Composition and Association of Vegetation with Medicinal Plant Pikajar (*Schizaeadigitata*) in Meratus Mountain, South Kalimantan, Indonesia

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Abstract: ***The Meratus Mountains save a wealth of biodiversity that functions as a medicinal plant. One of the medicinal plants is pikajar (Schizaeadigitata). This plant species is effective for maintaining stamina, treating back pain and being able to overcome impotence. But this plant species in natural forests has begun to decrease its potential and regeneration still relies on natural regeneration. As a forest community, of course the existence of other species is very dependent on other species, as well as pikajar, so it is important to conduct research on the association between vegetation around the pikajar with pikajar itself, because in cultivation always pay attention to the associated plant communities with plants that become objects of preservation so that these plants can grow well. This study aims to analyse the composition and structure of vegetation and the dominant species that have an association relationship with pikajar so that later can be used as consideration for conservation in an exact manner. The results of the study found that there were about 50 species of vegetation in the community unit, 38 species of seedlings, 31 species of sapling, 15 species of poles and 10 species of trees. The association of pikajar with 5 dominant species that have a very strong relationship is mahang (Macarangajavanica) for seedling and sapling levels, while at the pole level and tree the strong association occurs with the rubber (Heveabrasiliensis).***

Keywords: association, conservation, biodiversity, plant community

1. Introduction

The World Health Organization (WHO) has estimated the present demand for medicinal plants is approximately US $ 14 billion per year **[34]**. The demand for medicinal plant-based raw materials is increasing at the rate of 15 to 25% annually, and an estimate of WHO, the demand for medicinal plants is to increase more than US % 5 trillion in 2050 **[34]**. Medicinal plants are mainly the alternate income-generating source of underprivileged communities **[28]**,**[22]**. The age-old traditional values attached with the various forest types and the varieties of forest products (i.e., medicinal plants) have gained tremendous importance in the present century **[42]**, **[19]**.

According to**[15]**, in a forest plant community there is interaction between species of population members. There are species that have to live in other plants, some need shade from other plants to live, so they can grow side by side to form a forest community. According to **[15]**this relationship of attraction to grow together is known as an association that can be both positive and negative or not associated. Several medicinal plants have slow growth rates, low population desities, and narrow geographic ranges **[18]**, **[30].**

The island of Borneo holds a wealth of biodiversity that has the potential as a medicinal plant that can be useful for human health. One of them is pikajar (*Schizaeadigitata*). Pikajar has long been known by ethnic groups on the island of Borneo in traditional medicine. This species is believed to treat various diseases, including believed to be useful for overcoming impotence, maintaining stamina and back pain **[32]**.

Figure 1: Medicinal plant pikajar (*Schizaeadigitata*)

Currently pikajar (*Schizaeadigitata*) harvesting still relies on its natural habitat, especially in secondary forests in the Meratus Mountains region in Malinau Village, Loksado District, SouthHulu Sungai Regency. Therefore research on the analysis of vegetation and the association of dominant species needs to be done in order to maintain the existence of plants that are difficult to cultivate outside of their natural habitat. Based on the above problems this study aims to analyze the composition and structure of vegetation types and analyze the dominant types associated with Pikajar. It is hoped that this research can be taken into consideration in an effort to optimize the cultivation of Pikajar and to become a reference for preservation.

2. Research Methods

This research was carried out in the Meratus Mountains area, Malinau Village, Loksado District, South Kalimantan Province. The object of research is all types of forest vegetation compilers covered in the research plot. Determination of sample points was done by purposive sampling based on location criteria found many pikajar. The point of the study sample was made using 10 × 10 m plots of 10 plots.

Figure 2: Location of research

Vegetation analysis uses the Important Value Index (IVI) to indicate the species that dominates the study site. Important Value Index (IVI) included the value of relative density (Rd), Relative frequency (Rf), Relative dominant (Rd_0)**[41]**.Data analysis for vegetation uses the Importance Value Index (IVI). For calculated of IVI (%) is IVI% = Rd% + Rf% + Rd_0%, where Rd (%) = Relative density (%), Rf (%) = Relative frequency (%),and Rd_0(%) = Relative dominance

Association analysis was carried out with the main constituent type having IVI ≥ 10% using the Ochiai Index**[24]**. The Ochiai Index aims to find out the associations between two species whether to associate or not and whether the association is maximum or minimum.

$IO = a / (\sqrt{(a + b)} . \sqrt{(a + c)})$

Information:

IO = Ochiai index

a = species A and B presented

b = species A presented, B not presented

c = species A not presented, B presented

3. Results and Discussion

a) Composition of Vegetation

Based on the results of the study it was found that there were 50 species of vegetation incorporated in seedlings, saplings, poles and trees, but not all species were found at every level, some of them were only found in certain plots and some were found in all plot growth rates. According to [9] if the species found at all levels of growth shows it does not have great competition among other plants, it is possible to grow together in a community. The important value index is quantitative parameters to determine the level of species dominance in plant communities **[40]**. Important values describe the ecological position of a species calculated based on the number of relative density values, relative frequencies and relative dominance.The results of subsequent observations, namely the composition of vegetation at the seedling level in detail are presented in Table 1.

Table 1: Important Value Index of 10 species dominant at the seedling level

No	Species	N	Rd (%)	Rf (%)	IVI (%)
1	*Macarangajavanica*	76	27,84	14,55	42,38
2	*Symplocosodorratissima*	45	16,48	12,73	29,21
3	Bindrang	36	13,19	9,09	22,28
4	*Dryobalanopscamphora*	23	8,42	9,09	17,52
5	*Ficusracemosa*	13	4,76	7,27	12,03
6	*Uncaria gambir*	16	5,86	3,64	9,50
7	*Brideliatomentosa*	10	3,66	5,45	9,12
8	*Palaqium quercifolium*	3	1,10	5,45	6,55
9	*Cratoxylonformosumb*	3	1,10	5,45	6,55
10	*Archidendronpauciflorum*	3	1,10	3,64	4,74

Table 1 shows 10species dominant at seedling level. This species of seedling composition has a large number of species due to the even distribution of species. The species have highest IVIwhich have an even distribution, abundant and dominating number of individuals compared to other species. The highest IVIof Macarangajavanicaat seedling level was 42.38%.The results of the next observation are data on the composition of the sapling level presented in Table 2.

There are 31 species of sapling found in this area, but Table 2 above only takes 10 dominant species at the stake level which are found living together with pikajar. The rare of stand allows the sapling and seedling plants to be able to grow well in the area.The seedling and sapling of *Ficusracemosa* and *Macarangajavanica* are both species very dominant in this area. They can grow together with pikajar. Canopy gab formation can influence species regeneration as well as the structure, dynamics, and composition of tropical secondary and old-growth forests

[5], **[7]**, **[14]**, **[26]**. Canopy gaps are relatively small and infrequent in secondary tropical forests compared to old-growth forest **[4]**, **[27]**, **[31]**, **[36].**

Table 2: Dominant species at the sapling level found in the area adjacent to pikajar

No	Species	N	Rd (%)	Rf (%)	IVI (%)
1	*Macarangajavanica*	52	22,32	12,77	35,08
2	*Dryobalanopscamphora*	34	14,59	10,64	25,23
3	*Symplocosodorratissima*	25	10,73	10,64	21,37
4	*Radermachera gigantean*	28	12,02	6,38	18,40
5	*Haveabrasiliensis*	24	10,30	6,38	16,68
6	Hiring-hiring	13	5,58	4,26	9,83
7	*Palaqium quercifolium*	7	3,00	6,38	9,39
8	*Ficusracemosa*	6	2,58	6,38	8,96
9	*Albiziachinensis*	15	6,44	2,13	8,57
10	Ruhut	4	1,72	4,26	5,97

Ficusracemosa and *Macarangajavanica* can grow very well in secondary forest where the areas are quite open and found some gabs. Compared with old-growth forests, gab closure and gab dynamics may be faster in secondary forests, where canopy height and canopy gaps are smaller, but growth rates and density of canopy trees are higher **[34]**. In secondary forests, canopy gabs could foster recruitment of commercially valuable, long-lived pioneer tree species that dominate the canopy but are scarce or absent in the understorey**[8]**, **[11]**.The results of the next observation are data on the composition of the growth level of the pole which can be seen in Table 3.

Table 3: Dominant species at the pole level found in the area adjacent to pikajar

No	Species	N	Rd (%)	Rf (%)	Rdo (%)	IVI (%)
1	*Haveabrasiliensis*	34	47,89	32,26	66,01	146,15
2	*Macarangajavanica*	15	21,13	22,58	17,23	60,94
3	*Symplocosodorratissima*	12	16,90	16,13	8,12	41,15
4	*Eugenia* spp.	3	4,23	9,68	3,07	16,97
5	*Dryobalanopscamphora*	3	4,23	9,68	2,54	16,44
6	*Vernoniaarborea*	3	4,23	6,45	2,00	12,68
7	*Radermacheragigantea*	1	1,41	3,23	1,04	5,68
8	*Myristica* sp.	1	1,41	3,23	0,98	5,61
9	*Archidendronpauciflorum*	1	1,41	3,23	0,98	5,61
10	*Tristaniopismerguensis*	1	1,41	3,23	0,75	5,38

Pole level composition has a number of individuals of 10 species, which differ greatly from the number of species at the seedling and sapling level. This might be due to the high growth rate which causes competition between plants to grow. Such competition can be in the form of nutrient acquisition, a place to grow or light. The results of the next observation are data on the composition of tree level growth which can be seen in Table 4.

Table 4: Dominant species at the tree level found in the area adjacent to pikajar

No	Species	N	Rd (%)	Rf (%)	Rdo (%)	IVI (%)
1	*Haveabrasiliensis*	11	47,83	42,11	44,59	134,52
2	*Macarangajavanica*	4	17,39	21,05	16,08	54,53
3	Artocarpus sp.	2	8,70	10,53	14,40	33,62
4	*Symplocosodorratissima*	3	13,04	10,53	9,30	32,87
5	*Archidendronpauciflorum*	1	4,35	5,26	6,82	16,44
6	*Vernoniaarborea*	1	4,35	5,26	5,48	15,09
7	*Alstoniascholaris*	1	4,35	5,26	3,32	12,94

Table 4 shows the number of dominant tree-level species found around pikajar. These plants have high density, frequency and dominance values compared to other plants. These species are certainly very influential on pikajar especially supporting the environment of this plant. *Heveabrasiliensis*, *Symplocosodorratissima*, *Macarangajavanica* are dominated species where found in these areas. These species were found in pole and tree level. Rubber IVI is 146.15%, it shows highest compared with other species. The difference between *Haveabrasiliensis* and*Macarangajavajavanica* is 85%. It is due to most of the research areas are rubber plantations belonging to surrounding communities, in contrast to other dominant species grow naturally.

B. Species Associations

Association of vegetations with Pikajar (*Schizaea digitata*)

Table 4: Species association with Ochiai index

Growth Level	No	Kind of Species		a	b	c	IO	Infor-mation
		A	B					
	1	Pikajar	*Macarangajavanica*	8	2	0	0,89	vh
	2	Pikajar	*Symplocosodorratissima*	7	3	0	0,84	vh
Seedling	3	Pikajar	Bindrang	5	5	0	0,71	h
	4	Pikajar	*Dryobalanopscamphora*	5	5	0	0,71	h
	5	Pikajar	*Ficusracemosa*	4	6	0	0,63	h
	1	Pikajar	*Macarangajavanica*	7	3	0	0,84	vh
	2	Pikajar	*Dryobalanopscamphora*	5	5	0	0,71	h
Sapling	3	Pikajar	*Symplocosodorratissima*	5	5	0	0,71	h
	4	Pikajar	*Passiflorafoetida*	3	7	0	0,55	h
	5	Pikajar	*Haveabrasiliensis*	3	7	0	0,55	h
	1	Pikajar	*Haveabrasiliensis*	10	0	0	1,00	vh
	2	Pikajar	*Macarangajavanica*	7	3	0	0,84	vh
Pole	3	Pikajar	*Symplocosodorratissima*	5	5	0	0,71	h
	4	Pikajar	*Eugenia* spp.	3	7	0	0,55	h
	5	Pikajar	*Dryobalanopscamphora*	3	7	0	0,55	h
	1	Pikajar	*Haveabrasiliensis*	8	2	0	0,89	vh
	2	Pikajar	*Macarangajavanica*	4	6	0	0,63	h
Tree	3	Pikajar	*Artocarpus sp.*	2	8	0	0,45	l
	4	Pikajar	*Symplocosodorratissima*	2	8	0	0,45	l
	5	Pikajar	*Archidendronpauciflorum*	1	9	0	0,32	l

Information:
IO = Ochiai index
a= species A and B presented
b= species A presented, B not presented
c = species A not presented, B presented
vh = very high
h = high
l = low

Table 4 is the result of the calculation of the association index between the study with the dominant type that has INP ≥ 10%. Based on the index value of the association the highest level of association strength in the seedling plot is owned by the type of mahang (0.89) and jirak (0.84). According to **[25]**, if the Ochiai index is closer to the value 1 then the association will be increasingly the opposite otherwise if it approaches 0, then the level of the association will be more minimum or even no relationship.

Pikajar association relations with mahang and rubber show tolerance to live together in the same area, or there are mutually beneficial relationships, especially the distribution of living space. In addition to the influence of interaction on a community, each plant also gives space and space to each other **[2].**

Macarangajavanica is a kind of species which has a relatively high frequency at each phase of growth. This species includes pioneer plants that are very fast growing when there is a gap or space that allows sunlight to enter the forest floor, so it is very suitable to live in secondary forests. The same condition is also experienced by pikajar, this type is a type of fern which also requires the environment to obtain sufficient sunlight and sufficient microclimate conditions in his life.. According to **[11]**that pikajar (*Schizaeadigitata* (Linn.) Sw.)is a medicinal plant species that can be found in secondary forest with altitude ranging from low to high, and where the temperature and humidity ranging from28-41°C, 56-89% and light intensity ranges from 2.1-27.6%. It needs light intensity from low to high. It can also spread on a wider habitats.

4. Discussion

Seedlings and saplings were generally influenced by and positively dependent on light availability. Most of seedlings and saplings of *Ficusracemosa* and *Macarangajavanica* were found and associated by pikajar. Both species is included fast-growing species which need enough light for growing up. Canopy gaps could also enhance regeneration of fast-growing in young secondary forests and can inhibit tree recruitment **[6]**, **[11]**, **[21]**, **[39].**

The distribution of plants in forest often exhibit patterns correlating with the variation of soil chemistry or condition of topography in tropical forests**[13]**, **[16]**, **[35]**, **[43]**, **[17]**. Niche differentiation may be important for maintaining species diversity and species coexistence. If environmentally biased spatial distribution result from niche differentiation, plant species should show particular habitat preferences. They would preferably occur in localities where they have competitive advantages, although spatial autocorrelation cannot be ignored when considering species-habitat associations **[23]**.

Macarangajavanica is a type of plant that is very fast growing, especially when the forest area is open whether due to tree felling or the presence of fallen trees due to natural factors or due to the age factor of a very old tree. Space that is openly spatial causes the formation of gab. This Gab causes sunlight to reach the forest floor directly. This condition causes *Macarangajavanica* to grow rapidly. This situation can be said that mahang is a pioneer plant that is very supportive of the growth of other species, such as pikajar. The results of this research show that in the seedling phase, sapling, pole and tree the existence of mahang is always present and associated with pikajar.

Likewise with *Haveabrasiliensis*, this species is always associated with pikajar starting from the phase of sapling, pole and tree. Pikajar is the habitat of life with rubber. Pikajar can obtain shade from rubber, so it can live well and quickly. If all the factors that influence the presence of species are relatively few, then the opportunity factor is more influential, where the species succeeds in living in that place, this usually forms a pattern of distribution **[10]**. Plants that live naturally in a place, form a collection that each individual finds an environment that can meet their life needs. In this collection, harmony is formed called associations and mutual relations that are mutually beneficial, so that a degree of cohesiveness is formed **[33]**. This is what happens between rubber and pikajar, namely the establishment of a degree of cohesiveness that is mutually beneficial to each other.

5. Conclusion

The composition of the vegetation found in the research location in the community unit was found 50 species, at the seedling level found 38 species of plants, the level of saplings was 31 species, the pillars of 15 species and trees of 10 species. Plant species that dominate around pikajar for seedling and sapling levels are *Macarangajavanica*, while at pole and tree level are rubber (*Haveabrasiliensis*). The results of the analysis of the pikajar association with five dominant plants which are strongly associated are both of *Macarangajavanica* and *Haveabrasiliensis*.

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