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Sustainable Harvesting of Jernang rattan (*Daemonorops draco* Willd.) by Anak DalamTribe in Jebak Village, Batanghari, Jambi Province

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ABSTRACT

The Conservation of tropical trees can be achieved if supported by the sustainable use of the forest by community living nearby through harvesting of nontimber woods, for instance, rattan. Furthermore, rattan jernang (*Daemonorops draco* Willd.) individuals and trees have significant associations. Therefore, the objective of this paper is to investigate the utilization of rattan jernang (*Daemonorops draco* Wild) related to the forest tree biodiversity by the Anak Dalam tribe in Jebak village, Muara Tembesi, Batanghari Jambi. The study has identified that populations of rattan jernang (*Daemonorops draco*) were 6 clumps in the forests and 100 clumps in plantations, in Sarolangun Jambi. Moreover, 65 individual trees consisted of 30 species were identified as rattan jernang hosts and conserved by the community. *Dialium platyespalyum* and *Quercus elmer*i, were rattan host trees with the highest populations in the area. Meanwhile, the biodiversity of non-host trees consisted of 30 individual trees from 15 species. Interviews revealed that traditional harvesters have acknowledged that trees have significant important ecological roles for the rattan livelihood and therefore it is very important to conserve the forests for the sustainability of harvest in the future. Furthermore, to secure the availability of rattan, the traditional harvesters had started rattan plantation in Sarolangun Jambi.

Key words : *Biodiversity, Harvest, Rattan, Trees, Tribe.*

Introduction

Massive deforestations is one of the causes of climate change. The loss of forest stands will lead to a decrease in carbon dioxide sequestrations and followed by carbon emissions to the atmosphere. The accumulation of greenhouse gasses then will affect the global climate. Meretsky and Moore (2009) reported that consequently, increased precipitation is most likely; rain will tend to run off more, and infiltrate soil less, thus leading to drier soils in the forest.

A solution to mitigate the impact of climate change is by shifting to nontimber forest products. This practice has a significant advantage because it does not affect the carbon sequestration ability in the forest since it requires fewer tree stands. Therefore, nontimber harvest practice will conserve forest biodiversity and increase carbon stocks. Rattan has

been known and widely used as nontimber forest products (NTFP) (Sulasmi *et al.* 2012). Soemarna. (2009) reported the utilization of various rattan species for making handicrafts. However, *Daemonorops draco* is different from other rattan species that have been used for NTFP (Sulasmi *et al.* 2012). Commonly, the rattan was logged for its stems for further processed into furniture, basket, and serving trays. In contrast, the utilization of this species is only based on the extraction of the resin (known as jernang) from its fruit (Purwanto *et al.* 2009; Sulasmi *et al.* 2012). Furthermore, *D. draco* is strongly correlated with the floral diversity of the surrounding forest and depend on the host trees for climbing purpose (Langenheim, 2003). Therefore, the use of *D. draco* for NTFP has a positive ecological impact because it only requires fruit collecting and thus can promote forest biodiversity. Likewise, *D. draco* can provide microhabitat to wildlife, for example, woodpeckers (Styring and bin Hussin 2004), and as woody species, it can increase carbon sequestrations (Snitzer and Bongers 2002).

Due to its diverse application, *D. draco* has been over-exploited. Because of its overexploitation and excessive trades, rattan jernang was identified as potentially threatened amongst the 22 species in the Workshop of Specialist Ethnobotany and Economic Botany In 1997. Excessive logging of rattan host trees, cutting directly the rattan stems, and collecting rattan fruits in high frequency has caused this species listed as vulnerable species and also cited in IUCN Red List (Gupta *et al.* 2008).

To augment this body of work, this paper tested the hypothesis that the utilization of rattan jernang (*Daemonorops draco*) will contribute to the forest biodiversity. Furthermore, several objectives are formulated to test that hypothesis, they are as follows: (i) To compare the availability of *Daemonorops draco* in the wild and from the plantation; (ii) To measure resin productions and prices among Anak Dalam tribe villages; (iii) To estimate rattan jernang (*Daemonorops draco*) host and non-host trees biodiversity; (iv) To describe some important contributions that Anak Dalam tribes have recently made, applying their traditional conservation knowledge and practices to the sustainable utilization of *Daemonorops draco.*

Materials and Methods

Study area

The data for this study was collected from Jebak villages (Figure 1) inhabited by the Anak Dalam tribe in, Jambi Province, Sumatra from December 2018 to August 2019. The villages were located in the District of Batanghari, Jambi that consisted of 40 households with 250 persons.

The specific name of the villages is Desa Jebak, Kecamatan Muara Tembesi, Kabupaten Batanghari, Jambi. Rattan wild population and host trees data were collected from field surveys in the forest near

Fig. 1. Map of the study site (circle) in the village of Jebak, Batanghari (bordered area), Jambi (BKSDA Jambi 2010).

the tribe's villages with altitude 20 m above sea level. Geographical locations were 103%5'-103%15' East longitude and 01%40'-01%50' South latitude. The temperature in the sites ranged from 20-29%C with humidity ranging from 81-87% (BPS 2010).

Communities based *D. draco* plantations were located and concentrated near their villages. The seeds were collected from fruits harvested from wild populations. Rattan seeds sowed flatly in the fields. Seedlings are ready when rattan seed is germinated. After that seedlings were moved to the nursery sites with fertile media until they are ready to be planted (7-9 months).

Procedures

Materials used and collected in this study were plant specimens. For all sites, voucher specimens, of all tree species were collected and identified. The vegetation was surveyed by establishing 50 randomly located 10 m x 10 m quadrats (Fahrul, 2007). Species and number of individuals of rattan and host trees were recorded. These procedures were conducted to estimate rattan jernang individual (*Daemonorops draco*) availability along with trees biodiversity and the availability of *D. draco* in the wild. To describe characteristics of rattan harvesting by the local community, rattan harvesters and villagers (40 persons) from the tribe were interviewed with a questionnaire focused on the local knowledge regarding the rattan harvest practices, rattan host trees, resin extraction methodology, agriculture practices, revenues, and resin productions (Sulasmi *et al*. 2012).

Data analysis

The data collected from the survey, both for biological aspect data (rattan clumps, trees) and socio data were analyzed descriptively, mainly by means and percentages, summarized and presented in tables and bar graphs where necessary. The statistical measurement was based on a comparison of the mean and standard deviation values.

Results and Discussion

Availability and economy of rattan jernang

The mean values of *Daemonorops draco* clumps from wild populations were lower than from plantation in Jebak villages (Table 1). However, high standard deviation from plantation data indicates that clumps were absent in these villages. Conversely, wild rattan clumps were distributed among villages even though the numbers were varied.

Table 1. Mean and Standard Deviation of Rattan Clumps from Wild population and plantation in Jambi

	Wild population	Plantation
Mean	58.25	135.00
Standard Deviation	12.63	211.36

Village at Tebo district has the highest wild population and Batanghari was the lowest one (Figure 2). Variability of *D. draco* among sites is related to several abiotic factors (Siebert, 2005). According to the altitude, the location of the site, which is in the lowland elevation (20 m above sea level) can increase rattan populations. Snitzer and Bongers

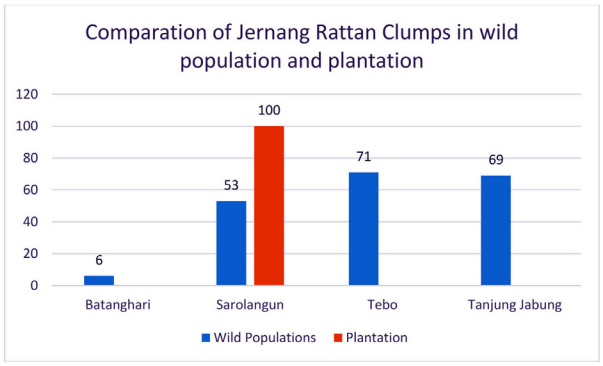

Fig. 2. Comparison of *Daemonorops draco* clumps in the wild and from a plantation in Anak Dalam tribes villages at Batanghari, Jambi Province.

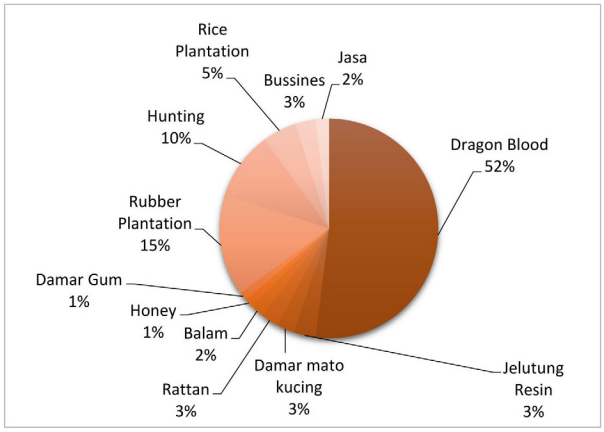

Fig. 3. Income sources of Anak Dalam Tribe in Jebak Village, Jambi

(2002) reported that rattan abundance thought to peak at low altitude and decrease in higher altitude (Ban *et al.*, 2005).

The availability of *D. draco* among those villages has provided significant contributions to the Anak Dalam tribes. Likewise, Figure 3 revealed that Non-Timber Forest Products were dominant income sources for the tribes. Furthermore, harvesting rattan resin has become a major activity for them. These results are consistent with Banjade and Paudel (2008). The NTFP can yield a significantly higher level of incremental benefits, especially through rattan harvesting.

Figure 4 confirmed that dragon blood productions and prices among villages were different. Differences in price related not only to the resin production but also due to rattan availability. Important factors that can affect the price are supply and demand. As reported by Singh *et al.* (2004), it is a common situation when supply from the wild resources is unable to meet local demand. This can lead to the shrinkage of the wild population and thus put the gene pool diversity under threat. As a consequence, the price will increase. For instance, the low population in Batanghari (Figure 2) may lead to a decrease in resin production and thus resulted in a higher price compared to other villages considering the high demand. Even though the high price can provide the community harvesters with significant income, yet, it is common that the harvesters almost no access to financial capital and low managerial capacity (Aquino and Adriano, 2006). Community-based NTFP harvesters have not been the priority sector for the financial institutions (Kunwar *et al.*, 2009).

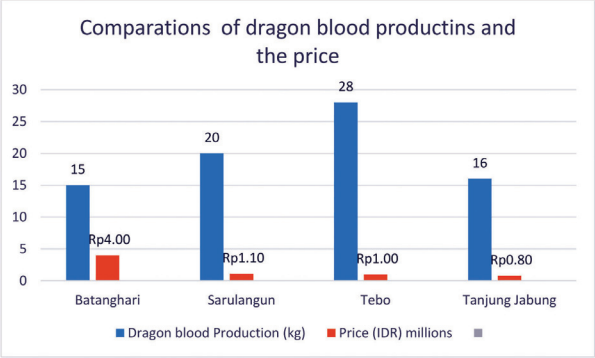

Fig. 4. Average dragon blood production (Kg) and price (IDR millions) within Anak Dalam tribes villages at Batanghari, Sarolangun, Tebo, Tanjung Jabung (East) districts, Jambi Province.

A shortage of supply is not the only important factor that could affect the prices. The disparity of resin production among villages was also related to the differences in harvesting skills across the members of Anak Dalam tribes. Since numbers of rattans were isolated in a remote area, it is almost impossible to impact knowledge of rattan jernang from all aspects ranging from physiology through harvesting, value addition, and chemical constituents. The diversity of income sources may indicate some portions of the community were not received the knowledge. According to Banjade and Paudel (2008), traditional knowledge available locally is usually preserved in the minds of a limited number of tribe members and is not shared with the next generations.

Rattan Jernang host tree biodiversity

Rattan jernang host tree confirmed in Table 2. Approximately 30 species trees with 65 individuals had been conserved by harvesters because those species were rattan host trees. Trunks and stems of intact trees required by rattan for climbing purposes have reduced the elimination of surrounding vegetation by harvesters (Sulasmi *et al.*, 2012). Therefore, numerous trees species found within the forests related to the tribe activities that were emphasized on the harvesting of NTFP.

Since harvesting rattan resins become more popular and profitable, conservations of host trees become important. Significant income from rattan resin has lead to the protection of trees instead of logging. Compare to other NTFP, rattan requires less intensive management, as a result, there is less interference with the natural product of forest recovery. Hence, forest biodiversity can be preserved. Figure 5 revealed that there were several non-host tree species also besides host trees. The current presence of non-host trees indicates the absence of logging practices since harvesting resin is more profitable. The deforestation can be reduced and avoided since the community can yield incomes from nontimber forest products. The population of host trees that higher than non-host trees can promote the biodiversity of forests. Dovie (2007); Jones and Lynch (2007) confirm since rattan depends on many species trees, then, it will lead directly to the protection and conservation of those trees.

The current trees biodiversity related to the forest harvested for rattan in this study is consistent with the study by Sulasmi *et al*. (2012). They confirmed

that the structure of the rattan induced forest was similar to that of the intact forest, with comparable tree species richness. According to Ban *et al.* (2005), if the volume of rattan is conserved, the diversity of forest ecological systems then is preserved.

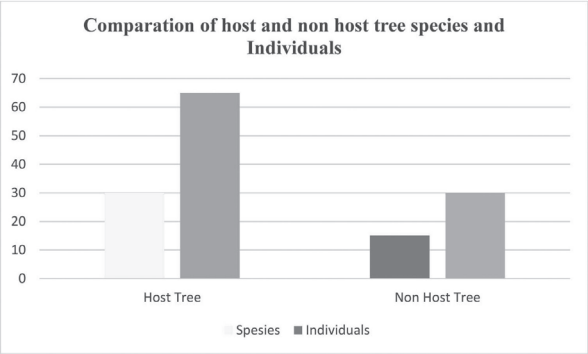

Fig. 5. Comparison of host and non-host tree species and individuals

Traditional conservation knowledge and practices

In general, the Anak Dalam tribes consider forest conservation as very important. They also agreed that the forest should be managed by the community. Correspondingly, the sustainability of rattan can be achieved if rattan resin was harvested only based on necessity. Furthermore, it is also important to limit harvest frequency. The tribes only harvest the resin twice, in August and December; this fact consistent with Soemarna (2009). According to Banjade *et al*. (2008) and Purwanto *et al.* (2009), the sustainability of nontimber forest products depends on the frequency and timing of harvesting.

Nowadays, the main threats of rattan jernang are related to the logging of tree host species. Local wisdom has great consideration regarding the roles of host trees to the rattan. However, recent deforestation and land clearing have caused great loss of host trees (BKSDA Jambi 2010). To anticipate this, ex-situ plantations have been prepared in several villages (Figure 2). For instance, villages in the Batanghari district had anticipated the shortage of resin stock by planting 40 clumps. Moreover, villages in Sarolangun district had planted a significant amount of rattan clumps. The community planting initiative in that village was 10 times higher than the wild population.

Soemarna (2009) argued that it is essential to induce in situ plantation besides relying on wild populations. Several steps need to be considered and undertaken to ensure the success of ex-situ plantations, for instance, seed storage and pretreatments. The plantation can be established within other NTFP, for instance, rubbers that are no longer productive. Therefore, it is essential to establish community-based trials emphasizing on the introduction of rattan jernang into agroforestry systems as well as enrichment planting of secondary forest, farm bush, or even abandoned lands (Singh *et al.* 2004).

The characteristic of rattan resin harvesting within Anak Dalam tribes is based on community-based management. This particular management emphasizes the principle that every member of the tribe has equal and open access to collect the rattan. The data confirmed that most of the communities agreed with this concept. Therefore, NTFP involves more people community around forest compared with timber forest products (Crevello, 2003; Malik and Sumadiwangsa, 2003). However, Purwanto *et*

Table 2. Rattan jernang host trees in Jambi

Scientific name	Individuals
Dialium platysepalum	4
Quercus elmeri	4
Eugenia sp.	3
Adinandra dumosa	3
Lansium domesticum	3
Durio zibethinus	3
Shorea teysmanniana	3
Celtis wightii	3
Paederia foetida	3
Castanopsis inermis	3
Gironniera subaequalis	2
Sloetia elongate	2
Koompassia malaccensis	2
Diospyros pilosanthera	2
Dyera costulata	2
Pangium edule	2
Pithecellobium saman	2
Spondias cytherea	2
Pithecolobium lobatum	2
Parkia speciosa	2
Mangifera foetida	1
Litsea sp.	1
Artocarpus champeden	1
Dillenia indica	1
Cinnamomum parthenoxylon	1
Macaranga hypoleuca	1
Adina minutiflora	1
Archidendron bubalinum	1
Artocarpus rigida	1
Eugenia densiflora	1
Total	65

al. (2009) argue that community-based management has several disadvantages. The open-access approach will encourage competition in harvesting the products without considering the maturity or even the quality of the products. While collecting the rattan fruits from the trees, harvesters deliver risk to destroy the whole plants or trees, severely impacting their regeneration potential and causing severe ecological destructions (Sulasmi *et al*., 2012). Therefore, within community-based management forests, these threats can be reduced if the timing and method of timing of harvesting are set.

Harvesting techniques are essential besides harvesting managements. Some particular techniques have an impact on the potential of sustainability of rattan extraction, particularly for clustering species. For instance, harvester often cut all stems in a clump (Sunderland, 2001). Besides that, rattan resins that harvested by traditional using conservative technology were traded as raw material or half-finished products. The consequence is a very low added value for the harvesters (Malik and Sumadiwangsa, 2003). However, Anak Dalam tribes have considered these and develop skills that can minimize the impact on the clumps. Usually, in collecting the fruits, they will deliberately avoid cutting the stems. They believe that by implementing these practices, the stems keep alive and still can produce fruits.

Conclusion

As essential socio-economic information combined with biological and ecological on rattan jernang resources originated from Jambi become available and suitable strategies to ensure NTFP harvests are implemented, there is significant potential for particular sustainable use by Anak Dalam tribes to contribute the forest biodiversity. Nowadays, it possesses several challenges. There were disparities of rattan availability. The study has identified that wild populations of *Daemonorops draco* were varied among villages. These conditions have affected the resin production capacity and prices. For instance, the low population in Batanghari may lead to a decrease in resin production and thus resulted in a higher price. However, through community-based management, in situ plantation, and timing of harvesting, rattan jernang utilization could provide an opportunity for the sustainable development of Anak Dalam tribes along with forest trees biodiversity conservation. Comparatively, there were several non-host tree species besides host trees. The current presence of non-host trees indicates the absence of logging practices since harvesting resin is more profitable. Therefore, baseline research must contribute to the development and implementation of long term NTFP.

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