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FLORAL DEVELOPMENT AND ASSISTED POLLINATION COMPATIBILITY OF D197 DURIAN VARIETY (RAJA KUNYIT/MUSANG KING)

NURLISA SU SY EI

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By

NURLISA SU SY EI

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NURLISA SU SY EI

April 2021

Chairman : Mohd. Firdaus bin Ismail, PhD
Faculty : Agriculture

Durian is a fruit under family Bombacaceae carrying the genus Durio has long been known as king of fruit and is locally highly in demand when it comes to seasonal fruits. Musang King (D197) variety is receiving a lot of attention due to its high-quality taste of arils. As the interest of growers increase for Musang King variety and to optimise its fruit production, growers start to plant durian in monovariety fashion instead as recommended conventionally to plant more than one variety in a planting area. Thus, this study aim is to elucidate the pollination compatibility status of *Durio zibethinus* variety D197 (Musang King) with regard of high fruit sets. Musang King trees used in this study were located at durian orchards in Lembah Klau, Raub, Pahang owned by Lembah Temir Resort. The experiment was carried out by pollinating flower of Musang King as maternal with Musang King pollen of the same tree (PST), with Musang King pollen of different tree (PDT), with pollen of D24 (xenogamy), autonomous autogamy and in comparison, with openly pollinated acted as control. Fruit sets of each treatment were recorded at 7th, 14th, 21st, 28th days after anthesis or pollination and at harvest. Musang King durian flowers showed herkogamy condition as the stamen tend to curve outward away from the stigma during anthesis and throughout the flower development there is difference of height between stigma and anther. Pollination study showed crossing of Musang King with D24 variety produce significant higher fruit set which was 16.28% at harvest while other treatments had 0% of fruits set at harvest except for control or open pollination which fruits set recorded were 0.87%. Fruits set were significantly higher when Musang King flowers were cross pollinated with D24 pollens (Xenogamy) compared to when self-pollinated and open pollination. This indicated that Musang King is suitable to be planted in polyvarieties instead of monovariety.

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

PERKEMBANGAN BUNGA DAN KESERASIAN PENDEBUNGAAN BERBANTU DURIAN VARIETI D197 (RAJA KUNYIT/MUSANG KING)

Oleh

NURLISA SU SY EI

April 2021

Pengerusi : Mohd. Firdaus bin Ismail, PhD
Fakulti : Pertanian

Durian adalah tanaman berbuah dibawah keluarga Bombacaceae iaitu di bawah genus Durio dan telah lama dikenali sebagai 'Raja Buah' dan mendapat permintaan yang tinggi di antara buah-buahan bermusim tempatan. Musang King (D197) mendapat perhatian ramai disebabkan oleh isinya yang berkualiti tinggi. Disebabkan minat penanam durian untuk menanam Musang King semakin meningkat dan ke arah mengoptimumkan pengeluaran klon ini, penanam mula menanam varieti ini secara monovarieti berbanding dengan saranan konvesional untuk menanam durian secara polivarieti bagi satu kawasan penanaman. Tujuan utama kajian ini adalah untuk mengenalpasti status keserasian pendebungaan *Durio zibethinus* variety D197 (Musang King) dengan mengambil kira kejadian buah yang ditinggi. Pokok Musang King yang digunakan di dalam kajian ini terdapat di kebun yang terletak di Lembah Klau, Raub, Pahang dimiliki oleh Lembah Temir Resort. Kajian telah dilakukan dengan mendebungakan bunga Musang King sebagai induk dengan debunga daripada Musang King dari pokok yang sama (PST), debunga Musang King dari pokok berlainan (PDT), debunga dari durian variety D24 (xenogami), autogami berautonomous dan dibandingkan dengan pendebungaan secara terbuka sebagai rawatan control. Kebolehjadian buah untuk setiap rawatan direkod pada hari ketujuh, ke-14, ke-21, ke-28 dan pada waktu antesis atau hari pendebungaan dan juga pada hari tuai. Bunga Musang King menunjukkan ciri-ciri herkogami kerana stamen mulai melengkung menjauhi stigma ketika antesis dan sepanjang pertumbuhan bunga terdapat perbezaan tinggi antara stigma dan anter.Pendebungaan menunjukkan pendebungaan silang antara Musang King dan varieti D24 menghasilkan kejadian buah yang tinggi secara signifikan iaitu sebanyak 16.28% ketika tuai manakala rawatan lain mendapat 0% kejadian buah ketika tuai kecuali pendebungaan terbuka yang telah mencatat 0.87%.Kejadian buah mempunyai tahap ketinggian yang signifikan apabila Musang King dikacukkan dengan debunga D24 (xenogami) berbanding dengan pendebungaan sendiri dan pendebungaan terbuka.

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This thesis was 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 were as follows:

Mohd. Firdaus bin Ismail, PhD
Senior Lecturer
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Yahya bin Awang, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

ZALILAH MOHD SHARIFF, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 14 April 2022

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) were adhered to.

Signature: _____

Name of Chairman of Supervisory Committee: Dr. Mohd. Firdaus bin Ismail

Signature: _____

Name of Member of Supervisory Committee: Associate Professor Dr. Yahya bin Awang

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LIST OF ABBREVIATIONS

D197	Raja Kunyit or Musang King
%	Percentage
<	Less than
≤	Same or less than
ANOVA	Analysis of Variance
et al.	And Friends
CRD	Completely Randomized Design
DOA	Department of Agriculture
EPP	Effective Pollination Period
SAS	Stigma-anther Separation
SAS	Statistical Analysis System
SI	Self-incompatibility
malf	Malformation
n.d.o	Non develop ovule
PST	Pollen from same tree
PDT	Pollen from different tree

CHAPTER 1

INTRODUCTION

Pollination is a transfer of pollen to the stigma of female part which might be in the same flower or different flower (Abrol, 2015). It is important step to produce seeds. There are many factors affecting the success of pollination for example pollen quantity and quality, number of pollinators visiting the plant and its effectiveness and also the population of the plant (Wilcock & Neiland, 2002). Factors mentioned can be concluded under the topic of pollination mechanisms which bear decisive power upon the plant breeding activities. Pollination mechanisms start from the transfer of pollen from one flower to another plant until the fertilisation process (Frankel & Galun, 2012). This includes the capability of the plant to have successful pollination through its pollination compatibility with its own pollen or other pollens. Plant which does not compatible with its own pollen is known to have self-incompatibility (Kao & McCubbin, 1996).

Self-incompatibility is a condition where plant is unable to produce functional male and female gametes to set seed when self-pollinated (Brewbacker,1957) and a system regulate by plant to prevent inbreeding (Takayama & Isogai, 2005) which is a condition that could result to reduction of genetic variability in the species (Kao & Mccubin, 1996). Thus, self-incompatibility is a way for plant to promote outcrossing between genetically different individuals of the same species (Barret, 1988). Further explanation on self-incompatibility will be in Chapter 2.

The relation of pollination study with durian is that, durian flower has long been known as night blooming flower or nocturnal flower making it most suitable to be pollinated by nocturnal pollinator agent. Most of durian varieties studied have shown self-incompatibility pattern and it is recommended to interplanting durian varieties within a planting area (Zainal & Zabedah, 1999). There is variability in the magnitude of self-incompatibility among the durian varieties studied (Lim & Luders, 1996). In relation with that, study done by Honsho et al., (2004b) had proven that, certain variety is able to obtain high yield when being self-pollinated like Kradum Thong. The difference study outcome of different variety of durian means that each variety has its own pollination preference of pollen. In Lim & Luders (1996) previous study on boosting durian productivity had found out that self-pollination resulted in more fruit drop, formation of deformed fruit and the occurrence of partial self-incompatibility of durian.

The confirmation of the pollination status could help growers of Kradum Thong variety to not worry about intervarieties planting when growing this variety as it showed high fruit set when pollinated with its own pollen.

In addition, this shows the impact of identification and confirmation of compatibility of durian variety could help growers to decide the best planting system for their durian orchard and help to increase their productivity efficiency. For Musang King durian, there were no scientific report regarding the pollination compatibility status. This could raise a question mark among Musang King growers if they could grow it in mono variety fashion in order to maximise the profit by growing only high value variety. This shows how important it is to determine the pollination compatibility status of Musang King durian as it is needed to make decision on the planting system.

Previous studies had used the pollination treatments as a way to identify which pollination method will give the highest fruit sets. For example, Lim & Luders (1996) cross pollinate three variety of female parents of durian (Gumpun, Gob and Gaan Yaow) with the different variety of durian and include self-pollination too in their study. For Bumrungsri et al., (2009), comparison was made between the effect of hand pollinated durian flower which later translated as facilitated autogamy, flower with open pollination and emasculated flower. Thus, both of stated above studies are the examples of methods used to investigate the pollination compatibility of durian.

For this study, the methods from the previous durian compatibility studies as above were used with two objectives listed to achieve the aim of the study. Both studies were conducted at Lembah Temir Resort, Lembah Klau, Raub Pahang (3.7182° N, 102.0347° E) from year 2017 until 2018 starting from January until December of both years. Therefore, the aim and objectives of this study were;

Aim: To elucidate the pollination compatibility status of *Durio zibethinus* variety D197 (Musang King) with regard of high fruit sets.

Objectives:

1) To understand the floral development and anthesis period of Musang King durian.
2) To investigate the pollination compatibility of Musang King durian through different pollination treatments in relation with fruit set success.

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