1	:	Water
T_2	:	Paclobutrazol (20ppm)
T_3	:	Paclobutrazol (40ppm)
T_4	:	Paclobutrazol (60ppm)
T_5	:	Cycocel (100ppm)
T_6	:	Cycocel (150ppm)
T_7	:	Cycocel (200ppm)
T_8	:	Paclobutrazol (20ppm) and cycocel (100ppm)
T_9	:	Paclobutrazol (20ppm) and cycocel (150ppm)
T_{10}	:	Paclobutrazol (20ppm) and cycocel (200ppm)
T_{11}	:	Paclobutrazol (40ppm) and cycocel (100ppm)
T_{12}	:	Paclobutrazol (40ppm) and cycocel (150ppm)
T_{13}	:	Paclobutrazol (40ppm) and cycocel (200ppm)
T_{14}	:	Paclobutrazol (60ppm) and cycocel (100ppm)
T_{15}	:	Paclobutrazol (60ppm) and cycocel (150ppm)

T_{16} : Paclobutrazol (60ppm) and cycocel (200ppm)

The Bulbs were cleaned, graded and dipped in growth retardants for 10 minutes then dried in shade for 30 minutes and finally 25 homogeneous bulbs were planted with a spacing of 20 cm x 25cm per plot ($1m^2$).Uniform cultural practices were carried out throughout the experimental period. Observations pertaining to different vegetative, floral and bulb production characteristics were recorded from five randomly selected plants of net plot area from time to time and data was analyzed statistically.

III. Results and discussion

The ability of plants to sprout was highly influenced by growth retardants. In general the time required for sprouting decreased when combination of growth retardants (paclobutrazol and cycocel) was applied to the bulbs. Earliest sprouting (6.33days) was observed under control where as maximum number of days taken to sprouting was observed in T_{16} (17.66 days) followed by T_{15} (16.66 days).The data presented here revealed that with the application of growth retardants the time taken by bulbs to sprout increased and vice versa.

This may be due to fact that growth retardants like paclobutrazol and cycocel act by inhibiting gibberellin biosynthesis which in turn delay the bulb sprouting When gibberellins synthesis is inhibited, more precursors in the terpenoid pathway accumulate and that resulted to the production of abscisic acid which in turn resulted in prolonged dormant period.The results are in conformity with the findings of Soumya *et al*. (2017). The effect of plant retardants played a significant role in reducing the plant height and leaf count plant^{-1}. All the treatments consisting of paclobutozole and cycocel reduced the plant height and number of leaves plant^{-1}. However T_{16} recorded shortest plant (45.18cm) and less number of leaves plant^{-1} (35). Since, gibberellin is known as a stimulating hormone for longitudinal growth in different plants (Devlin and Witham, 1983). Hence, reduction of endogenous gibberellins level due to the use of growth retardant treatments led to reduction in the length of different cell types and consequently resulted reduction in plant height and number of leaves. Similar results had been found by Krug *et al.* (2006) and Demir and Celikel (2019).There was a significant effect of growth retardants on flowering attributes of Lilium. Minimum days to colour break (48days), less number of days to anthesis (52) was found in $T_{16.}$ Same results were found by Demir and Celikel (2019) in Narcissus, James *et al. (*2020) in Carnation and (Nazarudin, 2012) in Hibiscus. The minimum number of days (48) taken to colour break and minimum days (52) to anthesis were observed under $T_{16.}$ The results are in conformity with the findings of Malik *et al.* (2017). This delay in flower colour break and anthesis might be attributed to the suppression of apical dominance and increased vegetative growth by the growth retardants. Delay of flowering is often observed after the application of growth retardants especially at very higher concentration (Pobudkiewicz 2008).Similar results were recorded by (Bhattacharjee 1984) with alar and ethephonin in Dahlia (Karaz and Karaguzel 2010) with paclobutrazol in Dahlia and (Kumar *et al.*, 2013) with CCC and MH in tulip, (Sharifuzzaman *et al.*, 2011)in chrysanthemum with CCC and MH, and (Pobudkiewicz and Treder 2006) in Oriental lily cv. Mona Lisa.The number of flowers plant^{-1} was recorded non significant. However maximum flower diameter (15.27cm) was found under T_7 followed by T_6 (15.15cm). Same results were found by Malik *et al*. (2017). The increase in flower size due to Paclobutrazole and cycocel might be due to availability of more carbohydrates during the development of buds. Similar results were obtained by Cathay and Stuart (1961) in chrysanthemum and Abas *et al.* 2007 in *Rosa damascene.*

Table 1: Effect of growth retardants on Growth and Flowering characteristics of Asiatic Lilium

Treatment	Days taken to bulb sprouting	Plant height (cm)	No. of leaves plant^{-1}	No of days to colour break	No of days to anthesis	No. of flowers plant^{-1}	Flower diameter (cm)
T_1	6.33	80.01	71.00	64.66	67.00	5.66	8.70
T_2	9.33	65.25	60.00	58.33	63.33	6.66	9.37
T_3	10.33	64.44	58.00	59.00	63.66	6.33	9.46
T_4	10.00	60.55	50.33	56.00	61.00	7.00	9.68
T_5	11.33	65.17	58.66	62.00	66.00	7.33	14.88
T_6	11.66	64.32	51.00	59.66	67.00	7.33	15.15
T_7	12.00	62.28	52.66	59.00	64.00	7.33	15.27
T_8	13.00	58.99	48.33	54.66	61.00	7.66	13.15
T_9	13.33	56.24	46.33	55.00	60.00	7.33	13.50
T_{10}	13.66	55.19	49.33	56.00	60.00	7.33	13.93
T_{11}	14.00	54.33	47.33	56.00	59.00	7.33	12.11
T_{12}	14.66	53.45	43.66	55.00	59.00	7.33	12.41
T_{13}	15.00	50.66	42.00	54.00	57.66	6.66	12.81
T_{14}	15.33	50.51	40.66	53.00	56.00	7.33	11.56
T_{15}	16.66	48.33	40.00	50.66	53.00	7.33	11.36
T_{16}	17.66	45.18	35.00	48.00	52.00	7.00	11.70
S. Em±	0.377	1.214	1.653	0.763	0.636	0.363	0.163
C.D($p<0.05$)	**1.094**	**3.523**	**4.798**	**2.216**	**1.847**	**NS**	**0.472**

Table 2: Effect of growth retardants on Bulb characteristics of Asiatic Lilium

Treatment	Number of bulbs plant^{-1}	Weight of bulbs plan^{-1} (g)	Diameter of the bulbs (cm)	No. of daughter bulbs bulb^{-1}	Diameter of the daughter bulbs (cm)	Number of scales bulb^{-1}	Scale size (cm)	Propagation coefficient
T_1	2.54	54.00	3.45	1.98	2.36	19.10	0.88	2.54
T_2	2.68	54.89	4.16	3.10	1.96	17.20	0.93	2.68
T3	2.72	55.20	4.26	3.20	1.92	16.78	1.15	2.72
T_4	2.81	60.58	4.29	3.39	1.89	16.36	1.21	2.81
T_5	2.59	94.25	5.82	2.15	2.15	9.19	1.91	2.59
T_6	2.60	96.55	5.95	2.18	2.10	8.86	1.98	2.60
T_7	2.64	98.10	6.33	2.27	2.00	8.78	2.03	2.64
T_8	2.90	85.20	4.59	2.31	1.77	10.10	1.66	2.90
T_9	2.96	90.50	4.88	2.38	1.63	9.94	1.73	2.96
T_{10}	3.25	92.00	5.65	2.49	1.59	9.59	1.81	3.25
T_{11}	3.30	75.80	4.40	2.64	1.44	13.97	1.41	3.30
T_{12}	3.37	78.20	4.47	2.68	1.40	13.76	1.47	3.37
T_{13}	3.40	80.70	4.48	2.72	1.36	13.59	1.56	3.40
T_{14}	3.60	67.20	3.70	2.80	1.15	14.98	1.25	3.60
T_{15}	3.72	70.40	3.85	2.95	1.00	14.81	1.28	3.72
T_{16}	3.91	72.90	4.00	2.98	0.98	14.48	1.36	3.91
S. Em±	0.007	0.328	0.060	0.005	0.007	0.006	0.006	0.007
C.D($p<0.05$)	**0.021**	**0.951**	**0.175**	**0.016**	**0.019**	**0.018**	**0.01**	**0.021**

In case of bulb yield attributes (Table 2) more number of bulbs plant^{-1} (3.91), diameter of bulbs (6.33cm), and highest propagation coefficient (3.91) was observed under T_{16} paclobutrazol (60ppm) and cycocel (200ppm). However weight of bulb (98.10 g) and maximum scale size (2.03) was obtained under T_7 (Cycocel200ppm).On the other hand number of daughter bulbs produced bulb^1 was observed under T_4 i.e. paclobutrazol @ 60ppm. This might be due to the fact that PGRs affect the balance of plant hormones in the treated plants and promote, inhibit or otherwise modify the plant's physiological processes (Rademacher 2015). Ilczuk*et et al.* (2005) had proved that flurprimidol used as a supplement in an *in vitro* medium increased the number of new bulblets per original bulb and the size of newly developed bulblets in *Hippeastrum× chmielii*. Zheng *et al*. (2012) demonstrated that the lily 'Sorbonne' treated with PGRs had higher levels of starch, sucrose and indole-3-acetic acid in the bulbs, which may stimulate the formation of new scales and bulb growth. The greater bulbweight of the plants treated with PGR's might be due to the mechanism of sink direction change.

IV. Conclusion

It may be concluded that growth retardants served as a vital tool not only in inhibiting growth and flowering attributes of lilium but also in regulating the flowering and also improved the propagation coefficient there by increased B:C ratio by producing more bulbs m^2. This approach can also serve as an alternative method in overcoming the lodging problem of lilium in urban landscape.

ACKNOWLEDGEMENTS

Authors wish to thank SKUAST-K for financial support.

References

[1] Abbas, M. M., Ahmad, S., Anwar, R. 2007. Effect of growth retardants to break apical dominance in Rosa damascena. *Pakistan Journal of Agricultural Sciences* **44**: 524-528.

[2] Abin, K., James, Devi Singh and Urfi Fatima 2020. Effect of Plant Growth Retardants on Carnation (Dianthus caryophyllusL.var. Orange viana) in Prayagraj Agro-climatic Condition. *International Journal of Current Microbiology and Applied Sciences* **9**(10): 2104-2108.

[3] Ahmad Nazarudin, M. R. 2012. Plant growth retardants effects on growth and flowering of potted *Hibiscus rosasinensis* L. *Journal of tropical Plant Physiology* **4**: 29-40.

[4] Arshid, A. L. 200. Effect of photoperiod and chemical retardants on growth and flowering of chrysanthemum. M.Sc. thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar.

[5] Bhattacharjee, S. K. 1984. Effect of growth regulating chemicals on growth and tuberous root formation of Dahlia variabilis. *Punjab Horticultural Journal* **24**:138-144.

[6] Cathay, H. M., Stuart, N. W.1961 Comparative plant growth retarding activity of AMO-1618, phosphon and CCC. Botanical Gazette **123**:51-57.

[7] Cathey, H. M. 1964. Physiology of growth retarding chemicals, *Ann. Rev. Plant Physiol* **15**: 271-302.

[8] Demir and Celikel 2019. Effects of plant growth regulators on the plant height and quantitative properties of Narcissus tazetta .*Turkish Journal of Agriculture and Forestry* **43**(1):105-114.

[9] Devlin, R. M. and Witham, F. G. 1983. Plant physiology (4th Ed.). CBS, New Delhi, India.

[10] Ilczuk, A., Winkelmann, T., Richartz, S., Witomska, M., Serek, M. 2005. In vitro propagation of *Hippeastrum× chmielii*Chm. Influence of flurprimidol and the culture in solid or liquid medium and in temporaryimmersion systems. *Plant Cell Tissue Organ Cult* **83**: 339-346.

[11] Karaz, S., Karaguzel, O. 2010. Influence of growth regulators on the growth and flowering in dahlia (Dahlia variabilis) cv. Charmit. *European J Scientific Res*. **45**(3):498-507.

[12] Khan, M. I., Muzamil, S., Abid, M., Aamir, H., and Mathew, B. 2012. Effect of different levels of cycocel and maleic hydrazide on growth and flowering of african marigold (*Tageteserecta* L.) cv. Pusanarangigainda. *Asian Journal of Horticulture* **7**(2):294 296.

[13] Krug, B. A., Whipker, B. E., McCall I, Dole J. M. 2006. Narcissus response to plant growth regulators. *Hort Technology* **16**: 129-132.

[14] Kumar, R., Ahmed, N., Singh, D. B., Sharma, O. C., Shiv Lal, Salmani M. M. 2013. Enhancing blooming period and propagation coefficient of tulip (*Tulipagesneriana* L.) using growth regulators. *African Journal of Biotechnology* **2**(2):168-174.

[15] Maheswari, T. and Sivasanjeevi, K. 2019. Response of tuberose (*Polianthestuberosa* L.) cv. Single to plant growth regulators. *Annals of Plant and Soil Research* **21**(1): 48-50.

[16] Malik, S. A., Rather, Z. A., Wani, M. A., Din, A., and Nazki, I. T. 2017. Effect of growth regulators on plant growth and flowering in dahlia (Dahlia variabilis) cv. Charmit. *Journal of Experimental Agriculture International* 1-7.

[17] Ahmad Nazarudin, M. R. 2012.

[18] Pobudkiewicz, A. 2008. The influence of growth retardants and cytokinins on flowering of ornamental plants. *Acta Agrobotanica* **61** (1):137-141.

[19] Pobudkiewicz, A., Treder, J. 2006. Effect of flurprimidol and daminozide on growth and flowering of oriental lily 'Mona Lisa'. *Scientia Horticulturea*. **110**(4):328-333.

[20] P. R. Soumya, Pramod Kumar and Madan Pal . 2017. Paclobutrazol: a novel plant growth regulator and multi-stress ameliorant*Indian Journal of Plant Physiology* **22**:267–278.

[21] Rademacher, W., 2000. Growth retardants: Effects on gibberellins biosynthesis and other metabolic pathways. Annu. Rev. *Plant Phys*. **51**: 501-531.

[22] Saika, K., Talukdar, M. C. 1997. Effect of chemicals and pinching on growth and flowering ofchrysanthemum. *Journal of Ornamental Horticulture* 5:16-19.

[23] Sharifuzzaman, S. M., Ara, K. A., Rahman, M. H., Kabir, K., Talukdar, M. B. 2011. Effect of GA_3, CCC and M H on vegetative growth, flower yield and quality of chrysanthemum. *International Journal of Experimental Agriculture* **2**(1):17-20.

[24] Youssef, A. S. M., and Abd El-Aal, M. M. M. 2013. Effect of paclobutrazol and cycocel on growth, flowering, chemical composition and histological features of potted TabernaemontanacoronariaStapf plant. *Journal of Applied Sciences Research* **9**(11):5953-5963.

[25] Zheng, R-R, Wu Y, Xia Y-P. 2012. Chlorocholine chloride and paclobutrazol treatments promote carbohydrate accumulation in bulbs of *Lilium* Oriental hybrid 'Sorbonne'. *J. Zhejiang Univ. Sci.* B **13**: 136-144.

Authors

First Author – K.M.Malik, Division of Horticulture, Faculty of Agriculture Wadura, Sopore, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Srinagar - 190 025 (Jammu & Kashmir)
Second Author – A.H.Wani, Division of Horticulture, Faculty of Agriculture Wadura, Sopore, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Srinagar - 190 025 (Jammu & Kashmir)
Third Author – I.T.Nazki, Division of Floriculture & Landscape Architecture, Faculty of Horticulture, Shalimar, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Srinagar - 190 025 (Jammu & Kashmir)

Correspondence Author – Mob: 9906491753 email:
kmmalik2014@gmail.com