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## Conservation Strategy of a vulnerable species of ‘Rosewood’ (*Dalbergia latifolia Roxb*) by Insect Pollinator Identification

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**Abstract.** Rosewood (*Dalbergia latifolia Roxb*) is a vulnerable species with quality and commercial timbers. Hence, a conservation is necessary to prevent rosewood from extinction in the near future. Information on insect pollinators is fundamental for initiating the rosewood conservation in wildlife. Insect pollinators are highly beneficial to bring fertilization. This research aims to identify the insect pollinators on rosewood plants. The research was implemented in Purwodadi Botanic Garden used Completely Randomized Design (CRD) with three replication. This research conducted when the flowers bloomed in September 2018 starting from 07.00 – 11.00 am. The insect abundance was calculated via a scoring method. The observation showed 5 types of the visiting insect pollinators in the rosewood collection of the Purwodadi Botanic Garden. Such five types of insects include *Xylocarpa confusa*, *X. fenestrata*, *X. iridipennis*, *Apis cerana*, and *Polistes metricus*. In term of the level of abundance, there are two species of pollinators found, namely *X. confusa* and *A. cerana*. Among the two, *X. confusa* is the most dominating species of pollinators on rosewood of around 25 bees. In accordance with the results of the research, it is necessary to develop a conservation strategy of *X. confusa* for rosewood in wildlife. One method of conserving the pollinator is by establishing a habitat to support the pollinators’ lives. The existence of *X. confusa* and *A. cerana* can preserve rosewood plants and save them from extinction.

### 1. Introductions

*Dalbergia latifolia* or rosewood is a native species of India and Indonesia, and exotic species of several other countries like Kenya, Malaysia, Myanmar, Nepal, Nigeria, Philippines, Sri Lanka, and Vietnam [1]. This species is widely used for plantation due to its ecological services of binding nitrogen and repairing soil [1,2]. Rosewood has premium quality timbers, which is internationally recognized as “Indian Rosewood”. It is mostly utilized in manufacturing, panel, and other decorative industries. Rosewood bark also produces tannin, which can act as medicine. Hence, this species comes with an economic value [3]. In timber trade, rosewood is known by many names such as: England (black rosewood, blackwood, Bombay black wood, East Indian rosewood, Indian palisandre, Java palisandre, Roseta rosewood; France (palisandre de l'Inde, Palissandre Asie, Palissandre d'Asie); German (Indischer Rosenholzbaum, Indisches Rosenholz, Palisander); Gujarati (kalaruk, shisham); Hindi (sital, bhotheula, shisham, bide, beete, chava); Indonesian (sonokeling, sonobrits); Javanese (pallisander, sonosungu, sonokeling, sonobrits); Nepali (sital); Sanskrit (shishapa); Tamil (karundoviral, eruvadi, iridi, itti, palkonda); Trade name (East Indian rosewood, rosewood, Bombay blackwood, Indian



rosewood); Urdu (shisham); Vietnamese (tr(aws)c) [1]. Data from IUCN Red List of threatened species 2018 shows that rosewood is categorized as vulnerable species. Thus, it is necessary to develop a conservation method to minimize the extension risk of the species in wildlife [4].

Rosewood is classified in Fabaceae family [2]. Some of the rosewood species are entomophily, namely plants of which pollination requires insects [5,6,7,8]. Hence, information on insect pollinators is crucial to initiate the rosewood conservation in wildlife since insect pollinators hold a vital role in moving pollen from the anther to the stigma of a flower that initiate pollination [9]. Identification of the pollinator can lead to a more effective management of pollination since it allows the sufficient provision of it in the flowering season.

Insect pollinators generally come from Lepidoptera, Hymenoptera, Diptera and Coleoptera groups. The Hymenoptera order includes many insect pollinators especially bees [9]. Modifications to flowers (color, scent, nectar content) and flowering season shall determine the variation levels of insect pollinator visits on plants [10,11,12].

## 2. Materials and Methods

### 2.1. Experimental Design of the research

The research was performed in Purwodadi Botanic Garden - Indonesian Institute of Sciences with altitude 300 m above the sea and a temperature ranging from 22° - 32° C during September 2018. Rosewood plant in Purwodadi Botanic Garden at Vak II.A. 21-21a (Figure 1). Care for the collection of rosewood plants following the maintenance procedures of Purwodadi Botanic Garden.



**Figure 1.** Location map of rosewood collection in Purwodadi Botanic Garden

### 2.2. Observation and identification on insect pollinator visits on rosewood plants

The experimental design was used Completely Randomized Design (CRD) with three replication. The observation on insect pollinator visits on rosewood plants on the flowering season of September 2018 from 07.00 – 11.00 am. Identification of pollinators was done in Laboratory of Plant Pests and Diseases, Indonesian Sweetener and Fiber Crops Research Institute, Agricultural Research and Development Agency, Ministry of Agriculture. Insect pollinator identification using Insect Classification. In: Entomology and Pest Management Book by Pedigo and Rice (2014) [13]. The abundance of the visiting insect pollinators was recorded by scoring system using the following pollinator abundance criteria :

- + = <5 pollinators
- ++ = 6-10 pollinators
- +++ = 11-15 pollinators
- ++++ = 15> pollinators

### 2.3 Data analysis

The abundance of visiting insect pollinators on the rosewood collection of Purwodadi Botanic Garden based on family of the insect pollinator were analyzed by T-Test. Hence, the abundance of visiting insect

pollinators on the rosewood collection of Purwodadi Botanic Garden based on genus of the insect pollinator were analyzed by ANOVA and if the results were significantly different ( $\alpha$  5%), continued with Duncan Multiple Range Test.

### 3. Result and Discussions

The observation showed 5 types of the visiting insect pollinators in the rosewood collection of the Purwodadi Botanic Garden. Such five types of insects include *Xylocarpa confusa*, *X. fenestrata*, *X. iridipennis*, *Apis cerana*, and *Polistes metricus* (Figure 2). Each type of insect pollinator has various abundance level (Table 1).



**Figure 2.** Types of insect pollinators on rosewood collection of Botanical Garden of Purwodadi (a) *Xylocopa confusa*, (b) *Xylocopa fenestrata*, (c) *Xylocopa iridipennis*, (d) *Apis cerana*, (d) *Polistes metricus*

**Table 1.** The abundance of visiting insect pollinators on the rosewood collection of Purwodadi Botanic Garden

Spesies	Genus	Family	Abudance
<i>Xylocopa confusa</i>	<i>Xylocopa</i>	Apidae	++++
<i>Xylocopa fenestrata</i>	<i>Xylocopa</i>	Apidae	+
<i>Xylocopa iridipennis</i>	<i>Xylocopa</i>	Apidae	+
<i>Apis cerana</i>	<i>Apis</i>	Apidae	++
<i>Polistes metricus</i>	<i>Polistes</i>	Vespidae	+

**Table 2.** The abundance of visiting insect pollinators on the rosewood collection of Purwodadi Botanic Garden based on family of the insect pollinator.

Genus	Number of visiting insect pollinators*
Apidae	31 a
Vespidae	5 b

\* The number in colloum followed by the same letter is not significantly different by T-Test ( $\alpha = 5\%$ ).

**Table 3.** The abundance of visiting insect pollinators on the rosewood collection of Purwodadi Botanic Garden based on genus of the insect pollinator.

Genus	Number of visiting insect pollinators
<i>Xylocopa</i>	25 a
<i>Apis</i>	6 b
<i>Polistes</i>	5 b

\* The average in colloum followed by the same letter is not significantly different by DMRT ( $\alpha = 5\%$ ).

Numerous factors may cause the extinction of a plant species. One of them is reproduction or pollination failure. An effort to increase the success of pollination is vital to support the conservation of a plant especially rosewood plant. Wind, human, mammals, and insect pollinators can improve pollination. Insect pollinator is considered as the best technique of pollination among others due to its high level of success. Therefore, it is necessary to conduct research on pollinator identification as a key strategy for vulnerable species of 'rosewood' conservation.

Data in table 2 and 3 showed that variance analysis showed significant values ( $p < 0.01$ ), which mean that significant differences between the abundance of visiting insect pollinators on the rosewood collection of Purwodadi Botanic Garden based on family and genus of the insect pollinator. The observation showed 2 insect families and 5 species of insect pollinators on rosewood. The insect families are included in Apidae and Vespidae. Apidae family dominated almost 80 % of the pollinators found on rosewood while Vespidae occupied the remaining 20 % (Table 2 and 3). Apidae family is known for its role as pollinator. The Apidae family consists of good pollinators both for natural or farming habitat [14]. Moreover, the Vespidae family is mostly known as pollinators but they are more likely to be pest predators instead of pollinators.

In term of the level of abundance, there are two species of pollinators found, namely *Xylocopa confusa* and *Apis cerana*. Among the two, *X. confusa* is the most dominating species of pollinators on rosewood of around 25 bees (Table 3). This type of pollinator is known to be an excellent pollinator due to its big size and it has a high body capacity to move the pollen. *X. confusa* frequently appears on weathered timber, log cabin, and dead branches. Usually, *X. confusa* dwells on shade but some of them also dwell on the heat [15]. It dwells to nurture its larvae.

Extreme changes on the environment due to the changing global climate and imbalanced agricultural cultivation due to chemical pesticide threaten the lives of insect pollinators. Such a threat will indirectly lead to the extinction of plants that depends on pollinators to cope with the environmental changes. Hence, it is vital to develop a pollinator conservation in order to conserve the rosewood plant. The pollinator conservation is possible by fulfilling its living needs by providing flowery plants as source of food and energy, and providing plants for pollinators to dwell and breed, which can protect them from the predators. The fulfilment of the living needs of the pollinators shall guarantee their survival and increase of population.

Identification of pollinators on rosewood plants is expected to provide the necessary information for the subsequent research aimed to prevent rosewood plants from extinction by conserving the pollinators of the rosewood plants. The existence of *X. confusa* and *A. cerana* can preserve rosewood plants and save them from extinction.

#### 4. Conclusions

Rosewood is entomophily plants of which pollination requires insects. Hence, information on insect pollinators is crucial to initiate the rosewood conservation in wildlife since insect pollinators hold a vital role in moving pollen from anther to stigma of a flower that initiate pollination. Identification of pollinators on rosewood plants is expected to provide the necessary information for the subsequent research aimed to prevent rosewood plants from extinction by conserving the pollinators of the rosewood plants. The observation showed 2 insect families and 5 species of insect pollinators on rosewood. In term of the level of abundance, there are two species of pollinators found, namely *Xylocopa confusa* and



*Apis cerana*. Among the two, *X. confusa* is the most dominating species of pollinators on rosewood of around 25 bees. The existence of *X. confusa* and *A. cerana* can preserve rosewood plants and save them from extinction.

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