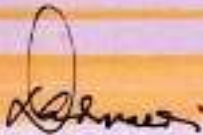


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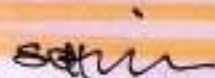
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SPECIES OF *FREYCINETIA* GAUD. IN MANOKWARI- WEST PAPUA¹

Fenny Ismoyo², Nurhaidah Iriany Sinaga³

ABSTRACT

Freycinetia is a one genus under Pandanaceae family beside *Pandanus*, *Sararanga* and *Martelidendron*. The Genus has widely variation in New Guinea island that is suspected as a centre biodiversity of *Freycinetia*. Study about taxonomy, biodiversity and distribution of Papuan *Freycinetia* species have been done in Manokwari (West Papua Province) using morphological Characters. Result show about 22 species of *Freycinetia* occur in the area. All species are put under 3 groups e.i imbricate, semi imbricate and unimbricate. Imbricate group are found both in primer and secondary forest but semi imbricate and unimbricate groups only found in primer forest. Result found that 6 species are only found in Manokwari, 1 species found in both Manokwari and West New Guinea and 14 species are found in all New Guinea area. One species i.e *F. funicularis* occur also in East Malesian region include Celebes and Moluccas.

Key words: *Freycinetia*, Pandanaceae, Manokwari

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- 1) Research will be discus on Flora Malesiana symposium
2&3) Lecture on University of Papua, Indonesia

ABSTRACT

Freycinetia is a one genus under Pandanaceae family beside *Pandanus*, *Sararanga* and *Martelidendron*. The Genus has widely variation in New Guinea island that is suspected as a centre biodiversity of *Freycinetia*. Utilities as a food and others using like ornamental plant, material for roof, handy craft and perfume cause the genus become interesting plant to explore and get benefit for human live. Therefore study about taxonomy, biodiversity and distribution of Papuan *Freycinetia* species have been done in Manokwari using morphological characters. The result show that 22 species of *Freycinetia* occur in the area and 4 species are new species namely *F. albaaria* Sinaga, A.P.Keim & Ismoyo, *F. folitenella* Sinaga, A.P.Keim & Ismoyo, *F. mandacana* Sinaga, A.P.Keim & Ismoyo and *F. iriana* Sinaga, A.P.Keim & Ismoyo. All species are put under 3 groups namely imbricate, semi imbricate and un-imbricate. Imbricate group are found both in primer and secondary forest but semi imbricate and un-imbricate groups only found only in primer forest. Result found that 6 species are only found in Manokwari, 1 species found in both Manokwari and West New Guinea and 14 species are found in all New Guinea area. One species i.e *F. funicularis* occur also in East Malesian region include Celebes and Moluccas.

Key words: *Freycinetia*, Pandanaceae, Manokwari

ABSTRAK

Freycinetia adalah salah satu marga dalam suku Pandanaceae disamping *Pandanus*, *Sararanga* dan *Martellidendron*. Marga ini memiliki variasi yang tinggi di pulau New Guinea yang diduga sebagai pusat keragaman marga. Kegunaan sebagai sumber pangan, tanaman ornamental, material untuk atap rumah dan berbagai barang souvenir serta parfum menyebabkan marga ini menjadi menarik untuk dipelajari dan terus dikembangkan untuk kehidupan manusia. Karena itu studi tentang taksonomi, biodiversity dan persebaran *Freycinetia* Papua dilakukan berdasarkan karakter morfologi. Hasil penelitian menunjukkan bahwa terdapat sebanyak 22 jenis *Freycinetia* di Manokwari dan 4 jenis diantaranya adalah jenis baru yakni *F. albaauria* Sinaga, A.P.Keim & Ismoyo, *F. folitenella* Sinaga, A.P.Keim & Ismoyo, *F. mandacana* Sinaga, A.P.Keim & Ismoyo dan *F. triana* Sinaga, A.P.Keim & Ismoyo. Jenis-jenis yang ada dikelompokkan atas 3 grup yakni grup dengan susunan daun bersirap atau *F. macrostachya* grup, grup dengan susunan daun agak bersirap atau *F. funicularis* grup dan grup dengan susunan daun tidak bersirap atau *F. oblanceolata* grup. *F. macrostachya* grup ditemukan baik di hutan primer maupun sekunder tetapi kedua grup lainnya hanya ditemukan di hutan primer saja. Hasil penelitian menunjukkan juga bahwa 6 jenis *Freycinetia* hanya ditemukan di Manokwari, 1 jenis ditemukan di Manokwari dan New Guinea Barat dan 14 jenis hidup di seluruh pulau New Guinea. Salah satu jenis yakni *F. funicularis* juga ditemukan hingga wilayah timur Malesia yakni di Maluku dan Sulawesi.

Kata Kunci : *Freycinetia*, Pandanaceae, Manokwari

INTRODUCTION

Pandanaceae is a large family within the Monocotyledoneae. Despite its conspicuous number of species (more than 900 species currently recognized), the family consists only four genera: *Freycinetia*, *Martellidendron*, *Pandanus*, and *Sararanga*.

Freycinetia was firstly described by Gaudichaud (1824). Currently there are about 200 species are recognized. The genus has the second widest distribution after *Pandanus*. Unlike the other members of Pandanaceae, *Freycinetia* is a climber, except for *F. arborea*, a Hawaiian endemic. Species of this genus are found in lowland and mountain forests from sea level up to 3000 meters above sea level. However, only few species are found in both lowland and mountain forests such as *F. funicularis*. The members of this genus prefer humid environments and this is believed to be the main reason for their abundant presence in the riverbanks (Stone 1982). As the consequence almost all species of *Freycinetia* are hardly found in secondary forests or open areas, except *F. macrostachya*, and *F. marginata*.

The centre of distribution of this genus is in New Guinea, where at least 60 species have been recognized (Stone 1976; 1983). This number is much higher compare to Borneo (24) and the Malay Peninsula (8).

Freycinetia is the sole member of the subfamily Freycinetoidea. This subfamily is characterised by the possession of multiovulate fruits, whereas the other subfamily, Pandanoidea, where *Martellidendron*, *Pandanus* and *Sararanga* are included possesses uniovulate fruits. Unlike other genera, fruits of *Freycinetia* is berry, when mature become soft and edible. Some mammals like foxs and marsupial consume the fruits and

they are become distribution agent too. Arfak People in Manokwari also eating the fruits and bracts. In New zeland beside fruits, they also eating flowers and they are already planting *Freycinetia* for food.

Utilities as a food and others using like ornamental plant, material for roof, handy craft and perfume cause the genus become interesting plant to explore and get benefit for human live. That is why we need to know how many species of *Freycinetia* in Manokwari and how about their distribution and classification. All information here as a basically information for other researches.

METHOD

The study was carried out from July to October 2009. It started by the collecting activities undertaken in several areas in Manokwari like Mupi, Andai, Nuni and Prafi in low land area and Anggi in the highland area. Specimens from fieldwork and some specimen that were keep in several herbariums were deeply studied. Using morphological approach, PAUP analysis were done to find out relationship among species.

RESULT AND DISCUSSION

Morphological Characters

The manokwari *Freycinetia* species have variation on their morphological characters in the stem, leaves, inflorescences arrangement, prophyll of bracts, stigmas and berry. All variation belonging to the 26 Manokwari *Freycinetia* species, that were divided into 3 groups namely semi imbricate group that have 3 species, non imbricate group have 10 species and the last imbricate group have 15 species. Fourth species under non imbricate namely *F. albaauria* Sinaga; *F. folitenella* Sinaga, *F. iriana* Sinaga & Ismoyo and *F. manokwariana* Sinaga and the 2 species under imbricate groups namely *F. aurihastata* Sinaga & Keim and *F. mandacana* Sinaga are purposed as new species.

Some non imbricate species have slightly ovate of the nodes and it is sometimes orange than green or pale yellow and grey.

The important characters of leaves is found in *F. albaauria* which have 2 kinds of leaves. The base leaves and the apex leaves are different and the base leaves also have 2 different shape of leaves on the one lamina. Base is linear and the apex one is ellips. The leaves characters showed changing group from semi imbricate group to the non imbricate group. The semi imbricate group like imbricate group have only linear or lanceolate leaves different from non imbricate that have many variation on the leaves, that are ellips, fusiforma, lanceolate, oblong, obovate and others.

Other important characters is showed by inflorescences of the *F. gunungmejensis* that have 2 kinds: terminalia and axillary arrangement but all inflorescences have prophyll bracts, which is more simple than other semi imbricate groups but not have same color to the bracts and only simple in the numbers too, it is 6 bracts not 9 to the 32 bracts like

present in the semi imbricate group. The prophyll is more soft than other semi imbricate prophylls and also membranaceous.

The mixed characters here showed the transition characters between semi imbricate groups to the non imbricate.

Semi imbricate group have many stigmas but it is lost in the non imbricate group. Mostly manokwari species have simple number of the stigmas, commonly 2,3,4 and rarely 1, except to *F. salomonensis* that has 5,6 or 10 stigmas and 2 mountains species namely *F. gibseae* and *F. sterophylla* with 4,5,6,7 stigmas.

The unique stigmas character also found in Manokwari species, especially in imbricate group. Three shape of stigmas on the one species e.i. semi terete, falcate and circular stigmas on the *F. aculeata*. As far as, transition stigmas is only recorded in this species that is commonly has semi terete stigma.

Variation of the Manokwari species are showed also in the berry. The stout simple berry with 3 segmens only, but stout is only found in *F. mandacana*. The narrowest berry with widely wings is found in *F. folitenella* but this species occurred in Jayapura too, it is northern species than locally species.

One important character that were note by Martelli in 1910 from Mupi is raceme flowers with 6,7 to 8 cephalia of the *F. arfakiana*. The character is never found in other Papuan *Freycinetia*, except *F. frutacylindrica* in Timika with raceme 4 cephalia. It is more west Malesia characters than east Malesia. Unfortunately, *F. arfakiana* are never found again, it was disappear in the original habitat and other places surrounding.

Phylogentic Analysis of The Manokwari *Freycinetia* Species

aurihastata, *F. iriana* and *F. folitenella* occurred in other new guinea area. Similarly to the previous species, about 6 species are locally distributed e.i. *F. flaviceps*, *F. gibbseae*, *F. gunungmeiensis*, *F. lagenicarpa*, *F. aculeata* and *F. arfakiana* , in the totally 9 species of Manokwari *Freycinetia* are locally distributed. (Table 1).

New Guinea species were divided into 3 distribution are. These are northern species, southern species and central highland species. It is appears because the island of New Guinean is topographically unique, in the sense that high mountains stretches along the central part of the island from the most western section covering the Vogelkop(Bird Head area)to the most eastern area. It thus constitutes an outstanding North-South dispersal barrier for many species of plant and animals.

The 8 species that are mentioned above are northern species because of the location in the northern area, include 3 other northern area namely *F. folitenella*, *F. iriana* and *F. aurihastata*. Southern species that are found in Manokwari are *F. tenuis* and *F. andajensis* and the last central highland species are *F. sterrophylla* and *F. biroii* . The remain seven species namely *F. marantifolia*, *F. bicolor*, *F. formosulla*, *F. klosii*, *F. plana*, *F. percostata* and *F. whitmorei* are found also in island surrounding but in fact, the island are situated also in the northern. The three other species are widely distributed namely *F. marginata*, *F. macrostachya* and *F. funicularis* that is also found in Moluccas and Celebes.

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Table 1. Distribution of the Manokwari *Freycinetia* Species (+ = present, - = absent)

No	Species in Group	Distribution	
		Manokwari	Other New Guinea Area
	The Grass Like Leaves Group		
		-	+
	The Semi Imbricate Leaves Group		
1	<i>F. funicularis</i>	+	+
2	<i>F. gibbseae</i>	+	-
3	<i>F. sterrophylla</i>	+	+(C)
	The Non Imbricate Leaves Group		
4	<i>F. albaauria</i>	+	-
5	<i>F. biroi</i>	+	+(C)
6	<i>F. flaviceps</i>	+	-
7	<i>F. folitenella</i>	+	+(N)
8	<i>F. gunungmejensis</i>	+	-
9	<i>F. lagenicarpa</i>	+	-
10	<i>F. iriana</i>	+	+
11	<i>F. manokwariana</i>	+	-
12	<i>F. marantifolia</i>	+	+(I)
13	<i>F. tenuis</i>	+	+(S)
	The Imbricate Leaves Group		
14	<i>F. aculeata</i>	+	-
15	<i>F. aurihastata</i>	+	+(N)
16	<i>F. andajensis</i>	+	+(S)
17	<i>F. arfakiana</i>	+	-
18	<i>F. bicolor</i>	+	+(I)
19	<i>F. formosulla</i>	+	+(I)
20	<i>F. klosii</i>	+	+(S&I)
21	<i>F. macrostachya</i>	+	+
22	<i>F. marginata</i>	+	+
23	<i>F. mandacana</i>	+	-
24	<i>F. plana</i>	+	+(I)
25	<i>F. percostata</i>	+	+(I)
26	<i>F. withmorei</i>	+	+(C&I)

Notes:

N= Northern area ; S= Southern area; C = Centre mountains; I = Island surrounding

THE FOURTH NEW SPECIES

1. *F. albaauria* Sinaga, A.P. Keim & Ismoyo, spec.nov.

Folia ellipsodeis, 11 -14 cm longa, 3 - 4 cm lata. Venis longitudinalibus nec distinctis in pagina abaxial, spot alba indumentum, adaxial glabrous. Auriculis apex hastatus, membranaceus albus, 4 cm longa, 1 cm lata. Infructescentia terminalis, 3 spicis oblongis, 3 - 5 cm longa, 1 -2 cm lata. Berries pyramideous, stigmatibus 1 -2. Typus. Sinaga NI 4057, Papua, Manokwari, Prafi (Holotype: Man!)

Climbing on tree, much branched, all is covered by leaves. Stem terete, 1 - 2 cm in diam, 1 - 2 cm internodes, pale green. Leaves are build by 2 kinds of leaves: base leaves and apex leaves; arrangement tritichous, internode between the leaves 1 cm. Base leaves has different shape of lamina, base lamina linear, 6 - 8 by 1 - 1.5 cm, but apex lamina lanceolate, 8 - 12 by 2.5 - 3 cm, apex caudate, adaxial smooth, abaxial pseudo nerves. Apex leaves ellips, 11 - 14 by 3 - 4 cm, desendent, apex acuminate, spines at base margin and the apex, not sharp; abaxial mid nerves without spines; adaxial has shadow longitudinal nerves; abaxial has regularly dot white indumentum that are keep on each lines by nerves, undistinctly longitudinal nerves, 5 - 6 on a half lamina. Auricle slightly hastata, 4 by 1 cm, 4 longitudinal nerves, milk color, conjugate on base auricle along 1/6, coducous. Bracts consist of 3 whorls; exterior bracts ovate, 2.5 - 3 by 2 cm, apex acuminate; middle bracts ovate 3 by 2.5 cm, apex acuminate; interior bracts lanceolate, 2 by 1 cm, fleshy. Inflorescence ternate, cylindric cephalia; peduncle terete, 1.5 by 0.5 cm; pedicle terete 2 by 0.3 cm. Fruits cylindrical, (3) 4 - 5 by 1 - 2 cm, mature one red; berries pyramide, joint together on the base, when mature globose and apex become flat, has 5 segments; stigma 1 - 2, discoid, wider than areola; areola circular, thin, surrounding each stigma.

Distribution. New Guinea. Papua in Manokwari to PNG in Madang.

Ecology. Living on the hill under canopy of forest near river.

Specimen Examined. New Guinea. Papua, Prafi Manokwari, alt. 120 m asl. Augst 2006. Sinaga NI 4057; PNG, Morobe Province, Madang, alt 1550 m asl. Oct 17-18 1995. W. Takeuchi 10881.

Notes. This species is probably closely related to *F. marantifolia*, from which it differs in the numbers of stigma, areola surrounding each stigma; segments of berry; shape of fruits, color of maturing fruits; shape, nerves and color of auricle, conjugate base of auricle; shape of leaves, also abaxial and adaxial surface of leaves. One character just belong to the species is two kinds of leaves. The leaves that situated on the base stem has linear-lanceolate lamina but the apex leaves is ellips. All characters cause the species to become a new species and the name refer to the milk colour of the auricle.

2. *F. folitenella* Sinaga, A. P. Keim & Ismoyo, spec. nov.

Folia oblonga, 8 - 15 cm longa, 1.5 - 2 cm lata, lamina tenellus, apex caudate. Venis longitudinalibus raro distinctis in pagina adaxial, minus in abaxial. Auriculis triangular, 2 cm longa, 1 cm lata. Bractea cymbiformis, 2 cm longa, 0.5 - 1 cm lata. Infructescentia terminalis, ternate. Syncarpia globosis, berries ovoideis, stigmatibus 2 (3) (5). Typus. Sands MJS Johns RJ 662, Papua, Jayapura (Holotype: BO!, Isotype: K!)

Climbing plant with much branched freely on the tree trunk, branches are covered all by leaves. *Stem* terete, 0.5 cm in diam. 1 cm internodes. *Leaf* tritichous arrangement, internodes between the leaves 0.5 to less than 0.5 cm, oblong, 8-15 by 1.5-2 cm, apex caudate 1-2 cm long; lamina soft thin, smooth, apex caudate, sharp spines especially on the apex and margin, include abaxial middle nerves; abaxial has distinctly longitudinal nerves, 9 on a half leaf, dot transversal nerves present; adaxial has pseudo terrace, look smooth. *Auricle* triangular, 2 by 1 cm, fibers, conjugate on base along $\frac{1}{2}$ auricle falling downpart by part on longitudinal side. *Bracts* consist of 3 whorls; exterior bracts, cymbiform, 2 by 0.5-1 cm, outer distinctly longitudinal nerves, 10, start from base to the apex; middle bracts ovate, 2 by 0.5 cm; inner bracts lanceolate 1 by 1 cm. *Inflorescence* terminalia. *Male Flower* pedicle semi terete, 2.5 by 0.2 cm; rachis falcate, 1 by 0.8 cm; stamen circular, 2 mm tall, anther 0.2 mm in diam., rarely spread on spadix, white. *Pistillate Flower* peduncle terete, 1 by 0.4 cm; pedicle semi terete, 2 by 0.3 cm. *Fruits* globose, young 1 cm in diam., when mature 2 cm in diam., orange bright to scarlet; berries obclavata, unconjugate base; berry styloberryous, 5 segments, soft wings pentapetrus, long style, 3-4 mm; stigma 1(2-3), discoid, central stigma surrounding by bold areola; areola 2 times stigma, widely on the transversal side. *Seed* fusiform, lateraly arrangement on each segment.

Distribution. New Guinea. Papua in Jayapura.

Ecology. Living in primary forest on coral stone.

Specimen Examined. New Guinea. Papua. Jayapura, alt. 50-100 m asl. fr. Koesterman & Soegeng 164; May 24 1994. Sands MJS Johns RJ 662; Mkw, Kebar, alt. 1700 m asl. fl. Augst 5 1995. A.P. Davis 827; Wandamen, Wondiwoi Mtn, alt. 950 m asl. fl. Feb 27 1962. CH Koster BW 13642.

Notes. Long caudate of the apex leaf is a character that is commonly found in *F. macrostachya* group but *F. folitenella*. It is combined to the thin lamina make a unique characters in the new species here. Actually, globose fruit with obclavata berries similar to the *F. lagenicarpa* but density of berries, apex of berry, number and shape of stigma, comparison and arrangement of the areola-stigma, shape and size of the leaves, also comparison between pedicle and fruits, are different. Therefore, the species here become a new one as *F. folitenella*. The name is refer to the thin of lamina.

3. *F. iriana* Sinaga, A.P. Keim & Ismoyo, spec.nov.

Folia oblonga, 15-20 cm longa, 3-4 cm lata Venis longitudinalibus numerous distinctis in pagina abaxial, minus in adaxial. Infructescentia terminalis, 3 spicis falcatus, berries deltoidis, stigmatibus 3,4 (6). Typus. Papua. Timika, Kuala Kencana, Sinaga NI 3996 (Holotype: MAN 1, Isotype: BO!)

Climbing plant with much branched freely on the tree trunk, branches covered by leaves. *Stem* terete, 1 cm in diam 3 cm internodes. *Leaf* oblong, tritichous arrangement, non imbricate, internodes between the leaves 2, 15-25 by 3-4 cm, apex cuspidate; lamina have 2 pseudo vertical lines, when lamina drying became soft like inner woody bark, chartaceae; abaxial has distinctly regular longitudinal nerves, 15 on a half leaf, transversal nerves dot, arrangement irregularly, some put between 2 regularly numerous longitudinal nerves, looks rough; adaxial has pseudo

Ecology. On primary forest.

Specimen Examined. New Guinea. Papua. Manokwari, Mount Arfak alt. 1200 m asl. fr. May 30 1928 .Dr. E. Mayr 63.

Notes. Stigmas that are hidden by broccoli areola together with character of the fruit and auricle causing the species that close to the *F. hagenicola* become different species, so that the new name as *F. manokwariana* are given . It is rifer to the place, where species living.

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