PARASITES AND PREDATORS OF *Laccifer lacca* Kerr ON LAC CULTURE IN EAST SUMBA, EAST NUSA TENGGARA

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ABSTRACT

Lac is one of the most important non-timber forest products and massively cultured in East Nusa Tenggara. It is the resinous secretion of lac insects (*Laccifer lacca* Kerr) which serves as a shield to protect the insects themselves from their enemy. Parasites and predators of the lac insect are the major problem associated with lac culture and hence potentially decrease lac production significantly. This study identified parasites and predators of the lac insect attacking cultures of lac in East Sumba, East Nusa Tenggara. Samples of insects were collected in March 2007 from Hambapraing, Mbatakapidu and Kuta in East Sumba, and identified in the Basic Entomology Laboratory, Gadjah Mada University, Yogyakarta. The new predators were identified as *Dolichoderus thoracicus* Smith (Hymenoptera: Formicidae) and *Catoblemma sumbavensis* Hampson (Lepidoptera: Noctuidae). The parasites species found were *Aprostocetus purpureus* Girault (Hymenoptera: Aphelinidae), *Coccophagus tschirchii* Madhihassen (Hymenoptera: Aphelinidae) and *Eupelmus tachardiae* Howard (Hymenoptera: Eupheliidae). High populations of parasites and predators are probably caused by poor maintenance and sanitation of the culture area. An in-depth study is needed to investigate the hyperparasitism mechanism in lac cultivation area at East Sumba and this should be taken as a priority.

Key words: *Laccifer lacca* Kerr, lac, parasites, predators, East Sumba

I. INTRODUCTION

Lac is one of the most important non-timber forest products (NTFPs) in East Nusa Tenggara. It is the resinous secretion of lac insects (*Laccifer lacca* Kerr, Lacciferidae, Coccoidea, Homoptera) which serves as a shield to protect the insects themselves from their enemy. Lac insects are cultivated on kesambi (*Schleichera oleosa* Merr), bidara (*Ziziphus jujuba*) and beringin (*Ficus sp.*), and grow massively in Sumba, Rote, and Alor Islands. Between 2002 and 2006, regional lac production increased significantly, especially in East Sumba which was known as the main production regency. Lac production in this area increased up to 300% in 2006. However, in 2007 lac production dropped by 70%, as a result of an attack by parasites and predators (Dinas Kehutanan Sumba Timur, 2007).

Parasites and predators of lac insect are the major problem encountered in lac cultivation. Generally, parasites and predators are useful insects in an integrated pest management, but in this case, parasites and predators are harmful insects. Both of

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them raise the mortality of lac insect and decrease lac production. Those parasites lay their egg in the body of the lac insects through the ovipositor tube which is located on the back of the stomach. After hatching, the larvae live inside the body, eat and kill the lac insect. Meanwhile, predators live around and lay their egg near the lac insect which is one of their food sources.

Predators potentially cause 100% damage on lac culture (Sriwahyuni, 1999 *in* Wiyono, 2002). Meanwhile, the parasites afford 60-90% attack intensity on young lac cultivation (Wiyono, 2002). In fact, 22 predators, 30 primary parasites and 45 secondary parasites of lac insect (*Kerria lacca*) were identified on lac culture in India which also cultivated on *S. oleosa*, *Butea monosperma*, *Ziziphus* sp., *Cajanus cajan*, *Acacia catechu*, etc. (Sharma *et al.*, 2006).

Parasites and predators have been reported in most of the lac culture areas in the world. Parasites species, i.e. *Aprostocetus purpureus* Girault (Aphelinidae), *Eupelmus tachardiae* Howard (Eupelmidae), *Coccophagus tschirchii* Madhihassen (Aphelinidae), *Tachardiaephagus tachardiae* Howard (Encyrtidae), *Brachymeria tachardiae* Cameron (Chalcididae), and *Elasmus claripennis* Cameron (Elasmidae) were found on lac culture in Northern Thailand (Pamberton *et al.*, 2006). Predator species, i.e. *Eublemma amabilis* Moore (Noctuidae) and *Holcocera pulvurea* Meyr (Blastobasidae) have been reported on lac culture in East Java (Setyodarmodjo, 1983). Meanwhile, there are no parasites and predators identified in East Sumba which is known as the main production area of lac in East Nusa Tenggara. This paper deals with the investigation on parasites and predators of lac insect (*L. lacca*) in East Sumba, and discusses controlling alternatives for their populations.

II. MATERIALS AND METHODS

A. Sample Collection

Samples of insects were collected in March 2007 from Hambapraing, Mbatakapidu, and Kuta Village that represent various locations of lac cultures in East Sumba District, East Nusa Tenggara. Lac insects were cultivated on natural stands of *S. oleosa* Merr and *Z. jujuba*. Most of lac cultivation on those area were encountered with the pest problems.

The insects that live in the outside of lac bulk were collected with tweezers; flying insects were captured with insect dragnet; and insects that live inside the lac bulk were trapped with dragnet trap. Afterwards, the collected insect samples were classified, isolated into glass bottle with screen cover, and labelled. The sample-containing bottles were placed into a plastic box (20x20x40 cm³) with screen ventilation to keep the samples alive.

B. Identification

Samples inside the bottle were documented and identified in the Basic Entomology Laboratory, Gadjah Mada University in Yogyakarta. Small size samples were documented and identified under microscope. In family level, samples uncategorized as parasites and predators families were eliminated. Samples classified as parasites and predators family are identified to species level. Identified species found in literature or in another lac culture location that were connected with lac insect, were judged as parasites and predators.

III. RESULTS AND DISCUSSION

In this study, two predators and three parasites of *L. lacca* attacking cultures of this insect on East Sumba were identified. Two predators were *Dolichoderus thoracicus* Smith (Hymenoptera: Formicidae) (Figure 1 and Appendix 1) and *Catoblemma sumbavensis* Hampson (Lepidoptera: Noctuidae) (Figure 2 and Appendix 1). Neither of these species has been reported as predator of *L. lacca*. *Dolichoderus thoracicus* is a common black ant found in most of lac culture in East Sumba. Other ant species, *Pheidologeton diversus* (Jerdon.) and *Crematogaster dohrni* (Mayr.), have been reported as potential predators causing reductions in lac production by 70-100% (Sriwahyuni, 1999 in Wiyono, 2002). *Catoblemma sumbavensis* is a noctuids moth, and other members of its family, i.e. *E. amabilis* Moore and *Eublemma rosenovia* Walker, are reported to cause major problems on lac culture in East Java and India (Setyodarmodjo, 1983; Narayana, 1962 in Pamberton *et al.*, 2006). Larvae of *C. sumbavensis* form tunnels inside the lac bulk and this causes lac secretion that covers the branch to fall down.

Figure 1. *Dolichoderus thoracicus* Smith (Hymenoptera: Formicidae)

Figure 2. *Catoblemma sumbavensis* Hampson (Lepidoptera: Noctuidae)

Figure 3. *Aprostocetus purpureus* Girault (Hymenoptera: Aphelinidae)

In addition to the predators, three parasites were identified, i.e. *A. purpureus* Girault (Hymenoptera: Aphelinidae) (Figure 3 and Appendix 2), *C. tschirchii* Madhihassen (Hymenoptera: Aphelinidae) (Figure 4 and Appendix 2), and *Eupelmus tachardiae* Howard (Hymenoptera: Eupelmidae) (Figure 5 and Appendix 2). These species are common parasites of lac cultures. They have been reported on lac culture in India and northern Thailand (Narayana, 1962 cited by Pamberton *et al.*, 2006; Sharma *et al.*, 2006). They are members of the Hymenoptera, sub order Aprocyta, super family Calcidoidea and insects belonging to this family commonly attack species of Lepidoptera, Diptera, Coleoptera, and Homoptera (Borror *et al.*, 1992).

Figure 4. *Coccophagus tschirchii* Madhihassen (Hymenoptera: Aphelinidae)

Figure 5. *Eupelmus tachardiae* Howard (Hymenoptera: Eupelmidae)

High populations of parasites and predators in East Sumba are probably due to poor maintenance and sanitation of the lac culture area. High populations of parasites and predators were found as much as 100% attacking lac culture areas in Lai Lara where traditional techniques were used (Sujatmoko, 2007). In this area, there are no activities between inoculations of the lac insects larvae on host plants

and the harvest of the lac secretion. In particular, no sanitation of the land and fogging are practiced, and no gauze traps are used. Pakan *et al.* (2003) also found that high populations of parasites and predators in East Nusa Tenggara were related to the lack of maintenance activities in lac culture area.

Intensive maintenance of lac culture should be considered as an effective method for controlling parasites and predators that includes land floor clearing, branch removal, the use of gauze pack, and controlled fogging. The removal of branches from the crown of the tree reduces crown density and will increase air circulation. The reduced humidity will then make the tree less attractive to parasites and predators. Clearing of weed species also reduces populations of predators and parasites. Better air circulation helps keep temperatures within the culture optimum for the lac insect (Rochayah *et al.*, 2004). Controlled fogging will regularly smoke out parasites of the lac insect (probably all the insects in the habitat), especially flying parasites. Finally, brood lac to be used for inoculation on new host plants, can be covered with gauze. The mesh size of the gauze is smaller than the size of the predators and parasites, thus the lac larvae are protected. The lac larvae, on the other hand, are small and can move through the gauze and infest a new host plant.

Theoretically, parasites of the lac insect could also be controlled biologically by hyperparasitic insect. This parasitic mechanism is the most successful method for controlling insect pests (Untung, 1993 in Jumar, 2000). Some species of hymenoptera are known hyperparasites species (Borror *et al.*, 1992). Parasites found in this study were known as secondary parasites of other parasites and of the predators identified. *A. purpureus* is a secondary parasite of *C. tschirchii*, while *E. tachardiae* is a secondary parasite of *E. amabilis* (Pamberton *et al.*, 2006) which is the same family species as *C. sumbavensis*.

IV. CONCLUSION

The predators of lac insect identified were *D. thoracicus* Smith (Hymenoptera: Formicidae) and *C. sumbavensis* Hampson (Lepidoptera: Noctuidae). The parasites of lac insect identified were *A. purpureus* Girault (Hymenoptera: Aphelinidae), *C. tschirchii* Madhihassen (Hymenoptera: Aphelinidae) and *E. tachardiae* Howard (Hymenoptera: Eupheliidae). An in-depth study is needed to know how the hiperparasitism mechanism happened in lac cultivation area at East Sumba. This study should be considered as a priority for future control of parasites and predators of lac insect.

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Appendix 1. Taxonomy of predator species

1. **Ordos** Hymenoptera

Subordo Aprocita

Super family Vasoidea

Family Formicidae

Subfamily Dolichoderinae

Genus Dolichoderus

Species *D. thoracicus* (Smith, 1860)

2. **Ordos** Lepidoptera

Family Noctuidae

Subfamily Erastrinae

Genus Catoblemma

Species *C. sumbavensis* (Hampson, 1910)

Appendix 2. Taxonomy of parasite species

1. **Ordos** Hymenoptera

Sub ordo Aprocita

Super family Chalcidoidea

Family Aphelinidae

Subfamily Tetrastichinae

Genus Aprostocetus

Species *A. purpureus* (Girault, 1913)

2. **Ordos** Hymenoptera

Subordo Aprocita

Super family Chalcidoidea

Family Euphelmidae

Subfamily Euphelminae

Genus Eupelmus

Species *E. tachardiae* (Howard, 1896)

3. **Ordos** Hymenoptera

Subordo Aprocita

Infraordo Terebrantes

Super family Chalcidoidea

Family Aphelinidae

Subfamily Coccophaginae

Genus Coccophagus

Species *C. tschirchii* (Madhihassen, 1923)