BIOEDUSCIENCE
ISSN: 2614-1558
http://journal.uhamka.ac.id/index.php/bioeduscience

Diversity of Semar Pockets (*Nepenthes sp.*) at Palangka Raya University

Muhammad Rizki[1*], Vinsen Willi Wardhana[1], Mawardin[1], Siti Sunariyati[1]

[1]Program Studi Biologi Fakultas MIPA Universitas Palangka Raya, Kampus Tunjung Nyaho Jl. Yos Sudarso, Kota Palangka Raya, Indonesia, 73111

*Correspondent Email: alfi.sophian@pom.go.id

ARTICLE INFO

Article history:
Received: 03 Apr 2021
Accepted: 09 Aug 2021
Published: 30 Aug 2021

Keywords:
Gonad Maturity Level;
Growth pattern;
Osteochilus waandersii;
Tambatan river;

A B S T R A C T

Background: This study is a pilot project on the effectiveness of flora, especially the type of semar bag (Nepenthes sp) found at the University of Palangka Raya (UPR). The research aims to identify semar bag plants at the University of Palangka Raya. The initial observations found at least more than one type of semar bag that lives in the peat forest of the UPR campus. The study was conducted in August-November 2020. **Methods:** Semar bag diversity data is collected by cruising methods. The data was analyzed using literature studies to be further identified using a sealed bag identification manual. **Results:** The study found three species of semar bags found in the forest campus of Palangka Raya University. The bag is a type of Nepenthes mirabilis (Lour.) Druce, *Nepenthes gracilis* Korth., and *Nepenthes rafflesiana* Jack. Morphological characters that distinguish these three species are the morphology of leaves and pouches. The range of environmental parameter values is air temperature 28-38oC, medium-open coverage, humidity 62-98%, and soil pH 5-7.5. **Conclusions:** This study's results are expected to be a database of flora biodiversity in Central Kalimantan.

Keanekaragaman Kantong Semar *(Nepenthes sp.)* di Universitas Palangka Raya

Kata kunci:
Osteochilus waandersii;
Pola pertumbuhan;
Sungai tambatan;
Tingkat kematangan gonad;

A B S T R A K

Background: Penelitian ini merupakan *pilot project* mengenai keanekragaman flora khususnya jenis kantong semar (*Nepenthes sp*) yang ditemukan di Universitas Palangka Raya (UPR). Penelitian bertujuan untuk mengidentifikasi tumbuhan kantong semar di Universitas Palangka Raya. Dari hasil observasi awal ditemukan setidaknya lebih dari satu jenis kantong semar yang hidup di hutan gambut kampus UPR. Penelitian ini dilakukan pada bulan Agustus-November 2020. **Metode:** Data keanekaragaman kantong semar dikumpulkan dengan metode jelajah. Data dianalisis menggunakan studi literatur untuk selanjutnya diidentifikasi menggunakan buku panduan identifikasi kantong semar. **Hasil:** Hasil penelitian ditemukan ada tiga spesies kantong semar yang terdapat di hutan kampus Universitas Palangka Raya. Kantong semar tersebut adalah jenis Nepenthes mirabilis (Lour.) Druce, Nepenthes gracilis Korth., dan Nepenthes rafflesiana Jack. Karakter morfologis yang menjadi pembeda ketiga spesies ini adalah morfologi daun dan kantong. Kisaran nilai parameter lingkungan yaitu suhu udara 28-38oC, tutupan (coverage) sedang-terbuka, kelembapan 62-98%, dan pH tanah 5-7,5. **Kesimpulan:** Dengan adanya hasil penelitian ini diharapkan menjadi basis data biodiversitas flora yang ada di Kalimantan Tengah.

Introduction

Nepenthaceae is one of the most prominent carnivorous plant families and has ecological and morphological adaptations that exhibit impressive adaptive radiation (Murphy et al., 2020), particularly in the territory of Indonesia. Borneo (Borneo, Sarawak, Sabah and Brunei) is the largest *nepenthes sp* distribution centre globally, where there are ±32 species of semar pouch species. There are 24 species on the island of Sumatra (Arimy et al., 2017) and several species in Sulawesi (9 species), Papua New Guinea (5 species), Maluku and Java (Philipps & Lamb, 1996). From the results of previous research, it is estimated that there are at least 13 types of Nepenthes sp in Central Kalimantan (Mansur, 2008).

In the forests of Kalimantan, semar pockets (Nepenthes sp) can be found in six main habitat types, including tropical rainforest lowlands, Kerangas forests, peat swamp forests, mixed peat swamp forests, mountain forests,

limestone mountains (Clarke, 1997). Most Nepenthes are vines or shrubs with little climbing, attaching themselves to adjacent vegetation using circular tendrils that develop from the ends of leaves. The majority are terrestrial species, but a small number of species grow epiphytically, mainly in mountainous habitats (Clarke, 1997).

of habitat cover (coverage) is described qualitatively with the criteria of close, medium to open the cover. This research activity is carried out using cruising methods through previously existing trails. The location (site) of the discovery of the semar bag can be seen in Figure 1.

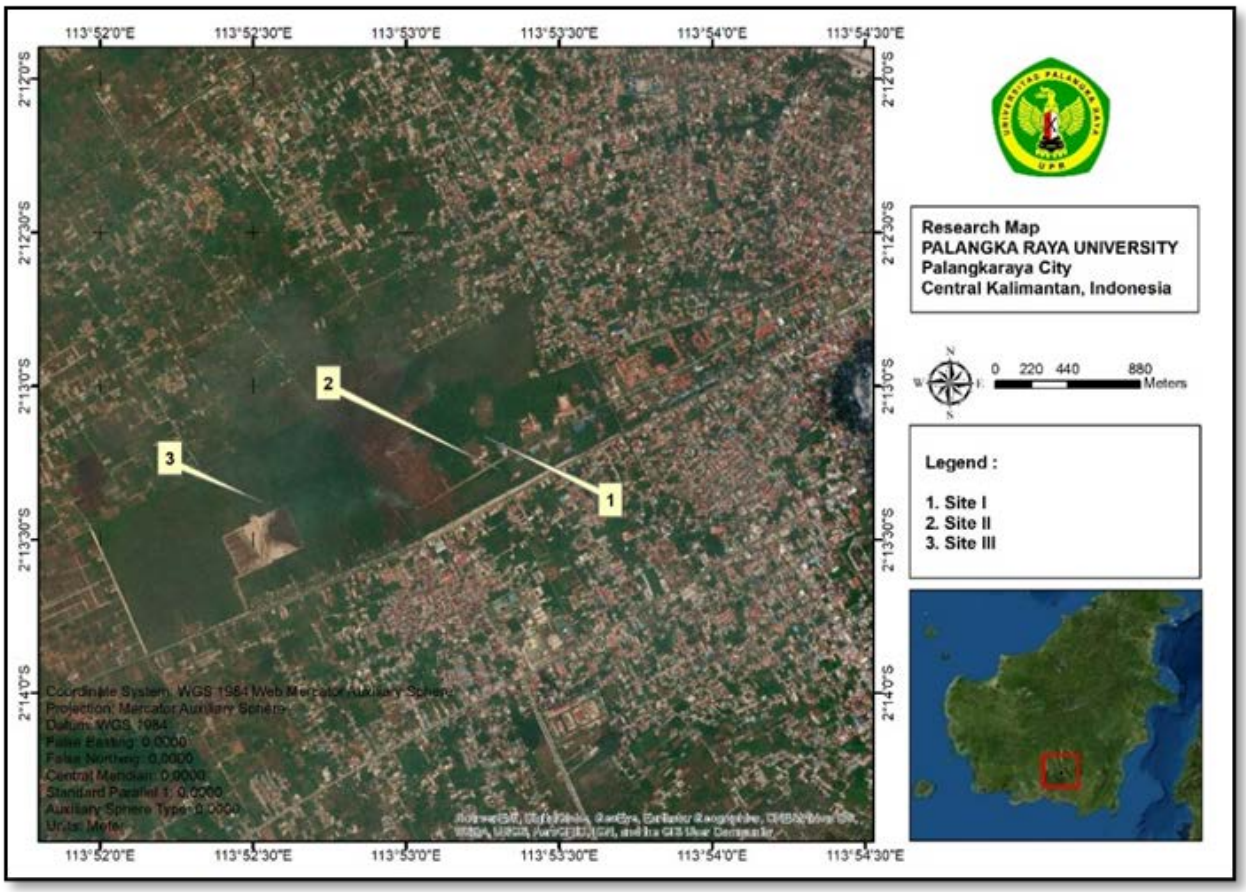

Figure 1. Map of research sites on Palangka Raya University Campus

Palangka Raya University (UPR) has peat forests that store many biological resources: a pocket of semar. However, until now, it is not known the types of pockets in UPR peat forests. The transfer of peat forest land functions into campus facilities and infrastructure development to support lecture activities in UPR and fires that often occur in the dry season will threaten the existence of semar pockets in their habitat. Therefore, studying the semar bag is necessary and then developing its conservation strategy both in-situ and ex-situ. This research aims to find out the type of pockets in the peat forests of Palangka Raya University.

Methods

The tools and materials used in the study are Thermo hygrometer, soil pH meter, camera, tally sheet, Nepenthes of Borneo identification book, Garmin eTrax 10 Global Positioning System (GPS), digital funnel term (Digital Caliper), meter and stationery. While to describe the state

Data collection of morphological characteristics and environmental parameters is carried out directly on the ground. Furthermore, the semar pockets found were identified by looking at morphological characteristics possessed based on relevant literature using the nepenthes of Borneo identification book (Clarke, 2001).

Results and Discussion

There are three species of semar bags. The semar pouch is a species of *Nepenthes mirabilis* (Lour.) Druce, *Nepenthes gracilis* Korth., and *Nepenthes rafflesiana* Jack. The following is stated the key to identification based on the distinguishing character or characteristics of the three types of semar bags found in the peat swamp forest of the UPR campus.

1. a. It has a leaf stalk..... 2
   b. It has no leaf stalks, cylindrical sac shape, narrow peristome..... *N. gracillis.*
2. a. The edges of the leaves are jagged..... *N. mirabilis.*

b. The *edges* of the leaves are not jagged, the peristome is wide and the pockets are large ..... *N. rafflesiana.*

The research results conducted in the forest area of the University of Palangka Raya (UPR) campus found there are three species of semar bags. The bag is a type of *Nepenthes mirabilis* (Lour.) Druce,

Description of Nepenthes mirabilis (Lour.) Druce

Nepenthes mirabilis (Lour.) Druce. Trunk: climbing, cylindrical, flat/slippery, thick with clear space. Leaves: stemmed, lanset, <30 cm long and <10 cm wide, taper leaf tip, wavy leaf edge and sometimes hair, tendril length <17 cm, greenish-yellow red.

Figure 2. a) Top pockets and leaves of green N. mirabilis, b) Green N. mirabilis bottom pockets with peristome, lid, and wing maron, c) Lower pockets of N. mirabilis green maron with peristome, lid, and wing maron, d) Top pockets of N. mirabilis green maron with peristome, lid, and wing maron, e) Top pockets and leaves of green N. mirabilis, e) Green N. mirabilis leaves.

Nepenthes gracilis Korth., and *Nepenthes rafflesiana* Jack. As well as the results of research by Rosmaina & Zulfahmi (2004) at UIN Suska Riau Campus for the colour variation of bags from *N. gracillis,* which was found to consist of two types, namely *N. gracillis* with green bags and *N. gracillis* with Maron red bag color with batik motif, while for *N. mirabilis* with the colour of green to light green bag spots maron. At the same time, *N. rafflesiana* with green to light green bag colour and Maron batik motif with Maron red patches/batik motif. Here is the morphological description of the direct observations of the three species of semar bags found.

The lower pocket, cylindrical, narrow and tilted at 1/2 of the bottom, cylindrical or narrowed towards the base of the mouth, is dark yellowish-green, <15 cm high, <35 mm wide. The mouth of the heart-shaped peristome width <5.5 mm is green-brownish-red on the inside of the bag. The bag cap is round in the shape of a reddish-green. The shape of the *N. mirabilis* pouch at first glance looks like the *N. gracilis* pouch, which distinguishes these two types lies in the leaves and the size of the peristome. Where the leaves of *N. mirabilis* have stalks of leaves, wavy with the edges of the leaves are hairy although sometimes found hairless, while the *N. gracilis* leaves have no leaf stalks, sits hugging thicker slipperier stems. Likewise, with the size of the peristome, N.

mirabilis has a thicker peristome size ranging from 3 - 5.5 cm, while *N. gracilis* has the shape of an egg round or oval bag mouth with a peristome that is very narrow, so it is not clearly visible. The shape of the *N. mirabilis* pouch and leaves can be seen in Figure 2.

This species of semar bag is the most widespread in the world. Its habitats range from shellfish, peat forests, and grasslands. It has several natural hybrids including *N. mirabilis x N. ampullaria, N. mirabilis x N. bicalcarata, N. mirabilis x N. gracilis and N. mirabilis x N. raffelsiana, as well as the most extreme varieties of N. mirabilis* found in Sarawak and Brunei are *N. echinostoma* (Trubus, 2006).

Figure 4. a) The shape of the leaves of N. gracilis green, b) The upper pocket of N. gracilis green c) N. gracilis maron, d) The upper pocket of N. gracilis batik motif maron color, e) The bottom pocket of the maron batik motif, e) The bottom pocket of N. gracilis green spotted maron.

Figure 3. (a) Female flower and (b) *N. mirabilis* fruit

Description of Nepenthes gracilis Korth.

Nepenthes gracillis Korth. Trunk: climbing, diameter < 4 mm, triangle. Leaves: thick stiff, sitting without stalks, lanset, length < 20 cm, width < 4 cm, taper end, towards the base narrowed, tendrils length < 18 cm. Bottom pockets and rosettes: the shape of the egg round at the bottom and the top of the tube shape, <16 cm high, <30 mm wide. Peristome narrow, width 1 - 2.25 mm, peristome teeth are not clear. Lid (Bag cap) round and the base of the bag.

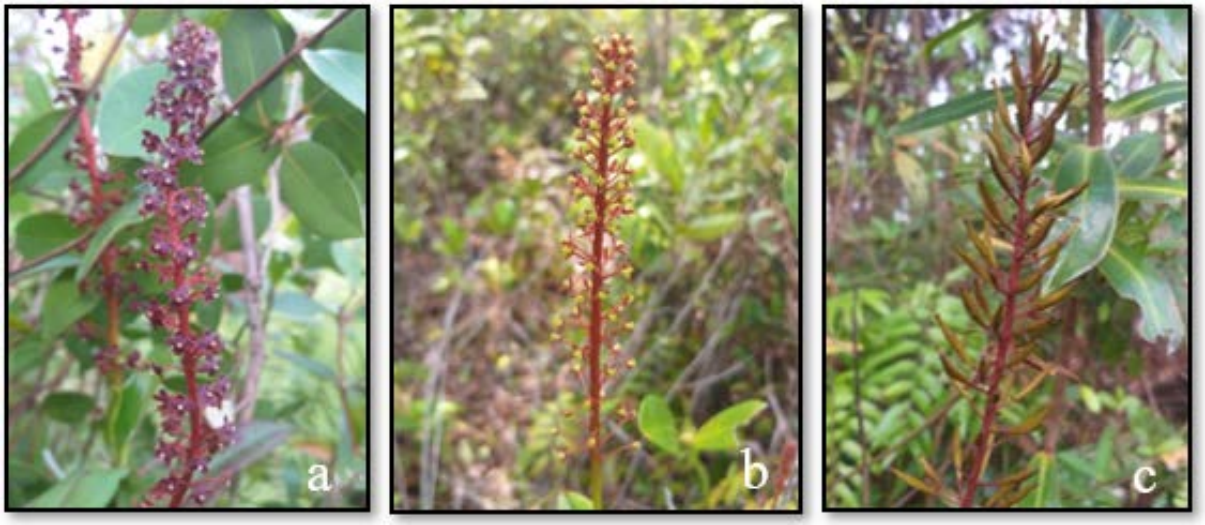

Figure 5. (a) Male flower, (b) female flower, (c) *N. gracilis* fruit

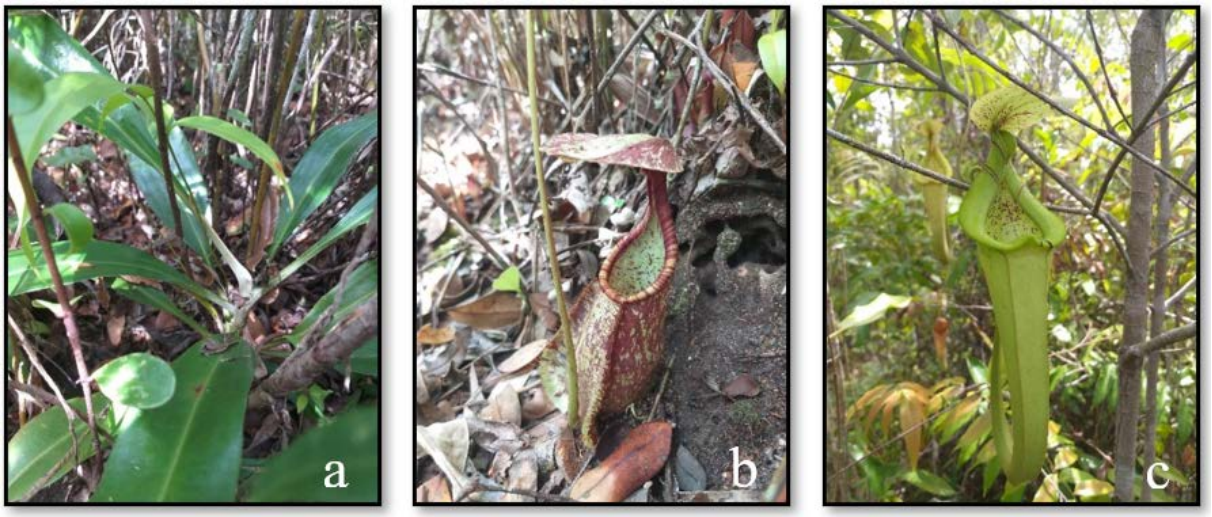

Figure 6. a) The shape of the leaves of *N. rafflesiana*, b) The lower pocket of *N. rafflesiana* motif batik maron, c) The top pocket of green *N. rafflesiana* with maron patches.

Upper pouch: the round shape of the egg at the bottom, then narrows the shape like a tube and widens again towards the mouth, reduced wings, rib-like shape. Mouth circular egg round, narrow peristome, peristome teeth are not clear, round lid and the body's base. The bag colour is green, sometimes Maron red or brownish-red. The shape of the *N. gracilis* pouch and leaves can be seen in Figure 4.

The difference in bag colour in *N. gracilis* is strongly influenced by the pH of the bag fluid (Rosmaina & Zulfahmi, 2004) and soil pH (Dariana, 2009).

This species of semar pouch has a higher tolerance to the environment than any other type (except N. *mirabilis*) (Mansur, 2007). The time of inflorescence of this type of semar bag is different from all other species of semar pouch because this difference in flowering time is rarely found in natural crossings in nature except *N. ampullaria* (Trubus, 2006). The presence of *N. gracilis* can be a natural indicator for critical soils in addition to people in West Sumatra using their stems as binding materials, while water from bags that are still closed is used for eye washing (Trubus, 2006).

Description of Nepenthes rafflesiana Jack.

Nepenthes rafflesiana Jack. The characteristics of this type are; slanted leaves, thick, stemmed, leaf length <30 cm, width <8 cm, tendril length < 38 cm; cylindrical rod, < 4 cm in diameter, can reach 15 m in length; peristome is wide <2 cm with short and clear teeth, the front of the peristome on the lower pocket is relatively high. While the upper pocket is rather high and wide on the front of the peristome; The lower pocket is oval-shaped with the colour of winged Maron batik motif and clean teeth, while the top pocket is green with Maron patches on the lid, peristome and the inside of the bag. The shape of the bag and leaves of *N. rafflesiana* can be seen in Figure 6.

Figure 7. Upper pockets of *N. rafflesiana* in peat habitat of UPR Campus

These three species of pockets are found in habitats that have a range of environmental parameter values, namely at air temperatures of 28-38oC, medium-open coverage, the humidity of 62-98%, and soil pH of 5-7.5—located in a type of habitat dominated by typical plants of secondary peat forests, namely *Combretocarpus rotundatus* (tumih), *Cratoxylum glaucum* (garunggang) and *Melaleuca cajuputi* subs. Cumingia (galam).

The existence of semar pockets at Palangka Raya University is expected to become a database of peatland biodiversity in Central Kalimantan. Forest fires, mining activities, the transfer of land/forests to agricultural or plantation land and overexploitation for commercial purposes continue to threaten the population of the semar pockets in nature, although for species *N. mirabilis* and *N. gracilis,* according to IUCN data, began to increase their populations in nature (Clarke, 2014; 2018a; 2018b).

The habitat of this shrinking semar bag is feared to impact population decline and the diversity of semar pockets. In fact, it can lead to extinction. For this reason, ex-situ conservation efforts need to be done immediately by domestication both through cultivation and breeding mechanisms to remain sustainable, considering that all types of semar bags in Indonesia are protected by Law No. 5 Of 1990, PP No. 7 of 1999 and PP No. 8 of 1999 (Mansur, 2007); (Hernawati et al., 2007; Mansur, 2013). Cultivation, by the way (seeds, stuns and tissue cultures) ex-situ by lovers of semar bags, semar bag cultivators, universities and research institutions is a positive thing and needs to be supported. Thus the preservation of the semar bag can be maintained and prevent it from extinction.

Conclusion

In the peat forest area of Palangka Raya University found three types of semar sacs, namely *Nepenthes mirabilis* (Lour.) Druce, *Nepenthes gracilis* Korth., and *Nepenthes rafflesiana* Jack. N. mirabilis has a variety of bag colours ranging from green to green patches / Maron red lines, *N. gracilis* has a variety of bag colours ranging from green, maron red to patterned red Maron batik and in *N. rafflesiana* has a variety of green colour bags of Maron patches to bags with batik motifs/spots of Maron. Now the existence of the three pockets in the area is threatened, so there needs to be a rescue effort. One of them is the in-situ biodiversity conservation action that must be done immediately considering the transfer of land functions continues. In addition, in-depth research on populations, distributions and molecular studies is expected.

Acknowledgement

The author thanked the University of Palangka Raya for funding this research through the DIPA PNBP Faculty of MIPA 2020. We would also like to thank the students involved (Mawardin, Aldo Gunawan Yuluci and Anita Maulina) who helped in shooting and data collection in the field.

Declaration statement

The authors reported no potential conflict of interest.

References

Arimy, N. Q., Nisyawati, & Metusala, D. (2017). Comparison of leaf anatomy on some Nepenthes spp. (Nepenthaceae) from highland and lowland habitat in Indonesia. *AIP Conference Proceedings*, *1862*. https://doi.org/10.1063/1.4991215

Clarke, C. (1997). *Nepenthes of Borneo* (K. . Wong (ed.); Reprinted). Natural History Publication (Borneo) Sdn. Bhd.

Clarke, C. (2001). *Nepenthes of Sumatrana and Peninsular Malaysia*. Natural History Publication (Borneo) Sdn. Bhd.

Dariana. (2009). *Keanekaragaman Nepenthes Dan Pohon Inang Di Taman Wisata Alam Sicikeh-Cikeh Kabupaten Dairi Sumatera Utara*. Universitas Sumatera Utara.

Mansur, M. (2007). *Nepenthes, Kantong Semar yang Unik* (Cet. 3). Penebar Swadaya.

Mansur, M. (2008). Penelitian Ekologi Nepenthes Di Laboratorium Alam Hutan Gambut Sabangau Kereng Bangkirai Kalimantan Tengah. *Jurnal Teknologi Lingkungan*, *9*(1), 67–73. https://doi.org/10.29122/jtl.v9i1.445

Mansur, M. (2013). Tinjauan tentang Nepenthes (Nepenthaceae) di Indonesia. *Berita Biologi*, *12*(1), 1–7.

Murphy, B., Forest, F., Barraclough, T., Rosindell, J., Bellot, S., Cowan, R., Golos, M., Jebb, M., & Cheek, M. (2020). A phylogenomic analysis of Nepenthes (Nepenthaceae). *Molecular Phylogenetics and Evolution*, *144*, 106668. https://doi.org/10.1016/j.ympev.2019.106668

Philipps, A., & Lamb, A. (1996). *Pither-plants of Borneo*. Natural History Publication (Borneo) Sdn. Bhd.

Rosmaina, & Zulfahmi. (2004). Eksplorasi Dan Karakterisasi Kantong Semar (Nephentes sp.) di Kampus UIN Suska Riau. *Jurnal Agroteknologi*, *2*(1), 51–55.

Trubus. (2006). Nepenthes. *Trubus Info Kit*, 284. www.trubus-online.com