



UNIVERSITI PUTRA MALAYSIA

**VIABILITY AND VIGOR OF DURA, PISIFERA AND TENERA OIL
PALM (*Elaeis guineensis* Jacq.) POLLEN**

KHIN AYE MYINT

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By

KHIN AYE MYINT

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July 2010

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Selecting pollen with high viability and vigor are important for ensuring the success of oil palm seed production through controlled pollination. Therefore, an estimation of pollen viability and vigor is essential for fruit and seed setting. This study consist of three experiments. In the first experiment, pollens from three oil palm fruit-forms of 20-year old *dura*, *pisifera* and *tenera* palms were collected at Malaysia Palm Oil Board (MPOB) Research Station, Kluang and MPOB/UKM Research Station, Bangi. The objective of this study is to establish a favorable medium pollen germination medium for the assessment of pollen viability and vigor in three oil palm fruit-forms. Three types of media: two solid media prepared with two types of sugar i.e. 11% sucrose and glucose and another is sucrose liquid medium (sucrose 2.5%+0.01% boric acid) was investigated. Pollen was incubated at 35°C for 2 hours. Experiment was carried out by using completely randomized design with four replications. Data were collected at 60, 120 and



180 minutes. *Dura* pollen germination percentage as well as pollen tube growth showed good response in solid sucrose medium compared to other media. Solid sucrose media yielded highest pollen germination percentage among the media tested at 60 min (69.7%) to 180 min (75.8%) which is significantly higher than liquid medium but no difference with glucose solid medium. Liquid media gave longer pollen tube (409.0 μ m) but with no significant difference with solid sucrose medium (405.7 μ m). Only liquid medium caused the rupturing of pollen tubes. Solid glucose medium produced only shorter pollen tubes and was significantly shorter than solid sucrose and liquid sucrose medium. The effect of liquid sucrose medium was more pronounced in *pisifera* pollen. Solid sucrose medium emitted longer pollen tube length (372.1 μ m) with smooth and slender tubes without bursting which is no difference with liquid sucrose medium (419.6 μ m). At 60 min after incubation exhibited was the highest pollen germination rate (PGR) and pollen tube length rate (PTLR) was the most important counting time. For PTLR, at 60 min counting time, all media tested were not significantly different for *dura* pollen. Solid sucrose and liquid sucrose media had significantly higher PTLR than solid glucose in *pisifera* pollen. For *tenera*, solid sucrose and solid glucose media provided significantly higher PTLR than liquid sucrose medium.

In the second experiment, the study was carried out to investigate the effect of different pollen sizes (small < 32 μ m and large>32 μ m) on pollen germinability and vigor. Experiment was carried out by using completely randomized design with four replications. Data were collected with 60 min interval up to 180 min. Results showed that small pollen generally have a higher germinability and is free from impaired factors such as slower tube growth rate and hypertrophy effect. Both rates of germination and tube



growth were highest at 60 min after incubation and increase with the declining rate up to 120 min and 180 min.

In the third experiment, pollen was taken from three different fruit forms of 20 and 8-year old oil palm and stored in sub-zero condition at different temperature regimes (0°C, -5°C, -10°C, -15°C and -20°C). Experiment was conducted by completely randomized design with four replications. Percentage of pollen germination (PG), rate of pollen germination (PGR), pollen tube length (PTL) and rate of pollen tube growth (PTLR) from 180 min measuring time was evaluated in each storage temperature level with 2 months interval until 6 months. Generally, all the tested pollen sources decrease viability and vigor with storage time. The germination percentage and vigor of all pollen sources were maintained during the first two months after storage. This experiment pointed that -15 °C was the best storage temperature among all the other tested temperatures regimes for both traits, pollen germination and tube growth.



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

KEBERNASAN DAN KECERGASAN DEBUNGA KELAPA SAWIT (*Elaeis guineensis* Jacq.) DURA, PISIFERA DAN TENERA

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Pemilihan debunga dengan kebernasan dan kecersagan yang tinggi adalah penting bagi menentukan kejayaan pengeluaran biji benih kelapa sawit melalui pendebungaan terkawal. Oleh yang demikian, anggaran kebernasan dan kecersagan debunga adalah sangat penting untuk pembentukkan buah dan bijibenih. Kajian ini mengandungi tiga eksperimen. Dalam eksperimen pertama, debunga daripada tiga jenis bentuk-buah sawit iaitu dari pokok sawit berumur 20 tahun *dura*, *pisifera* dan *tenera* yang diperolehi dari Stesen Lembaga Minyak Sawit Malaysia (MPOB), Kluang dan Stesen Penyelidikan MPOB/UKM, Bangi. Objektif kajian ini adalah untuk menentukan media yang sesuai bagi mendapatkan percambahan debunga yang optimum untuk penilaian kebernasan debunga dengan mengukur panjang tiub debunga dan kadar kebernasan untuk tiga jenis bentuk-buah kelapa sawit. Tiga jenis media digunakan iaitu; dua media pejal disediakan dengan menggunakan dua jenis gula iaitu 11 % sukrosa dan glukosa dan media ketiga adalah satu cecair sukrosa (sukrosa 2.5 % + 0.01 % borik asid). Debunga disimpan pada 35 °C selama 2 jam. Eksperimen dijalankan dengan menggunakan rekabentuk rawak



lengkap dengan empat replikasi. Data diambil pada setiap selang 60 minit(min) sehingga 180 minit(min).

Debunga *dura* mencatatkan peratus percambahan dan pertumbuhan tiub debunga yang baik di dalam media pejal sukrosa berbanding jenis media yang lain. Media pejal sukrosa merekodkan peratusan percambahan tertinggi berbanding media yang lain pada 60 minit (69.7 %) sehingga 180 min (75.8 %) di mana ia lebih tinggi secara bererti berbanding media cecair tetapi tidak berbeza dengan media pejal glukosa. Media cecair memberikan pertumbuhan tiub debunga yang lebih panjang (409.0 μm) tetapi tidak menunjukkan perbezaan yang bererti dengan media pejal sukrosa (405.7 μm). Hanya media cecair yang mengakibatkan kerosakan tiub debunga. Media pejal glukosa menghasilkan tiub debunga yang pendek dan ketara lebih pendek berbanding tiub debunga dari media sukrosa pejal dan media sukrosa cecair. Kesan media cecair sukrosa lebih jelas ke atas debunga *pisifera*. Media pejal sukrosa menggalak pertumbuhan tiub debunga yang lebih panjang (372.1 μm) dengan tiub yang licin dan halus tanpa meletus di mana ia tiada perbezaan dengan media cecair sukrosa (419.6 μm). Pada 60 minit selepas pengeraman merekodkan kadar percambahan debunga(PGR) dan kadar panjang tiub debunga(PTLR) yang tertinggi ialah masa pengiraan yang paling penting. Untuk PTLR, pada 60 min pengiraan, semua media yang diuji adalah tidak berbeza secara bererti untuk debunga *dura*. Kesan media pejal dan cecair sukrosa mempunyai PTLR yang paling tinggi dan perbezaanya adalah ketara dengan *pisifera* debunga dalam media pejal sukrosa. Bagi *tenera*, media pejal sukrosa dan pejal glukosa memberikan PTLR yang lebih tinggi secara bererti berbanding media cecair sukrosa.

Dalam eksperimen kedua, kajian dijalankan untuk melihat kesan saiz debunga yang berlainan terhadap kebolehan debunga untuk bercambah dan kecergasannya. Eksperimen dijalankan menggunakan rekabentuk penuh rawak dengan empat replikasi. Data dikumpulkan pada setiap selang 60 min sehingga 180 min. Keputusan menunjukkan bahawa debunga kecil secara umumnya mempunyai kebolehan bercambah yang lebih tinggi dan bebas daripada faktor penghalang seperti kadar pertumbuhan tiub yang perlahan dan kesan hipertrofi. Kedua-dua kadar percambahan dan pertumbuhan tiub debunga adalah tertinggi pada 60 min selepas pengeraman dan dengan peningkatan kadar yang semakin berkurangan sehingga 120 min dan 180 min.

Dalam eksperimen ketiga, debunga diambil dari tiga jenis bentuk-buah yang berbeza iaitu daripada pokok berusia 20 dan 8 tahun dan disimpan pada suhu di bawah kosong (0 °C, -5 °C, -10 °C, -15 °C and -20 °C). Eksperimen dijalankan menggunakan rekabentuk penuh rawak dengan empat replikasi. Peratus percambahan debunga (PG), PGR, panjang tiub debunga (PTL) dan PTLR pada 180 min dinilai pada setiap suhu penyimpanan pada setiap selang 2 bulan sehingga 6 bulan. Secara umumnya, semua jenis debunga yang diuji menunjukkan penurunan kebernasan dan kecergasan dengan masa penyimpanan. Peratus percambahan dan kecergasan debunga bagi semua sumber debunga adalah kekal pada dua bulan pertama selepas penyimpanan. Kajian ini menunjukkan bahawa -15 °C adalah suhu simpanan terbaik berbanding suhu yang lain berdasarkan kedua-dua ciri percambahan debunga dan pertumbuhan tiub debunga.

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I certify that a Thesis Examination Committee has met on 29 July 2010 to conduct the final examination of Khin Aye Myint on her thesis entitled “ Viability and Vigor of Dura, Pisifera and Tenera Oil Palm (*Elaeis guineensis* Jacq.) Pollen” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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DECLARATION

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

KHIN AYE MYINT

Date: 29 July 2010



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