

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfilment of the requirements for the degree of Masters of Science

**SEED PRIMING OF *Andrographis paniculata* (Burm. F.) Nees TO INDUCE SEED GERMINATION, PLANT GROWTH AND PRODUCTION OF ANDROGRAPHOLIDE**

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Seed priming is a low-cost and effective technique to enhance seed germination, seedling growth, plant growth, and yield. *Andrographis paniculata* is among the important medicinal plants grown in Asia, with poor seed germination, seedling growth and plant yield. So, the purpose of this research was to determine the effect of seed priming on seed germination and seedling growth of *A. paniculata*, thus analysing the expression of genes encoding for gibberrellin biosynthesis (gene expression) during seed germination. Lastly, to understand the effect of seed priming on the growth of *A. paniculata* and production of andrographolide. *A. paniculata* seeds were osmoprimed in four concentrations of PEG-8000 (-0.4, -0.8, -1.2, -1.6 MPa) and hormoprimered in four level of GA<sub>3</sub> (50, 75, 100 and 125 ppm) and were germinated for 14 days. Meanwhile, the non-primed seeds were considered as control. Seed treated with PEG at -0.8 and -0.4 MPa showed the highest germination percentage (71.75% and 64%) and -0.4 MPa of PEG resulted in the longest seedling length (2.52 cm) with significance difference ( $p \leq 0.05$ ) from control. Gene expression for (*GA20ox* and *GA20ox1*) was evaluated in -0.4 MPa and 100 ppm primed seeds and control. Result from RT-PCR showed that *GA20ox* and *GA20ox1* genes were expressed in all the treatments from 0 HAS to 28 HAS. Later, the seeds primed with -0.4 MPa of PEG 100 ppm of GA<sub>3</sub> and control, were further grew and were transplanted into polybags at their 8-leaf stage. The highest plant height (65.29 cm), number of branches (70.30)

and number of leaves (155.41) were obtained from seed primed with -0.4 MPa of PEG with statistically different ( $p \leq 0.05$ ) from the control. For andrographolide extraction, 10 g of the dried powdered leaves from each treatment were soaked in ethanol for 2 days before being filtered. The samples were further prepared for HPLC analysis. Statistical analysis for yield and content of andrographolide revealed no significant difference between primed seeds and control. Although, the seed primed with PEG significantly produces high quality of seedling, highest plant and leaves size.

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**PRIMING BIJI BENIH *Hempedu Bumi* UNTUK MENINGKATKAN  
PERCAMBAHAN BIJI BENIH, PERTUMBUHAN TANAMAN DAN  
PENGHASILAN ANDROGRAPHOLIDE**

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Priming biji benih ialah teknik kos rendah dan berkesan untuk meningkatkan percambahan benih, pertumbuhan anak benih, pertumbuhan tumbuhan dan hasil. *Andrographis paniculata* adalah antara tumbuhan ubatan penting yang ditanam di Asia, dengan percambahan benih, pertumbuhan anak benih dan hasil tanaman yang rendah. Jadi, tujuan penyelidikan ini adalah untuk menentukan kesan priming terhadap percambahan benih dan pertumbuhan anak benih *A. paniculata*, dan seterusnya menganalisis ekspresi gen pengekodan untuk biosintesis gibberrellin (ekspresi gen) semasa percambahan benih. Akhir sekali, untuk memahami kesan priming benih ke atas pertumbuhan *A. paniculata* dan pengeluaran andrographolide. Biji *A. paniculata* telah osmopriming dalam empat kepekatan PEG-8000 (-0.4, -0.8, -1.2, -1.6 MPa) dan hormopriming dalam empat tahap GA<sub>3</sub> (50, 75, 100 dan 125 ppm) dan dicambahkan selama 14 hari. Sementara itu, biji benih bukan priming dianggap sebagai kawalan. Biji benih yang dirawat dengan PEG pada -0.8 dan -0.4 MPa menunjukkan peratusan percambahan tertinggi (71.75% dan 64%) dan -0.4 MPa PEG menghasilkan panjang anak benih terpanjang (2.52 cm) dengan perbezaan yang signifikan ( $p \leq 0.05$ ) daripada kawalan. Ekspresi gen dinilai dalam -0.4 MPa dan 100 ppm anak benih dan kawalan. Keputusan daripada RT-PCR menunjukkan kehadiran gen *GA20ox* dan *GA20ox1* pada 0 HAS hingga 28 HAS. Kemudian, benih yang dipriming dengan -0.4 MPa PEG 100 ppm GA<sub>3</sub> dan kawalan, disemai dan dipindahkan ke dalam polibeg pada peringkat 8

helai daun. Ketinggian tumbuhan tertinggi (65.29 cm), bilangan dahan (70.30) dan bilangan daun (155.41) diperoleh daripada biji benih yang disemai dengan -0.4 MPa PEG dengan perbezaan statistik yang signifikan ( $p \leq 0.05$ ) daripada kawalan. Untuk pengekstrakan andrographolide, 10 g serbuk daun kering daripada setiap rawatan direndam dalam etanol selama 2 hari sebelum ditapis. Sampel telah disediakan selanjutnya untuk analisis HPLC. Analisis statistik untuk hasil dan kandungan andrographolide tidak menunjukkan perbezaan yang signifikan antara benih priming dan kawalan. Walaubagaimanapun, benih yang disemai dengan PEG menghasilkan kualiti anak benih, saiz tumbuhan dan daun tertinggi dengan perbezaan yang signifikan.