

ACCLIMATIZATION OF PLANT COLLECTION FROM EAST NUSA TENGGARA EXPLORATION (EGON FOREST, MUTIS MOUNT, AND CAMPLONG PARK) AT PURWODADI BOTANIC GARDEN

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ABSTRACT

Acclimatization is treatment to adapt the plants material from forest exploration. This activity determine the survival of plants material in nursery at Purwodadi Botanic Garden. Endemic and rare species from East Nusa Tenggara are expected to survive in the Purwodadi Botanic Garden plant collection. This research is aimed to observe acclimatization process in Purwodadi Botanic Garden and to know the species of plant in East Nusa Tenggara which they can't adapt in the Purwodadi Botanic Garden. The research was conducted at nursery unit with observational methods. The results show that 50% of 209 accession plants from East Nusa Tenggara can't survive at Purwodadi Botanic Garden. It consists of 60 accession plants from Egon, 20 accession plants from Mutis, and 18 accession plants from Camplong.

Key words: Acclimatization, East Nusa Tenggara, Purwodadi Botanic Garden

INTRODUCTION

Exploration is one of the main activities held by Purwodadi Botanic Garden in every year. This activity aims to inventory the plant from forest, especially the rare and endemic species, to conserve at Purwodadi Botanic Garden. In 2011, exploration is conducted in East Nusa Tenggara. Biogeographically, East Nusa Tenggara lies in the Wallacea region. These conditions lead to very diverse flora and fauna (Monk *et al.* 2007). In 2011, Exploration is conducted in three areas, They are Egon Forest, Mutis Mountain and Camplong Park. Until 2012, there are 59 accessions of Purwodadi Botanic Garden plant collection from Nusa Tenggara (Suprpto *et al.* 2007). Exploration is performed two times in 2011. The first exploration is collected 129 accession numbers from Egon (Abban *et al.* 2011). The second exploration is collected 32 accession numbers from Mutis Mountain and 48 accession is collected from Camplong Park (Solikin *et al.* 2011).

Acclimatization is a treatment step after exploration activities. Acclimatization is aimed to conditioning plant from exploration in order to survive in Purwodadi Botanic Garden. Acclimatization process will determine how many plants can survive, because the native environment conditions are different with the Purwodadi Botanic Garden. Nusa Tenggara is a region with dry climate, so that, the general climate condition is similar with Purwodadi Botanic Garden. Plants collection at the Purwodadi Botanic Garden can be used to the next research.

A good acclimatization is needed in order adaptation of plants to be ready for plant collection at the Purwodadi Botanic Garden. This research is aimed to observe the acclimatization process in the nursery unit and unsurvival plants material after one year at the Purwodadi Botanic Garden. The results of this research can be used to provide input to the next acclimatization process in nursery unit at Purwodadi Botanic Garden.

METHODS

This research was conducted in greenhouse nursery unit from September 2011 to July 2012 or 11 month. The number of plant samples are 129 accession numbers from Egon Forest, 32 accession numbers from Mutis, and 48 accession numbers from Camplong Park, East Nusa Tenggara. The observational method is used to determine the acclimatization process and to

Garden. Observation of temperature, humidity, medium pH, and light are used to determine the environmental factors in nursery unit and to compare with native habitat. Acclimatization process is divided into two groups, they are general collection (non-orchids) and orchids collection. Acclimatization step to general collection is initial acclimatization on purely sand-box, then, its transplant is entered in the polybag media with a ratio (sand: soil: cattle dung = 1:1:1), removal to indoor paranet, and maintenance. The orchid collection grows in greenhouse orchids. Epiphytic orchids grows in planted in tree-fern fiber media and the terrestrial orchid is planted in growing media that mixed of compost, soil, and sand in ratio 1:1:1. The general plant material is observed twice, first, after plant grows in sand media and second, after transplant grows in polybag (paranet house). The orchid is observed in 12 months since it is planted in nursery. If any species are dead, it will be recorded to know the caused. The data is described by descriptive.

RESULTS

The results show that acclimatization process is quite well by nursery unit. It gives 50% collection plants from East Nusa Tenggara where they can survive at Purwodadi Botanic Garden. There are 63 % accession numbers from Egon, 38 % from Mutis and 63 % from Camplong. They can survive in Purwodadi Botanic Garden (Figure 2 and 3) until 11 month acclimatization. The environment factor such as temperature, humidity, Ph, altitude, intensity of light in native habitat and Purwodadi Botanic Garden are recorded (Table 1 and 2). Mutis has a different of environment condition. The altitude of Mutis is very high.

Table 1. Environment Factors in Native habitat

No	Forest/Native habitat	Environment Factors			
		Temperature (°C)	Humidity (%)	Medium pH	Altitude (m. ASL)
1	Egon Forest	27-32	78-96	5,9-6,5	250-890
2	Mutis Mount	23-33	56-70	6,3-6,9	1560-1780
3	Camplong	28-29	79-82	6,7-6,9	250-440

DISCUSSION

Based on the research show that the growth of plants are determined by several environment factors. Heat, light, water and nutrients are the most influential. Light and temperature are crucial factors (Taskovics *et al.*, 2010).



Figure 1. General treatment step of plant material from exploration (seedling material collection). a until c is treatment in field, d until i is treatment until come in nursery at Purwodadi Botanic Garden. a) reducing of leaves and then wrap the roots with moss, b) material dipped in a rootone solution, c) caps the plant material with plastic, after plant material come in nursery then d) growing material in pure sand, e) & f) covered plant material with plastic, g) plant material was growth, h) transplanting plant in polybag, i) maintenance plants in paranet house.

Table 2. Environment Factors at Nursery Unit

No	Acclimatitation located	Environment Factors			
		Temperature (°C)	Humadity (%)	Medium pH	Light (Lux meter)
1	Greenhouse (sand media)	23-29	73-88	6,6	194-1140
2	Paranet house (polybag media)	22-29	70-80	5,4	580-3500
3	Orchids Greenhouse	24-28	72-77	5,2	750-2500

Altitude of Purwodadi Botanic Garden is 320 m ASL

Table 3. List of unsurvival General Plant Collection (non –orchid) in Nursery at Purwodadi Botanic Garden

Location of Explorasion	List of accession plant
Egon	<i>Aglaia sp.1, Syzygium sp. 1, Plectocomia sp., Buchanania sp., Aglaia sp.3, Aglaia sp.4, Burserceae, Tarenna sp., Urticaceae, Canarium sp., Gen dub, Derris sp.1, Asplenium sp., Eucalyptus urophylla, Psilotum triquetrum, Ammomum sp.1, Aquilaria filaria, Cerbera sp.1, Elaecarpus sp.2, Alseodaphne sp., Ammomum sp.1, Ammomum sp.2, Pittosporum sp., Canarium sp., Borasus flabellifer, Saurauia sp., Rhammus sp, Aglaia sp.5, Bambusa sp., Amnonaceae, Ortosiphon sp., Eucalyptus urophylla, Celtis sp, Grewia sp., Ixora sp., Tacca sp., Capparis sp., Dillenia sp., Commelina sp., Commelina sp., Blechnum sp., Pyrosia sp., Dischidia nummularifolia</i>
Mutis	<i>Kalanchoe sp.(Balpeas), Euphorbiaceae (Natbona), Eucalyptus urophylla S. T. Blake , Asplenium sp., Alocasia sp., Occimum sp., Flacourtiaceae (Haumolo/Kismolo), Zanthoxylum sp (Poan), Tetrastigma sp, Coleus sp., Euphorbiaceae, Kalanchoe sp 1., Asplenium sp 2, Cordia sp.</i>
Camplong	<i>Ficus sp.(Nisum), Pterocymbium sp, Podocarpus sp.(Papi), Flacourtiaceae (Bidara hutan), Flacourtiaceae, Euphorbiaceae Amorphophallus campanulatus, Casia javanica, Sapindaceae, Zizipus timoriensis, Verbenaceae, Aglaia sp, Menispermaceae, Flourtiaceae, Garcinia sp.(Manggis), Albizia saponaria, Ficus sp.</i>

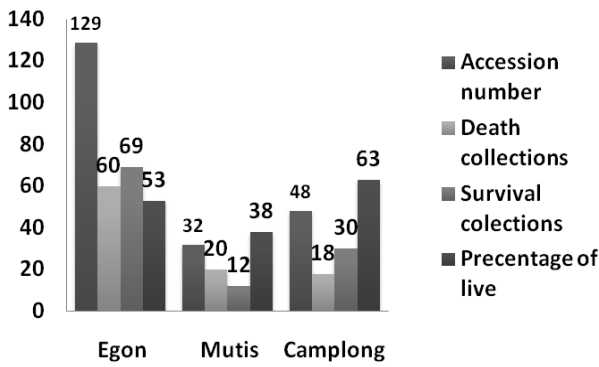


Figure 2. The Result of Acclimatization Nusa Tenggara Plants

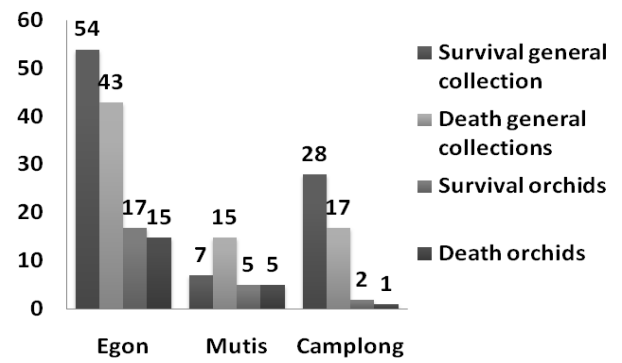


Figure 3. The Result of Acclimatization to General and orchid Collection

Table 4. List of Orchids Collection can not survive in Purwodadi Botanic Garden

Location of Exploration	List of accession plant
Egon	<i>Malaxis blumei</i> , <i>Acriopsis indica</i> , <i>Thelasis sp</i> , <i>Corybas insuliformis</i> , <i>Dendrobium salaccense</i> , <i>Trichotisia annulata</i> , <i>Pteroceras emarginatum</i> , <i>Tropidia sp</i> , <i>Goodyera sp.2</i> , <i>Goodyera sp.1</i> , <i>Goodyera sp.3</i> , <i>Thrixspermum sp.</i> , <i>Dendrobium sp. 2</i> , <i>Habenaria sp. 1</i> , <i>Habenaria sp. 2</i> , <i>Nervilia punctata</i> , <i>Thrixspermum arachnites</i> .
Mutis	<i>Bulbophyllum sp.</i> , <i>Bulbophyllum odoratum</i> (Blume) Lindl., <i>Robiquetia sp.</i> , <i>Calanthe sp.</i> , <i>Bulbophyllum ovalifolium</i> (Blume) Lindl.
Camplong	<i>Dendrobium sp.</i>

The documenting environment factors are needed to know the condition of acclimatization in the nursery unit. Environment factors of acclimatization in the greenhouse show that the growing medium of pure sandbox has been already qualified and steril. Temperature and pH are eligible for plants to live when they are compared with native habitat. Environment factors (temperature, humidity and light) in the greenhouse orchids are also eligible to live. Environment factors are affect to number of survival plant species. This is evidenced that many plant materials from Mutis are dead because this environment factors are very different with Purwodadi Botanic Garden.

1.Acclimatization of General Collection (Non-Orchid)

The first orbervation of this acclimatization give the succes in adapting plant. 89 % collection can survive in sand media. Many plants can grow well (Figure 4). The seed can germinate in sand media. The tuber plant like *Amorphophallus* can grow well. The pure sand media is eligible to adapt the plant with different life or their native habitat. Purwodadi Botanic Garden has dry and lowrain climate, so this clime can reduce the tranpiration of plant material, using plastic to caps this plant material in nursery. The process gives good result. This material plant is watered after they show leaf bud. The first observation show that this process is good way to adapt plant. Pure sand media can be used to adapt the material plant with different climate. The using plastic to caps plant material in in sand media give good result. It makes humadity awake, and reduce the transpiration. The plant can germinate quickly. The leaf and roots bud look like so fresh. This process gives the success in adapting plant.

In second obervation, there are many plants die. It is happened after this plant are transplanted in the polybags. 47% of plants from the forest Egon, 62% of Gunung Mutis, and 37% of Camplong can not survive. Removal plants in polybags cause the roots condition to be adapted again. Unuseful technique in changing of plant medium is not excluded from media such

Composition of polybag growing media (sand: soil: cattle dung =1:1:1) give the acidity of the media. The pH of Growing media is 5,4. Acid pH is necessary to plant grow, there are species intolerant with soil acidityn (Deska *et al*, 2011). In some cases this results are from toxic properties of alumunium ions, and responsible for soil hydrolytic acidity. Some times, the presence of H+ ions only has a negative effect on plant deveopment (Slootmaker, 1974). Acid soil pH also determines the availability of macro and micro elements necessary for plant development. The addition of organic compounds in acid soils, such as inceptisol, ultisol and Andisol, they are able to increase the pH of the soil and to reduce the Al ion swapped in soil (Suntoro, 2001).

Location of exploration is effect for plant materials to grow. Mutis has defferent enviroment factor with Purwodadi Botanic Garden. Many plant collections from Mutis are not able to be adapted in nursery. Only 38 % of plant materials can survive. This plant collections are found in higher altitude (1575-2427 m ASL). Mutis has low temperature and humadity. Several material are death in first observation. That is different with Egon and Camplong that almost have same enviroment with Purwodadi Botanic Garden. Plant material from Egon and Camplong are more suitable than plant materials from Mutis. Endemic species are difficult to adapt in nursery. *Eucaliptus urophylla* is endemic species Nusa Tenggara. It is found in Mutis and Egon Forest. It is not able to adapt in the initial acclimatization of pure sand media. There are some death in first observation. Own treatment is needed for acclimatization to endemic species in native habitat. Seed material can possibly be applied to acclimatize endemic species because many seed materials from Nusa Tenggara can be germinated in nursery. Seed material from Egon is *Casia sp*, it is capable to germinate the thrive. *Litsea*, *Suregada*, *Terminalia*, *Mangifera*, *Aegle*, *Flacourtia*, *Artocarpus*, *wrightia* seed materials from Camplong collection can also be germinated and thrive in the Purwodadi

Botanic Garden. Seeds are not capable in germination, it can be solved by the addition of PGR (Plant Growth Regulators). Several researches have shown that the PGR effect on seed germination, like atonik is effect on the speed of Duku seed germination (Suparwoto *et al*, 2006).

Growing media of soil, sand and cattle dung in the ratio (1:1:1) make pH to be acid (5,4). Growing media were treated to all accession of plants exploration result in the Purwodadi Botanic Garden. Plants need a normal PH (6-7) in order to thrive. Characteristics of growing media is good water holding capacity, aeration and good draenase, a pH corresponding to the type of plant, and contains nutrients to support plant growth. The suitable composition of growing media is needed for plants to thrive. Dewi (2005) reported that the planting medium with a mixture of sand, cattle dung, soil in ratio 1:1:2 yields are the best response to the total plant height and length

of shoots in mango nurseries. Susilawati, (2007) reported that the composition of husk charcoal media, soil, compost in ratio (1:2:1) yields are an influence on the growth of vegetative and generative plant *Helichrysum bracteatum*. Experiments with mixtures of growing media appropriate the comparison needs to be applied in determining a suitable growing media of the acclimatization process in the Purwodadi Botanic Garden.

The treatment of material plants collection in field is also effects of plants adaptation. Appropriate methods are needed to reduce the number of dead plants at the field. For ferns, wrapping the roots with black plastic to maintain the stability of auxin at the root (Hartini, 2006). Soaking roots with Rootone liquid can be applied to stimulate of root growth (Wawangnigrum and Puspitaningtyas, 2008). Benlate fungicide solution (Benomyl 0.03%) can be used to reduce the decay of the material cutting (Danthu *et al*, 2002).



Collections from NTT



Artocarpus sp.



Musa glauca



Amorphophallus campanulatus



Ixora sp



Mangifera timorensis



Scaveola taccada



Crinum sp



Angiopteris sp

Figure 4. General collections (non-orchid) from East Nusa Tenggara

2.Acclimatization of Orchid Collection

Acclimatization of orchids collection only gives average 50% of survival. Collections of orchid species from Egon are more varied. 32 accession orchids are collected, and 17 accessions can be adapted in orchid greenhouse. There are 5 unsurvival accession numbers of orchid from Mutis. Only 1 from 5 orchid accessions from Camplong can survive in Purwodadi Botanic Garden. Many death orchids evidence that the orchid

from Nusa Tenggara can not adapt in Purwodadi Botanic Garden. There are two possibilities of causing death orchids, environmental condition is different with native habitat and a proces of acclimatization is not appropriate. The conditions of orchids from Egon, Mutis and Parks Camplong are not fresh in a greenhouse. Orchids collection from Mutis are fresher than orchids from Egon forest. *Eria retusa*, *Eria rhynchostyloides*, *Pholidota glabra*, *Ceratostylis radiata*, *Nervilia aragoana*,

Dendrobium kuhlii, *Goodyera rubicunda* are obtained from East Nusa Tenggara exploration and they can adapt well in the Purwodadi Botanic Garden (Figure 5).

Many orchids are dried up, especially for epiphytic type. Epiphytic orchids are acclimatized with just a sprinkling and without any addition of nutrients. Epiphytic orchids need additional nutrients to grow properly, because in their habitat, orchids have nutrient from humus decay in their medium. Tirta (2006) reported that a mixture of ferns and kadaka media (1:1) plus 2.5 mL of fertilizer inabio L-1 provides a good growth on *Dendrobium*. Micronutrients are given through the leaf by spraying or watering the plants, so it can be absorbed to cover the nutrition for growth and development. Specific organic fertilizer for orchids is needed to stimulate rooting and vegetative growth (Donizetti *et al.*, 2010). Addition of nutrient can be applied in epiphytic orchid from exploration. Fertilizer

concentration must be considered because the possibility of death due to nutrient toxicity and salinity when nutrients are supplied in excess.

Watering is an important factor for epiphytic orchids acclimatization. Epiphytic orchids obtain nutrients and water through their media and air. Purwodadi Botanic Garden greenhouse orchids are sprinkling in the morning, between Monday to Friday. On Saturday and Sunday are not done. Frequency factor of irregular sprinkling is also a cause of many epiphytic orchids dry. In green house orchid, epiphytic orchid are planted on tree fern media. They can not keep the water in long time. They need suitable media to epiphytic orchid, especially the unresistant orchids in drought. Moss media can be applied to add tree fern media. Moss media can keep the water in long time, so drought orchid problem can be reduced.



Figure 5. Orchid Collection from East Nusa Tenggara

Several accessions of terrestrial orchids look like so fresh. Availability of nutrients in the soil causes it. But, several terrestrial orchids are dead in first observation. The pH of the growing media is to be acid (5.2). The Acidity of the causing media is used for too long. The growing media to terrestrial orchids is mixture of soil, sand and compost in ratio (1:1:1). Several species of orchid can survive with the condition. The Presence of fungi and bacteria occur possibly in the acidic media. It need to replace of new growing media because there are some unresistant orchids in acidic conditions. Only one accession can survive from 4 accession *Goodyera* sp in the growing media. The addition of nutrients to the soil orchids are also required to satisfy the nutrient that not contain in the growing media. Addition of lime (Calcium carbonate) can be applied to increase pH medium. Additions of ag lime also supply valuable Ca (and possibly Mg) for plant nutrition. Some secondary benefits of neutralizing soil acidity with ag lime include increasing phosphorus (P), Improved Nitrogen (N), better water used, nutrient recovery, plant performance with a healthier root system (IPNI, Uchida *et al.* 2010)

Corybas insulyformis is one terrestrial type of endemic orchid that found in Egon. These orchids are not able to adapt in short times. Orchids need nutrients in its growth. The addition of fertilizer need to satisfy nutrient with the soil. Inorganic and organic fertilizer are able to support the development of orchid plant productivity (Rondonumu *et al.*, 2009). The addition of fertilizers can be applied. It can spray on the leaves or direct on their substrat. Several terrestrial orchids need to interact with mycorrhizae or fungi to life. The mycorrhizas are fungi associations. they consider to be a requirement for the survival of orchids that live naturally in ecosystems, since this group of plants depends on the fungi to germinate, as well as for their establishment (Victor, 2013). Terrestrial orchids are taken with this soil together in native habitat, they can be applied to anticipate mycorrhizae presence in their possibility interaction.

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