

Full Length Research Paper

Diversity of *Nepenthes* spp. in West Kalimantan

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The paper is describing the result of survey of pitcher plants (*Nepenthes* spp.) diversity at six habitats in West Kalimantan. The research was conducted by investigation of specimens at Herbarium Bogoriense and *Nepenthes* nurseries in Pontianak. Besides that, the research was also supported by personal communication with *Nepenthes* hobbies in Pontianak and related literature. The study found 12 original *Nepenthes* species and 16 natural hybrids in the peat-wamp and heath forest as the common habitat of *Nepenthes* in lowland areas. The results shows that the habitat and the heath forest were destructed by human activities.

Key words: Diversity, *Nepenthes*, habitat, West Kalimantan.

INTRODUCTION

Since 2004, eight new species of *Nepenthes* have been published: *Nepenthes chaniana* (Clarke et al., 2006), *N. adrianii*, *N. jamban* (Lee et al., 2006), *N. flava* (Wistuba et al., 2007), *N. naga* (Akhriadi et al., 2008), and *N. pitopangii* (Lee et al., 2009). The results increased the total world's species of *Nepenthes* to 93 in 2009. However, the rate of new species recognition can not keep up with the rate of habitat destruction and over-exploitation of the plants. It has been discovered recently that *N. clipeata*, *N. campanulata*, *N. ehippiata*, and *N. aristolochioides* are close to extinction in natural resources.

Borneo island has been recognized as the world's largest centre of distribution of *Nepenthes*, with 31 recorded species (Clarke, 1997). It hosts almost 50% of Indonesian species (Mansur, 2006) or 36.5% of the 85 species known to science (Clarke and Lee, 2004). West Kalimantan is a province in Borneo Island (Indonesia) rich in *Nepenthes* diversity. The endemic species being recorded in the province, are *N. clipeata*, *N. veitchii*, and *N. bicalcarata*. Some of them are found in natural

resources conservation areas, that is, Mandor, Bukit Kelam, Gunung Palung, Gunung Poteng, Gunung Pasi. Annual forest fire during dry seasons, forest reclamation for agriculture, oil palm plantation, gold mining, illegal logging, and over-exploitation of *Nepenthes* may lead to a decrease of population and diversity of *Nepenthes* in West Kalimantan, particularly endemic species by disturbing the habitat. The recurring stress on the population and habitat of *Nepenthes* may end up with species extinction. Therefore, in an effort to conserve the habitat and the population, it needs to lead by inventory and cultivation program.

MATERIALS AND METHODS

Investigation on diversity of pitcher plants (*N. spp.*) in West Kalimantan was conducted between August and September 2009. Inventory was managed by exploring some forest areas around of Pontianak that was expected to host *Nepenthes*, that is, Wajau Ulu, Mandor Nature Reserve, Anjungan, Pasir Panjang, Gunung Pasi, and Anjungan Dalam (Figure 1). The survey consist of species name and the environment condition especially microclimate (air temperature, humidity, light intensity) and soil condition (pH). The samples of the species were collected and saved as an herbarium at Herbarium Bogoriense of Research Center for Biology, Indonesian Institute of Science, Cibinong, Indonesia.

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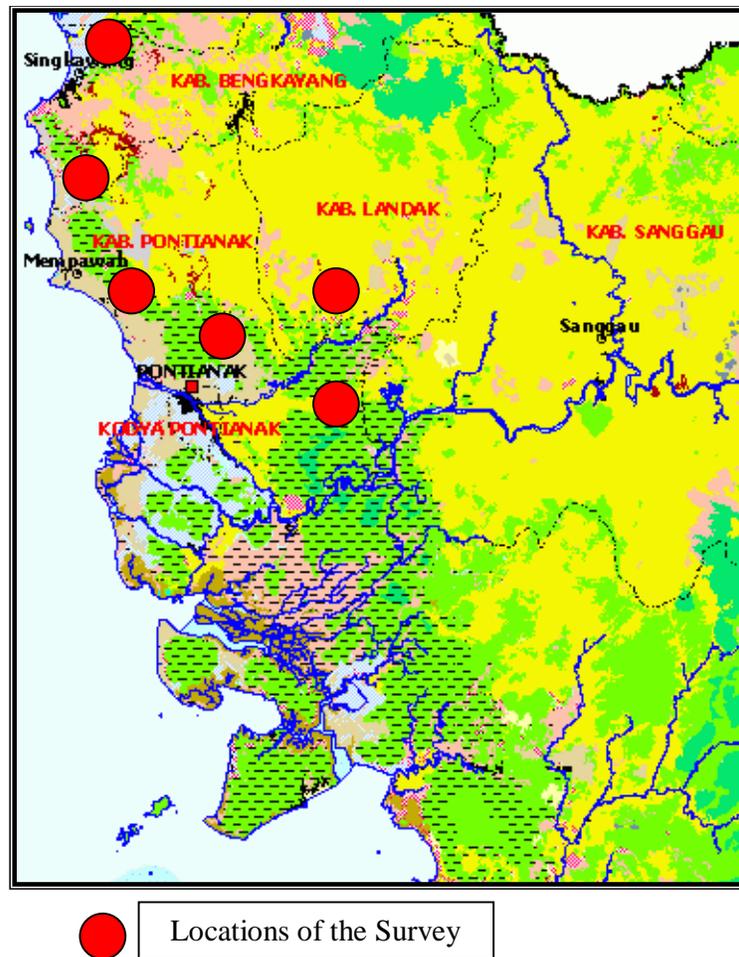


Figure 1. Map of West Kalimantan showing the six locations of habitat included in the study.

RESULTS

The survey found seven original species and five natural hybrids. The species are *N. ampullaria*, *N. rafflesiana*, *N. gracilis*, *N. bicalcarata*, *N. mirabilis*, *N. vieitchii*, and *N. reinwardtiana*; while the natural hybrids are *N. xhookeriana* (*N. ampullaria* x *N. rafflesiana*), *N. xneglecta* (*N. gracilis* x *N. mirabilis*), *N. xkuchingensis* (*N. ampullaria* x *N. mirabilis*), *N. xcatleyi* (*N. bicalcarata* x *N. gracilis*), and *N. gracilis* x *N. reinwardtiana*. All of the original species and natural hybrids are categorized as the lowland species. The plants are living in peat-swamp forest and dry-heath forest (forest with quartz sand floor). The detail of the description of the plants in each area:

Wajau ulu

Wajau Ulu area is about 20 km northern of Pontianak, have altitude of 10 m above sea level. The habitat type of

this area is peat-swamp forest which very closed to agriculture and settlements conditions. The species were found in this area are *N. ampullaria* (dominant), *N. gracilis*, *N. rafflesiana*, and *N. bicalcarata* (very low density). Since 2006, many of *Nepenthes* species were taken out from this habitat, especially *N. bicalcarata* species, due to the *Nepenthes* plants become a popular exotic plant and trading commodity.

Mandor nature reservation (Conservation)

This nature reservation is about 120 km or 2.5 hour by car from Pontianak. The area is a part of Mandor Subdistrict, Landak District. The Mandor Nature Reservation dominated by plane topography and consists of lowland tropical peat forest and dry heath forest. The species that was found in this area are: *N. gracilis*, *N. ampullaria*, *N. rafflesiana* and *N. xhookeriana*. Originally, this area have a function as a host for a large

Table 1. The Identification of *N. bicalcarata* and measurement of the microclimate at Anjungan Area.

Parameter	Sample						
	1	2	3	4	5	6	7
Height (cm)	37	32	293	30	42	23	328
Number of leaves	11	9	24	7	9	10	40
Diameter of stem (cm)	0.95	1.15	1.55	1.65	1.80	1.2	1.8
pH	5.2	5.2	5.6	5.6	5.6	5.3	6.6
Soil humidity (%)	95	95	98	98	97	65	80
Air temperature (°C)	36	36	34	34	34	32.5	32
Air humidity (%)	53	53	59	59	59	66	63
Light intensity (lux)	6850 (12:50)	3360 (12:50)	10730 (13:30)	10330 (13:30)	10552 (13:30)	2850 (14:00)	1063 (14:00) rain

population of *N. bicalcarata*, unfortunately in the current conditions, it is very difficult to find out *N. bicalcarata* because of an over-exploitation *Nepenthes* as the exotic plants. In 1982 the nature reserve conservation covered of 3080 hectares area. However, due to illegal gold mining since 1999, recently almost 2/3 of Mandor Nature Reservation area has been severely damaged Nowadays a large part of the area looks like a desert.

Anjungan

Anjungan is located between Pontianak and Mandor Nature Reserve, approximately 100 km from Pontianak. The habitat type of this area is peat-swamp forest. The *Nepenthes* that was found in this area were *N. bicalcarata*, *N. gracilis*, *N. ampullaria*, *N. mirabilis*, *N. rafflesiana*, and *N. xhookeriana*. In this location, some *N. bicalcarata* have been selected for measuring the length of stem, the number of leaves and the micro-climate condition. The result of measurement display in Table 1.

Pasir Panjang-Singkawang

This area is located right beside the main road that connecting of Pontianak and Singkawang, approximately 180 km from Pontianak. The habitat type of this area is dry-heath forest which has been explored and damaged by quartz sand mining. The species of *Nepenthes* that found in the area were *N. reinwardtiana*, *N. mirabilis*, *N. ampullaria*, *N. gracilis*, and a natural hybrid between *N. gracilis* and *N. reinwardtiana*.

Gunung Pasi-Singkawang

This area is an ecotourism site with fully of the forest in a lowland hill with top height of 900 m above sea level. It is about 200 km from Pontianak and 5 km from

Singkawang. Clarke (1997) reported that *N. veitchii* lived here, however the current survey was found there is no species anymore in this area there. It is predicted that the species extincting from this site or overlooking as the epiphyt grows in tree trunks and branches.

Anjungan dalam

This area is a part of Anjungan area, but it is several kilometers passed out from main road. *Nepenthes* in this location grow up in dry-heath forest which is damaged as a consequence of sand mining, illegal logging, and forest fire. In the area, it can found *N. mirabilis*, *N. ampullaria*, *N. gracilis*, *N. rafflesiana*, *N. bicalcarata*, *N. xhookeriana*, *N. xneglecta*, and *N. xcatleyi*. *Nepenthes* in this location more variable than in peat-swamp forest.

DISCUSSION

Based on *Nepenthes* species that were collected in Herbarium Bogoriense, specimens in Nursery of Aliri in Pontianak, and some related references (Listiwati and Siregar, 2008), this study compiled 5 (five) new species and 11 (eleven) new hybrids from West Kalimantan. The species are *N. clipeata*, *N. albomarginata*, *N. hirsuta*, *N. tentaculata*, and *N. ephippiata*. *N. clipeata* and *N. albomarginata* were reported from Bukit Kelam-Sintang, *N. hirsuta* from Gunung Palung, *N. tentaculata* from Bengkayang, and *N. ephippiata* from Bukit Raya adjacent to Central Kalimantan. Other species, *N. veitchii* were from Gunung Pasi and Betung Kerihun National Park. *N. ampullaria*, *N. rafflesiana*, *N. mirabilis*, *N. gracilis*, *N. reinwardtiana*, and *N. bicalcarata* are lowland *Nepenthes* that found in the study areas. The natural hybrids that was found in the area were *N. xhookeriana*, *N. xneglecta*, *N. xcatleyi*, a cross between *reinwardtiana* x *gracilis*.

Populations of *N. bicalcarata* and *N. veitchii* are very limited. More over, the population of *N. clipeata* is close

Table 2. A list of original species and natural species hybrids of *Nepenthes* and their distribution in West Kalimantan.

No.	Species	District	Hybrid	District
1.	<i>N. albomarginata</i>	Skw, Stg, Skd, Ptsb, Ktp	<i>N. albomarginata</i> x <i>N. clipeata</i>	Stg
2.	<i>N. ampullaria</i>	All	<i>N. albomarginata</i> x <i>N. reinwardtiana</i>	Skw, Bky
3.	<i>N. bicalcarata</i>	Ldk, Ptk, Kbr, Ptsb, Sgu, Skw	<i>N. albomarginata</i> x <i>N. ampullaria</i>	Bky
4.	<i>N. clipeata</i>	Stg	<i>N. albomarginata</i> x <i>N. rafflesiana</i>	Bky
5.	<i>N. ehippiata</i>	Ngp	<i>N. ampullaria</i> x <i>N. bicalcarata</i>	Ptk, Skw, Bky
6.	<i>N. gracilis</i>	All	<i>N. ampullaria</i> x <i>N. gracilis</i>	All
7.	<i>N. hirsuta</i>	Bky, Btbs, Stg, Sbs	<i>N. ampullaria</i> x <i>N. mirabilis</i>	All
8.	<i>N. mirabilis</i>	All	<i>N. ampullaria</i> x <i>N. rafflesiana</i>	All
9.	<i>N. rafflesiana</i>	All	<i>N. bicalcarata</i> x <i>N. gracilis</i>	Ldk, Ptk, Kbr, Stg, Ptsb, Sgu, Skw
10.	<i>N. reinwardtiana</i>	Skw, Stg, Bky, Ldk	<i>bicalcarata</i> x <i>mirabilis</i>	Ldk, Ptk, Kbr, Stg, Ptsb, Sgu, Skw
11.	<i>N. tentaculata</i>	Bky, Ptsb	<i>N. bicalcarata</i> x <i>N. rafflesiana</i>	Ptk
12.	<i>N. veitchii</i>	Skw, Ptsb	<i>N. clipeata</i> x <i>N. reinwardtiana</i>	Stg
			<i>N. gracilis</i> x <i>N. mirabilis</i>	All
			<i>N. mirabilis</i> x <i>N. rafflesiana</i>	All
			<i>N. mirabilis</i> x <i>N. reinwardtiana</i>	Skw, Stg, Bky, Ldk
			<i>N. gracilis</i> x <i>N. reinwardtiana</i>	Skw

Skw=Singkawang; Stg=Sintang; Skd=Sekadai; Ptsb=Putussibau; Ktp=Ketapang; Ldk=Landak; Ptk=Pontianak, Kbr=Kuburaya; Sgu=Sanggau; Bky=Bengkayang; Sbs=Sambas; Ngp=Nangapinoh; All=all districts/towns.

to the extinction. The local Institute for Conservation of Natural Resources reported that only three individuals of *N. clipeata* remained in Bukit Kelam.

Finally, this study has recorded at least 12 original species and 16 natural hybrids of *Nepenthes* from West Kalimantan (Table 2). The results shows that, there are more various of *Nepenthes* species in West Kalimantan than Central Kalimantan (that found only nine species and seven hybrids (Mansur, 2007). The habitat of *Nepenthes* in this area has been damaged and the population has been decreasing due to forest fire, illegal logging, illegal gold mining, illegal sand mining, and forest reclamation to oil palm plantation.

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