

## **Jernang rattan (*Daemonorops draco*) management by Anak Dalam Tribe in Jebak Village, Batanghari, Jambi Province**

**IIK SRI SULASMI<sup>1</sup>, NISYAWATI<sup>2</sup>, YOHANES PURWANTO<sup>3</sup>, SITI FATIMAH**

<sup>1</sup>Conservation Biology, Post Graduate School, Faculty of Mathematic and Natural Sciences, University of Indonesia, Depok, West Java, Indonesia, Tel. +62-21-7270013, \*email: iik\_08@yahoo.com

<sup>2</sup>Department of Biology, Faculty of Mathematic and Natural Sciences, University of Indonesia. UI Campus, Depok 16424, West Java, Indonesia

<sup>3</sup>Division of Botany, Research Center for Biology, Indonesian Institute of Sciences, Cibinong-Bogor, West Java, Indonesia

Manuscript received: 23 June 2012. Revision accepted: 14 July 2012.

### **ABSTRACT**

Sulasmi IS, Fatimah S, Nisyawati. 2012. *Jernang rattan (Daemonorops draco) management by Anak Dalam Tribe in Jebak Batanghari, Jambi Province. Biodiversitas 13: 151-160.* Management of Jernang Rattan (*Daemonorops draco* Willd.) in Jebak Forest, Batanghari, Jambi is not well documented. It is noted that fruit of *D. draco* is the best income source for Anak Dalam Jambi people since 1624. They harvest fruit of *D. draco* as much as they need. The Jebak forest is an open access, so all the people of Anak Dalam Jambi Tribe have the same right and responsibility on the forest. However, almost 60% of Jebak Forest area has been degraded because of illegal conversion into oil palm plantation. This is the reason why people of Suku Anak Dalam, try to cultivate *D. draco* by growing 40 clumps of this species in their rubber plantation. The aim of their activity is to conserve *D. draco* at their forest. Based on the recent situation, research study of jernang rattan management in Jebak Forest was conducted. The research method was semi structural interview. All data were analyzed descriptively. The results showed that the management and cultivation of *D. draco* in Jebak Forest was very difficult because the availability of seeds was not sufficient for root stocks.

**Key words:** cultivation, income source, Jebak Forest, management, jernang rattan.

### **INTRODUCTION**

The people belonging to Anak Dalam Tribe in Jebak Village, Batanghari District, Jambi Province are the refugees who came from South Sumatra. They came to the forest in Jambi province in 1624 because of the war between the Sultanate of Palembang and Jambi Kingdom. The majority of the populations are moslems. Their daily language is Malay. The people of Anak Dalam Tribe in Jebak forest have yellow skin, ranging in height between 140-160 cm. Their houses are usually made of wood and thatch-roofed (Ministry of Social Affairs 1998).

The people of Anak Dalam Tribe who settle in Jebak forest make use of all forest products as a source of their livelihood. All members of the population have equal opportunity to use forest products. One of uses of jernang rattan is as a producer of red resin called dragon's blood. The people of Anak Dalam Tribe who work as seekers of dragon blood are between 40-75 years old. Those under the age of 40 years collect other forest products such as honey, rattan sticks, *raman* fruit, *petai*, and *kabau* and hunt wild bear, snakes, turtles, and birds. According to Muchlas (1975), extraction activities of dragon's blood are done individually. Extraction of jernang rattan has been done intensively by the people since the 1600s (BKSDA Jambi 2010).

The extraction of jernang rattan in the past was the main income for most people living in forest areas in

Sumatra, especially for people in Jambi, such as the Malay people and Anak Dalam Jambi Tribe. Traditionally, the people of Anak Dalam Jambi Tribe extract dragon's blood in the surrounding forest, and so do the people of Anak Dalam Tribe who live in Jebak village.

Demand for dragon's blood continues to increase, causing over-exploitation of jernang rattan. This causes the increase of harvest of jernang rattan without considering its sustainability that is harvesting by cutting the stems. Beside over-exploitation, which threatens the sustainability of the jernang rattan in Batanghari, there is also encroachment and illegal logging. Therefore, the people of Anak Dalam Tribe in the village of Batanghari try hard to find strategies to manage jernang rattan for sustainability and benefit to people's lives and seek to develop and cultivate rattan in the forest of Anak Dalam Tribe in Jebak village.

One of Anak Dalam Tribe's efforts to conserve jernang rattan is harvesting the fruits by climbing up a tree where the jernang rattan creeps its stems. The people of Anak Dalam Tribe take only the fruits and never cut the stems during harvesting the fruits. Therefore, the harvesting technique done by the Anak Dalam Tribe does not reduce the population of jernang rattan. Although harvesting rules are not institutionalized, but the local people respect and obey the unwritten regulation that has been in effect from the past until now (Winarni et al. 2004; Purwanto et al. 2009b; Soemarna 2009). Based on direct observations and specimen observation in the Herbarium Bogoriense

observations, there are two rattans that produce dragon's blood in the village of Batanghari. They are jernang rattan (*Daemonorops draco*) and kelemunting rattan (*Daemonorops didymophylla*). The jernang rattan can be processed to make modern medicine and high-quality dye (Soemarna and Anwar 1994; Purwanto et al. 2009b). Development of jernang rattan is very important as one of alternatives to increase the income of Malay people in Tanjung Jabung Barat (Purwanto et al. 2009b; BKSDA Jambi 2010), Anak Dalam Tribe in Sarolangun district, and Anak Dalam Jambi Tribe in Batanghari forest area Jambi (BKSDA Jambi 2010).

The development of jernang rattan can be done by cultivating *Daemonorops draco* in its natural habitat, especially in the area near the river (Purwanto et al. 2009a). This species should be chosen as one of the leading crops in agroforestry systems in forest areas of Anak Dalam Jambi Tribe in Jebak village and trade system of dragon's blood should be regulated by shortening the jernang rattan marketing chain, so there is no monopoly by a producer (Purwanto et al. 2009b; BKSDA Jambi 2010). Jernang rattan cultivation in its natural habitat in the forests area of Anak Dalam Jambi Tribe has some benefits including conservation of biodiversity and reducing the excessive exploitation of nature. The presence of jernang rattan species in the forest will prevent conversion of forest into agricultural land (Soemarna and Anwar 1994; Purwanto et al. 2009b).

The development and the cultivation of jernang rattan can also be done in the area of rubber plantations as intercropping plants which may provide more benefits than converting rubber plantations to oil palm plantations (Purwanto et al. 2009b). This intercropping practice has been done by the people of Anak Dalam Jambi Tribe, in Lumban Sigatal, Sipintun and Sarolangun districts since 2005 (Soemarna 2009), but those in Jebak village of Batanghari have not done this.

The objectives of this study were to examine how the Anak Dalam Tribe manages *Daemonorops draco* to remain sustainable and beneficial, and to analyze the possibility of the development and cultivation of *Daemonorops draco* in the forest areas of Anak Dalam Jambi Tribe in order to provide both economic and ecological benefits.

## MATERIALS AND METHODS

### Time and place

The research was carried out in forest areas of Anak Dalam Jambi Tribe in Jebak village, Muara Tembesi, Batanghari, Jambi Province. This selection of site was based upon information that the forest is a habitat of jernang rattan populations (*Daemonorops draco*).

Jebak Village of Jambi is an old village of Anak Dalam Jambi Tribe. The Jebak village is 60 km from Jambi city, which can be reached within 1 hour road trip. It is located between West Tanjung Jabung, South Sumatra, Muaro Jambi, Sarolangun and Tebo. Geographically, Jebak village is located at 103° 05'-103° 15' E and 01° 40'-01° 50' S, with an altitude of 20 m above sea level, rainfall of 2296

mm/year. The population is 250, consisting of 40 households (BPS Jambi 2010; BKSDA Jambi 2010) (Figure 1).

### Procedures

The methods used in this study were interviews, direct observation, and literature review. Interview method was done to obtain information about the history of jernang rattan in the forest area of Anak Dalam Jambi Tribe, the use, the habitat, the non-destructive harvesting techniques, the characteristics of fruits that can be harvested, the management, the conservation and the cultivation of jernang rattan by Anak Dalam Jambi Tribe, and the socio-economic value of dragon's blood. Interview technique used was semi-structural interview that had guidelines in the form of questions, but could be developed, according to the needs in the field. The interviewees were men aged 20-75 years. The approach was based on information from key informants from traditional elders, and of ordinary people of Anak Dalam Jambi Tribe as dragon's blood seekers in the village of Jebak (Rugayah et al. 2004).

### Data analysis

Data were analyzed descriptively and in conjunction with the data retrieval process. The data analyses consisted of organizing data, sorting data, and drawing conclusions.

## RESULTS AND DISCUSSION

### Anak Dalam Jambi Tribe and jernang rattan

Jebak Village has been inhabited by Anak Dalam Jambi Tribe since 1624. But their existence has been definitive since 1970. Prior to 1970, they lived in nomadic thatched house on stilts. Since 1970, they have been localized and given shingle-roofed houses, each measuring 36 m<sup>2</sup>, and 2 hectares of rubber land near their homes (Figure 2). Jebak village is inhabited by 40 families comprising 250 people: 104 men and 146 women (BPS Jambi 2010).



**Figure 2.** Anak Dalam Jambi Tribe's home in Jebak Village Batanghari, Jambi.

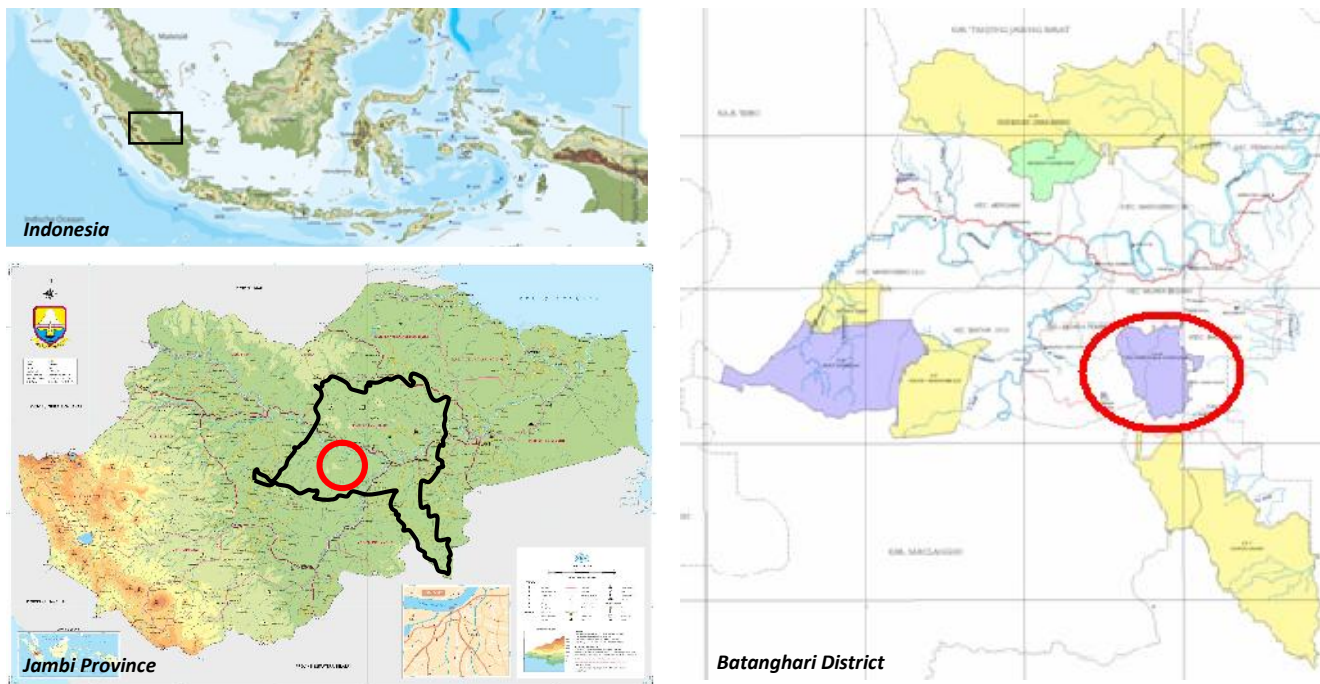


Figure 1. Map of study site (circle) in the village of Jebak, Batanghari (bordered area), Jambi (BKSDA Jambi 2010).

The people of Anak Dalam Jambi Tribe are the descendants of South Sumatran people. Therefore, they are familiar with the Islamic religion, clothing, and food from their ancestors. Most of the people of Anak Dalam Jambi Tribe just graduated from elementary school. Their livelihood is to extract the Non Timber Forest Products (NTFPs), such as *balam*, *jelutung*, *damar*, *damar mato kucing*, rattan, honey, and dragon's blood. Because NTFPs are sources of their livelihood, Anak Dalam Tribe in Jambi forest treat them in such a way that prevent damage.

In the 1990s, transmigrants from Java, West Sumatra, South Sumatra and North Sumatra, were located in forest areas of Anak Dalam Jambi Tribe. The first villages for transmigration were Sridadi and Jangga Baru. In 1993 transmigration area was opened in the village of New Bulian, and the last was Mekar Jaya village, which was opened in 1995. Since 1990, the encroachment of forest has grown out of control because of lack of supervision from the government and because of unclearness of the boundary between the forest area and the villages around the area. (BKSDA Jambi 2010).

Jernang rattan is a plant which is used as a source of family income, because it produces dragon's blood which is relatively expensive. Jernang rattan has been used by Anak Dalam Jambi Tribe in Jebak village since 1624. There are two species of rattan producing dragon's blood in Jebak village, namely jernang rattan g (*Daemonorops draco*) and kelemunting rattan (*Daemonorops didymophylla*). According to Rustiami et al. (2004), there are 12 species of rattans producing dragon's blood, namely *Daemonorops acehensis*, *D. brachystachys*, *D. didymophylla*, *Daemonorops draco*, *D. dracuncula*, *D. dransfieldii*, *D. maculata*, *D. micracantha*, *D. rubra*,

*D. sekundurensis*, *D. siberutensis*, and *D. uschdraweitiana*.

### The use of dragon blood

Dragon's blood is resin that covers the fruit skin of the jernang rattan. It is red, amorphous, solid, shiny, clear or dull, and having a specific odor (Coppen 1995)(Figure 3). Dragon's blood is used for dyes, pharmaceuticals ingredients, perfume ingredient, substitute for incense in religious ritual (Purwanto et al. 2009b), as raw material for varnish, and as medicine to heal a wound (Soemarna 2009). Since 1624 dragon blood has been used by Anak Dalam Jambi Tribe as a source of income, medicines for injury, diarrhea, headache, accelerator of parturition and as explosive. Puerperal blood will dry within 3-7 days after using dragon blood pills.

The main component of dragon blood is alcoholic resin of dragon's blood, resinolanol draco (56%); when heated it will produce a smell like incense. Because it is red, then it is known as the red incense. Anak Dalam Jambi Tribe communities use the one as a substitute for incense in ritual ceremonies (Table 3). Dragon blood is also used as a power booster in a magical ritual. The burning of incense increases the level of magical spells recited. It is also used to strengthen passion, so it is added to the "love sachets", oil and soap (Purwanto et al. 2009c; Soemarna 2009).

Dragon's blood contains Draco Resin (11%), Draco Alban (2.5%), amino acid and benzoate (Winarni et al. 2004; Waluyo 2008). Benzopyran serves to stop the bleeding when injury occurs. Benzopyran can be processed as a biopesticide; trierene can cure impotence in men; flavonoids acts as antioxidants; saponins plays a role in neutralizing and clearing toxins (Soemarna and Waluyo 2009), and tannins stops diarrhea (Waluyo 2008).





**Figure 3.** A. Jernang rattan fruits that contain lots of dragon blood: Rattan fruit before extraction (left), Rattan fruit after extraction (right). (Waluyo 2008); B. Jernang rattan fruits before extraction. C. Dragon blood



**Figure 4.** Jernang fruit and the separation process of dragon's blood (Purwanto 2009)

#### Extraction activity and production systems

Extraction of dragon blood is done every year, but in August and December jernang rattan bears the greatest number of fruits, so Anak Dalam Jambi Tribe call it great harvest. Jernang fruit is harvested when it is not too ripe and not too young. If harvested too ripe or too young, the production of dragon's blood is not optimal. According to Anak Dalam Jambi Tribe, the thickest dragon blood is obtained from the fruit at the age of 9 months from flowering. In each extraction season (from August to December) every person can obtain 30-50 kg of dragon blood. It also depends on the luck factor. In general, each tree can produce 10-60 kg of fruit, depending on the conditions of growth and soil fertility.

Jernang rattan plants in the forest are an "open access", meaning that every member of the society in the region has the same rights and opportunities to extract jernang fruits. There is no specific ownership for the jernang fruit in the forest in this region. The harvest principle is: the person who knows first that the jernang rattan is bearing fruit is the one who can harvest it. When he does not harvest it at once, then the next day other community members may harvest the fruit, and the first man cannot claim that the

fruit is his. The harvest system is: who is faster then he gets the fruit (Figure 4).

This situation causes problems, because in the next harvest period, the fruits will be harvested at younger age for fear that other community members will get them. Some respondents said that if someone finds jernang rattan bearing fruit and then gives a sign, the fruit is generally not harvested by other people. But if someone harvests it, the person who has given the sign can not state his objection.

In the 1990s before the transmigration and oil palm plantation companies entered the region or in the period before the logging of primary forest, more than 15 clumps of jernang rattan could be found in one hectare of forest, it could produce up to 60 kg of fruit at a price of Rp 250,000/kg. In general, these jernang plants grow in the forest area around the river or a forest area that often gets overflow of river water.

In 2009 and 2010, the production of dragon's blood from logged over forest ranged from 0.1 to 1.5 kg per hectare. The area of forest was 25,000 ha, and the number of community members who extracted dragon's blood ranged from 3-4 persons from about 40 families.

The separation of dragon blood is as follows: the fruit of jernang rattan is aerated for 3 days in order that dragon blood attached to the shell of the jernang rattan fruit can be separated easily from the shell. Having been aired for three days, the rattan fruit is then pounded in the filter basket. It produces red powder (dragon's blood). The dragon's blood is then sieved to separate the dragon's blood from its shell. Then, dragon blood is put in a plastic bag, let stand for 1-2 hours. The dragon's blood in the form of powder hardens to form lumps. Dragon blood lumps are ready for sale. Twenty kg of jernang fruit is needed to produce 1 kg of dragon's blood.

### Socio-economic aspects

Each jernang rattan plant produced 0.1 kg-1.5 kg of dragon blood each month in 2011. For one month Jebak village was only able to produce 0.4 kg-6 kg of dragon blood. Batanghari district was only able to produce 1.8 kg-20 kg dragon blood per month: Bukit 12 produced 0.5 kg-6 kg, Jebak Village 0.4 kg-6 kg, and Batin XXIV 0.9 kg-8 kg. Every month dragon blood collectors were only able to collect 12.3 kg-88 kg of dragon blood from extractors: in Batanghari 1.8 kg-20 kg, in Tebo 3 kg-30 kg, in Sarolangun 5 kg-20 kg, and in Tanjung Jabung 2.5 kg-18 kg (Table 1).

**Table 1.** The production of dragon blood in each district

District	The production of dragon blood production / month
Batanghari	1.8 kg-20 kg
Tebo	3 kg-30 kg
Sarolangun	5 kg-20 kg
Tanjung Jabung	2.5 kg-18 kg

According to Soemarna (2009) and the observations, the quality of dragon blood based on the composition of the

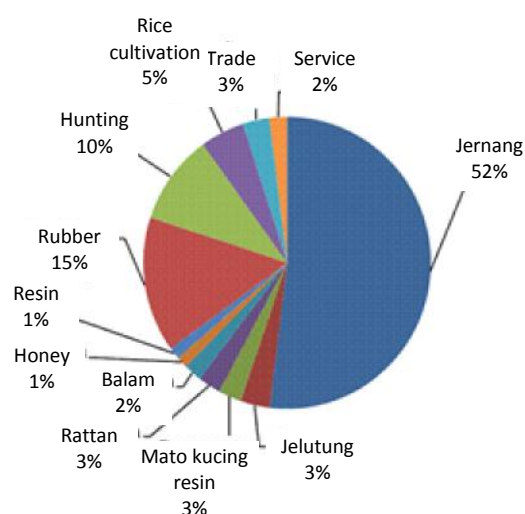
mixture can be seen in Table 2. The best dragon blood is the one from Batanghari District, because the result of extraction is pure. Some people mixed dragon's blood with *dammar mato kucing*, seeds and rind of jernang rattan fruit, or even brick powder to increase the weight. They cheated because it is hard to find jernang rattan in the forest and the mixture physically looks the same as the pure dragon's blood.

Dragon's blood is the main source of Anak Dalam Jambi Tribe's income, (Figure 5). It gives the largest contribution to the total income of Anak Dalam Jambi Tribe. The condition has decreased since the influx of transmigrants in 1990, because since then the forest of Anak Dalam Jambi Tribe in Jebak village Batanghari has been damaged significantly.

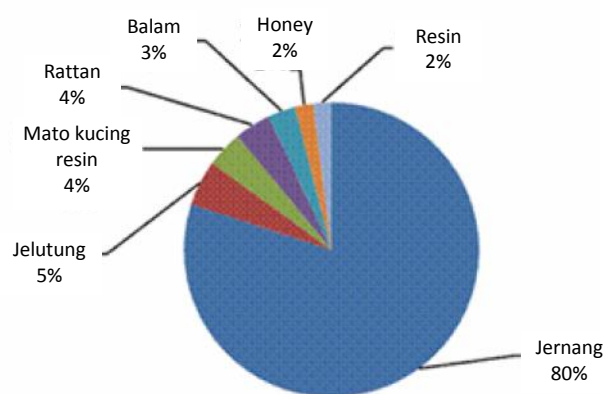
Dragon Blood plays a very important role in the economy of Anak Dalam Jambi Tribe. Eighty percent of the economy of Anak Dalam Jambi Tribe derives from dragon blood extraction (Figure 6). From the extraction of these dragon blood, Anak Dalam Jambi Tribe can meet all their basic needs, such as sending their children to school, supplementing their household needs in order not to be left behind by the outsider community. However, these conditions are hard to come by this time, because the population of jernang rattan in nature has been decreasing.

### Post-harvest handling and trading

After the separation process of dragon's blood is completed, and then the extraction product in the form of powder is put in a plastic bag weighing 0.5 to 1 kg. Thirty minutes-one hour later, the dragon's blood powder will harden to form lumps. The lump of dragon's blood is sold in the market or to traders. There is no special treatment while waiting for dragon's blood to be sold to traders. In general, dragon blood is stored in a safe place, to prevent theft, because it has a high economic value.



**Figure 5.** Income source of Anak Dalam Jambi Tribe in Jebak village



**Figure 6.** Income sources of Anak Dalam Jambi from NTFPs

**Table 2.** Quality of dragon blood based on its composition

Quality	Price/ kg	Local Name	Market name	Composition
A	Rp 1.000.000-2.000.000	Jernang (Batanghari)	Dragon's blood	Pure dragon blood
B	Rp 600.000-Rp 1.200.000	Lulun meson (Sarolangun)	Dragon's blood	Mixed with damar mato kucing resin or brick powder (50%-60%)
C	Rp 500.000-Rp 900.000	Lum jernang (Tebo)	Dragon's blood	Mixed with jernang rattan fruit and damar mato kucing resin (70%-80%)
D	Rp 350.000-Rp 700.000	Dragon blood (Tanjung Jabung)	Dragon's blood	Mixed with seed, jernang rattan fruit shell and damar mato kucing resin (80%-90%)

**Table 3.** Results of interviews with eight persons of Anak Dalam Jambi Tribe in Jambi on their knowledge of dragon blood, the use, and the feature of rattan-producing dragon blood.

No	Questions	Answers	d	Description
1	Have you known the term of dragon's blood?	Yes, I have	8	Two people not seekers of dragon's blood
2	What is meant by dragon's blood?	Resin that covers the skin of jernang rattan fruit	8	
3	What is the characteristic of dragon's blood?	Reddish black Black Shiny If it is burnt, its smell is like the smell of incense	4 2 6 6	
4	How to extract dragon's blood?	There are 2 ways, wet and dry	6	
5	What are the uses of dragon's blood?	Income source Cure wounds For diarrhea Accelerate the completion of parturition Explosive Headache medicine	4 8 6 6 3 1	
6	When has Anak Dalam Jambi Tribe started to make use the dragon's blood?	Since 1624	8	
7	Can you distinguish rattan producing dragon blood from the non-producing rattan?	Yes, I can	6	
8	How do you distinguish jernang rattan from other rattans?	It can be seen from: stem Leaves Fruits Thorn	6 6 6 6	
9	What are the differences? ( no 8)	Small stem, diameter: 1 cm-3 cm 1 cm-2 cm 1,5 cm-3 cm the young leaves colored reddish green. lots of fruits colored black lots of thorn colored black	3 1 2 6 6 6	
10	What species of rattan that produce dragon blood?	jernang rattan ( <i>Daemonorops draco</i> ) and mengkarung/kelemunting rattan ( <i>Daemonorops didymophylla</i> )	6	
11	Which rattan produce the best dragon blood ?	jernang rattan ( <i>Daemonorops draco</i> )	6	
12	Why?	It produces lots of dragon blood	6	
13	What are the characteristics of jernang rattan that produces high quality of dragon blood?	Lots of fruits Long strands of fruits Color of fruits: shiny black Lots of thorn covering stems Stem high: 8 m-15 m Rod segment: 15 cm-20 cm 15 cm-25 cm 20 cm-30 cm Number of individuals in a clump : 5-20 stems	6 6 6 6 6 2 1 3 6	
14	When does jernang rattan begin to bear fruits ?	3-4 years 4-5 years	1 5	
15	What are the characteristics of rattan jernang producing fruits?	Light green leaves Rod segment: 15 cm-20 cm 15 cm-25 cm 20 cm-30 cm Long flower strand	2 1 3 6	
16	Why?	There are male and female trees. Male jernang rattan: flowering no fruit Short flower strand Rod segment: 35 cm-40 cm Number of individuals in a clump: 3-5 stems	6 6 6 1 1	

17	How many jernang rattan fruits can be produced in a clump?	3 kg-20 kg 5 kg-20 kg	2 4	
18	How many times a year is the harvest done?	2 times, August and December	6	
19	How to identify the time harvest jernang rattan?	Fruit color bright black	6	
20	When does the fruits produce lots of resin?	When it is half ripe	6	One of them added that when fruits are half ripe, it is about 9 months from flowering.
21	Can all fruits be used as seed?	No, they can't	6	
22	Why ?	Because only the half ripe fruits is taken as seeds.	6	
23	What is the characteristic of jernang rattan that is good for seeds?	Reddish black fruits	6	2 persons added that ripe fruits taste sweet and bitter.

Note: Symbol  $\Sigma$  = Number of individuals who answered the question

**Table 4.** Utilization, management and conservation of jernang rattan by Anak Dalam Jambi Tribe in Jebak village Batanghari, Jambi.

No	Questions	Answers	d	Description
1	What are the uses of jernang rattan for Anak Dalam Jambi Tribe?	For income source. To take dragon blood	5 8	2 persons are not dragon blood seekers
2	When did Anak Dalam Jambi start taking use of jernang rattan?	Since 1624	8	
3	What is the role of jernang rattan in Anak Dalam Jambi Tribe's economy?	Very large role	8	
4	Why?	80% Because it produces expensive dragon's blood , so it can meet the living needs of Anak Dalam Jambi Tribe.	1 8	
5	What is the price of dragon blood/kg?	Rp 1.5 million Rp 1 million-Rp 2 million Rp 1.5 million-Rp 2 million In 2009-2010 Rp 3 million	1 4 3 6	
6	What is the percentage of the income of Anak Dalam Jambi Tribe in earning from extracting dragon blood?	80%	8	
7	Do Anak Dalam Jambi Tribe use jernang rattan arbitrarily or purposely?	It is done purposely	8	
8	How do you harvest jernang rattan?	Climbing trees used to creep rattan plant, then jernang fruits are hooked with poles.	6	
9	why?	In order that jernang rattan doesn't die and can produce fruits again.	6	
10	Where is the habitat of jernang rattan?	In river bank, low land, and dry brackish.	6	
11	How does jernang rattan live?	Creeping on the propagation tree	6	
12	What species of trees can be used as the host tree?	All of trees can be used as jernang rattan's vine.	6	
13	How many clumps of jernang rattan are there in 2011?	10 clumps < 15 clumps 15 clumps	1 4 1	
14	Does the population decline every year?	Yes, it does.	6	
15	How many clumps of jernang rattan were there before 2011?	25 clumps 15-25 clumps 20-25 clumps 25-30 clumps 30-35 clumps	1 1 1 2 1	
16	Why?	60 % forest has been encroached to convert as palm oil field. The forest has damaged, the woods have been logged by transmigrants	5 1	
17	What is the effect of the decline of jernang rattan population for Anak Dalam Jambi Tribe?	It's difficult to look for dragon blood, decrease income.	6	
18	How is the management of jernang rattan in the forest area of Anak Dalam Jambi Tribe?	Maintain together. There are no special rules that bind Anak Dalam Jambi Tribe. Whatever found in the forests belongs to together and must be maintained together. Since 1990, when transmigrants began to come in, life Anak Dalam Jambi Tribe communities in Jambi have been more difficult because the forest has been occupied by migrants.	6	

19	Is there any special ownership to jernang rattan in the forest area of Anak Dalam Jambi Tribe?	There is no specific ownership of jernang rattan g in the forest of Anak Dalam Jambi Tribe. Anak Dalam Jambi Tribe's forest area in Jambi is a common property and should be kept together.	6
20	What efforts have been done by Anak Dalam Jambi Tribe to keep jernang rattan from extinction in nature?	Harvesting jernang rattan fruit without cutting the trunk. Thus the jernang rattan tree can bear fruit again.	6
21	Are there any persons who are willing to cultivate jernang rattan ?	Yes. There are 2 persons, Mr. Suin and Mr. Sudirman. They grew 40 clumps but there are only 25 clumps left.	6
22	How to cultivate jernang rattan ?	It is planted by intercropping with rubber trees.	6
23	How to get the seed of jernang rattan ?	By collecting mature jernang rattan fruit.	6

Note: Symbol  $\Sigma$  = Number of individuals who answered the question

The chain of dragon's blood trade in Jambi is still closed, ie, there are no rules that govern trade and association. Prices are set by the collectors; there is no standardization, depending on them. The flow of dragon blood trade in Jambi is as follows:

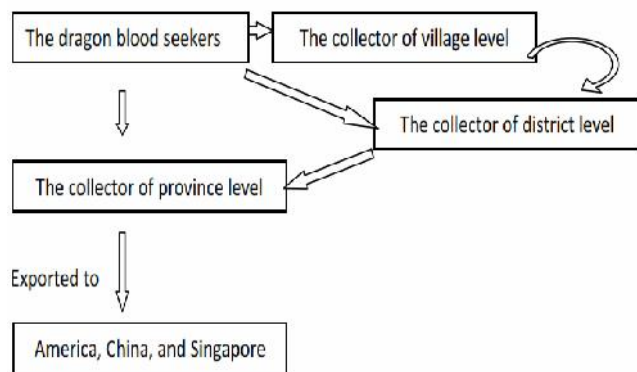


Figure 7. Flowchart of dragon's blood trade in Jambi Province.

The dragon's blood trade in Jambi province is ruled by a major collector who lives in the town of Jambi (Figure 7). The major collector has an agent in each district. The district agent usually controls 2-3 collectors in village level. The collectors at the village level are directly related to dragon's blood seekers. However, it is possible that seekers make direct contact to the major collectors in Jambi, because dragon's blood is purchased at higher prices than the prices at the village level. If the price is Rp 1 million-2 million/kg at the village level, then it can be Rp 1.2 million-2.2 million/kg at the major collector. The price is lower than the one in 2009-2010 which reached USD 3 million/kg. This is in accordance with the opinion of Soemarna (2009), which stated that the price of dragon's blood ranged between Rp 2.3-Rp 3 million/kg.

### Development and conservation of jernang rattan

#### *The decline of population and number of species*

The forest has been diminishing and even replaced by oil palm plantations, rubber plantations. It is now more and more difficult to find rattan in the forest of Jebak village.

Damage to the natural habitat of jernang rattan causes a decrease in population size and number of species of rattan-producing dragon blood in the region (Table 4). In fact there are only 8 clumps of jernang rattan in Jebak village. The damage was caused by logging and encroachment. According to Anak Dalam Jambi Tribe, the destruction of forests has reached 60% of forest area (15,830 acres).

The method of harvesting jernang rattan fruit is very good and not against the concept of conservation (Figure 8). This is in accordance with the opinion of Soemarna (2009) which stated that *Daemonorops draco* harvesting is not done by cutting down trees, but by plucking. The method of harvesting does not damage the crown cover, so it does not disrupt the forest ecosystem (Dali and Soemarna 1985; Sudarmalik et al. 2006). The part used is the resin of fruit shell. According Winarni et al. (2004), *Daemonorops draco* must be harvested little by little, so it does not directly lead to overexploitation.

#### *Development and conservation efforts*

The demand of dragon's blood from China continues to increase every year. The economic value and use value of dragon's blood are high enough. The development of modern medicine and high-quality staining is the future prospect of dragon's blood. Thus, the development of jernang rattan is very important, as one alternative to improve the income of Anak Dalam Jambi Tribe, who live in forested areas in Jebak village. What can be done are to cultivate jernang rattan in its natural habitat, develop it as one of the leading crops in the region of agroforestry system and set the trade system of dragon's blood by shortening the marketing chain of dragon blood, so there is no monopoly which harm producers.

The development and the cultivation of jernang rattan can also be done in the area of rubber plantations as intercropping plants which may provide more benefits than converting rubber plantations into oil palm plantations. According to Anak Dalam Jambi Tribe, since 2008 they've been doing the cultivation of jernang rattan. That year they tried to plant 40 clumps of jernang rattan under Anak Dalam Jambi Tribe's rubber trees in Jambi named Sudirman (15 clumps) and Suin (25 clumps). Of those 40 clumps, only 25 clumps still lived in the garden in 2011. All jernang rattan which grew in Sudirman's rubber trees died because wild boars ate them. Nowadays people are very difficult to obtain jernang rattan seed in nature





**Figure 8.** How to harvest jernang rattan fruit.

because of jernang rattan population decreases in nature and the fruits are not harvested before maturity so the extracted seed can not be germinated.

Planting jernang rattan in a natural habitat in the logged over forests has several benefits, one of them is the conservation of biodiversity. The presence of jernang rattan in the forest will prevent conversion of forest to agricultural land.

#### *Promotion and future role of dragon's blood*

Dragon's blood is produced from the extraction in the forests and not the result cultivation. Excessive extraction can cause damage and population decline of jernang rattan. In addition, the system of ownership of the "open access" becomes one of triggers for competition in extracting dragon's blood. Consequently, the method to harvest becomes uncontrolled that causes disruption to the natural population of jernang rattan. Therefore, the strengthening of social institutions in the management of biological resources that involve community participation is very important.

The role of dragon's blood as a natural product in the future is still needed, although artificial products are being developed. This refers to other natural products such as resins, incense, aloes, which remain important and irreplaceable by their artificial products. The problem is how to conserve the natural habitat of jernang rattan to ensure the sustainability of dragon's blood production and its benefits to the community.

#### *Consequences of commercialization of dragon's blood*

The consequences of commercialization of dragon's blood can be profitable but also damaging. The advantage is that commercialization will trigger the effort to keep the jernang rattan population and possibly develop it into one of the crops that provides an important role in increasing income of farmers around the forest areas in Jebak village.

The disadvantage is that commercialization will cause over-exploitation, and competition in jernang rattan extraction. Such conditions may accelerate the destruction of jernang rattan population in the region. To prevent this, it is necessary to discover jernang rattan cultivation technique and its application to the public, and to create the dragon's blood community from forest cultivation.

## CONCLUSIONS AND RECOMMENDATIONS

Jernang rattan is a source of income for Anak Dalam Tribe because it produces dragon's blood. The dragon's blood prices in 2011 ranged from Rp 1 million-Rp 2 million/kg. It is relatively expensive when compared with the price of honey which is between Rp 20,000-Rp 25,000/kg. Besides, dragon's blood is utilized by Anak Dalam Jambi Tribe as drug for injuries and migraine headaches and accelerator of parturition. It is also used as substitute for incense in rituals and as explosives. The community has used dragon's blood since 1624.

Anak Dalam Jambi Tribe Jambi is expected to maintain populations of jernang rattan left in the wild, working in such a way so that supplies of seeds for cultivation is maintained, and They should also maintain the jernang rattan cultivated by Suin. Further research is needed to cultivate jernang rattan through vegetative propagation.

## ACKNOWLEDGMENTS

The authors thank to Dr. Luthfirda Sjafirdi, Dr. Kuswata Kartawinata, Dr. Himmah Rustiami, Yana Soemarna, Mega Atria, Wisnu Wardana, and Andrio Ariwibowo, thank you for willing to give time for discussion.

## REFERENCES

- BKSDA Jambi. 2010. Non-timber forest product of Jambi province. Department of Forestry, Jambi Area Office, Jambi. [Indonesia]
- BPS Jambi [Badan Pusat Statistik Provinsi Jambi]. 2010. Jambi in figures. BPS Provinsi Jambi, Kota Jambi. [Indonesia]
- Coppen JJW. 1995. Gum, resin, and latex of plant origin. Non wood forest product (6). FAO, Roma.
- Dali Y, Soemarna Y. 1985. Potential rattan cultivation. Proceeding of the National Symposium on Rattan. IDRC Canada-Forest Research and Development Agency. Department of Forestry, Jakarta. [Indonesia]
- Ministry of Social Affairs. 1998. Isolated communities of Anak Dalam Tribe from Solea and Melinani hamlets. Department of Social Affairs, Republic of Indonesia, Jakarta. [Indonesia]
- Purwanto Y, Polosakan R, Susiarti S, Waluyo EB. 2009b. Extractivism of dragon blood (*Daemonorops* spp.) and its development. In: Purwanto Y, Walujo EB, Wahyudi A. (ed). 2009. Valuation of non-timber forest product after forest logging (in conservation area of PT Wirakarya Sakti Jambi). Indonesian Institute of Sciences (LIPI), Bogor. [Indonesia]
- Purwanto Y, Walujo EB, Afriastini JJ. 2009a. Analysis of the cultural value of non-timber forest products for the valuation potential and its development. In: Purwanto Y, Walujo EB, Wahyudi A. (ed). 2009. Valuation of non-timber forest product after forest logging (in conservation area of PT Wirakarya Sakti Jambi). Indonesian Institute of Sciences (LIPI), Bogor. [Indonesia]
- Rugayah, Widjaya EA, Praptiwi. 2004. Manual of plant diversity collection data. Research Center for Biology, Indonesian Institute of Sciences (LIPI), Bogor. [Indonesia]
- Rustiami H, Setyowati FM, Kartawinata K. 2004. Taxonomy and uses of *Daemonorops draco* (Willd.). J Trop Ethnobiol 1 (2): 65-75.
- Soemarna Y, Anwar C. 1994. Distribution and ecology of natural forest area of Pasir Tugu, Jasinga Bogor. Bul Kehut 562: 49-61. [Indonesia]
- Soemarna Y. 2009. Jernang rattan cultivation (*Daemonorops draco* Willd.). J Litbang Kehut 2 (3): 5-10. [Indonesia]
- Sudarmalik, Rochmayanto Y, Purnomo. 2006. The role of several non-timber forest products (NTFP) in Riau and West Sumatra. Proceeding of Research Seminar of the Center for Research and Development on Forest Engineering and Forest Products Processing, Bogor: 199-219. [Indonesia]
- Waluyo T. 2008. Traditional extraction technique and analyzes of jernang characteristic of Jambi. J Penel Hasil Hut 26 (1): 30-40. [Indonesia]
- Winarni I, Waluyo TK, Hastoeti P. 2004. A review on jernang as a valuable commodity. Proceeding of the forest products, Bogor: 173-176. [Indonesia]