



UNIVERSITI PUTRA MALAYSIA

**EFFECTS OF PLANT GROWTH – PROMOTING RHIZOBACTERIA AND
NITROGEN ON GROWTH OF PEGAGA (*Centella asiatica* (L.) IN A
HYDROPONIC SYSTEM**

SYED NAZERI SHAH PUTRA SYED JA'AFAR

FP 2015 142

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By:

SYED NAZERI SHAH PUTRA BIN SYED JA'AFAR

A project submitted to the Faculty of Agriculture, Universiti Putra Malaysia

In fulfilment of the requirement of PRT4999 (Project) for the award of degree of

Bachelor of Agricultural Science

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

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CERTIFICATION

This project entitled “**Effects of Plant Growth-Promoting Rhizobacteria and Nitrogen on Growth of Pegaga (*Centella asiatica* (L.)) in a Hydroponic System**” is prepared by Syed Nazeri Shah Putra Bin Syed Ja’afar and submitted to the Faculty of Agriculture, Universiti Putra Malaysia in partial fulfilment of the requirement of PRT4999 (Project) for the award of degree of Bachelor of Agricultural Science.

Student’s name:

Student’s signature

SYED NAZERI SHAH PUTRA BIN SYED JA’AFAR

Certified by:

.....
PROF. DR ZULKIFLI HJ. SHAMSUDDIN

Project Supervisor,

Department of Land Management,

Faculty of Agriculture,

Universiti Putra Malaysia,

Serdang, Selangor

Date:

ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious, the Most Merciful. First and foremost I would like to thank Allah SWT for the blessings which certainly helped me to accomplish my final year project successfully. I would also like to thank my parents, Syed Ja'afar Bin Syed Hassan and Suhaila Binti Yacob for their support, motivation, and love for me to move on with this project.

Next, I want to give my highest and respectful appreciations to my knowledgeable supervisor Prof. Dr. Zulkifli Hj. Shamsuddin for all his guidance, advice, and help throughout the project. Under his supervision and guidance, I am able to complete my final year project without any major difficulties.

I would also like to give a special thank you to the laboratory assistants, Mr. Dzulkifli Duaji and postgraduate students Adilah Surimin, Nurfahana Che Hassan, and Siti Suheda Sofi for their guidance and help during the entire project. They have helped me a lot in sharing their knowledge and taught me the procedures of the experiments.

Last but not least, I would also like to thank all my friends especially Nur Nadia Farlina and lecturers who have helped me to carry out the project successfully either directly or indirectly.

TABLES OF CONTENTS

CONTENTS	PAGES
I. ACKNOWLEDGEMENT	i
II. CONTENTS	ii
III. LIST OF TABLES	v
IV. LIST OF FIGURES	vi
V. ABSTRACT	vii
VI. ABSTRAK	viii
CHAPTER	
1.0 INTRODUCTION	1
2.0 LITERATURE REVIEW	
2.1 Microorganisms	3
2.1.1 Plant Growth Promoting Rhizobacteria (PGPR)	3
2.1.2 Rhizospheric bacteria	4
2.1.3 Endophytic bacteria	4
2.1.4 Mechanism of nitrogen fixation	5
2.1.5 Benefits of nitrogen-fixing bacteria	5

2.1.6 Biofertilizer	6
2.2 Plant nitrogen	6
2.3 Characteristic of Pegaga	7
2.3.1 Taxonomy	7
2.3.2 Description and distribution of Pegaga	8
2.3.3 Uses of Pegaga	9
2.3.4 Cultivation of Pegaga	10
2.4 Hydroponic (Water culture system)	10
2.4.2 Advantages of hydroponic	11
3.0 MATERIALS AND METHOD	
3.1 Research location	12
3.2 Bacterial preparation	12
3.3 Plant materials	14
3.4 Water nutrient solution	14
3.5 Treatments preparation	15
3.6 Water culture system	16
3.7 Experimental design	16

3.8 Parameters	17
3.9 Statistical analysis	17
4.0 RESULT	
4.1 Biochemical tests on the abilities to fix nitrogen	18
4.2 Incremental height and greenness of leaf at week 2.	19
4.2.1 Incremental height	19
4.2.2 Greenness of leaves	21
5.0 DISCUSSION	24
6.0 CONCLUSION	26
REFERENCES	27
APPENDIX	35

LIST OF TABLES

TABLE	PAGES
1 The different PGPR and nitrogen concentrations used as the experimental treatments	15



LIST OF FIGURES

FIGURES	PAGES
3.1 Pegaga roots after surface sterilization	14
3.2 Arrangements of <i>C. asiatica</i> planted in test tubes	16
4.1 Observation of Nfb medium after inoculation with bacteria and incubated for 24 hours	18
4.2 Effect of PGPR inoculation and fertilizer-N on plant height of <i>C. asiatica</i> at 14 DAP	20
4.3 Relative chlorophyll contents of <i>C. asiatica</i> under different PGPR inoculation and fertilizer-N treatments at 14 DAP	22

ABSTRACT

Centella asiatica (L.), pegaga, is a small creeping herb. It is one of the top 5 Malaysian herbs categorized for their medicinal quality to enhance the national income. *C. asiatica* is known to aid in the treatments of wounds, ulcers, skin diseases, tuberculosis and various mental disorders. Plant Growth-Promoting Rhizobacteria (PGPR) are defined as root colonizing bacteria which increase plant nutrient uptake and promote plant growth and development. This experiment was carried out to study the effects of different PGPR and nitrogen levels on growth of *C. asiatica* under hydroponic system. The objective of this experiment was to determine the best PGPR strain and the optimum level of nitrogen for increased vegetative growth of *C. asiatica* under hydroponic system. The three selected PGPR strains (UPMB10, Rhizospheric and Endophytic pegaga isolates) were inoculated to *C. asiatica* with three different levels of nitrogen (0%, 33% and 100%) in test tubes and left for 21 days in a plant growth chamber with twelve treatments and three replications using a Completely Randomized Design (CRD). The parameters were incremental height and leaf greenness (SPAD values). The data were analyzed using ANOVA and the means were compared by using Tukey test. At the end of the experiment, it was observed that there was no significant difference between all treatments for incremental height (growth rate) at week 1 and week 3 and leaf greenness (SPAD values). However, a significant difference was observed in incremental height (growth rate) between N levels at week 2. The best PGPR strain that have a good relationship with the optimum usage of nitrogen for *C. asiatica* were U strain (UPMB-10) and E strain (endophytic) with 0 % nitrogen, which had higher incremental heights and greenness of leaves compared to R strain.

ABSTRAK

Centella asiatica (L.) atau dikenali sebagai pegaga adalah herba menjalar kecil. Ia adalah salah satu daripada 5 herba Malaysia yang dikategorikan untuk pengeluaran kualiti perubatan dan peningkatan pendapatan negara. *C. asiatica* telah diperhatikan untuk membantu dalam rawatan luka, ulser, penyakit kulit, batuk kering dan pelbagai gangguan mental. Rhizobacteria penggalak tumbesaran tanaman (PGPR) ditakrifkan sebagai bakteria yang membantu akar tumbuhan dengan meningkatkan pengambilan nutrien tanaman dan menggalakkan pertumbuhan dan pembentukan tumbuhan. Eksperimen yang telah dijalankan adalah untuk mengkaji kesan PGPR terhadap tahap nitrogen yang berbeza kepada pertumbuhan *C. asiatica* dalam sistem hidroponik. Objektif eksperimen ini adalah untuk mengetahui PGPR yang mempunyai hubungan yang baik dengan penggunaan nitrogen yang optima untuk meningkatkan pertumbuhan vegetatif *C. asiatica* dalam sistem hidroponik. Tiga jenis PGPR (UPMB10, pengasingan pegaga rizosfera dan endofitik) dipilihtelah diinokulasi ke dalam tabung uji yang mempunyai *C. asiatica* dan mengandungi tiga kadar nitrogen (0%N, 33%N dan 100%N) dan dibiarkan selama 21 hari di dalam kebuk pertumbuhan dengan 12 rawatan dan 3 replikasi menggunakan reka bentuk rawak atau CRD. Parameter yang telah diambil adalah perbezaan ketinggian pucuk (kadar pertumbuhan) & kehijauan warna daun. Data yang diperoleh telah dimasukkan kedalam sistem ANOVA dan ujian Tukey telah digunakan untuk melihat perbandingan diantara rawatan yang berbeza. Pada akhir eksperimen, didapati bahawa tidak terdapat perbezaan signifikan di antara semua rawatan kepada perbezaan ketinggian pucuk (kadar pertumbuhan) pada minggu pertama dan ketiga dan juga kehijauan warna daun pada minggu kedua. Walau bagaimanapun,

terdapat perbezaan signifikan pada ketinggian pucuk yang mempunyai perbezaan nitrogen pada minggu kedua. Pada rawatan yang diinokulasi secara kesimpulannya, jenis PGPR yang mempunyai hubungan yang baik dengan penggunaan nitrogen yang optimum bagimembantu meningkatkan ketinggian *C.asiatica* adalahbakteria U (UPMB10)dan bacteriaE (endofitik) daripada *C.asiaticadi* dalam kondisi 0% nitrogen yang menunjukkan kesan pertambahan ketinggian berbanding dengan bakteria R.



CHAPTER 1

1.0 INTRODUCTION

Herbal plants play an important role in human life. Several thousand years ago, these plants have been used extensively for food and medicine. Hippocrates, the greek father of medicine, has established the Temple of Aesculapius, a Medical College, and has studied extensively about medicine by using herbs from people of Egypt.

Malaysia is a country that is rich in native plants to make traditional medicines. Traditional medicine is rich in nutrients, as well as its ability to cure a variety of ailments. It has been used since a long time ago and it remains as a popular treatment until now. Traditional medicine is a science or medical training and health care that has been passed down over the ages. It has been handed down verbally or in writing through practice or beliefs of a community.

Centella asiatica (L.) is a small creeping herb that belongs to the Apiaceae family and it originated from Asian and East African regions including Madagascar, Sri Lanka and India. It also spreads out to other countries such as Malaysia, Japan, China, Pakistan, West Indies, East Africa, Australia and South America (Loc *et al*, 2010). It is commonly found growing in wet areas near river banks and canals.

The plant is known for its medicinal use since ancient times as it possesses various healing effects and antioxidant properties. It has been used for healing treatments of small wounds and burns. The increasing demand of *C. asiatica* is met by collecting from the natural habitats. Because of limited cultivation and unrestricted exploitation of this natural resource on a large scale, the wild stock of *C. asiatica* has declined rapidly and is now listed as a threatened species by the International Union for Conservation of Nature and

National Resources (IUCN) (Mercy *et al.*, 2012) and an endangered species (Paramageetham *et al.*, 2004). Therefore, there is a need to increase *C. asiatica* production and cultivation to maintain and conserve this plant.

A hydroponic system can be applied to replace the traditional use of soil as a planting medium with water and dissolved nutrients an alternative for rapid growth of plants. Plant Growth-Promoting Rhizobacteria (PGPR) are beneficial bacteria which live on (rhizospheric) or in (endophytic) plant roots and have the ability to fix nitrogen from the atmosphere and provide the host plants with the fixed nitrogen. At present, there is minimal research carried out to understand the requirements for growth and multiplication of *C. asiatica*. Therefore, this experiment was carried out with the following objective:

To determine the best strain of PGPR that have a good relationship with the optimum use of fertilizer nitrogen to increase growth of *C. asiatica* under hydroponic condition.

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