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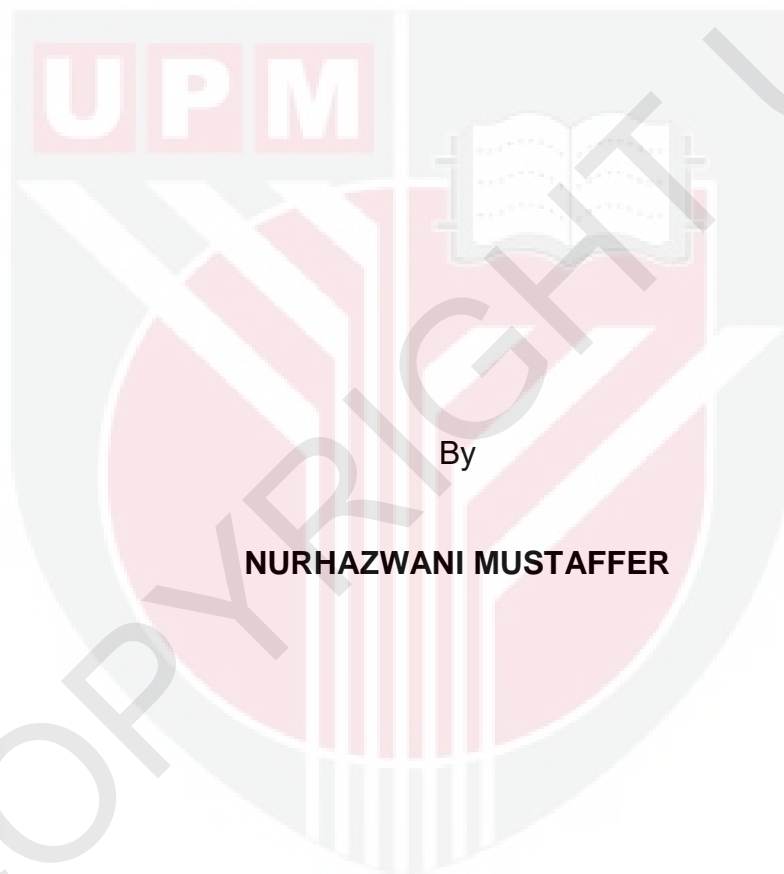
**PLANT GROWTH AND DEVELOPMENT OF *Ruellia brittoniana* Leonard  
AFFECTED BY INDOLE-3-BUTYRIC ACID AND DAMINOZIDE**

**NURHAZWANI MUSTAFFER**

**FP 2018 15**



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By

**NURHAZWANI MUSTAFFER**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra  
Malaysia, in Fulfillment of the Requirements for the Degree of  
Master of Science**

**November 2017**

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in  
fulfilment of the requirement for the degree of Master of Science

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AFFECTED BY INDOLE-3-BUTYRIC ACID AND DAMINOZIDE**

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November 2017

**Chairman : Associate Professor Yahya Awang, PhD**  
**Faculty : Agriculture**

*Ruellia brittoniana* is a landscape plant, generally propagated by seeds and cuttings but the problem lies in a very low germination percentage. Propagation using stem cutting is therefore become a logical choice but the success of the propagation could be low without rooting hormone and it may vary amongst different type of cuttings. It is a fast growing plant with a strong tendency of vegetative growth that occurs at the expense of flowering capability, thus regular pruning for height control is necessary. Chemical pruning using suitable growth retardant may offer similar effects on stem and branch elongation, and flowering of the plants could be promoted. This study was carried out to determine the rooting performance of various type of cutting materials by using different concentration of indole 3-butyric acid (IBA) and to evaluate the varying rate of daminozide on the growth and flowering of *Ruellia brittoniana*.

Evaluation of the effects of different IBA concentrations revealed that stem cuttings dipped in IBA at 500 mg/L produced significantly higher root formation, and generated plants with larger leaf and root area compared to the non-treated cuttings and those treated with 250 and 1000 mg/L IBA. Overall, hardwood cutting produced the highest root formation, root and leaf area. On the whole plant, foliar application of daminozide effectively reduced the vegetative growth, as seen in reduction of plant height, internode length, leaf area, dry weight of leaves, stem and roots. Daminozide concentration range between 1000 mg/L and 2000 mg/L had reduced the plant height by 49-58% compared to control with less reduction in number of flowers compared to plants treated with higher daminozide concentration. Variation in application frequency of daminozide markedly affected the growth and physiological

processes of the plants. Results of a two factorial experiment involving two application frequencies (double and triple applications) and five concentrations of daminozide (0, 500, 1000, 1500, 2000 mg/L) showed that different concentration of daminozide and application frequencies significantly affected the vegetative growth, photosynthesis, transpiration and chlorophyll content. Daminozide at 500 mg/L with triple application caused a reduction of 42% in plant height compared to those in control with less detrimental effects on flower number. Daminozide application had no effect on stomatal conductance and leaf nutrients composition.

In conclusion, hardwood cutting treated with 500 mg/L of IBA was the best combination for *Ruellia brittoniana* rooting and application of daminozide at 500 mg/L given in triple application was found to be effective in producing short, compact plants with more flowers.

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

**PERTUMBUHAN DAN PERKEMBANGAN POKOK *Ruellia brittoniana*  
Leonard DIPENGARUHI OLEH IBA DAN DAMINOZIDE**

Oleh

**NURHAZWANI MUSTAFFER**

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*Ruellia brittoniana* adalah sejenis tumbuhan lanskap yang kebiasaannya propagasi melalui keratan batang dan biji benih tetapi mempunyai masalah menghasilkan peratusan percambahan yang sangat rendah. Oleh itu, kaedah pembiakan keratan batang adalah cara yang terbaik tetapi kejayaan propagasi boleh menjadi rendah tanpa penggunaan hormon dan berbeza bagi pelbagai jenis keratan. Pertumbuhan pokok ini sangat cepat dengan kecenderungan pertumbuhan vegetatif yang tinggi berlaku dengan keupayaan berbunga yang rendah dan memerlukan pemangkasan yang kerap untuk mengawal ketinggian pokok. Sebagai alternatif, bahan kimia untuk merencat pertumbuhan yang sesuai boleh memberi kesan pada dahan dan bunga pada tumbuhan, di samping itu dapat menghasilkan pokok yang rendah, padat dengan penghasilan bunga yang banyak. Kajian ini dijalankan untuk menentukan peratusan perakaran menggunakan pelbagai jenis bahan keratan dengan kepekatan *Indole 3-butyric acid* (IBA) yang berbeza dan untuk menentukan kadar optimum daminozide terhadap pertumbuhan dan penghasilan bunga pada pokok *Ruellia brittoniana*.

Penilaian kajian kepekatan larutan IBA yang berbeza menunjukkan bahawa keratan yang dicelup dalam larutan IBA berkepekatan 500 mg/L telah member kesan berbeza bererti terhadap pembentukan pengakaran dan menggalakkan pertumbuhan dengan luas daun dan luas akar yang lebih besar berbanding keratan yang tidak dirawat dan dirawat dengan kepekatan IBA 250 mg/L dan 1000 mg/L. Secara keseluruhannya, keratan kayu keras pokok *Ruellia brittoniana* menghasilkan pembentukan akar, luas akar dan luas daun yang tertinggi. Pada keseluruhan pokok yang menggunakan daminozide secara foliar berkesan mengurangkan pertumbuhan vegetatif, seperti yang

ditunjukkan oleh penurunan dalam ketinggian tumbuhan, panjang ruas, luas daun, berat kering daun, batang dan akar tanpa menjejaskan pengeluaran bunga. Kepekatan daminozide 1000 dan 2000 mg/L telah mengurangkan ketinggian pokok sebanyak 49-58% berbanding pokok kawalan dengan pengurangan bunga yang rendah berbanding pokok yang dirawat dengan kepekatan daminozide yang tinggi. Variasi kekerapan penggunaan daminozide memberi kesan yang tinggi kepada pertumbuhan vegetatif dan proses fisiologi tumbuhan. Keputusan eksperimen dua faktor yang melibatkan frekuensi aplikasi (dua dan tiga aplikasi) dengan lima kepekatan daminozide (0, 500, 1000, 1500 dan 2000 mg/L) menunjukkan kepekatan daminozide yang berbeza dan frekuensi aplikasi yang berbeza mempengaruhi pertumbuhan vegetatif, fotosintesis dan transpiration dengan signifikan. Daminozide berkepekatan 500 mg/L dengan tiga aplikasi menyebabkan pengurangan sebanyak 42% ketinggian pokok berbanding dengan pokok kawalan dengan kesan pengurangan bunga yang rendah. Daminozide tidak menjejaskan stomata dan komposisi nutrient dalam daun.

Kesimpulannya, keratan kayu keras dengan kepekatan 500 mg/L adalah kombinasi terbaik untuk pengakaran pokok *Ruellia brittoniana* dan kepekatan daminozide pada 500 mg/L dengan tiga aplikasi frekuensi adalah berkesan dalam menghasilkan pokok yang rendah, padat dan bunga yang banyak.

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This thesis was submitted to the Senate of the 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 were as follows:

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## LIST OF ABBREVIATIONS

mg/L	Miligram per litre
%	Percentage
°C	Degree Celsius
cm	Centimetre
cm <sup>2</sup>	Centimetre square
IBA	Indole 3-butyric acid
IAA	Indoleacetic acid
NAA	Naphthalene acetic acid
ABA	Absciscic acid
mg/L	Part permillion
N	Nitrogen
P	Phosphorus
K	Potassium
Mg	Magnesium
Ca	Calcium
g	Gram
mg	Miligram
RCBD	Randomize complete block design
min	Minute
$\mu\text{molCO}_2 \text{ m}^{-2}\text{s}^{-1}$	Photosynthetic rate
$\text{mol m}^{-2} \text{ s}^{-1}$	Stomatal conductance
$\text{mmol m}^{-2}\text{s}^{-1}$	Transpiration rate

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

*Ruellia brittoniana*, also known as Mexican-petunia, Mexican bluebell or Britton's petunia is described as a "hardy perennial plant, commonly used as flower beds and groundcovers." The stems are green or purple and leaves are dark green, oppositely arranged and lance-shaped, roughly 15 to 30 cm in length and 1.3 to 2 cm wide. Veins are prominent on the underside of the leaf. Leaf margins are can be smooth or wavy. Flowers are trumpet shaped (4 to 8 cm in diameter), solitary or borne in clusters at the tips of the stems, and are attractive to butterflies, bees and other pollinators. The fruits or capsules are cylindrical, containing 4 to 28 seeds. The capsules have explosive dehiscence and seeds are spread long distances. Seeds produce a gel-like substance when wet that enables them to stick to surfaces when they dry. Mexican-petunia is able to tolerate a wide range of environmental conditions including variations in light, moisture and temperature. *Ruellia brittoniana* is a fast-growing plant and can even undergo self-seeding. This growth habit makes it one of the popular shrubs for landscaping.

Cutting is often the preferred method for plant propagation, including *Ruellia* spp. It is inexpensive, rapid and simple and does not require special techniques as required in other vegetative propagation methods. However, the success rate or rooting performance may vary between species or even variety (Awang *et al.*, 2009). The rooting performance may also highly dependent on type of cuttings and ontogenic age of mother plants (Awang *et al.*, 2011). Application of rooting hormone on the intrinsic factors such as Indole 3-butyric acid (IBA), an auxin, would reduce dependence for rooting ability of the cuttings.

Auxin is commonly used on the stem cuttings for accelerating the formation of adventitious roots (Galavi *et al.*, 2013). Kasim and Rayya, 2009 reported that auxin significantly influence the speed and increases the rooting percentage of the stem cuttings. Auxins that have been established as most reliable in stimulating adventitious root production in cuttings include naphthalene acetic acid (NAA), indole acetic acid (IAA) and Indole 3-butyric acid (IBA) (Randhawa and Mukhopadhyay, 1994). IBA is the most effective on promoting root-initiation and adventitious root production in stem cuttings (Waisel, 1991). Bhusa *et al.* (2001) showed that the effect of Indole 3-butyric acid (IBA) significantly increased root number and root length of the stem cutting of *Citrus sp.*

Gibberellic acid (GA) is one of the plant hormones that regulates many crucial growths and developmental processes, including seed germination, leaf expansion, stem elongation and induction of flowering (Phillips, 1998). A common problem in the production of ornamental potted plants is undesirably tall growth, so inhibitors of GA biosynthesis including Bonzi (paclobutrazol), A-rest (ancymidol), Cycocel (chloromequat chloride), B-nine (daminozide), and Sumagic (uniconazole), are usually used to control plant growth (Rademacher, 2000; Liu *et al.*, 2002). Likewise, daminozide is also one of the chemicals used for controlling plant growth. Daminozide showed several positive effects and physiological advantages on trees, shrub and ornamental plants. Daminozide significantly reduces the plant height, leaf area and internode length and also decreases the shoot fresh weight (Matysiak, 2002; Lewis *et al.*, 2004).

*Ruellia brittoniana* is a fast growing flowering ornamental plant. Due to fast growing plant habit, these plants need regular pruning, two or three times during growing months for optimal height maintenance, promote branching and also to enhance flowering (Ventura, 2009). To reduce labour, chemical pruning using suitable growth retardant and appropriate dosage could be an effective alternative. Moreover, the plants also need pruning to influence the growth for producing flower (Knox and Gilman, 2009). Application of GA inhibitor such as daminozide would reduce the apical dominance, and this consequently would promote lateral branching and reproductive growth, and such plants would normally generated more flowers.

In this study, we focused on the use of rooting promoting hormone, Indole 3-butyric acid (IBA) to influence rooting performance and also the use of a growth retardant, daminozide to reduce shoot extension, promote lateral branching, making the plants more compact with profuse flowers.

## 1.2 Objectives of the study

- **General objective**

The objective of the study was to evaluate the effects of a rooting hormone (IBA) on rooting performance and growth inhibitor (daminozide) on development and physiological processes of *Ruellia brittoniana*.

- **Specific Objectives :**

1. To determine the effects of Indole 3-butyric acid (IBA) on the rooting of various types of cutting material of *Ruellia brittoniana*.
2. To determine the optimum concentration of daminozide application on the vegetative growth and flowering of *Ruellia brittoniana*.

3. To determine the effects of different application frequency (double and triple applications) of daminozide on growth and physiological processes of *Ruellia brittoniana*.



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## LIST OF PUBLICATIONS

### Submitted

Nurhazwani Mustaffer and Yahya Awang (2016). Rooting performance of *Ruellia brittoniana* as affected by type of cutting and IBA concentrations. *International Agriculture Conference, Malaysia*.

Nurhazwani Mustaffer and Yahya Awang (2017). Growth performance of *Ruellia brittoniana* as affected by daminozide concentrations. *Malaysian Society of Plant Physiology Conference, Malaysia*.

Nurhazwani Mustaffer and Yahya Awang (2017). Manipulation of growth and flowering of Mexican petunia (*Ruellia brittoniana*) by using daminozide. *MARDI Science and Technology Exhibition, Malaysia*.

Nurhazwani Mustaffer and Yahya Awang (2017). Growth, flowering and gas exchange of *Ruellia brittoniana* treated with different concentrations and application frequencies of daminozide. *Malaysian Applied Biology Journal*.



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