

INDIGENOUS TREE DIVERSITY IN MALUKU AND FIJI AS A FUNCTION OF PLANT GROWTH PROMOTING RHIZOBACTERIA

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ABSTRACT: In Maluku and Fiji islands, forest trees are an important vegetation to protect environment quality and provide economical value for community as well as state. In sustainable tree nursery, using Plant Growth Promoting Rhizobacteria (PGPR) to enhance plant growth is recommended. The objective of this assessment was to provide information concerning the diversity and similarity of native forest tree species—based on secondary data—grown in both tropical Melanesian regions; and the possibility to apply PGPR in its seed nursery. The result demonstrated that at least 15 trees genus among them five tree species are naturally grown in both region but the main utilization of those trees in both regions is differed. Tree similarity provides evidence on the same natural factors affecting the process of vegetation establishment in Maluku and Fiji. Timber production in Fiji is more extensive than the one in Maluku, but seed nursery in both regions has not yet applied PGPR as bio fertilizer and bio stimulant. Researchers elsewhere have been studying the presence on PGPR in 10 of 15 genus that also grown in Maluku and Fiji. The future use of PGPR is very promising since naturally indigenous PGPR has been colonizing those tree roots. Further collaborative research is needed to develop certain bio fertilizer for native tree nursery in Maluku and Fiji.

Keywords: bio fertilizer, indigenous microbe, native tree

1. INTRODUCTION

Both Maluku Province in Indonesia and Republic of Fiji are archipelago region located at east of weber line which separate fauna distribution in Indonesia and part of the Pacific. The Maluku Islands are transition zone between Asian and Australian fauna; and the vegetation of the islands includes many tree genus even species that might be similar to Fiji Islands. Local tree species is economically important for either Maluku or Fiji development. At a glance, both countries depend on chemical fertilizer as nutrition source in tree production.

Chemical (inorganic) fertilizers are well correlated with tree performance in early vegetative growth. However, if it is used in large quantities and continuously, it becomes significant sources of environmental pollution and reported elsewhere reduce soil quality. In sustainable forestry as

well as agriculture, the utilization of renewable fertilizer such as Plant Growth Promoting Rhizobacteria (PGPR) is a strategy directed to timber and non-timber tree production in local community forest or private estate [1]-[2]. Inoculation of PGPR is cheap, environmental friendly and can reduce fertilizer dose.

Tree nursery is an important step to provide good circumstances for growing tree seedlings until they are ready to transplant in field. Nurseries emphasize mass production of high-quality seedling (planting stocks). Inoculation of seedling in nursery with PGPR results in a significant *augmentation* in both beneficial fungi and bacterial in their rhizosphere which more guarantee their health and growth [3]. The objective of this assessment were to identify the diversity of similar genus or species of timber tree grown naturally in Maluku and Fiji islands, and their utilization in both region. This article will discuss the presence of PGPR in some indigenous tree in Maluku and Fiji as a consideration to develop biofertilizer in order to decrease chemical fertilizer and increase seedling health.

2. METHODOLOGY

The method of this study was descriptive study with case study in Maluku and Fiji (Table 1). Both sites are in the tropical island where the inhabitants are dominated with Melanesian Race.

Table 1. Geographical and land characteristics of Maluku and Fiji

Variabel	Maluku	Fiji
Location	3° 14' 18" S / 130° 8' 43" E	18° 0' 0" S / 178° 0' 0" E
Climate; Time Standard	Tropic; UTC+9	Tropic; UTC+12
Ocean area	658,294.69 km ²	1,290,000 km ²
Terrestrial area	54,185 km ² (7.6%)	18,272 km ² (1.4%)
Island number	1,300	332
Soil	Coastal sand, Inceptisols, Entisols, Spodosols	Coastal sand, Inceptisols, Entisols, Mollisols, Spodosols
Vegetation	Dense vegetation, tropical forest, wet land	Dense vegetation, tropical forest, wet land, savana

Literatures investigation has been carried out to discover and compare the similar genus or species of indigenous tree diversity grown naturally in both regions. Identification of the similar tree grown in both regions was determined dis after deep Intensive discussion involving tree utilization. In order to have information about PGPR living and proliferating in their rhizosphere, literature study has been performed.

3. Native Timber Tree and Its Utilization in Maluku and Fiji

There are at least 26 indigenous timber trees grown naturally in Fiji (Alston, 1982). Comparison between tree genus and species in Fiji with those in Maluku has been performed. There are 15 similar indigenous tree genus adapted to the tropical climate in both region (Table 2). The genus of *Acacia*, *Agathis*, *Barringtonia*, *Calophyllum*, *Canarium*, *Casuarina*, *Cocos*, *Garcinia*, *Gmelina*, *Intsia*, *Metrosideros*, *Myristica*, *Palaquium*, *Podocarpus* and *Terminalia* are indigenous and endemic tree in both regions.

Among them, six indigenous tree species are grown naturally in Maluku and Fiji: Borneo Mahogany (*Calophyllum inophyllum* Linn.), Casuarina (*Casuarina equisetifolia* Linn), Coconut (*Cocos nucifera* Linn.), Mangosteen (*Garcinia mangostana* Linn), Teak (*Intsia bijuga* O. Kuntze), and Brown Pine (*Podocarpus neriifolius* D.Don ex Lamb.). All of species are economically important for timber but in fact, especially in Maluku, certain trees are important food sources.

Most of indigenous tree in both region are timber tree (Table 2). The wood are used mainly to make indoor furniture, household utensil, craft, as well as building, home, and shipping construction (Table 3). However general use of some indigenous trees in both regions is different.

Despite of wood quality, people in Maluku doesn't utilize *Canarium* nut (*Canarium amboinense* Hoch) and nutmeg tree (*Myristica fragrans*) as a timber. In Maluku, those trees provide an economical value from the fruit. Nutmegs are very important exported commodity for Maluku Province; 80% of Maluku's nutmeg either seed or mace are exported to Europe mainly used as herbs. Kernel of canarium nut is important Maluku food ingredient.

Traditionally, coconut (*Cocos nucifera* L.) has multiple uses in Maluku and Fiji. The fruit is used for cooking and the wood is best for housing and handicraft. The coconut plantation in Fiji is often integrated with beef cattle and dairy farms with intensive management [4]. In Maluku, the coconuts are grown naturally in their garden or field without maintenance and mostly owner never replant the new one so the plant productivity is low. However, since 2015, the government of Maluku Province has been developing 750 ha coconut plantation in Seram Barat District and Seram Timur Districts as well as in Tanimbar Island in Maluku Tenggara Barat District.

Most timber from indigenous tree is good in quality. Good quality wood is *Metrosideros* as it has very hard wood for long live used. The most qualified timber is teak (*Intsia bijuga* O. Kuntze); their local name in Maluku is Kayu Besi and in Fiji is named Vesi. They are apparently good stands still in Indonesia and Fiji. Teak plantation forest in Fiji is more massive than that in Maluku. A private company has been established since a decade ago in Fiji. Teak plantation which cover 200 ha was developed in Province of Ra and Nadroga in Western Division of Fiji [5].

Expansion of timber estate in Fiji is expected to reach over 200 ha mainly for Caribbean Pine and Mahogany. Proper nursery of both introduced tree has expanded to increase supply of seedling; fulfil an estimate of 40 ha suitable land for planting immediately and 773 ha of land available for lease. However in Maluku seed nursery is only developed in relatively small scale

since in Maluku large timber estate is not well developed. In general, timber production in Maluku is carried out by local community in their own garden (*Dusung*) and heritage land.

4. Plant Growth Promoting Rhizobacteria in Forest Tree

In sustainable tree production, the use of PGPR is strongly recommended. Low fertility soil, which deficient in major nutrient, distributes evenly in tropical region. Growth and productivity of tree grown in tropical soil are to be maintained by plant and microorganism adaptation to soil environment [6]-[7].

Interaction between plants and soil microbes in rhizosphere demonstrates growth promoting effects. Naturally, plant roots are colonized by non-pathogenic microbes which benefit tree through two direct mechanisms. First, PGPR produces certain secondary metabolites [2], and phytohormones [3]; as well as second they are facilitating nutrition availability [3]-[8]. Indirectly, PGPR induces tree development through a systemic resistance induction against any tree pathogen [9] and antagonistic mechanisms against soil-borne diseases [2]-[10].

The presence of PGPR in forest tree rhizosphere-the soil nearest plant roots-and the characteristics of the free living rhizobacteria have been reported in a few studies (Table 4). Research on symbiotic bacteria in tree rhizosphere is more intensive than those on non-symbiotic PGPR. Of 15 tree genus grown in Maluku and Fiji Islands (Table 1), *Acacia* and *Casuarina* have a symbiotic relationship with nitrogen-fixing microbes that enzymatically change dinitrogen to ammonia which then to be protonated to form ammonium which hence uptake by plant roots.

Acacia, the tree of family Fabaceae, has roots system colonized by rhizobia and form nodule. Rhizobium strains of diverse geographical origins were isolated from root nodules of the hybrid *Acacia mangium* x *A. auriculiformis* and its parents [11]. *Acacia mangium* is abundant tropical legume trees in Maluku, Indonesia while *A. richii* is a tree species present in Viti Levu and Vanua Levu, Fiji.

Casuarina is an Actinorhizal plants enable to develop an endosymbiosis mutualistic with nitrogen-fixing soil actinomycetes of genus *Frankia* [12]. Interaction between *Frankia* and host plants in the rhizosphere form root nodules within which nitrogen fixation is taken place. Many actinorhizal plants enable to form ectomycorrhizal-associations [13] and the two kind of symbiosis gives them a capability to grow in marginal and poor soils. Free living bacteria naturally colonize rhizosphere since roots excrete beneficial substance for bacterial metabolisms [3]. Non-pathogenic and beneficial free living bacteria which act as PGPR in rhizosphere of the same trees that also grow in Maluku and Fiji are documented (Table 4).

Table 2. Similar native plant genus grown in Maluku and Fiji Islands

Nr	Genus Family	Maluku ¹		Fiji ²	
		Species	Local	Species	Local name

			name		
1	<i>Acacia</i> Fabaceae	<i>Acacia mangium</i> Willd <i>A. auriculiformis</i> <i>A. wetarensisi</i>	Akasia	<i>Acacia richii</i> A. Gray	Qumu
2	<i>Agathis</i> Araucariaceae	<i>Agathis dammara</i> (Lamb.) Rich.	Damar	<i>Agathisvitiensis</i> (Seem.) Benth, and Hook. F. ex Drake	Dakua Makadra (Fiji Kauri)
3	<i>Barringtonia</i> Lecythidaceae	<i>Barringtonia apiculata</i> , <i>B. asiatica</i> (Linn) Kurz	Butun	<i>Barringtonia edulis</i> <i>B. asiatica</i> (Linn) Kurz	Vutu
4	<i>Calophyllum</i> Cluciaceae	<i>Calophylluminophyllum</i> Linn.	Bintanggor	<i>Calophyllum neo-</i> <i>ebudicum</i> Guillaumin syn <i>C. leucocarpum</i> A.C. Smith	Damanu
5	<i>Canarium</i> Burseraceae	<i>Canariumamboinense</i> Hoch. <i>C. asperum</i> Benth var. <i>asperum</i> <i>C. indicum</i>	Kenari	<i>Canarium vitiense</i> A. Gray	Kaunicia
6	<i>Casuarina</i> Casuarinaceae	<i>Casuarina equestifolia</i> Linn.	Kasuari Pantai	<i>Casuarina</i> <i>equisetifolia</i> Linn. <i>C. nodiflora</i> Forst. f. Syn <i>Gymnostoma vitienses</i> L.A.S. Johnson	Nokonoko
7	<i>Cocos</i> Palmae	<i>Cocos nucifera</i> Linn.	Kelapa	<i>Cocos nucifera</i> Linn.	Coconut
8	<i>Garcinia</i> Clusiaceae	<i>Garcinia bancana</i> . Miq	Manggis hutan	<i>Garcinia myrtifolia</i> A.C. Smith	Laubu
9	<i>Gmelina</i> Verbenaceae	<i>Gmelinamoluccana</i>	Kayu Titi	<i>Gmelina vitiensis</i> Seem	Rosawa
10	<i>Intsia</i> Fabaceae	<i>Intsiabijuga</i> O. Kuntze	Kayu Besi	<i>Intsia bijuga</i> (Colebr.) O. Kuntze	Vesi
11	<i>Metrosideros</i>	<i>Metrosideros vera</i>	Kayu Nani	<i>Metrosideros colina</i>	Vuga

	Myrtaceaeae				
12	<i>Myristica</i> Myristicaceae	<i>Myristica speciose</i> Warb.	Pala	<i>Myristica</i> spp.	Kaudamu
13	<i>Palaquium</i> Sapotaceae	<i>Palaquium obtusifolium</i> . Burck <i>P. amboinense</i>	Niki/Nyatoh	<i>Palaquium hornei</i>	Sacau
14	<i>Podocarpus</i> Podocarpaceae	<i>Podocarpus neriifolius</i> <i>P. blumei</i> endl <i>P. rumphii</i> El.	Kayu Cina	<i>Podocarpus neriifolius</i> D.Don ex Lamb. Var, neriifolius	Kuasai
15	<i>Terminalia</i> Combretaceae	<i>Terminalia catappa</i> Linn.	Ketapang	<i>Terminalia pterocarpa</i> Melville and Green	Tivi

Data Sources:

¹[14]-[15]-[16]-[17], ²[18]-[19]-[20]

Table 3. Utilization of timber tree in Maluku and Fiji

No	Maluku ¹		Fiji ²	
	Native Tree Species	Utilization	Native Tree Species	Utilization
1	<i>Acacia mangium</i> Willd A. <i>auriculiformis</i> <i>A. wetarensis</i>	The wood is used for pulp and paper industry, household utensils, home construction, for firewood, window and door and their frames,	<i>Acacia richii</i> A. Gray <i>A. farnesiana</i> (Linn.) Wild <i>A. mathuataensis</i> A. C. Sm. <i>A. simplicifolia</i> (Linn.f)	Hard wood is used for decorative flooring, furniture, paneling, building and construction. Source of a black dye
2	<i>Agathis dammara</i> . Lamb.	The wood is used for furniture, plywood industry, guitar and toys making. Tree produce <u>Gum</u> called <i>kopal</i> in Indonesian language.	<i>Agathis macropgylla</i> (Lindl.) Mast. Syn. <i>Agathis vitiensis</i> (Seem.) Benth, and Hook. f. ex Drake	Useful timber for light construction, furniture, veneer and plywood, boat planking and decking, kitchen equipment, vats and tanks, paneling, and home utensils, handicraft. Kauri gum, called <i>makadre</i> by the Fijians.

3	<i>Barringtonia apiculata</i> , <i>B. asiatica</i> (Linn)	Extract from the fruits is a traditional medicine for eyes irritation.	<i>Barringtonia asiatica</i> (Linn) Kurz <i>B. edulis</i> <i>Barringtonia</i> spp.	Fruits are used as floats for fishing nets in earlier times. The fleshy of the fruit is crushed and used to stupefy/poison fish. Seeds are eaten raw or cooked.
4	<i>Calophyllum inophyllum</i> Linn.	Useful good quality timber for home construction and furniture, Window and door frames and their frames, Resin collected from Borneo Mahogany is used in paint industry.	<i>Calophyllum neoebudicum</i> Guillaumin Syn. <i>C. leucocarpum</i> A.C. Smith <i>Calophyllum</i> spp.	General construction, interior stairs, flooring, interior lining and finishing, furniture, joinery, weatherboard, fascia board, turnery, boat frames, flooring, cases, veneer.
5	<i>Canarium amboinense</i> Hoch. <i>Canarium asperum</i> Benth var. <i>asperum</i> <i>Canarium indicum</i>	Timber for home construction and handy crafts. Resin from this tree is used in varnishes. Edible nuts are consumed by Mollucan and Indonesian	<i>Canarium vitiense</i> A. Gray <i>C. harveyi</i> Seem. var. <i>harveyi</i> <i>C. harveyi</i> var. <i>scandens</i> Leenhouts; <i>Canarium</i> spp	Useful timber for Interior finishing and fitting, shelving, flooring, utility furniture, light construction, crates, boxes, veneer and plywood. Edible nuts
6	<i>Casuarina equisetifolia</i> Linn	Timber tree exploited for low quality wood for flooring parquet, indoor furniture and household utensils and other wood-base goods.	<i>Casuarina equisetifolia</i> Linn.	Hard timber was used to make war clubs. Bark is used in traditional herbal medicine. Sometimes used as a windbreak, reforestation, soil stabilization and coastal protection.
			<i>C. nodiflora</i> Forst. f. syn <i>Gymnostoma vitienses</i> L.A.S. Johnson	The Wood is used for heavy Construction, and firewood. Saplings used as fishing rods. The wood was used to make war clubs.
7	<i>Cocos nucifera</i> Linn.	The wood is used for Handy craft making,	<i>Cocos nucifera</i> Linn.	The wood, depending on density is used for

		furniture, parquet, indoor home and construction and high quality handy craft. Important ingredient for local food, copra and coconut oil. Leaves are utilized to wrap food		decorative flooring, including parquet flooring, furniture, paneling, carving, general building timber, sub floor, framing, lining, insulation.
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Data Sources:

¹[14]-[15]-[16]-[17], ²[18]-[19]-[20]

Table 3. Utilization of timber tree in Maluku and Fiji (cont.)

8	<i>Garcinia bancana</i> . Miq <i>G. mangostana</i> Linn.	Timber for household utensils, indoor furniture. Fruit of <i>G. mangostana</i> is tropical delicious fruit.	<i>Garcinia myrtifolia</i> A.C. Sm. <i>Garcinia mangostana</i> Linn <i>Garcinia</i> spp.	General construction, including decking, industrial and decorative flooring, tool handles. Timber is of high quality.
9	<i>Gmelina moluccana</i>	Wood is used for particle board, firewood, small boats (local name: <i>perahu</i> ; <i>sampan</i>) making and for home construction.	<i>Gmelina vitiensis</i> Seem. Syn. <i>Vitex vitiensis</i> Seem. <i>G. arborea</i> Roxb	A useful timber tree used for furniture, Boat building-decking, interior and exterior cabin work, oars, window and door frames, sills, pattern making, carving, food manufacturing equipment.
10	<i>Intsia bijuga</i> O. Kuntze	The important timber trees. High quality wood is used for furniture, flooring parquet, home, bridge and building construction, and truck and cart bodies	<i>Intsia bijuga</i> (Colebr.) O. Kuntze	The wood is used for heavy construction, poles, wharfs, bridging, truck and cart bodies, stumps, piles, cross-arms, stairs and decking, door and window sills, boat keels, boat framing, domestic and heavy duty flooring.
11	<i>Metrosideros vera</i> Roxb.	Hard wood timber tree used in building	<i>Metrosideros collina</i> var. <i>Villosa</i>	Larger trees used for timber used for house pots,

		and shipping construction and poles. Rural community often used tree's twigs as firewood. Bark is used as traditional medicine for diarrhea	(Sm.) A. Gray <i>Metrosideros</i> spp.	heavy duty and parquet flooring, mallets, chisel handles, bridges, wharf decking, and general building construction. Flowers used as decortioan.
12	<i>Myristica fragrans</i> Houtt	Very important spice tree of Maluku. Seed and mace are exported to Europe. Fruit and seed of nutmeg contain active compound for health.	<i>Myristica castanefolia</i> A. Gray <i>Myristica</i> spp.	Widely used timber and plywood, Joinery, interior paneling, furniture, covered flooring, molding, weatherboard, fascia board, turnery items, handles, novelties, light construction, cases, veneer and plywood.
13	<i>Palaquium obtusifolium</i> . Burck <i>P. amboinense</i>	The wood is used for building, home and boat construction, plywood, floor, and home utensils.	<i>Palaquium hornei</i> (Hartog ex Baker) Dubard <i>Palaquium</i> spp. .	Heavy construction, framing, sleepers, heavy duty decking, stairs, sills, flooring, vehicle interior body parts, mallet heads, cross arms, boat keels.
14	<i>Podocarpus neriifolius</i> <i>P. blumei</i> endl <i>P. rumphii</i> El.	Important softwood timber is used for home construction, furniture making, cabinet making, interior trim, household utensils, sports goods and wood carving. It is also used for plywood.	<i>Podocarpus neriifolius</i> D.Don ex Lamb. var, neriifolius <i>P. neriifolius</i> var, degeneri N. E. Gray, with two varieties: <i>P. affinis</i> Seem. (Endemic to Fiji) <i>P. decipiens</i> N. E. Gray	One of the rarer softwood timbers used for interior fitting, furniture, cabinet, molding, lining, joinery, boat planking and decking, light construction and boxes. Traditionally used by Fijians for making spears, poles and dugout canoes.
15	<i>Terminalia catappa</i> Linn.	The wood is used for light building and home construction and plywood.	<i>Terminalia pterocarpa</i> Melville and Green <i>Terminalia</i> spp.	-Versatile timber suitable for general building construction, molding, interior finishing, furniture, paneling, flooring, weatherboards,

				light construction.
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Data Sources:

¹[14]-[15]-[16]-[17], ²[18]-[19]-[20]

Bacillus megaterium TSB16 has been colonizing coconut [21], *Pseudomonas* and *Bacillus* spp. has been isolated from rhizosphere of the *Garcinia lanceifolia* (G.Don) Rox [22]. Nitrogen fixing as well as phosphorous and potassium solubilizing bacteria were proliferated in rhizosphere of nutmeg plants [23]. Those plants mentioned above are some of tree grow naturally in either Maluku or Fiji; and we concern to the used of bacterial inoculant in seed nursery. However rhizobacteria in the rhizosphere of *Barringtonia*, *Canarium*, *Intsia*, *Metrosideros*, and *Palaquium* might have not been study even though those trees are economically important.

Table 4. Potential Plant Growth Promoting Rhizobacteria isolated from indigenous tree Genus

No	Genus	Plant Growth Promoting Rhizoacteria	References
1	<i>Acacia</i>	Symbiotically N fixer <i>Bradyrhizobium</i> in <i>A. mangium</i> and <i>A. auriculiformis</i>	[11]
		Five isolates of PGPR	[24]
2	<i>Agathis</i>	Rhizobacteria	[24]
3	<i>Barringtonia</i>	-	
4	<i>Calophyllum</i>	Phosphote Solubilizing Bacteria, IAA producer PGPR	[25]
5	<i>Canarium</i>	-	
6	<i>Casuarina</i>	Symbiotically N-fixer Frankia	[12]
7	<i>Cocos</i>	<i>Bacillus megaterium</i> TSB16	[21]
8	<i>Garcinia</i>	<i>Pseudomonas</i> and <i>Bacillus</i> spp. from rhizosphere of t he <i>Garcinia lanceifolia</i> (G.Don) Roxb.	[22]
9	<i>Gmelina</i>	<i>Proteus vigaris</i> , <i>Escherichia coli</i> , <i>Bacillus polymyxa</i> , <i>Cinetobcter parapertusis</i> , <i>Acinetobacter parappertusis</i> , <i>Acinetobacter iwoffii</i> , <i>Actinomyces</i> sp., <i>Bacillus cereus</i> , <i>Bacillus subtilis</i> , <i>Alcaligenes feacalis</i> ,	[26]
10	<i>Intsia</i>	-	
11	<i>Metrosideros</i>	-	
12	<i>Myristica</i>	P and K solubilizing bacteria	[23]

13	<i>Palaquium</i>	-	
14	<i>Podocarpus</i>	Antifungal <i>Bacillus simplex</i> and <i>B. subtilis</i> ,	[27]
15	<i>Terminalia</i>	<i>Bacillus</i> species, <i>Corynebacterium</i> species <i>Flavobacterium</i> species <i>Streptococcus</i> species <i>Azomonas</i> species	[28]

Inoculation is necessary when native trees are to be grown on plantation. Plant inoculation with effective PGPR is needed to ensure the positive effect of rhizobacteria on plant growth. Inoculant preparation of PGPR for seed nursery should be considered. Tree inoculation should be carried out in seed nursery when the seed is sown to ensure early rhizobacterial colonization in roots. Selection of effective strains for each tree should be taken place to obtain well colonized seedling to be planted in new area. Inoculation of tree with PGPR is recommended in order to conserve native tree biodiversity as well as increase plant health in nursery to assure the best tree development in new area. Beneficial rhizobacteria play an important role to provide major plant nutrient -nitrogen and phosphorous- and stimulate plant growth through mode of action of secondary metabolites and phytohormones production

In order to obtain better tree roots colonization by PGPR, a series of research concerning those characteristics along with application method test should be taken place. Since biofertilizer application in seed nursery in Maluku as well as in Fiji islands is not yet done, a comprehensive research in laboratory and field should be considered to maintain the existence of 15 indigenous tree in the two Melanesian region, Maluku and Fiji.

5. CONCLUSION

This comparative study demonstrated that at least 15 indigenous tree genus are naturally grown in Maluku Province and Republic of Fiji. Those genus enrich the biodiversity of both region. Among them, we found similar native tree species i.e Borneo Mahagony (*Calophyllum inophyllum* Linn.), Casuarina (*Casuarina equisetifolia* Linn), Coconut (*Cocos nucifera* Linn.), Mangosteen (*Garcinia mangostana* Linn), Borneo Teak (*Intsia bijuga* O. Kuntze), and Brown Pine (*Podocarpus neriifolius* D.Don ex Lamb.).

The presence of beneficial rhizobacteria which stimulate plant growth in root system of most of indigenous tree has been documented elsewhere. However no report about PGPR in the rhizosphere of genus of *Barringtonia*, *Canarium*, *Intsia*, *Metrosideros*, and *Palaquium*. Future used of PGPR isolated from tree in Maluku and Fiji is very promising since naturally indigenous PGPR has been colonizing those tree roots. However further study and research to develop and proved the effectiveness of biofertilizer in tree nursery of both region is needed.

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