Traditional Cultivation Of Laccifer lacca Kerr. in Alor, East Nusa Tenggara

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Abstract. Lac is a resin produced by secretion of small insect of Laccifer lacca in Kesambi trees. Lac resin is important for paint, ink, pharmacy, cosmetic, electricity, coating (candy, fruits, and vegetables), textile and candle industries. Lac price in the market is IDR 10,000.00/kg in 2019, while the lac price in 2005 – 2006 was IDR 60,000.00/kg. The decrease of lac price in Alor Island due to lack of technology in increasing the lac quantity, quality and no special institution to facilitate lac marketing. The objective of this survey was to study the traditional practices of lac cultivation in Alor Island. The method was done by field survey in the farmer gardens and interviewed the farmers. The result showed that lac cultivation in Alor Island is done traditionally and low technological inputs. Insect inoculation is done on young branches at 1 m above ground of 16 years old of Kesambi trees as a host. The maintenance of Kesambi trees is done by cutting old branches. Lac harvesting is done in June, July and in December by cutting the colonized branches into small size, and dried under sunlight. Lac resin is crushed into granular sizes, and packed into plastic bags for post-harvesting technology.

1. Introduction

Laccifer lacca insects included in the order Hemiptera, family Tachardiidae (Kerriidae), and insects included in this order are characterized by the mandible and maxillae modified into stylet, covered in labium modified to form "beaks" or "rostrum". Part of the mouth specifically modified to pierce plant tissue and suck up liquid [1]. Basically, L. lacca insect lives from a sap liquid of Schleichera oleosa (Kesambi) trees and the sucked liquids are secreted and disposed as lac.

L. lacca insects basically produce three useful ingredients namely, resin, coloring and wax. The main constituents of lacquer are resin (68%), coloring (1.2%), wax (6%), others (25%) such as sugar, protein, dissolved salt, sand, wood material, and insect body flakes [2]. Lac is a resin derived from the secretions of L. lacca insects. Lac is one of nature's most precious gifts to humans. Lac has been used in various sectors such as paint, ink, pharmacy, cosmetic, electricity, coating (candy, fruits, and vegetables), textile and candle industries [3].

In Alor farmers use the Kesambi tree as a host of Llacca insects. The choice of host plants and the continued growth of insects depends on the quality aspects of phloem fluids which contain nutrients such as sugars and amino acids [4]. Sucrose (58.9 - 85.6%) is a predominant sugar in phloem from 3 host plants namely S. oleosa (Lour.) Oken, Butea monosperm (Lam.) and Ziziphus mauritana (Lam.) With glutamic acid (33.1 - 39.8%) as its main amino acid, while trehalose (62.3%) is a predominant sugar in phloem fluid in hemolimp lice with tyrosine (61%) as its main amino acid [5].

Data from the NTT Province Forestry Service in 2008 showed that the lac production in 2005 was 3,217,294 Kg, in 2006 lac production decreased to 2,805,943 Kg, and in 2007 lac production dropped
dramatically to 73,700 Kg. Currently, lac cultivation in NTT is only carried out in Alor. This is caused by the reduction of Kesambi as a place to live and a source of food for *L. lacca* insects. The reduced of Kesambi trees and the attack of black or red ant pests have caused the extinction of *L. lacca* insects in the NTT Province [6] to date. The facts, certain farmer still produce seedlac from their garden using very simple technology. Therefore, it is important to observe the factors affecting their success in producing lac. The objective of this research was to study the traditional practices of lac cultivation in Alor Island.

2. Method
This research was conducted in the garden own by Mr. Rahman lac farm in Alor, East Nusa Tenggara. The total land planted by Kesambi trees is around 1000 m$^2$. The total observed Kesambi trees was 20 trees. Farmers and middleman were also interviewed about their traditional cultivation of lac, pest attack and trading.

3. Result and Discussion
3.1 History of lac cultivation in Alor Island
Traditional lac cultivation in Alor, East Nusa Tenggara began with the planting of Kesambi in 2004 as many as 1000 trees. In 2012 inoculation began when the age of the plant was 8 years old, resulting in many Kesambi plants died because the age of the seedlings was too young and not ready to be inoculated by *L. lacca* insects. Inoculation was started again at the age of 16 years and the finally the farmers successfylly to master the lac cultivation technology and to produce lac resin. The cultivation process is still carried out traditionally without the addition of fertilizers and nutrients from the outside because of its ecosystem is still very good and natural. The cultivation process is carried out in several stages, namely, lac inoculant selection, inoculation, maintenance, and harvesting.

3.2 Lac inoculant selection
Lac inoculants were obtained from the Kesambi trees having *L. lacca* insects from the farmer gardens. The lac inoculant must be selected from big colony, around 3-5 cm in diameter, 15 cm in length. The colour of lac colony is wrapped by white filament, and having red colour when it is broken using hand. Red colour is an indicator that the insects are still alive.

3.3 Lac inoculation
Lac inoculation is done by binding the lac ticks on the Kesambi branch with a height of up to 1 m from the ground. The size of branch diameter is 1–1.5 cm, and 1-year branch old. Those branches were resulted from previous pruning or 1–2 year (s) after pruning. In the practices of lac cultivation, it is known that lac insects can live only on stems that are not too young or not too old [1].

Lac insects will starts to spread out and colonize the other branches in the first to fourth weeks after inoculation, after that the inoculant is removed from the branches that may contain insect predators, which is probably disturbed the new colony. Inoculation and formation of a new colony of *L. lacca* insects is shown in Figure 1.

The proper time for lac inoculation is at the end of rainy season or entering to dry season. During rainy season the *L. lacca* insects will breed to form settled colony, while during entering the dry season all the larvae of lac insects will move to form new colony. Therefore, in the dry season the *L. lacca* insects is able to survive in its new colony.
3.4 Maintenance

The use of Kesambi trees as a host of *L. lacca* insects does not receive optimal treatment. Some limited host treatments include pruning of old branches and land clearing surrounding the host tree. To prevent the lac insects from the predators, the farmers do fogging by burning some dried weeds under the trees, once a week (Figure 2). Weeding was also done to minimize the nutrient competition. Farmers take advantage the presence of humus surrounding the trees as source of nutrient. Without such kind of treatments, the production of lac resin will reduce, unsustainable and stems of Kesambi become stunted. Pruning of old branches is needed to stimulate new young branches, because *L. lacca* insects are difficult to stick to old branches.

![Figure 2. Weeding and cleaning the area under the tree](image1)

![Figure 3. Fogging in the area around the tree](image2)

The presence of red and black ants may decrease of lac resin production. Ants will suck the honey produced by *L. lacca* insect secretion. Two other predators that attack the cultivation of lac in Eastern Sumba namely *Dolichoderus thoracicus* Smith and *Catoblema sumbavensis* Hampson. Those predators live around the *L. lacca* and leave eggs near the *L. lacca* that are fodder for predators [7]. These red and black ants come from the underground that climbs into trees and makes nests on the stems of plants that have been damaged and weathered. Control is done by trimming branches that have been damaged and weathered. Control using dirty oil on the stems of plants causes drastically reduced production yields. This is caused by the number of *L. lacca* insects that fall to the ground carried by rainwater or the wind cannot return to the stem of the Kesambi plant as a place of formation of the colony because it is blocked by the oil. So, another alternative is fogging the tree to prevent red and black ants (Figure 3). Another way is to use biological pesticides such as Kurstaki Bacillus thurigiiensis to eradicate *Chrysopa* predatory attack on *L. lacca* insects in India [8].
3.5 Harvesting

Lac harvesting is done twice a year, namely in June or July, and December. Harvesting is done by using a machete to pick up lac attached to the branches of the porch and to chop into smaller sizes. Yields from each tree reach 5 Kg of shellac for large trees and range from 1 Kg to 2 Kg for small trees. The length of lac colony formed reaches 28 cm (Figure 4). The yields are separated from the branches of Kesambi (Figure 5) and then crushed into small granules (Figure 6). The process of drying lac granules is also still done in a simple way, which uses sacks as a base for drying the shellac, granules and then sold to local collectors at a selling price of Rp. 10,000/Kg. Based on the results of market analysis, demand for seedlak both for domestic needs and for exports continues to increase every year with a fairly high selling price. However, so far the demand for shellac (seedlak) has not been fulfilled because production is still low due to biotic factors that affect the cultivation of L. lacca [9], low technology and no additional nutrients or fertilizer which causes the price is cheap in the market.

Figure 4. Length of lac colony
Figure 5. Lac separation of from the branches
Figure 6. Lac Granules

4. Conclusion

Lac cultivation in Alor Island was done traditionally and low technology, no additional nutrients or fertilizer. Lac cultivation is carried out by directly inoculating the sticks inoculant on young Kesambi branches or twigs. Age of branches is 1-year-old, and the age of the Kesambi trees are around 16 years. Host maintenance is done by pruning of old branches. Harvesting is done twice a year, namely in June or July, and December. Lac harvesting is done by cutting the colonized branches into small size, and dried under sunlight. Lac resin is crushed into granular sizes, and packed into plastic bags for post-harvesting technology.

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