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Pandans Diversity in Mts. Jayawijaya Papua Indonesia

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Abstract
The research aims to describe the diversity of Pandans species from Mts. Jayawijaya, Papua Indonesia. Field survey was conducted from March to July 2013 in Mts. Jayawijaya. The exploration was focused to five villages namely Ekapame Village (elevation 2000-3200 m asl.), Kemiri Village (elevation 2000-3700 m asl.), Tika Village (elevation 1800-2200 m asl.), Papa Village (elevation about 1900-3500 m asl.), and Wosi Village (elevation 1700-2500 m dpl). The morphological analysis was done to measure roots, steam, leaves and fruit of Pandans. Result was analysis descriptively. Through the morphological characteristics, there are about 7 species of Pandans were found in Mts. Jayawijaya. Five species are recognized as *Pandanus conoideus, Pandanus julianettii, Pandanus brosimos, Pandanus iwen,* and *Pandanus antaresensis*. Two species potentially becomes new species, namely *Pandanus* sp. 1 (local people called *Owadak*) and *Pandanus* sp. 2 (local people called *Woromo*). There are three variant within *Pandanus julianettii,* three variant within *Pandanus iwen,* and three variant within *Pandanus brosimos*. *Pandanus* sp. 1 (*Owadak*) have three variant and *Pandanus* sp.2 (*Woromo*) have three variant. The conservation of Pandans diversity in Papua is crucial.
Keywords: Pandanaceae, Biodiversity Papua, Indigenous knowledge

1. Introduction

Papua Island has greatest biodiversity in the world which is important for recent and future generations. According to de Fretes et al. (1999), Indonesian Papua has highest endemic species. There was estimated about 25,000 woody plants species; 164 mammals species, 329 Amphibians species, 650 birds, and about 1200 marine fishes. Papua rich in term of ecosystem, ranging from marine to highland which is distributes at Mts. Jayawijaya. The fascinating biodiversity of Papua is sources of economic developments. The flora of Papua Island has high value for medical and food developments.

Systematically, Pandans belong to the Pandanaceae. In Malesian phytoregions, the family of Pandanaceae consist of 3 genera, namely Sararangan, Freycinetia and Pandanus. In Papua and Papua New Guinea, there were estimated about 60 species of Freycinetia, more than 100 species of Pandanus and one species of Sararanga (Purwanto and Munawaroh, 2010). The distributions of Pandans are ranging from lowland to highland. Mountain contains huge biodiversity, but many of them often lees studied. In many tropical developing countries, the remotes sites and accessibility of mountains regions often becomes the barrier of mountain biodiversity exploration (Hakim and Miyakawa, 2013). Lack of such data base lead has to the problems of mountain biodiversity conservations and ecosystems restorations.

Pandans is one of the important plants in Papua Island. Scholars notes that Pandans intensively used for numerous purposes. Leaf of Pandans was uses as traditional house roofs (locally called *honai*). The roots were processed as traditional basket and sacs (locally called *noken*). The fruit of Pandans was collected as sources of carbohydrates. Pandans also harvested and processed as medical materials. The numerous functions of Pandans in daily life of Papuan was considered diverse and important (Stone, 1978; Hyndman, 1984; Budi, 2002; , Keim *et al*., 2006; Keim, 2009; Purwanto and Munawaroh, 2010).

Exploration of Pandans diversity has been done and produces some scientific information. Mostly, research was done in Papua New Guinea and little has been conducted at West Papua. Remotes area, safety, and accessibility become the limited factor for Pandans exploration in western Papua. While researcher facing technical problems in exploration, the local people in such area for a long time has been able to recognize Pandans diversity and its value. The study of Pandans diversity and its uses in remotes area in Papua basically are important for scientific reasons and local developments. The research aims to determines the diversify of Pandans in Mts. Jayawijaya in Indonesian Papua and discuss the implication of the research in future conservation of Pandans diversity in Papua.

2. Methodology

Study site

Field was done at March to July 2013 at five district at Mts. Jayawijaya, namely Ekapame Village – Yilu District (elevation 2000-3200 m asl.), Kemiri Village- Makki District (elevation 2000-3700 m asl.), Tika Village

- Tagime District (elevation 1800-2200 m asl.), Papa Village - Tolineri District (elevation about 1900-3500 m asl.), and Wosi Village- Kurulu District (elevation 1700-2500 m dpl). Ekapame and Kemiri Villages belong to the Lanny Jaya Regency and Tika Village belongs to the Memberamo Tengah Regency. Papa villages were belongs to Tolikara Regency and Wosi Villages belong to Jayawijaya Regency. These villages are home of Dani Tribal community, one of the indigenous people in Papua Island. Local people live in traditional ways and practicing shifting agriculture. In the past, access to modern society was limited but recently the development of road to connect each villages and other regency has been started.

Methods

The previous survey was done by examining literature related to diversity and distribution of Pandans in Papua. Survey was done by exploring areas within five villages in Mts. Jayawijaya. Local people invited to guide field exploration because they have information related Pandans population distributions. The close relationship between man and forest in remotes mountainous forest area lead local people has ability to recognize plants biodiversity. Employing local people becomes one of the key for field exploration (Hakim and Miyakawa, 2013). In the field, Pandans species in each location was observed and specimens were collected. In the field, morphological measurement was done by measuring exposing aerial roots diameters, plant height, steam diameters, length of leaves, wide of leaves, weight of fruits, length and diameters of fruits. Length of exposing aerial roots was measured from roots internodes in main bark to the lands. The fruits weight was measured using kitchen scale, and fruits diameter was measure using tape measure. The color of roots, steam, leaves, infructescence (a cluster of Pandans fruit), fleshy receptacle, drupe (a single hard stone that encloses a pandan's seed), and seed coat (testa) were assessed using *Royal Horticultural Society* (RHS) color chart. Vegetative and generative organs of Pandans were prepared as herbarium specimen for further analysis in Herbarium Bogoriensis in Bogor, West Java.

In the field, the distribution of Pandans were recorded using Global Positioning System (GPS). Coordinates data were store in GPS system for further spatial distribution analysis in laboratory. In every site, the physical environmental data was measure. Secondary data related to rainfall in Mts. Jayawijaya was generated o the nearest meteorological station. Temperature was measure using thermometer and humidity was measure using hygrometer. Morphological data was analysis descriptively using SPSS 2.2.

3. Result and discussion

Species diversity

Morphologically, Pandans in Mts. Jayawijaya has great morphological character which leads to species and variety diversity. Through the specimen analysis in Herbarium Bogorienses, specimen of Pandans from field survey in Mts. Jayawijaya can be classified into 7 species of Pandans. Five species were identified and recognized as *Pandanus conoideus, Pandanus julianettii, Pandanus brosimos, Pandanus iwen, Pandanus antaresensis*. Two species potentially becomes new species, namely *Pandanus* sp. 1 (local people called *owadak*) and *Pandanus* sp. 2 (local people called *woromo*). These two species not yet reported by authors in Pandans taxonomic literature.

Within the species, there were varieties in morphological characters. It can be found at length of roots, roots diameters, plant height, steam diameters, length of leaves, wide of leaves, weight of fruits, length and diameters of fruits variety. The variety of species is a respond of environmental condition and evolutionary process. In Papua, species diversity and variety within species has been reported high. Papua Island is centre of endemism in Malesia pytogeographic regions (Stone, 1978).

Through the empirical experiences, local people divided species of Pandans into some variety. The morphological reorganization confirm that *Pandanus iwen* in Mts. Jayawijaya consist of three variant namely *"yibinokokop", "eromagap"* and "*kolingginik*". Within *Pandanus julianettii* there are three variant namely "*lirungga*", "*kopena*" and "*endogonep*". The *Pandanus brosimos* consist of three variant, i.e. "*lirungga*", "*kopena*" and "*endogonep*". Only one *Pandanus antaresensis* was recognized by local people and this information similar with Jebb (1992) notes. The local knowledge on the Pandans variety within such species is one of the form of indigenous knowledge which is important for tribal community survival in remotes area.

The two new potential species come from *Pandanus* Sp. 1 (*Owadak*) and *Pandanus S*p. 2 (*Woromo*). *Owadak* and *Woromo* Pandans were not listed in global Pandans databases and therefore open new opportunities as new Pandans species from Mts. Jayawijaya. Local people argue that there are varieties within species. Local people state that *Owadak* has three variant namely "*yalekwe*", "*kelonggop*" and "*kerawo*". In case of *Woromo* pandans, local people divided such species into three variant namely "*lirungga*", "*kopena*" and "*endogonep*". Previously, there are no records of *Owadak* and *Woromo P*andans in Mts. Jayawijaya. This research therefore contributes to the recent distribution information on such species in Mts. Jayawijaya. The morphological measurement of all species and cultivar was given in Table 1.

Fruits are an important plants organ. Systematically, fruits can inform the identity of plans species and variety within species. The morphological character of Pandan's infructescence was given in Table 2.

Plant's organ color varies greatly within species. Color in plats organs is chemical aspect within plant which referring the diversity off metabolism process and therefore reflecting the genetic diversity. There are three class of color producing compound in plants, namely Porphyrin, Carotenoid and Flavonoid. Various combination of such class in plants organs lead the diversity of plants organ color (Alkema and Seager, 1982). The varieties of Pandans color in Mts. Jayawijaya were given in Table 3.

From the numerous morphological data, the diversity of Pandans in Mts. Jayawijaya can be clustered following Fig.1. This data confirms that among specimen variety between species was high, indicates that the variety possible come from similar ancestors and in many characteristics shows as single species.

The typical characteristics of species and variant within species were describes bellow:

Pandanus julianettii

Locally called *Gawan*. *P. julianettii* distributes in tropical rain forest at 1750 m to 3000 m asl. Local people recognize and classify *P. julianettii* into three cultivar, namely *Gawan Lirungga, Gawan Kopena* and *Gawan Endogonep*. The fruits are edible and consume by local people.

Table 1. Plants organs measurements (Notes: number in parentages is standard deviation).

No	Species	Roots (cm)		Height (m)	Steam diameter (cm)	Leaves (cm)	
		length	Diameters			length	Wide
1	*Pandanus julianettii lirungga*	2.30 (± 1.21)	3.7 (± 1.48)	11.10 (± 7.36)	62.8 (± 15.56)	2.73 (± 0.82)	7.9 (± 1.04)
2	*Pandanus julianettii kopena*	2.10 (± 1.25)	3.5 (± 1.54)	14.61 (± 7.58)	65.1 (± 15.56)	2.81 (± 0.85)	7.5 (± 0.96)
3	*Pandanus julianettii endogonep*	2.45 (± 1.29)	3.2 (± 1.59)	12.75 (± 7.87)	67.3 (± 16.14)	2.65 (± 0.88)	7.8 (± 0.90)
4	*Pandanus iwen yibinokokop*	1.40 (± 1.34)	1.2 (± 1.65)	4.87 (± 1.18)	44.5 (± 16.80)	1.30 (± 0.92)	4.7 (± 0.75)
5	*Pandanus iwen eromagap*	1.42 (± 1.33)	1.7 (± 1.53)	3.95 (± 1.04)	47.1 (± 16.02)	1.37 (± 0.85)	5.0 (± 0.71)
6	*Pandanus iwen kolingginik*	1.15 (± 1.31)	1.9 (± 1.43)	3.55 (± 1.63)	49.5 (± 15.14)	1.45 (± 0.74)	4.5 (± 0.69)
7	*Pandanus brosimis lirungga*	4.75 (± 0.75)	5.0 (± 0.36)	21.12 (± 8.35)	83.1 (± 2.11)	3.33 (± 0.06)	5.5 (± 0.20)
8	*Pandanus brosimis kopena*	3.33 (± 0.82)	5.5 (± 0.14)	23.51 (± 8.63)	85.7 (± 2.96)	3.40 (± 0.09)	5.6 (± 0.21)
9	*Pandanus brosimis endogonep*	4.50 (± 1.21)	5.7 (± 1.48)	21.20 (± 8.36)	81.5 (± 15.56)	3.27 (± 0.82)	5.9 (± 1.04)
10	*Pandanus antaresensis*	5.14 (± 1.21)	5.9 (± 0.38)	26.10 (± 7.35)	94.9 (± 5.98)	2.85 (± 0.24)	6.1 (± 0.27)
11	*Pandanus* Sp 1 (*owadak yalekwe*)	2.00 (± 0.77)	2.8 (± 1.57)	8.35 (± 5.25)	56.1 (± 17.15)	2.45 (± 0.43)	5.7 (± 0.22)
12	*Pandanus* Sp.1 (*owadak kelonggop*)	1.90 (± 1.47)	2.8 (± 1.57)	6,92 (± 2.13)	51.9 (± 16.90)	2.50 (± 0.42)	5.5 (± 0.25)
13	*Pandanus* Sp. 1. (*owadak kerawo*)	1.75 (± 1.37)	2.3 (± 1.48)	8.40 (± 6.83)	58.2 (± 13.59)	2.47 (± 0.39)	5.9 (± 0.24)
14	*Pandanus* Sp.2. (*woromo lirungga*)	2.82 (± 1.22)	4,5 (± 1.30)	17.44 (± 6.81)	74.4 (± 14.05)	3.75 (± 0.56)	6.8 (± 0.54)
15	*Pandanus* Sp.2. (*woromo kopena*)	2.90 (± 1.29)	4.2 (± 1.37)	17.60 (± 7.22)	71.5 (± 14.90)	3.83 (± 0.55)	6.9 (± 0.50)
16	*Pandanus* Sp.2. (*woromo endogonep*)	2.83 (± 1.37)	4.8 (± 1.47)	19.70 (± 7.72)	76.1 (± 15.91)	3.81 (±0.51)	6.7 (± 0.39)

According to local people, reproduction can be done through generative. In 5-7 years, the individual can produce flowers. The species easily cultivated in open area and forest.

Previous distribution records shows that *P. julianetti* distribute at highland ecosystem in Papua New Guinea (Stone, 1978; Hyndman, 1984; Rose, 1982). In western Indonesia, Purwanto and Munawaroh, (2010) notes that *P. julianettii* found in Wamena. In this study, the distribution of *P. julianetti* in Papa

(Tolikara), Ekapame and Kemiri (Lanny Jaya), Tika (Membermo Tengah), and Wosi (Jayawijaya) is new records. Three variant shows different testa thickness. *Lirunga* variant has small sheed with thin layers, but *Kopena* has medium seed with thin layers. Endogenep has big seed with thin seeds layers.

Table 2. Comparative measurement of infructescence

No	Species	Weight (kg)	Diameters (cm)	Length (cm)
1	*P. julianettii lirungga*	5.9(± 2.64)	67.8(± 18.48)	27.3(± 7.56)
2	*P.julianettii kopena*	6.0(± 2.73)	62.5(± 19.13)	27.1(± 7.69)
3	*P.julianettii endogonep*	5.8(± 2.84)	66.4(± 19.78)	26.8(± 7.98)
4	*P.iwen yibinokokop*	1.7(± 2.95)	44.5(± 20.02)	14.3(± 8.30)
5	*P.iwen eromagap*	2.5(± 2.81)	40.3(± 20.02)	19.5(± 7.63)
6	*P.iwen kolingginik*	1.9(± 2.69)	48.1(± 18.32)	15.6(± 7.43)
7	*P.brosimis lirungga*	8.4(± 0.73)	91.4(± 3.97)	30.7(± 0.95)
8	*P.brosimis kopena*	9.5(± 0.98)	88.2(± 3.32)	30.8(± 1.13)
9	*P.brosimis endogonep*	8.1(± 2.64)	83.5(± 18.48)	32.4(± 7.42)
10	*P.antaresensis*	10.7(± 1.18)	106.5(± 9.94)	35.1(± 2.05)
11	*Pandanus* sp.1. (*owadak yalekwe*)	3.9(± 2.87)	53.5(± 20.81)	22.9(± 5.52)
12	*Pandanus* sp.1. (*owadak kelonggop*)	4.7(± 2.77)	58.9(± 19.84)	20.3(± 5.50)
13	*Pandanus* sp.1. (*owadak kerawo*)	3.6(± 2.69)	55.2(± 18.73)	24.4(± 3.93)
14	*Pandanus* sp.2. (*woromo lirungga*)	6.8(± 2.33)	79.3(± 3.97)	36.4(± 6.18)
15	*Pandanus* sp.2. (*woromo kopena*)	6.9(± 2.49)	75.1(± 18.03)	37.6(± 6.21)
16	*Pandanus* sp.2. (*woromo endogonep*)	6.5(± 2.66)	76.5(± 19.27)	36.5(± 5.91)

Notes: number in parentages is standard deviation

Pandanus iwen

Locally called *Terep*. Local people can recognized *P. iwen* into three cultivar, namely "*Terep Yibinokokop*", "*Terep Eromagap*" and "*Terep Kolingginik*". These cultivars distribute at rain tropical mountain forest at 2000-2500 m asl. These plants were used as food resources. Local people state that cultivation very easy. The mature individual will established reproduction organs in 4-5 years. Plants were cultivated at open land and under forest canopy. The plants management was very simple. Through the field survey, *Pandanus iwen* was found at Tika Village (Memberamo Tengah) and can be said new records to the area. "*Terep Eromagap*" has reported by Keim *et al*., (2006) in Timeria Village (Kelila District) and "*Terep Yibinokokop*", and "*Terep Kolingginik*" was reported from Tika, Memberamo Tengah.

Pandanus brosimos

Locally called *Lim*. Previous study notes the species grows in 2400-3000 m asl in Papua New Guinea (Merrill and Perry, 1939). In western Papua, Jebb (1992) report the species found in Wamena. The plants height in Mts. Jayawijaya varies from 20 – 25 m tall, similar with previous report by Jebb (1992). In Mts. Jayawijaya, the population of *P. brosimos* easily found in mountains slopes in Wosi (Jayawijaya) and Kemiri (Lanny Jaya). This distribution can be said new records in Jayawijaya. According to local people *P. brosimos* consist of three cultivars, namely "*Lim Lirungga*", "*Lim Kopena*" and "*Lim Endogonep*". Wild population grows in forest, and some of them are semi cultivated by local people. The *Lirungga* variant has moderate testa and big seed; while *Kopena* has testa and seed medium. The *Endogonep* has hard testa and little seeds.

Pandanus antaresensis

Locally called *Kyumbe*. Previously reported distributes at Papua New Guinea. Local people said there are no variant within species. They often found grows at altitude 2000-3800 m asl. Local people uses such species as edible fruit. Propagated by generative techniques from mature seeds. Seeds propagated through generative; plant mature and produce flower in 10-15 years. Local people cultivated the species in forest with simple management. New records in Mts. Jayawijaya, particularly in Tika Village (Memberamo Tengah) and Wosi (Jayawijaya). St. John (1973) report that *Pandanus antaresensis* in tropical mountain forest at 1580 m asl in Papua New Guinea (PNG).

***Pandanus* sp.1. (*Owadak*)**

Locally called *Owadak*. Not yet reported in Pandans publications. According to local people, there are about three cultivar of *Owadak* Pandans namely "*Yalekwe*", "*Kelonggop*" and "*Kerawo*". These cultivar considered

endemic and distributes along altitude 2000-3000 m asl. Local people use such species as food resources. These plants easily cultivated at open area and under tropical forest canopy. The management of plant was easy. There are no distribution record in literature and lead this findings become new record in Mts. Jayawijaya. This species found in remotes area in Papa Village, Tolikara.

***Pandanus* sp.2. (*Woromo*)**

Locally called *Woromo*. There are no publications related to *Woromo* Pandan in the world. This could be new record in Mts. Jayawijaya. Recent survey confirms that the species found in Papa (Tolikara), Ekapame and Kemiri (Lanny Jaya), Tika (Membermao Tengah), and Wasi (Jayawijaya). *Woromo* consist of three cultivar, namely "*Lirungga*", "*Kopena*" and "*Endogonep*". There no report previously in Mts. Jayawijaya. In Mts. Jayawijaya commonly found at 2000-3000 m asl. The fruit was consumable. Cultivation was done by vegetative techniques. Cultivated in forest. Plant produces flowers in 10-15 years.

The testa and seeds thickness of *Lirungga* was medium. Testa and seeds thickness of *Kopena* was big, while testa and seeds thickness of *Endogonep* was small.

Table 3. Color comparison of Pandans organs

Pandas species	Color based on RHS Colour Chart						
	roots	steam	leaves	Infructescence	fleshy receptacle	drupe	testa
P. julianetti lirungga	-	199B	130C	150C	158C	200B	199B
P. julianettii kopena	100B	100B	144B	150C	158C	200B	199B
P. julianettii endogonep	100B	100B	144D	150C	158C	200B	199B
P. iwen yibinokokop	100B	199A	142D	149C	155B	199B	199B
P. iwen eromagap	100B	199A	130B	149C	155B	199B	199B
P. iwen kolingginik	100B	199A	127D	149C	155D	199B	158B
P. brosimis lirungga	143C	100D	133D	144D	155B	196A	199A
P. brosimis kopena	143C	100D	133D	144D	155B	199A	199A
P. brosimis endogonep	199C	199B	127C	144D	18A	199A	199A
P. antaresensis	199C	199C	130B	133D	18A	199B	199A
Pandanus sp 1. (*owadak yalekwe*)	199C	199C	130B	144D	18A	199B	199A
Pandanus sp.1. (*owadak kelonggop*)	199C	199B	134B	144D	18A	199B	199A
Pandanus sp. 1. (*owadak kerawo*)	199C	199B	130B	144D	100A	199B	199A
Pandanus sp.2. (*woromo lirungga*)	199C	202A	132D	144D	155D	158A	199A
Pandanus sp.2. (*woromo kopena*)	199C	202A	132D	144D	155D	158A	199A
Pandanus sp.2. (*woromo endogonep*)	199C	199B	142A	144A	155D	199B	199A

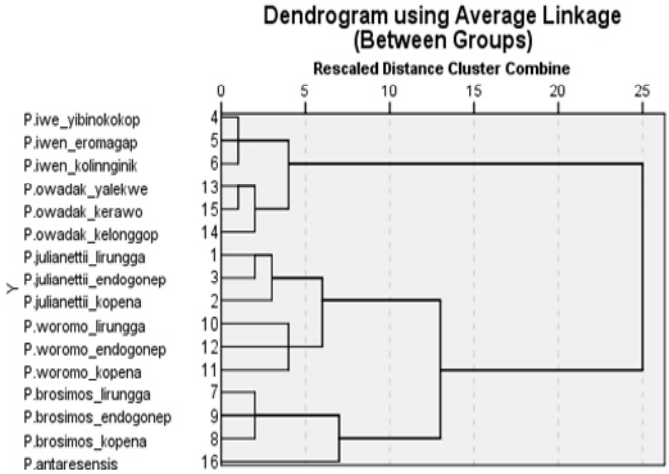

Fig.1 Specimen morphological similarity of Pandanus from Mts. Jayawijaya

Pandans distribution

Previous survey confirms that Papua and its surrounding islands is important habitat for world's pandanaceae. Kiem (2009) on his survey found 11 species of Pandanacea in Yapen, one of the islands in Cenderawasih bay Papua. It is encompasses 3 species of Freycinetia (i.e. *F. allantoidea* A.P. Keim, *F. beccarii* Solms, *F. spinifera* A.P. Keim), 7 species of Pandanus (i.e.: *P. conoideus* Lam., *P. dubius* Spreng., *P. kaernbachii* Warb., *P. krauelianus*, *P. papuanus* Solms., *P. pseudosyncarpus* Kaneh.) and 1 species of Saranga (*S. sinuosa* Hemsl.).

In the study area *Pandanus antaresensis* only found in Tika (Memberamo Tengah) and absent in Papa (Tolikara), Ekapame-Kemiri (Lanny Jaya) and Wosi (Jayawiya). Previous notes by Jebb (1992) notes that *Pandanus antaresensis* was recorded at Papua New Guinea. Therefore, *Pandanus antaresensis* findings in Mts. Jayawijaya become new records.

In Mts. Jayawijaya, *Pandanus brosimus* commonly found in Wosi (Jayawijaya) and Kemiri (Lanny Jaya). The population absent in Tika (Memberamo Tengah), Papa (Tolikara), and Ekapame (Lanny Jaya). Previous notes by Jebb (1992) states that *Pandanus brosimus* found in central of Papua New Guinea at about 2400-3100 m asl. And in Mts. Bintang (eastern of Mts. Jayawijaya) in West Papua. It is new records in Mts. Jayawijaya.

Pandanus iwen only found in Tika (Memberamo Tengah) and absent in Papa (Tolikara), Ekapame-Kemiri (Lanny Jaya) anda Wosi (Jayawiya). Jebb (1992) report that the species is grows wild in forest and semi-cultivated by people in the central of Papua New Guinea. The recent distribution of *Pandanus iwen* in Tika (Memberamo Tengah) is new records.

Pandanus julianettii found in Tika (Memberamo Tengah), Papa (Tolikara), Ekapame-Kemiri (Lanny Jaya) and Wosi (Jayawijaya), represent the wide distribution of such species in Mts. Jayawijaya. Jebb (1992) found this species distributes at Papua New Guinea and absent in West Papua, including Mts. Jayawijaya.

Woromo pandans were abundance and easily found in Mts. Jayawijaya, while *Owodak* pandan has limited distribution in Papa (Tolikara). This species needs advance taxonomic study to clarify the species status within Pandanus. Such studies were crucial as a first important step in endemic plants species conservations.

The physical environments of Pandans habitat in Mts. Jayawijaya are given in Table 4. In southern area of Mts. Jayawijaya, Pandans population in altitude 1750-2400 m asl grows associated with *Musa* spp., *Ficus* sp., *Neolitsea villosa* and *Salix favonica*. In altitude 2400-3000, Pandans grows together with *Salix favorica*, *Gordonia papana*, *Libocerdus papuana*, *S. plumenun*. Up to 3000 m asl, Pandans population grows with conifer, *G. podocarpus*, *H. cupanioides*, *C. papuana* and *Pinus mercusi*.

Table 4. Physical characteristic of Pandans habitat in Mts. Jayawijaya.

Altitude	1750-2400 m asl	2400-3000 m asl	3000-3500 m asl
Southern area of Mts. Jayawijaya			
Temperature (°C)	20.35	16.95	12.55
Humidity (%)	88	91	96
Light intensity (lux)	484.75	514.23	626.52
Rainfall (mm/year)	2572.04	2795.1	3115.7
Northern area of Mts. Jayawijaya			
Temperature (°C)	26.08	21.35	18.95
Humidity (%)	72	77	80
Light intensity (lux)	863.75	986.25	1174.31
Rainfall (mm/year)	1731.15	2095.22	1174.31

In northern area of Mts. Jayawijaya, Pandans populations grows with *Salix favonica*, *Musa* spp., *F. adenosperma*, *Myristica subulata* and *Kibara kasuarina* in altitude 1800-2400 m asl., while in altitude 2400-3000, Pandans grows in association with *Musa* spp., *Ficus wassa*, *Olea paniculata*, *Sterculia* sp., and *Citrus* sp. In are with altitude >3000 m asl., Pandans population grows with *Syzygium verstegi*, *Piper* sp., *Pinus mercusii*, *Grevilea papuana*, *M. longicaudatus* and *Dodonea viscose*.

Conclusions

There are about 7 species of Pandans, namely *Pandanus conoideus, Pandanus julianettii, Pandanus brosimos, Pandanus iwen, Pandanus antaresensis, Woromo* Pandan and O*wadak* Pandan. There were three variant in *Pandanus iwen,* namely *P. iwen yibinokokop, P. iwen eromagap* and *P. iwen kolingginik;* three variants within *Pandanus julianettii* namely *P. julianettii lirungga, P. julianettii kopena* and *P. julianettii endogonep*. The *brosimos* Pandans consist of three variant, namely *lirungga, kopena* and *endogonep*. The *Woromo* pandans consist of three variant, namely *lirungga, kopena* and *endogonep*. The O*wadak* pandan has three variant namely *Yalekwe, Kelonggop* and *Kerawo*;

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