Spines growth responses of dragon blood (*Daemonorops draco*) rattan seedlings in several compositions of organic media

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Abstract. Cultivation of *Daemonorops draco* is one of the conservation strategies to conserve its population in nature. Complete data and information about morphology are needed to support cultivation techniques. There has been much research on the morphology of *D. draco*, but the research of rattan spines is lack. Rattan spines have an important function in protecting themselves against herbivores or seed predators. Growing media is one of the factors that influence the growth of rattan spines. We studied the growth of rattan spines from several compositions of organic media in nurseries. The experiment was arranged in a completely randomized design, with five treatments and three replications. The treatments were compositions of organic media content, i.e.: 0%, 25%, 50%, 75%, and 100%. The variables observed were the number of rattan spines, spines color, and spines angle. Our results showed that the media composition of 75% organic matter tends to show higher spines growth response even though statistically not significantly different with 100% mineral soils. Spine's color was light green to yellow. Spines angle was pointed downward towards the grounds.

1. Introduction

*Daemonorop draco* is one of the rattan species that produces a red resin, traditionally known as *jernang* [1]. In Jambi, *jernang* rattan has many benefits for economic, ecological, and social value. This is why the *jernang* rattan has been nominated as a superior local plant [2]. This species has the potential to be developed outside of forest areas [3] and is also suitable to be cultivated in rubber agroforestry systems in a minimum area of 1.28 hectares [4-6].

Recently, the source of *jernang* was decreasing and threatened while its demand is increasing [7]. A large amount of *jernang* has been produced from rattan extraction in natural forests. In contrast, natural forests as a rattan habitat are degraded and deforested due to illegal logging, forest fires, and land conversion [5, 8]. For example, [9] reported that the population of *D. draco* in Jebak forest-Jambi declined because of illegal logging and forest encroachment.

Cultivation of *D. draco* is one of the conservation strategies to conserve its population in nature [10]. Although in terms of genetic diversity, the cultivated population has a lower genetic diversity value than the natural population [11]. Complete data and information about morphology are needed to support cultivation techniques. Spines are various parts of rattan morphology. There has been much research on the morphology, but research on rattan spines is lacking [12]. Rattan sheaths have spines...
for protection themselves against herbivores or seed predators [13]. Rattan spines play a significant role in supporting the rattan as it grows over trees and other plants in the rainforest [14]. Growing media is one of the factors that influence the growth of rattan spines. Organic media can be used as a growth media and gave the growth response that was not different from mineral soil media [15]. Organic media can be applied as an alternative growing media for substitutes of topsoil. The advantages of organic media are easy, cheap, and abundant [16].

This study aimed to investigate the spines growth of leaf sheaths from several compositions of organic media in nurseries and the morphology. The results of this study can be used to complete the data of rattan morphology and to support for species identification and cultivation technique.

2. Experimental Methods
2.1. Study site
The research was conducted from August 2010 to July 2011 in the nursery of Wana Griya, Forestry Research Institute Palembang. This nursery is a semi-permanent nursery located in Srijaya Village, Alang-Alang Lebar Sub-district South Sumatra Province (2°56’59.3" S, 104°43’42.5" E) (Figure 1). Based on data of BMKG Kenten-Palembang in 2011, this area had an average annual rainfall of 1,452 mm.

Figure 1. Map of the study site.
2.2. Material
The material used was seedlings of jernang rattan from 2.5 to 8.5 months age grown in organic media (Figure 2). Organic media used was composted wood sawdust, which comes from sawmill waste. Mineral soil was taken from topsoil around the nursery, while seeds were collected from mother trees in Lamban Sigatal Village, Pauh Sub-district, Sarolangun district, Jambi Province. Seeds were germinated in August 2010 and transplanted into polybags in November 2010. Seedlings were placed in the shade with an intensity of 65%. Seedlings were put in a puddle to save water. Chemical properties of the media was described in Table 1 [15].

![Figure 2. Seven months old seedlings and leaf sheath spines of jernang rattan.](image)

| Organic media content | pH   | C (%) | N-tot (%) | C/N (%) | P (ppm) | K⁺ | Na⁺ | Ca²⁺ | Mg²⁺ | CEC  |
|-----------------------|------|-------|-----------|---------|---------|----|-----|------|------|------|
| 0%                    | 6.17 | 3.6   | 0.25 M    | 14.4 M  | 120 VH  | 2.2 VH | 0.5 M | 5.5 L | 0.5 L | 17.4 M |
| 25%                   | 6.25 | 4.8   | 0.32 M    | 15 M    | 103 VH  | 1.6 VH | 0.7 M | 5.7 L | 0.8 L | 19.6 M |
| 50%                   | 6.56 | 15.3 VH | 0.46 M    | 33.4 VH | 114 VH  | 2.9 VH | 0.8 H | 6.8 M | 0.7 L | 26.1 H |
| 75%                   | 6.56 | 21 VH  | 0.81 VH   | 25.9 VH | 124 VH  | 4.5 VH | 1.3 VH | 7.3 M | 0.7 L | 34.8 H |
| 100%                  | 6.98 | 36 VH  | 0.81 VH   | 44.4 VH | 107 VH  | 5.2 VH | 1.7 VH | 9.8 M | 0.8 L | 34.8 H |

Remarks: L= low, M= medium, H= high, VH= very high (Source: Soil Research Center, 2009)

2.3. Research method
This investigation is experimental research to study the spines growth of leaf sheaths on several compositions of organic media. The experiment design was arranged in a completely randomized design (CRD) with five treatments and three replications. The treatments were compositions of
organic media content, i.e.: 0% (100% mineral soil), 25%, 50%, 75%, and 100%. Mixing organic matter and mineral soil based on volume (%).

The variables observed were the number of spines of leaf sheaths, spines color, and spines angle. The observation was carried out every 1.5 months from 2.5 (seedlings transplanted into polybag) to 8.5 months age (seedlings ready to be planted in the field). Descriptive analysis and inferential analysis were used to analyze the obtained data. Data of number and leaf sheath spines were analyzed by analysis of variance using the linear model [17].

3. Results and Discussion

3.1. Effect of organic media to growth of leaf sheath spines

Results of analysis of variance on the effect of media on the growth of leaf sheath spine from 2.5 to 8.5 months age are presented in Table 2. Table 2 showed that growing media has no significant influence on the number of leaf sheath spines statistically. Organic media was not significantly different to the growth of leaf sheath spines.

| Organic media content (% volume) | Means of number of leaf sheath spines at seedlings age |
|---------------------------------|------------------------------------------------------|
|                                 | 2.5 months | 4 months | 5.5 months | 7 months | 8.5 months |
| 0%                              | 0          | 0        | 3.1        | 6.5      | 10.8       |
| 25%                             | 0          | 0        | 4.5        | 8.4      | 13.8       |
| 50%                             | 0          | 0        | 3.0        | 6.9      | 12.4       |
| 75%                             | 0          | 0        | 3.6        | 9.4      | 14.0       |
| 100%                            | 0          | 0        | 4.9        | 8.0      | 12.7       |

Based on descriptive analysis, organic media tend to show higher spines growth response than without organic media (100% mineral soil) (Figure 3). The spines of leaf sheath began to appear at 5.5 months age. At the age of 7 and 8.5 months, growing media with 75% organic matter content shows a growth rate of 9 and 14 spines of the leaf sheath, whereas mineral soil media (0%) produce a growth rate of 6 and 11 spines.

Organic media like composted wood sawdust had a good chemical properties and higher major nutrients (N, P, K, Mg, and Ca), pH, and CEC [15]. Organic media also has excellent physical properties because it increased saturated hydraulic conductivity and gas diffusivity coefficient. The physical properties of growing media had correlated with plant growth (dry weight) [18].
Our result showed that the spines color of seedlings was light yellow. Spines angle was pointed downward towards the ground. The spines of *Daemonorops* have different shapes and colors. For example, *D. robusta* has thin spines shape and whitish to black in color. *D. sabut* has smooth spines, which are black and brown [20]. The downwards spine angle might be specifically designed to discourage climbing leaf and seed predators [12].

![Figure 3. The growth of leaf sheath spines on various media and age.](image)

3.2. *Morphology of leaf sheath spines*

The leave consists of a tubular base wrapped by a leaf sheath, which arises from the node on the stem. The sheath narrows into the petiole that continues into the rachis or leaflet-bearing portion of the leaf. Spiny leaf sheaths cover the stems of rattan (Figure 4). Spine arrangement on the leaf sheath is remarkably diverse and frequently of diagnostic importance [19]. [12] also reported that the leaf sheath spines have regular shapes and therefore are reliable for species identification. The number and arrangement of spines varied from one species to another and from genus to other genus and even between individual stems of the same species.

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4. Conclusions
The media composition of 75% organic matter tends to show higher spines growth response even though statistically not significantly different with 100% mineral soils. Spine's color was light green to yellow. Spines angle was pointed downward towards the ground.

Acknowledgments
The author would like to thank the Forestry Research Institute of Palembang for financial support. I am grateful to Joni Muara and Arli to make a nursery and assistance the seedlings measurement, Aris Boediono and Mahardhika to make a study site map.

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