Journal of Tropical Plant Physiology 1(1) (2006): 66-72

GROWTH INHIBITION OF *SYZYGIUM CAMPANULATUM* KORTH BY THE APPLICATION OF PACLOBUTRAZOL

Ahmad Nazarudin, M.R.[1*], Mohd Fauzi, R.[2] and Tsan, F.Y.[3]
[1]Forest Research Institute Malaysia (FRIM), 52109 Kepong, Selangor Darul Ehsan
[2]University Putra Malaysia (UPM), 43400 Serdang, Selangor Darul Ehsan
[3]University Teknologi MARA (UiTM), 40450 Shah Alam, Selangor Darul Ehsan
*Tel: +603-6279 7235; Fax: +603-6280 4625; E-mail: naz@frim.gov.my

ABSTRACT

The study was conducted to investigate the effects of plant growth regulator namely paclobutrazol on the growth of this specie is a highly demanded ornamental plant for urban areas. It has always been selected to beautify the urban sites such as parks, highways, pocket spaces, golf courses and residential areas. In landscape, this species has been planted as hedge plant, topiary, single planting and a good candidate for screening purpose. Nevertheless, *Syzygium campanulatum* requires frequent trimming in order to maintain their forms and landscape functions. Unfortunately, landscape maintenance activities such as trimming are time consuming, labor intensive and costly. It can be scheduled as frequently as fortnightly to maintain the landscape areas. However, paclobutrazol which inhibits gibberellin biosynthesis in plants was found to be able to control the plant growth of *S. campanulatum.* This compound controls the vegetative growth and hence, reduces the trimming work. *S. campanulatum* treated with paclobutrazol has smaller leaves size and thus increases its aesthetic value. A significant difference at 5% between untreated control and treated plants was observed in terms of height increment and leaf area. There was, however, no significant difference for relative chlorophyll content among the treated and untreated plants. Even though it has the potential in maintaining the growth of vigorous landscape plants, application of paclobutrazol is yet to be introduced as a maintenance tool especially in managing the urban landscapes.

Keywords: landscape, maintenance, *Syzygium campanulatum*, paclobutrazol, trimming, urban

INTRODUCTION

Syzygium campanulatum is found in the seashore areas of Malaysia, especially Terengganu, Kelantan, Pahang and Johor. It is formerly known as *Eugenia oleina* or Kelat Paya among the locals. This species belongs to the family of Myrtaceae. *Syzygium campanulatum* has conical crown shape during its young stage and almost rounded when mature. Owing to the striking appearance of its reddish new leaves and dense branching structure, *S. campanulatum* is popular for urban landscapes. It is always planted as hedge plant and topiaries that provide aesthetic to the

landscapes. Because of these planting purposes, *S. campanulatum* needs to be trimmed to maintain its shape and the functions.

Pruning and trimming of landscape trees and shrubs to control excessive vegetative growth and improve plant form is a major expense in landscape maintenance (Keever 1990). Trimming is normally scheduled fortnightly to achieve the mentioned purpose, especially in the cases of maintaining the hedge plants and topiaries. In certain countries, the disposal of large quantity of trimmed biomass was also becoming an issue in tree maintenance program (Bowles 1985).

In temperate countries, growth inhibition in plants by the application of plant growth regulators (PGR) has been attempted since the early 1960s for reducing the trimming cost (Bowles 1985). Paclobutrazol has been widely recorded as the most persistent triazole compound in controlling the vegetative growth of a wide range of angiosperms (De Jong & Doyle 1984; Quinlan & Richardson 1984; Sterret 1985; Patrick et al. 1996; Fletcher et al. 2000). It was also found that paclobutrazol was able to extend the trimming cycles, would imply reducing the labour cost (Mann et al. 1995). Moreover, such practice generally does not result in undesirable phytotoxic effects. Rademacher (2000) reported that PGR, when used properly, can restrict plant growth without side effects. Paclobutrazol was found to be applied to perennials and other potted crops at the rates of 1 to 90 mg/L (Dole & Wilkins 1999). Million et al. (2002) stated that application of PGR was a better approach in managing landscape trees especially on budgets, time and skill workers.

The aim of the study is to determine if paclobutrazol could retard the growth of *S. campanulatum* and hence, produce plants with compact appearance. With retarded growth, the trimming rotations could be reduced and the aesthetic value enhanced.

MATERIALS AND METHODS

The study site was established at the nursery in Forest Research Institute Malaysia, Kepong. Plants were obtained from a private nursery in Yong Peng, Johor. The plants were planted in polyethylene bag sized 33 x 27 cm, filled with a mixture of top soil, organic matter and sand at a ratio of 3:2:1. The plants were then raised to approximately 100 cm in height before they were trimmed into columnar shape. Trimming was carried out on 1st June 2004 and the plants were allowed to flush to cover the trimming effects. *Syzygium campanulatum* required a period of thirty days to flush and recover from the trimming effects. Then, paclobutrazol was applied as soil drenching on 1st July 2004. The experiment was based on a Randomised Complete Block Design (RCBD) with four replicates. The dosages of paclobutrazol tested were 0, 1.25, 2.50 and 3.75 g/L. A total of 16 plants were used in the experiment. Fertilizer (NPK 15:15:15) was applied monthly at a rate of 5 g per plant to ensure satisfactory plant growth. Maintenance such as weeding, watering, pest and diseases control were carried out when necessary.

The mean of plant height, leaf area and relative chlorophyll were measured monthly. Plant height was measured from the soil surface to the highest shoot tip by using a telescopic height pole and recorded in centimeter (cm). The first three fully developed leaves from each plant were collected and measured using Leaf Area Meter, LI-3100 Nebraska, USA. The average leaf area was recorded in square centimeters (cm^2). For the relative chlorophyll content measurement, a total of ten fully expanded leaves per treatment were used. Data for relative chlorophyll content was recorded using a non destructive portable meter SPAD 502, Minolta Japan. The data obtained were analysed by using Statistical Analysis Software (SAS). Analysis of Variance (ANOVA) was conducted and the treatment means were then compared by using Tukey's Studentized Range (HSD) Test to detect significant difference among treatments.

RESULTS AND DISCUSSION

The treatment had significantly reduced the height of the plants ($p \leq 0.01$) over a period of five months (Figure 1). However, height increment among the plants treated with different dosages of paclobutrazol was not significantly different. Five months after the application of paclobutrazol, the difference in height between the non-treated plant and the plant treated with the highest dosage was about 25 cm. At this stage, the height increase of the control plants was about 21.1% while, the plants treated with 1.25 g/L and 2.50 g/L increased by 2.0%, and plants treated with 3.75 g/L paclobutrazol only increased by 1.0%. The height increment in the control plants at this stage affected its landscape function and required trimming to restore its shape. Several research reports supported the current result; paclobutrazol drenched to *Swainsona formosa* at 10, 20 and 50 mg/pot reduced both main and lateral shoot growth of (Hamid & Williams 1997). Ahmad Nazarudin et al. (2003) found that the control plants of *Ficus microcarpa* gained height increment of approximately ten fold when compared to those treated with 5 g/L paclobutrazol after four months application of this PGR. It was further suggested that the application of paclobutrazol inhibited gibberellin biosynthesis, reducing cells elongation and retarding the growth of a plant (Fletcher et al. 2000).

The treatment was also significantly reduced the leaf area ($p \leq 0.01$) of *S. campanulatum* (Figure 2). However, there was no significant difference among the plants treated with different concentrations of paclobutrazol. Although the leaf area of treated plants were reduced, no deformation of leaves were noticed, which is advantage to be considered for maintaining landscape aesthetic. At five months after the treatment, the mean leaf area of the plants treated with the highest concentration of paclobutrazol was about 4.47 cm^2 while the non-treated plant leaf area was approximately 11.17 cm^2, showing a reduction by 60.0%. This could be due to the inhibition effect of paclobutrazol on cell elongation in the leaf. Tonkinson et al. (1995) found that the application of triazole decreased length of wheat leaves by the reduction of cell length rather than cell number.

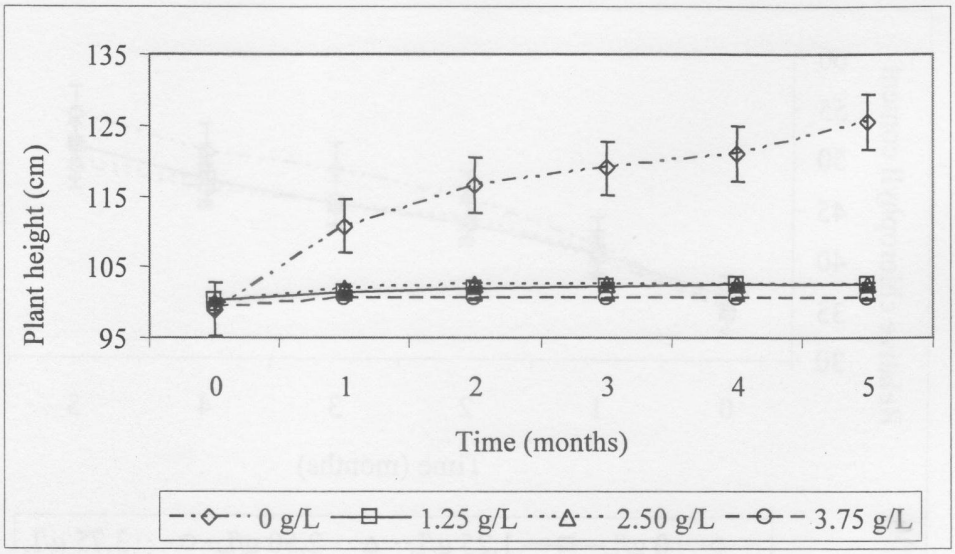

Figure 1. The growth of *S. campanulatum* after being treated with paclobutrazol.

Paclobutrazol does not significantly increase the relative chlorophyll content in *S. campanulatum* (Figure 3). However, the relative chlorophyll content of the plants was observed to increase gradually with time. Nevertheless, the treated plants were noted to have darker leaves colour as compared to the control plant. According to Khalil, (1995) this was due to a more densely packed chloroplast in a smaller leaf area. Cathey (1975) also reported that the darker green leaves may also due to reduced cell size and smaller intercellular spaces in the leaves.

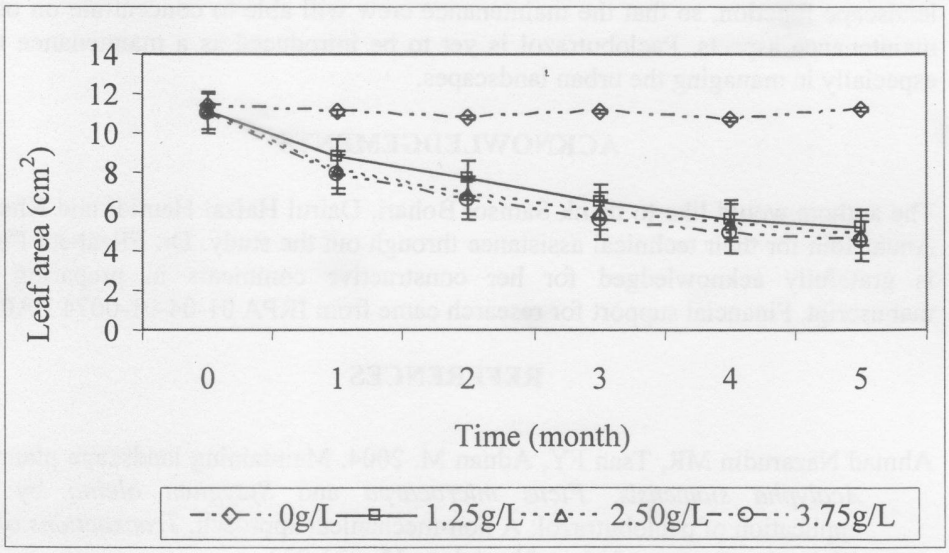

Figure 2. The leaf area of *S. campanulatum* after being treated with paclobutrazol.

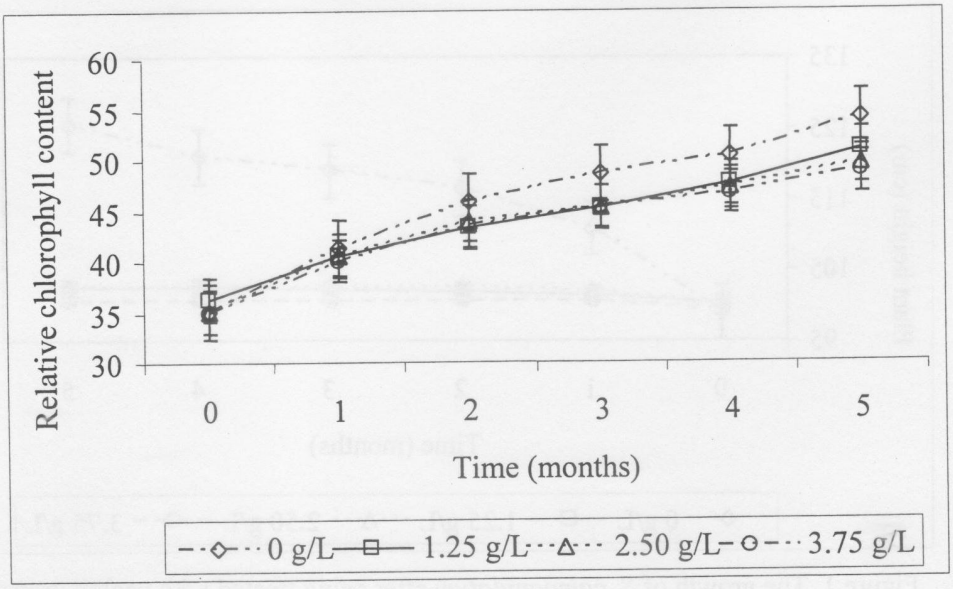

Figure 3. The effects of paclobutrazol on the relative chlorophyll content in *S. campanulatum*.

CONCLUSION

Based on the preliminary data, it showed that paclobutrazol has persistent inhibition effect on *S. campanulatum* which may be useful for controlling the plant height. Paclobutrazol also reduced the leaf size of *S. campanulatum*, but no abnormal leaves formation. Therefore, this technique has the potential to maintain the landscape function, so that the maintenance crew will able to concentrate on other maintenance aspects. Paclobutrazol is yet to be introduced as a maintenance tool especially in managing the urban landscapes.

ACKNOWLEDGEMENTS

The authors would like to thank Samsol Bohari, Dairul Haizal Hamidi and Khairul Anuar Idin for their technical assistance through out the study. Dr. Elizabeth Philip is gratefully acknowledged for her constructive comments in preparing the manuscript. Financial support for research came from IRPA 01-04-01-0074 EA001.

REFERENCES

Ahmad Nazarudin MR, Tsan FY, Adnan M. 2004. Maintaining landscape plants of *Acalypha siamensis, Ficus microcarpa* and *Syzygium oleina* by the application of paclobutrazol: A non-mechanical approach. *Transactions of the Malaysian Society of Plant Physiology* **12**: 231-233.

Bowles H. 1985. Growth retardant used by the utility companies. *Journal of Arboriculture* **11**: 59-60.

Cathey HM. 1975. Comparative plant growth retarding activities of ancymidol with ACPC, phospon, chlormequat and SADH on ornamental plant species. *HortScience* **10**: 204-216.

De Jong T, Doyle JF. 1984. Leaf gas exchange and growth responses of mature "Fantasia" nectarine trees to paclobutrazol. *Journal of American Society of Horticultural Science* **109**: 878-882.

Dole JM, Wilkins HF. 1999. *Floriculture: Principles and species*. Prentice-Hall. Upper Saddle River, New Jersey.

Fletcher RA, Gilley A, Sankhla N, Davis TD. 2000. Triazoles as plant growth regulators and stress protectants. *Horticultural Reviews* **24**: 55-138.

Hamid MM, Williams RR. 1997. Translocation of paclobutrazol and gibberellic acid in Sturt's desert pea (*Swainsona formosa*). *Journal of Plant Growth Regulator* **23**: 167-171.

Keever GJ, Foster WJ. 1990. Chemically induced branching of woody landscape plants. *Journal of Environmental Horticulture* **8**: 78-82.

Khalil IA. 1995. Chlorophyll and carotenoid contents in cereals as affected by growth retardants of the triazoles series. *Cereal Research Communications* **23**: 183-189.

Mann MP, Holt HA, Chaney WR, Mills WL, McKenzie RL. 1995. Tree growth regulators reduce line clearance trimming time. *Journal of Arboriculture* **21**: 209-212.

Million JB, Barrett JE, Nell TA, Clark DG. 2002. Inhibiting growth of flowering crops with ancymidol and paclobutrazol in sub-irrigation water. *Horticultural Science Journal* **34**(6):1103-1105.

Patrick LB, Richard HW, William NK. 1996. Red maple and silver maple growth evaluated 10 years after application of paclobutrazol tree growth regulator. *Journal of Arboriculture* **22**(2): March 1996. Pp. 61-66.

Quinlan JD, Richardson PJ. 1984. Effects of paclobutrazol on apple shoot growth. *Acta Horticulture* **146**: 105-111.

Rademacher, E. 2000. Growth retardants: effects on gibberellin biosynthesis and other metabolic pathway. *Annual Review of Plant Physiology and Molecular Biology* **51**: 501-531.

Sterret JP, 1985. Paclobutrazol: A primary growth inhibitor for injecting into woody plants. *Journal of the American Society for Horticultural Science* **110**: 4-8.

Tonkinson DL, Lyndon RL, Arnold GM, Lenton JR. 1995. Effect of Rht3 dwarfing gene on dynamics of cell extension in wheat leaves, and its modification by gibberellic acid and paclobutrazol. *Journal of Experimental Botany* **46**: 1085-1092.