EFFECTS OF PACLOBUTRAZOL AND UNICONAZOLE ON THE GROWTH AND DEVELOPMENT OF *SYZYGIUM CAMPANULATUM* KORTH

By

AHMAD NAZARUDIN BIN MOHD ROSELI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

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Chairman: Associate Professor Mohd Fauzi Ramlan, PhD

Faculty: Agriculture

Syzygium campanulatum is a perennial indigenous species. It has been widely planted in urban areas as hedge plant, topiary and container planting. This ornamental species requires frequent trimming to maintain its shape due to its vigorous growth. However, the process of pruning or trimming is costly, time consuming and labour intensive. Such a practice may have to be scheduled as frequent as fortnightly to achieve the mentioned purpose, especially in the cases of maintaining the hedge plants and topiaries.

Therefore, this study aims to discover an alternative approach in plant maintenance. The main objectives of the study are to determine the effects of plant growth retardants (PGRs) and the optimal dosage for controlling the growth of *S. campanulatum* for container purposes. This study also aims to determine the effects of PGRs on the appearance of this species after the

treatment. The PGRs used were paclobutrazol and uniconazole. The first study screened paclobutrazol at ascending rates i.e. 0 gL^{-1}, 1.25 gL^{-1}, 2.50 gL^{-1} and 3.75 gL^{-1}; and uniconazole at 0 mgL^{-1}, 10 mgL^{-1}, 20 mgL^{-1}, and 30 mgL^{-1}. The application of these PGRs inhibited the vegetative growth, reduced leaf area and increased the leaf area index significantly. Photosynthetic rate and transpiration rates of the plants treated with 3.75 gL^{-1} paclobutrazol were significantly reduced to 3.70 $\mu molm^{-2}s^{-1}$ and 1.43 $mmolm^{-2}s^{-1}$ respectively as compared to the control plants. On the other hand, uniconazole at 30 mgL^{-1} reduced transpiration rate and stomatal conductance to 1.26 $\mu molm^{-2}s^{-1}$ and 0.1 $molm^{-2}s^{-1}$ respectively as compared to the control plants. The most effective means for height suppression were application of paclobutrazol at 1.25 gL^{-1} and uniconazole at 10 mgL^{-1}.

The second study was carried out to determine the effects of these PGRs on plant tissue structure. The leaf and stem specimens of *S. campanulatum* were viewed under Scanning Electron Microscope, JSM 5610LV at an acceleration voltage of 15 kV. Cross sections of the treated leaf lamina of these PGRs showed that the palisade and spongy mesophyll cells were closely arranged due to the decreased leaf size. The palisade cell was found thicker following the treatment. As a result, the thickness of the treated leaf increased. Paclobutrazol at 3.75 gL^{-1} and uniconazole at 30 mgL^{-1} increased the palisade parenchyma by 35.17% and 37.56% respectively as compared to the control plants. Micrograph images of the stem cross section showed reduction in xylem thickness after the treatment with paclobutrazol or uniconazole. The xylem thickness were reduced by 48.56% and 39.38 after the application of paclobutrazol at 3.75 gL^{-1} and uniconazole at 30

mgL^{-1} respectively. This condition may affect water and nutrient uptake and ultimately slowed the growth of the treated plant.

The third study was conducted to assess public preference on the appearance of the treated plants. A questionnaire form was designed and used in the survey. Results showed that 93.3% of the respondents agreed that the treated *S. campanulatum* plants had more attractive appearance and 96.7% of the respondents agreed that the aesthetic value of the treated plants increased.

The results of these studies revealed that applications of paclobutrazol and uniconazole were very effective in controlling the growth of *S. campanulatum* in container, and hence extend the trimming cycle. This method can be a better alternative to overcome landscape maintenance problems such as shortage of funding, time and skilled gardeners.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KESAN PACLOBUTRAZOL DAN UNICONAZOLE TERHADAP TUMBESARAN DAN PERKEMBANGAN POKOK *SYZYGIUM CAMPANULATUM* KORTH

Oleh

AHMAD NAZARUDIN BIN MOHD ROSELI

Oktober 2006

Pengerusi: Profesor Madya Mohd Fauzi Ramlan, PhD

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Syzygium campanulatum adalah spesies tempatan yang banyak ditanam di kawasan bandar sebagai pokok pagaran, topiari dan pasuan. Pokok hiasan ini memerlukan pemangkasan yang kerap kerana pertumbuhannya cepat dan bagi memastikan bentuknya terkawal. Walau bagaimanapun, pemangkasan melibatkan kos, masa dan tenaga buruh yang tinggi. Aktiviti ini adakalanya perlu dilaksanakan setiap dua minggu terutamanya bagi pokok pagaran dan topiari.

Oleh itu, kajian ini bertujuan untuk mencari pendekatan baru dalam penyelenggaraan pokok. Objektif utama kajian ini adalah untuk mengkaji kesan bahan perencat pertumbuhan pokok dan mengenalpasti kadar optima yang dapat mengawal pertumbuhan species *S. campanulatum* yang ditanam di dalam pasu. Kajian ini juga bertujuan untuk menilai kesan bahan perencat

pertumbuhan pokok terhadap penampilan species ini selepas rawatan. Bahan perencat pertumbuhan pokok yang digunakan ialah paclobutrazol dan uniconazole. Kajian pertama melibatkan paclobutrazol dengan kadar 0 gL^{-1}, 1.25 gL^{-1}, 2.50 gL^{-1} dan 3.75 gL^{-1}; dan uniconazole pada kadar 0 mgL^{-1}, 10 mgL^{-1}, 20 mgL^{-1}, dan 30 mgL^{-1}. Kedua-dua bahan didapati merencatkan pertumbuhan vegetatif, mengurangkan luas daun dan meningkatkan indeks luas daun. Paclobutrazol pada kadar 3.75 gL^{-1} menurunkan kadar fotosintesis dan kadar transpirasi kepada 3.70 $\mu molm^{-2}s^{-1}$ and 1.43 $mmolm^{-2}s^{-1}$. Manakala uniconazole merendahkan kadar transpirasi dan rintangan stomata kepada 1.26 $\mu molm^{-2}s^{-1}$ and 0.1 $molm^{-2}s^{-1}$. Kadar optimum yang dapat mengawal tinggi pokok adalah 1.25 gL^{-1} paclobutrazol dan 10 mgL^{-1} uniconazole.

Kajian kedua bertujuan mengkaji kesan paclobutrazol dan uniconazole terhadap struktur tisu pokok ini. Pemerhatian terhadap spesimen-spesimen daun dan batang pokok dilakukan menggunakan Mikroskop Imbasan Elektron, JSM 5610LV dengan kelajuan voltan 15 kV. Keratan rentas lamina daun untuk pokok yang dirawat dengan kedua-dua bahan perencat didapati mempunyai sel mesofil palisad dan sel mesofil span yang tersusun padat akibat saiz daun yang lebih kecil. Paclobutrazol pada kadar 3.75 gL^{-1} dan uniconazole pada kadar 30 mgL^{-1} meningkatkan ketebalan mesofil palisad sehingga 35.17% dan 37.56% berbanding pokok kawalan. Sel-sel palisad didapati lebih tebal menyebabkan ketebalan daun meningkat. Keratan rentas batang pokok pula menunjukan penurunan ketebalan xilem selepas rawatan paclobutrazol atau uniconazole. Paclobutrazol pada kadar 3.75 gL^{-1} dan uniconazole pada kadar 30 mgL^{-1}

menurunkan ketebalan xylem sehingga 48.56% dan 39.38% berbanding pokok yang tidak dirawat. Keadaan ini mungkin mempengaruhi pengambilan air dan nutrien dan seterusnya menyebabkan pertumbuhan pokok menjadi perlahan.

Kajian ketiga bertujuan mengenalpasti pendapat responden terhadap pokok yang dirawat dengan bahan perencat. Borang soal selidik direka dan digunakan di dalam survei ini. Data-data yang diperolehi menunjukkan 93.3% responden berpendapat bahawa pokok *S. campanulatum* yang dirawat mempunyai penampilan yang lebih menarik dan 96.7% responden berpendapat nilai kecantikan pokok yang dirawat meningkat.

Keputusan daripada kajian-kajian ini membuktikan bahawa paclobutrazol dan uniconazole sangat berkesan untuk mengawal pertumbuhan pokok *S. campanulatum*, yang ditanam di dalam pasuan, dan seterusnya dapat memanjangkan kitaran pemangkasan. Kaedah ini menawarkan alternatif yang lebih baik dalam menangani masalah penyelenggaraan landskap seperti kewangan, masa dan pekerja mahir.

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I certify that an Examination Committee has met on 11th October 2006 to conduct the final examination of Ahmad Nazarudin Mohd Roseli on his Master of Science thesis entitled "Effects of Paclobutrazol and Uniconazole on the Growth and Development of *Syzygium campanulatum* Korth" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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AHMAD NAZARUDIN BIN MOHD ROSELI

Date: 6 DECEMBER 2006

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