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## A STUDY ON SPECIES DIVERSITY AND COMMUNITY STRUCTURE OF PITCHER PLANTS (*NEPENTHES*) AT SUNGAI MERAH, SIBU, SARAWAK

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### ABSTRACT

A study on species diversity and community structure of *Nepenthes* at Sungai Merah has identified the occurrence of *Nepenthes gracilis*, *N. rafflesiana* and *N. ampullaria* in 0.25 hectare study plot. They can be differentiated from each other by the differences in the morphological characteristic of leaves, stem, pitcher, honey glands and digestive glands. *Nepenthes gracilis* have angular stem and sessile leaves whereas the other species have rounded stem and stalked leaves. Matured populations of *N. gracilis* and *N. rafflesiana* have a very strong tendency to grow on the fringe of the secondary bush; and these two species comprising of 236 and 106 matured plants outnumbered the *N. ampullaria* and *N. mirabilis* with 57 and 34 plants respectively. The domination of *N. gracilis* and *N. rafflesiana* was contributed by the dry and exposed condition of the plot. Age structure of *N. gracilis* was highly represented by matured plants, saplings and seedling with the ratio of 98:62:76; followed by *N. rafflesiana* with the ratio of 65:25:16; the representation of *N. ampullaria* and *N. mirabilis* was comparably low with the other two species with the ratio of 18:17:16 and 16:12:6 respectively. The populations of all the species and their life stages have a very strong tendency to grow in aggregation. The  $I_d > 1$  of all the species and the  $X^2$  analysis showed that their dispersion population pattern were significantly contagious. The analysis of Contingency Table and the  $X^2$  showed no significant increase of pitcher productions with stem size increment in *N. gracilis* and *N. rafflesiana*.



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A study on the species diversity and community structure of *Nepenthes* at Sungai Merah has identified the occurrence of *Nepenthes gracilis*, *N. mirabilis*, *N. rafflesiana* and *N. ampullaria* in 0.25 hectare study plot. They can be differentiated from each other by the differences in the morphological characteristic of leaves, stem, pitcher, honey glands and digestive glands. *Nepenthes gracilis* have angular stem and sessile leaves whereas the other species have rounded stem and stalked leaves. Matured populations of *N. gracilis* and *N. rafflesiana* have a very strong tendency to grow on the fringe of the secondary bush; and these two species comprising of 236 and 106 matured plants outnumbered the *N. ampullaria* and *N. mirabilis* with 57 and 34 plants respectively. The domination of *N. gracilis* and *N. rafflesiana* was contributed by the dry and exposed condition of the plot. Age structure of *N. gracilis* was highly represented by matured plants, saplings and seedling with the ratio of 98:62:76; followed by *N. rafflesiana* with the ratio of 65:25:16; the representation of *N. ampullaria* and *N. mirabilis* was comparably low with the other two species with the ratio of 18:17:16 and 16:12:6 respectively. The populations of all the species and their life stages have a very strong tendency to grow in aggregation. The  $I_d > 1$  of all the species and the  $\chi^2$  analysis showed that their dispersion population pattern were significantly contagious. The analysis of Contingency Table and the  $\chi^2$  showed no significant increase of pitcher productions with stem size increment in *N. gracilis* and *N. rafflesiana*.

## INTRODUCTION

Carnivorous plants have always fascinated human imagination. Pitcher plants or *Nepenthes* is one of the plant carnivores that exists on this planet. In general these plant carnivores did not eat but they possessed specialized structure capable of trapping their prey such as insects and then digested and absorbed nutrients from them as the source of food (Juniper *et al.*, 1989).

*Nepenthes* are the only genus belonging to family Nepenthaceae. They are dioecious that is the male and female inflorescence are borne on different plants, climbers or scramblers (Phillipps & Lamb, 1996; Som, 1988). Most of the species are terrestrial plants but few species such as *N. lowii*, *N. curtisii* can grow epiphytically on tree trunks and branches; *N. vietchii* an endemic on the island of Borneo was truly epiphytic and there have been no report of this species growing on the floor of the forest. The genus *Nepenthes* contained 81 species in the world, their distribution restricted in the tropical area (Adam, 1995) with the centre of distribution in Borneo, Peninsular Malaysia, Sumatra, Philippines and New Guinea. The distribution in the west include Sri Lanka, Seychelles and Madagascar, in the east extended up to New Guinea and The Isle of Pines, in the north it was recorded in Khasia Hill, Indo-China and Southern China whereas in the south up to Queensland in Australia. More than half of the species was recorded in Borneo, growing from low lying country up to more than 3000 m above sea level in the montane area of the island (Phillipps & Lamb, 1996).

One of the main characteristic features of this genus is the production of pitchers on the tip of the leaf tendrils, which possess different shape, colour and sizes. Honey glands on the upper surface of the sepal of both male and female flowers produce fluid and nectar with very faint smell. This smell attracts insects such as ants, flies, diptera and hymenoptera. These species grow in habitat with poor nutrient. The nutrient requirement is supplemented by their carnivorous habit. The honey glands on the lower surface of the pitcher lid and in between the peristome teeth act as an attractant to the potential prey. The efficiency of this trap is supported by waxy

and slippery layer on the inner pitcher wall. The inner surface of the pitcher is also covered with numerous digestive glands that excrete fluid containing enzyme which help to digest the prey. The same digestive glands can also absorb the nutrient release from the digestive process of the prey.

Some species of pitcher plants may have symbiotic relationship with the colony of ants (Lloyd, 1942). The ants search for food or nectar produces by the honey glands on the lower surface of the pitcher lid and in between the peristome teeth. Only few ants were trapped and digested by the pitcher but most of the ants escape the trap and were able to return safely to their nest. As only the working ants were killed, the ant-pitcher plants relationship can be categorized as mutualism. The ants and the queen ant get the food from the honey produce by the pitchers and the flowers whereas the pitcher plants get nutrient source from the ant trapped, digest and absorbed by the digestive glands.

Past researchers found that *Nepenthes* in the tropics prefer to grow contagiously with high density in open habitat such as young secondary forest, bris forest, and disturbed forest within the gap which can be reached by high light intensity (Adam, 1995; Green, 1967; Noratiza, 2002; Phillipps & Lamb, 1988; Safiah Salwana, 1992; Smythies, 1965). These pitcher plants can hardly survive in closed canopy forest such as the dipterocarp forest in which the forest floor condition has a very low light intensity (Adam *et al.*, 1992 & 1994; Holttum, 1940). According to Holttum (1940), the pitcher plants grow well in open habitat and absent in the closed forest. The population density of pitcher plants were found to be higher in the open habitat and decreased significantly with increasing vegetation cover (Adam *et al.*, 1992 & 1994; Safiah Salwana, 1992). These plants were reported to have various uses in traditional medicine. The decoction of the roots and stems were claimed to cure dysentery, cough and flu.

The objectives of this study were to determine the diversity of the pitcher plants species, age structure distribution, population distribution pattern of seedlings, saplings and matured plants of all