

THE EXPLORATION OF PLANT SPECIES IN NATURE RESERVE OF MOUNT MUTIS EAST NUSA TENGGARA PROVINCE

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ABSTRACT

This research was aimed to explore and inventory the plant diversity, especially medicinal plants in Nature Reserve of Mount Mutis. Data were collected in Fatumnasi Village, Fatumnasi District of South Central Timor Regency in October 2011 through plant exploration and interview the local people. Plants inventory was conducted along the tracks during exploration. Herbs vegetation analysis was conducted among the tree stands of *Eucalyptus urophylla*. In addition, orchid vegetation analysis was only conducted to orchids that have been found attaching to *Eucalyptus urophylla* trees. Results showed that there were about 52 family, 78 genera and 84 species of plants in the observed area. Tree species was dominated by 'ampupu' (*Eucalyptus urophylla*), while orchid species was dominated by *Eria retusa*. Herbaceous plant communities were dominated by *Centella asiatica*, *Cyperus* sp. and *Cynodon dactylon*. There were about eight plant species of medicinal plants and one food plant species found in the forest that have been known by local people.

Keywords: exploration, inventory, Mount Mutis, nature reserve

INTRODUCTION

Biodiversity and ecosystem of forests in East Nusa Tenggara have specific characters due to its location in Wallace region such along with Maluku and Sulawesi (Husna and Faisal, 2008). East Nusa Tenggara Province known as area with low rainfall, high wind speeds, and high solar emission that make it becomes the driest regions in Indonesia (RePPProT 1989 in Monk et al., 1997). These environmental conditions also affect structure, composition, and type of the vegetation.

The Nature Reserve of Mount Mutis is located in South Central Timor Regency, it is the centre region of East Nusa Tenggara province with distinctive biodiversity. The location of The Nature Reserve in Mount Mutis is strategic. It is located between Indonesia and Timor Leste where there are three major watersheds that will meet, including Noelmina and Benain watersheds, which have estuarine area in Besikama, district of Belu and Bena in South Central Timor Regency (Poy, 2012).

BAPPENAS (1993; 2003 in Risna et al., 2010) reported that the diversity and endemism of plant species in Nusa Tenggara is low compared to the other major islands in Indonesia. It only has about 150 species and 3 endemic species of plants. Plants conservation threat is relatively high due to both of the human activities and nature condition.

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At this time, it is estimated that one-fifth of 380,000 plant species in the world is threatened with extinction. IUCN (2009) reported that 22 per cent of plant species are endangered. An estimation said that about 1-50 plant species will extinct in the wild each year (BAPPENAS, 2003). Thus, the exploration, inventory, and conservation of potential plant species are very important in order to sustain and utilise the endanger species of plants.

This study aimed to explore and inventory the terrestrial and epiphytic plants except lichens and algae in the forests of Nature Reserve of Mount Mutis, East Nusa Tenggara Province. The study was also conducted to obtain data of potential medicinal plants.

METHODS

Study was conducted in the forest of Nature Reserve in Mount Mutis (Figure 1) in October 2011. Data was collected through plant exploration and interview the local people.

Inventory of plant species was carried out along the exploration tracks. Standard vegetation analysis that was used to evaluate the composition of herbaceous plants among the tree stands was square plots sampling with size 1x1 m² for each of 20 plots. Plots were placed randomly between the tree stands. Relative density (RD), relative frequency (RF), relative dominance (RDm), and Importance Value Index (IVI) of observed plant species were calculated based on the following formula (Indriyanto, 2008; Gopal & Bhardwaj, 1979; Soegianto, 1994):

$$RD = \frac{\text{Density of a species}}{\text{Density of all species}} \times 100$$

$$\text{Density} = \frac{\text{Individual number of species}}{\text{Widely across plots (sample)}}$$

$$\text{RF} = \frac{\text{Frequency of species}}{\text{Frequency of all types}} \times 100$$

$$\text{Frequency} = \frac{\text{Number of plots that species found}}{\text{Total plots (samples)}}$$

$$\text{RDm} = \frac{\text{Relative dominance of a species}}{\text{Relative dominance of all species}} \times 100$$

$$\text{Domination} = \frac{\text{Number of closure species}}{\text{Widely across plots (sample)}}$$

$$\text{IVI} = \text{RD} + \text{RF} + \text{RDm}$$

Distribution and composition of epiphytic orchids that found in *Eucalyptus urophylla* were determined as categorization follows (Johansen, 1975; Tirta and Lugrayasa, 2006):

- Zone I Area that cover the base of the tree(third part of the main stem)
- Zone II Area that includes main stem of the tree up to the first branches (third part of the main trunk)
- Zone III Area that includes parts of the basal branch (third part of the total long branch)
- Zone IV Area covering the central part of the branch (one-third the middle of next branch)
- Zone V Region in the outermost of branch (third outermost branches)

Calculation of RD, RF, and IVI on vegetation analysis of orchid species were using these formula:

$$\text{RD} = \frac{\text{Individual number of species}}{\text{Total of individual number}} \times 100$$

$$\text{RF} = \frac{\text{Frequency of species}}{\text{Frequency of all species}} \times 100$$

$$\text{IVI} = \text{RD} + \text{RF}$$

Inventory of plant potentials was focused on their utilization as medicine and food. The inventory process was conducted through interview the local people. Plants were identified directly in field by comparing them to herbarium. The determination key from 'Flora of Java' has been also used in identification process (Backer and van Den Brink Jr, 1963: 1965; 1968).

Location

The Nature Reserve of Mount Mutis was established by the Decree of Forestry Minister 89/Kpts-II/1983 in 12,000 ha of forest area. It is located in Fatumnasi district, South Central Timor Regency, East Nusa Tenggara prov-

ince at the altitude of 1500 - 1700 m above sea level. This area has 1500 - 3000 mm of annual rainfall with temperature around 14-29°C (Balai Besar Konservasi Sumber Daya Alam Provinsi Nusa Tenggara Timur, 2011). Geological condition in Sonebait and Kekeno are composed by crystalline schists, medium wet rocks, wet rocks, also meogen and palaeogene rock deposits. Soil types found in Nature Reserve of Mount Mutis consist of complex and medium soil types with complex mountain (Poy, 2012).

RESULTS

There have been found about 51 families, 78 genera, and 84 species of plants after inventory (Table 1). Observed area in was relatively dominated by homogeneous species namely 'ampupu' (*Eucalyptus urophylla*). While, there were about 11 families, 21 genera, and 22 species of herbaceous plant species that were found growing surround 'ampupu' (Table 2). In addition, there were about 7 families and 8 species of potential medicinal plants (Table 3). Orchid species that found live attaching to 'ampupu' tree were about 5 genera and 7 species (Table 4). At last, both epiphytic and terrestrial ferns diversity that found were 10 families, 10 genera, and 11 species (Table 1).

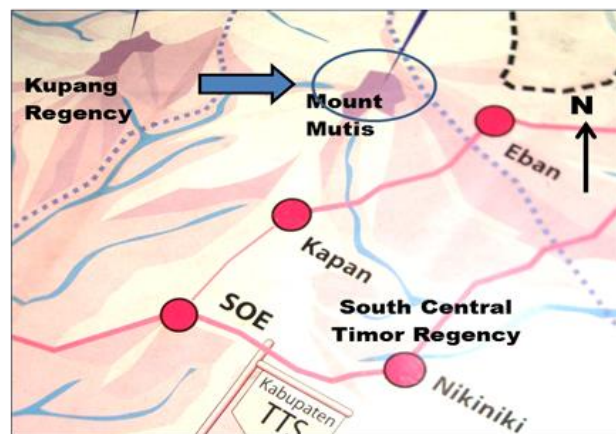


Figure 1. Location of Exploration

DISCUSSION

Nature Reserve of Mount Mutis has quite homogeneous vegetation dominated by 'ampupu' (*Eucalyptus urophylla*), especially in savanna region. This species is belongs to Myrtaceae family that has been also found dominated tree communities. This plant can grow optimally at altitude of 300 - 3000 m asl with average rainfall of 1000 - 1500 mm / year and temperature around 8 - 29°C. It needs open location with moist soil conditions, good aeration, and deep subsoil to grow.

Eucalyptus urophylla tree can grow up to 50 m height with diameter up to 200 cm and sometime it hollows in the center of the stem. The branch is not really thick and the bark colour is brown or reddish-brown. It has single leaf type with opposite or disperse, lanceolate-shaped, and size of 8-15 x 4-8 cm. In details, the flower type is inflorescence with 5-10 of petals, axillary, small seeds, and has 4-6 seeds in each fruit.

Eucalyptus urophylla has important role in hydrological systems in the surrounding of its place to grow, it also provides the main food sources for honey bees. Therefore, bee nests often can be found in its trees during

flowering season. The other tree species found in Nature Reserve of Mount Mutis area were *Podocarpus imbricatus*, *Santalum album*, *Casuarina junghuhniiana*, and *Litsea* sp.

Table 1. Lists of the plant species in The Nature Reserve of Mount Mutis East Nusa Tenggara

Acanthaceae	Davalliaceae	Myrtaceae	Polypodiaceae
<i>Asystasia</i> sp.	<i>Davallia</i> sp.	<i>Acmena acuminatissima</i>	<i>Pyrrhosia longifolia</i>
Aceraceae	Elaeagnaceae	<i>Eucalyptus urophylla</i>	<i>Pyrrhosia</i> sp.
<i>Acer laurinum</i>	<i>Elaeagnus latifolia</i>	Oleandraceae	Pteridaceae
Adiantaceae	Equisetaceae	<i>Nephrolepis caudata</i>	<i>Pteris</i> sp.
<i>Adiantum caudatum</i>	<i>Equisetum romanzhianum</i>	Orchidaceae	Rosaceae
Apiaceae	Euphorbiaceae	<i>Bulbophyllum odoratum</i>	<i>Potentilla indica</i>
<i>Centella asiatica</i>	<i>Euphorbiaceae</i>	<i>Bulbophyllum ovalifolium</i>	<i>Rubus</i> sp.
Apocynaceae	<i>Macaranga</i> sp.	<i>Calanthe triplicata</i>	Rubiaceae
<i>Alyxia</i> sp.	<i>Omalanthus populneus</i>	<i>Ceratostylis radiata</i>	<i>Borreria hispida</i>
Araceae	Papilionaceae	<i>Dendrobium kuhlii</i>	Rutaceae
<i>Acorus calamus</i>	<i>Alysicarpus vaginalis</i>	<i>Eria retusa</i>	<i>Clausena</i> sp.
<i>Alocasia</i> sp.	<i>Desmodium triflorum</i>	<i>Eria rhynchostyloides</i>	<i>Euodia</i> sp.
<i>Colocacia esculenta</i>	Flacourtiaceae	<i>Goodyera</i> sp.	<i>Zanthoxylum</i> sp.
Araliaceae	<i>Flacourtiaceae</i>	<i>Oberonia</i> sp.	Santalaceae
<i>Schefflera</i> sp.	Gleichinaceae	<i>Polidota rubra</i>	<i>Santalum album</i>
Asclepiadaceae	<i>Dicranopteris</i> sp.	Parmeliaceae	Sapindaceae
<i>Hoya</i> sp.	Iridaceae	<i>Usnea barbata</i>	<i>Alectryon</i> sp.
Aspleniaceae	<i>Belamcanda chinensis</i>	Piperaceae	Smilacaceae
<i>Asplenium</i> sp.	Lamiaceae	<i>Piper</i> sp.	<i>Smilax</i> sp.
Asteraceae	<i>Coleus</i> sp.	<i>Piperomia</i> sp.	Solanaceae
<i>Ageratum conyzoides</i>	<i>Ocimum</i> sp.	Pittosporaceae	<i>Solanum</i> sp.
<i>Artemesia vulgaris</i>	Lycopodoceae	<i>Pittosporum timorense</i>	<i>Solanum torvum</i>
<i>Emilia sonchifolia</i>	<i>Lycopodium</i> sp.	Plantaginaceae	Urticaceae
<i>Vernonia cinerea</i>	Malvaceae	<i>Plantago major</i>	<i>Boesenbergia</i> sp.
Casuarinaceae	<i>Sida rhombifolia</i>	Poaceae	<i>Laportea</i> sp.
<i>Casuarina junghuniana</i>	Melastomataceae	<i>Cynodon dactylon</i>	<i>Gonostegia hirta</i>
Crassulaceae	<i>Melastoma malabatricum</i>	<i>Eragrostis tenella</i>	Verbenaceae
<i>Kalanchoe pinnata</i>	Meliaceae	<i>Imperata cylindrical</i>	<i>Hiptis capitata</i>
Cyatheaceae	<i>Dysoxylum</i> sp.	<i>Oplismenus burmannii</i>	Vitaceae
<i>Cyathea</i> sp.	Mimosaceae	<i>Paspalum conjugatum</i>	<i>Vitis</i> sp.
Cyperaceae	<i>Adenantha</i> sp.	Podocarpaceae	
<i>Cyperus brevifolius</i>	Myrsinaceae	<i>Podocarpus imbricatus</i>	
<i>Cyperus</i> sp.	<i>Myrsina</i> sp.		

Table 2. Herbaceous plant species composition surround *Eucalyptus urophylla* trees in Fatumnasi village

Species	Family	RD	RF	RDm	IVI
<i>Ageratum conyzoides</i>	Asteraceae	3.859	3.261	5.272	12.39
<i>Agrostis tenella</i>	Poaceae	0.322	1.087	0.417	1.826
<i>Alysicarpus vaginalis</i>	Papilionaceae	0.322	1.087	0.263	1.671
<i>Borreria hispida</i>	Rubiaceae	2.894	6.522	4.041	13.46
<i>Centella asiatica</i>	Apiaceae	28.94	15.22	29.52	73.68
<i>Cynodon dactylon</i>	Poaceae	8.039	6.522	9.18	23.74
<i>Cyperus brevifolius</i>	Cyperaceae	6.431	10.87	5.642	22.94
<i>Cyperus</i> sp.	Cyperaceae	18.65	9.783	13.06	41.49
<i>Desmodium triflorum</i>	Papilionaceae	3.215	5.435	3.489	12.14
<i>Emilia sonchifolia</i>	Asteraceae	0.643	2.174	0.735	3.552
<i>Eucalyptus urophylla</i>	Myrtaceae	0.322	1.087	0.355	1.763
<i>Gonostegia hirta</i>	Urticaceae	3.537	7.609	3.353	14.5
<i>Hydrocotyle</i> sp.	Apiaceae	0.643	1.087	0.834	2.564
<i>Imperata cylindrical</i>	Poaceae	6.109	7.609	6.161	19.88
<i>Justicia obtusa</i>	Acanthaceae	0.643	1.087	0.525	2.255
<i>Belamcanda chinensis</i>	Iridaceae	0.643	1.087	0.645	2.375
<i>Oplismenus burmannii</i>	Poaceae	2.894	3.261	3.749	9.904
<i>Panicum</i> sp.	Poaceae	2.251	4.348	2.715	9.314
<i>Paspalum conjugatum</i>	Poaceae	4.18	4.348	3.487	12.01
<i>Plantago major</i>	Plantaginaceae	3.215	3.261	4.431	10.91
<i>Potentilla indica</i>	Rosaceae	0.643	1.087	0.709	2.439
<i>Vernonia cinerea</i>	Asteraceae	1.608	2.174	1.412	5.194

Table 3. Plant species that found in Nature Reserve of Mount Mutis and known as traditional medicine by local people in Fatumnasi village.

Species	Local name	Family	Parts used	Use
<i>Elaeagnus</i> sp.	Nonkulahe	Elaeagnaceae	Stem	Wood is used to strengthen teeth by brushing the teeth with sticks that had been cut into pieces
<i>Flacourtiaceae</i>	Haumolo	Flacourtiaceae	Stem	Rods boiled and drunk for jaundice

<i>Imperata cylindrica</i>	Hun	Poaceae	Root	Roots boiled and drunk to cure fever
<i>Melastoma malabatricum</i>	Manmana	Melastomataceae	Leaf	Leaves crushed and pasted on the forehead to reduce high body heat
<i>Piper sp.</i>	Maonitu	Piperaceae	Leaf	Leaves boiled and drunk to cleanse dirty blood after childbirth
<i>Piperomia sp.</i>		Piperaceae	Leaf	Leaves until finely ground and then mixed with walnut oil and applied to the skin for hair thresher
<i>Vitis sp.</i>	Abovo	Vitaceae	Stem	Sap coming out of the trunk to cure wounds
<i>Zanthoxylum sp.</i>	Pipsao	Rutaceae	Bark	Chewed bark, left in the mouth for a while and then discarded, for the pain of cavities

Table 4. Epiphytic orchids found attaching to “ampupu” trees (*Eucalyptus urophylla*) in The Nature Reserve of Mount Mutis

Species	RD	RF	IVI
<i>Bulbophyllum ovalifolium</i>	0.205	0.862	1.067
<i>Bulbophyllum odoratum</i>	2.050	2.586	4.636
<i>Ceratostylis radiata</i>	2.050	0.862	2.912
<i>Dendrobium kuhlii</i>	0.103	4.310	4.413
<i>Eria retusa</i>	57.919	45.328	103.200
<i>Eria rhynchostyloides</i>	33.009	43.466	76.470
<i>Pholidota rubra</i>	4.664	2.586	7.250

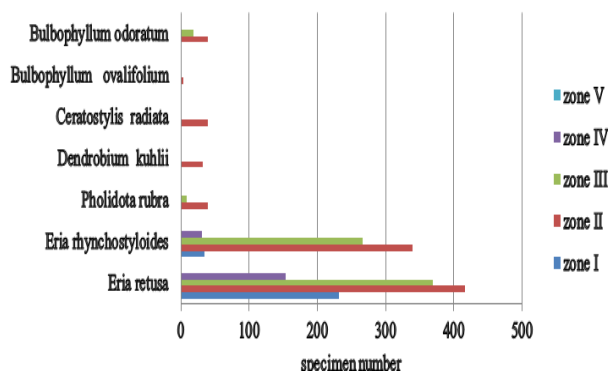


Figure 2. The specimen number of epiphytic orchids species on the stem branching zones of *Eucalyptus urophylla*

The domination of *Eria retusa* might be caused by its ability to adapt morphologically to habitat with open canopy by having small thick leaf and pseudobulb as water sink. *Eria retusa* is epiphytic orchid that has short rhizomes, oval green pseudobulb with 4-14 mm wide, green leaf of 7-17x 17-33 mm and 1-4 mm thick with rounded tip, inflorescence flower compound, racemous, petals yellowish white, and appears in the leaf axillar (Figure 4).

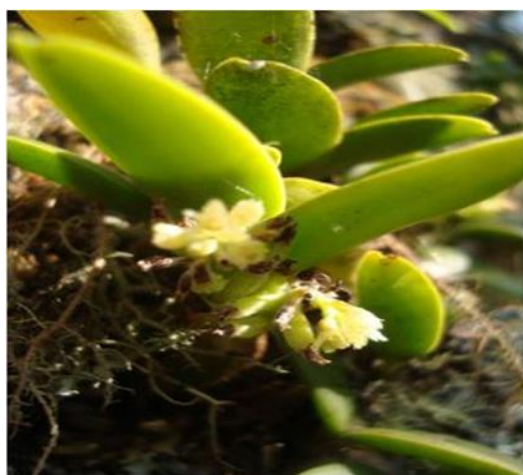


Figure 4. *Eria retusa*

Beside of *Eucalyptus urophylla*, epiphytic orchids were found attach to the other trees such as *Podocarpus imbricatus*, *Casuarina junghuhniana*, and *Litsea sp.* The most dominant epiphytic orchid on *Eucalyptus urophylla* trees was *Eria retusa* with IVI 103.20. On the contrary, the least dominant was *Bulbophyllum ovalifolium* with IVI 1.06. According to Gopal and Bhardwaj (1979), species wwith the highest IVI is the most dominant on the community. It is also shown on Figure 2 that *Eria retusa* specimen has the most abundant among the other species.

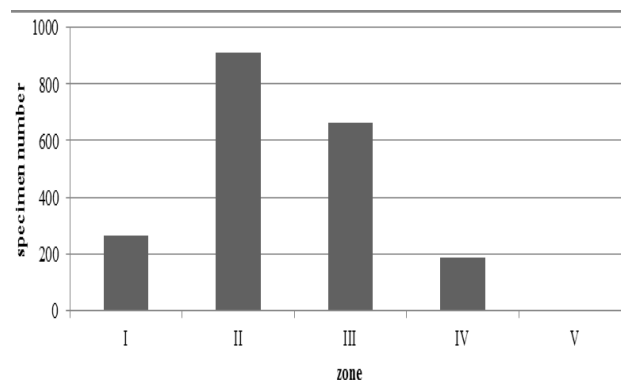


Figure 3. The specimen number of epiphytic orchids found on branching zones of *Eucalyptus urophylla*

The epiphytic orchids found spread at the trunk of the tree from the bottom up to branches and mostly found in zone II (Figure 3). All epiphytic orchid species were found in this zone, it was dominated by *Eria retusa* and *Eria rhynchostyloides* (Figure 2). It was also reported by Solikin (2009) that most of orchid specimens in Nature Reserve of Mandor West Kalimantan were found in zone II and III or zone around 2/3 upper main stem and first branching. Orchids such as *Pholidota rubra*, *Ceratostylis radiata*, *Bulbophyllum ovalifolium*, and *Bulbophyllum odoratum* were found in zone I. *Bulbophyllum odoratum* were found in zone I and IV. There were no orchids found in zone V due to it is directly exposed by the sun, moreover, this zone has lower humidity and thinner bark.

Terrestrial orchids were only two species that have been found in exploration area, namely *Calanthe triplicata* and *Goodyera sp.* Species that was commonly found on shady region of the trees was *C. triplicata*. This orchid has stunning white flower. There were seven species of terrestrial fern found along the route, namely *Adiantum caudatum*, *Cyathea sp.*, *Equisetum romanzhianum*, *Dicranopteris sp.*, *Lycopodium sp.*, *Nephrolepis caudata*, and *Pteris sp.* On the other han, the epiphytic fern that found were *Asplenium spp.*, *Davallia sp.* *Pyrrosia longifolia*, and *Pyrrosia sp.* *Pyrrosia* was the most abundant genus found attaching to the trees.

Herbaceous plants surrounding the *Eucalyptus urophylla* tree stand were dominated and covered up the savanna region in the Nature Reserve of Mount Mutis. Livestocks such as cows and horses were commonly found in the savanna grazing those herbaceous plants. On the contrary, tree seedlings were rarely found in savanna. Poaceae has dominated the savanna among the other family (zone I). It consisted of six species, namely *Eragrostis tenella*, *Cynodon dactylon*, *Imperata cylindrica*, *Oplismenus burmanni*, *Panicum* sp., and *Paspalum conjugatum* (Table 1). However, Table 1 shows that the most dominant herbaceous plants is *Centella asiatica* with IVI 73.68. This plant grows creeping in the ground, so it shorter than other species. Due to that, its possibility to be grazed by animals was relatively lower than higher plant.

Eight species of these plants have been known to have efficacy as traditional medicine (Table 3). Local people utilize several plants as traditional medicine for diseases, such as fever, hair thresher, jaundice, and pain. Almost all of plant parts can be manufactured as medicine, such as leaf, root, bark, and stem. The knowledge of local people in Fatumnasi village about medicinal plants was relatively low compared to “dayak benuaq” local people in East Kalimantan (103 species) (Solikin and Wuryanti, 2006), Moyo Island West Nusa Tenggara (20 species) (Trimanto et al., 2013), and in Camplong East Nusa Tenggara (11 species) (Solikin, 2012). The knowledge limitation of Fatumnasi local people probably due they have less plant diversity. Several plant species have been known have potential medicinal value, unfortunately they were not recognized by local people such as *Centella asiatica*, *Desmodium triflorum*, *Borreria hispida*, and *Acorus Calamus*. The only plant that has potential to be consumed as food was *Colocasia esculenta*. This species was found around the pools in the nature reserve area.

In conclusion, there were about 51 families, 78 genera, and 84 species of plants in the forests of Nature Reserve in Mount Mutis, Fatumnasi village. Besides, tree community was dominated by 'ampupu' (*Eucalyptus urophylla*), while the epiphytic orchid species was dominated by *Eria retusa* with IVI 103.2%. Herbaceous ground cover surrounding *Eucalyptus urophylla* trees was dominated by *Centella asiatica* with IVI 73.68. Furthermore, there were eight plant species known by local people as traditional medicine and there was one species consumed as dietary source.

ACKNOWLEDGEMENT

Author would like to thank to director of Purwodadi Botanical Garden, Indonesian Institute of Sciences and director of Center for Natural Resources East Nusa Tenggara Province who gave supports and advises. Also thanks to the other research team members namely Ach-

mad Masrum, Suhadinoto, and Japar who contributed on the exploration in Nature Reserve of Mount Mutis in East Nusa Tenggara. At last, thanks to Ilham Kurnia for the assistance.

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