

BS-005

DIVERSITY OF LICHENS ON THE STANDS OF MAHONI (*Swietenia macrophylla*) FUNCTIONING AS SHADE PLANTS IN MEDAN

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ABSTRACT

The objective of the study was to identify the diversity of lichens types which are tolerant on the mahoni trees (*Swietenia macrophylla*) functioning as shade plants in Medan. Descriptive research method by means of exploratory surveys and inventory of the types of lichens on the mahoni trees was carried out. Purposive sampling location determination was based on the level of traffic density with different levels of air pollution. The results of the study identified as many as 8 species of lichens with 2 types of thallus (Crustose and Foliosae). *Lepraria incana* and *Pertusaria amara* which belong to the cosmopolite type have been found in the three study sites. The most common types of thallus are crustose and foliose. Thallus color varies from white, green, dark brown and black striped white. The types of thallus which are unidentified include *Lepraria* sp. And *Parmelia* sp.

Keywords: *Diversity, Distribution, Lichens, Tree Stands*

INTRODUCTION

Plant diversity in Indonesia is fairly broad, and it requires further research. According to Suwarso (1995) based on data of Herbarium Bogoriensis Bogor, there are 40,000s species of Lichens plant in Indonesia; however, not many researchers in Indonesia have fully conducted research on Lichens, so the opportunity to examine Lichens in Indonesia is still widely and potentially open.

Lichens is one group of thallus plants, part of biodiversity that has not received much attention. It is a combination of fungi and algae so that it is morphologically and physiologically a unity, and it lives in an epiphyte manner on trees, on the ground, on rocks, at the seaside or in high mountains.

The growth of Lichens is very slow and the existing condition tends to accelerate its rate of growth. Lichens does not require a high standard of living conditions and is resistant to water shortage in a very long period. Lichens living on rocks can become dry due to the heat of the sun, but this plant is not dead, and if it rains, then it can come back to life. This plant as a variety of colors such as white, grayish green, yellow, orange, brown, red and black (Tjitrosoepomo, 1989; Hawks worth, 1984, Sudirman, 2009).

The number of lichens always changes due to changes in the environment where they grow. Lichens can be spread through a variety of habitats that are supported by state of the environment (Anonymous 2002). Air, water, soil and living microorganisms are the most common places where it spreads, and air plays an important role in its spread. Lichens species diversity in an area is affected by the level of the emerging air pollution (Clifford, 1987, Panjaitan, *et al*, 2010). The research result of Kansri (2003) indicates that lichens species diversity in Bangkok will be reduced since it grows nearer to the pollutant sources.

Industrial development in Medan has given an impact on the increasing transport activities affecting the air quality. Lichens diversity on mahoni tree stands (*Swietenia macrophylla*) functioning as shade plants along the streets in Medan can be used as a reference to determine the air quality in the area. This study aimed to determine the diversity of lichens types tolerant to mahoni trees (*Swietenia macrophylla*) as functioning as shade plants along the streets in Medan.

METHODOLOGY

The study was conducted in Medan, and the location determination was carried out by purposive sampling based on the level of traffic density and different levels of air pollution. The locations included the streets in Jl. Yos Sudarso, Medan (high traffic density), in Jl. Sudirman, Medan (medium traffic density) and in Jl. Cik Ditiro, Medan (low traffic density). The method used was descriptive using exploratory surveys and inventories of lichens types living on as many as 10 mahoni trees. Sample collection technique applied the "Vertical transect" method, rising as high asonometer. Plot one was made in the first 50 cm, and plot two was made in the second 50 cm. The number of plot for the mahoni tree stands at two locations reached as much as 10x2x2 equal to 40 plots. Each type of lichens was collected for the purposes of identification and documentation. Parameters observed included the morphological types of thallus. The reference of "Key to the lichens general of Bogor, Cibodasand Singapore" was used for the identification activity (Sipman, 2003). The identification was also conducted using the reference book of "Grasses, Ferns, Mosses & Lichenses", reports, and records associated with lichens (Phillips, 1990). The measurement of physical environmental factors including air temperature, air humidity, wind speed, and light intensity was performed in conjunction with the lichens sample collection. Lichens diversity found in the three study sites was calculated with the Diversity Index of Shannon-Wiener (Odum, 1994). Furthermore, the distribution pattern of lichens was obtained using the varian ceratio formula with a median value with a criterion that $S^2/\bar{X} = 1$ indicates a random distribution), >1 indicates a clumed distribution, and <1 : indicates a uniform distribution.

RESULTS AND DISCUSSIONS

Lichens Found in Mahoni Stands

The explorations of Lichens on mahoni trees in the three study sites found as many as 897 samples of lichens which include 8 families and 8 species (Table 1). The lichens is then grouped into 2 types of thallus, namely foliose consisting of 3 types (the structure of the thallus resembles leaves and mostly has the colors from green to grayish green), crustose consisting of 5 types (structure of thallus resembles a crust layer firmly attached to the substrate and has various colors); however, squamulose and fruticose types were not found. Types of lichens found in the study sites are shown in Table 1.

Table 1. Number of Lichens Types Found in All Locations of Observations

No	Name of Species	Family	Type of Thallus	Total			
				Location/Thallus/Species			Total
				I	II	III	
1	<i>Lepraria</i> sp.	Leprariaceae	Crustose	-	32	-	32
2	<i>Parmelia</i> sp.	Parmeliaceae	Foliose	-	3	9	12
3	<i>Parmelia glabratula</i>	Parmeliaceae	Foliose	-	8	19	27
4	<i>Parmelia saxatilis</i>	Parmeliaceae	Foliose	60	10	-	70
5	<i>Lepraria incana</i>	Leprariaceae	Crustose	64	45	155	264
6	<i>Graphis scripta</i>	Graphidaceae	Crustose	-	87	154	241
7	<i>Opegrapha atra</i>	Opegraphaceae	Crustose	-	7	13	20
8	<i>Pertusaria amara</i>	Pertusariaceae	Crustose	3	52	176	230
Total of Colony per location				127	244	526	897
Average				15.87	30.50	65.75	112.12
Standard Deviation (SD)				28.50	29.52	79.94	
Presence Percentage of Lichens (%)				5.87	11.27	24.29	100

Note: Location I. Jl. Yos Sudarso, Medan; Location II. Jl. Sudirman, Medan; Location III. Jl. Cik Ditiro, Medan

Based on the data from Table 1 above, there are 6 genera and 8 species of lichens in the three locations; moreover, *Lepraria incana* and *Pertusaria amara* types are found in the three study sites. The types are classified into a cosmopolite and tolerant type because they can be found in the whole observation locations. The number and types of lichens vary tremendously. Each type of lichen has characteristics that are so diverse between one species and another as it can be seen from the thallus type, shape, color, surface and other characteristics. The characteristics and morphological property of lichens are different from one to another.

The proportion of Lichens diversity is different in each study site due its pollution from the motor vehicles. There are 8 species of lichens found on *Swietenia macrophylla* at reeson Jl. T. Cik Ditiro, Medan; Jl. Sudirman, Medan and Jl. Yos Sudarso, Medan.

The results of this study show the variation of the number and types of lichens for each study site, indicating that there are different levels of tolerance of lichens toward the level of air pollution. The differences can simply be shown in the following diagram in Table 2

Tabel 2. The Results of Identify Character of Lichens

No	Type Thallus		ColourThallus							Thallus							Morphology Thallus					Anatomy			Reproduce			Species		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		28	29
1	√		√	√			√	√		√		√		√								√	√	√	√	√	√	√	√	Lepraria sp.
2		√		√				√		√					√		√	/	/		√	√	/	/	√			√	√	Parmelia sp.
3		√			√				√	√					√		√				√	√	√	√	√			√	√	Parmelia glabratula
4		√						√		√		√		√	√		√					√	√	√	√			√	√	Parmelia saxatilis
5		√			√						√			√	√				√			√	√	√	√		√		√	Lepraria incana
6	√			√			√		√			√		√				√				√	√	√	√		√	√	√	Graphis scripta
7	√			√		√		√			√			√	√		√		√			√	√	√	√	√	√	√	√	Opegrapha atra
8	√		√	√				√			√						√	√			√	√	√	√	√	√	√	√	√	Pertusaria amara

Notes :

- | | | | | | |
|-----------------------|--------------------------|--------------------|------------------|-------------------|--------------|
| <i>Type Thallus :</i> | 1. Crustose | <i>Morphology:</i> | 14. Lobed | <i>Reproduce:</i> | 27. Soredia |
| | 2. Foliose | | 15. Cumulative | | 28. Lobula |
| <i>ColourThallus:</i> | 3. white grey | | 16. Surging | | 29. Rhizines |
| | 4. Young green | | 17. Black spot | | |
| | 5. Old green | | 18. Lobus | | |
| | 6. Chocolate black | | 19. Askokarp. | | |
| <i>Thallus :</i> | 7. white mark with lines | | 20. Insidia | | |
| | 8. Smooth | <i>Anatomy :</i> | 21. Septa | | |
| | 9. Hars | | 22. Granula | | |
| | 10. Wrinking | | 23. Korteksatas | | |
| | 11. Mealy | | 24. Lapisan alga | | |
| | 12. Tebal | | 25. Medula | | |
| | 13. Lines black | | 26. Kortekbawah | | |

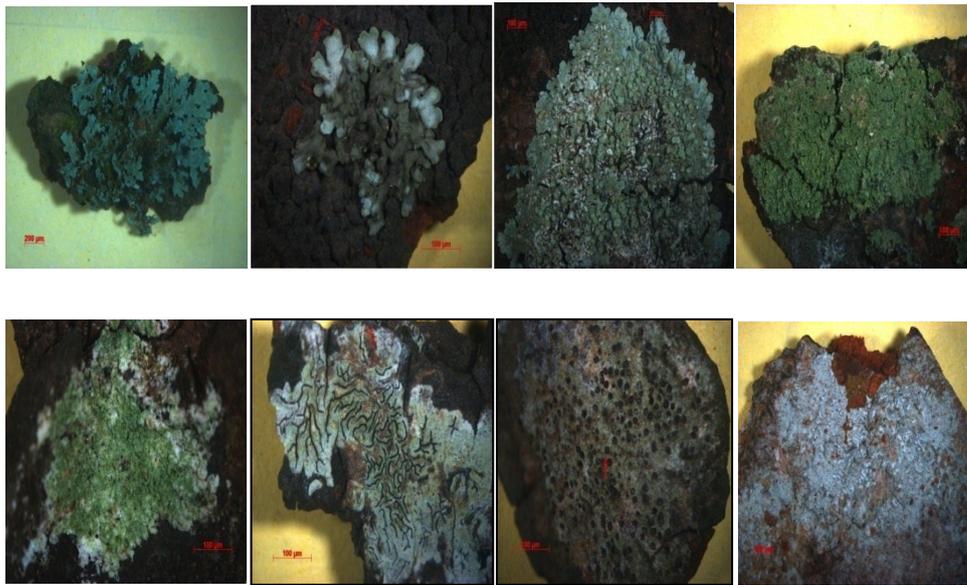


Figure 1. Types of lichens found in the study sites: a. *Parmelia grabatula*; b. *Parmelia saxatilis*; c. *Parmelia* sp.; d. *Lepraria incana*; e. *Lepraria* sp.; f. *Graphis scripta*; g. *Opegrapha atra*; h. *Pertusaria amara*

Diversity Index of Lichens

Diversity was obtained through the data from the research on the three study sites from 40 plots, and these plots were considered to represent the entire communities at the study sites. Diversity index values are shown at Table 2 below.

Table 2. Diversity Index of Lichens in the study sites

No	Name of Species	Total of Colony	H' / Location		
			I	II	III
1	<i>Grafiss cripta</i>	241	0.359	0.368	-
2	<i>Lepraria incana</i>	264	0.360	0.312	0.345
3	<i>Lepraria sp.</i>	32	-	0.266	-
4	<i>Opegrapha atra</i>	20	0.091	0.102	-
5	<i>Parmelia glabratula</i>	27	0.120	0.112	-
6	<i>Parmelia saxatilis</i>	70	-	0.131	0.354
7	<i>Parmelia sp.</i>	11	0.070	0.054	-
8	<i>Pertusaria amara</i>	230	0.366	0.329	0.088
TOTAL		895	1.366	1.674	0.787

Note: Location I of Jl. Yos Sudarso; Location II of Jl. Sudirman; Location III of Jl. Cik Ditiro

Diversity index value obtained in the area of Jl. Yos Sudarso is $H' = 0.787$ which is low because its value is smaller than one. This is acceptable since the pollution of the study site is high as there is a large number of vehicles passing this area.

Diversity index values in the are as of Jl. Jend.Sudirman and Jl. Cik Ditiro, Medan are $H' = 1.674$ and $H' = 1.366$ which are medium level as the values are greater than 1 and less than 2. This is acceptable because the study sites also have high pollution as a large number of vehicles pass these areas.

Distribution Pattern of Lichens in Medan

Lichens distribution pattern was determined using the variance ratio formula with a mean value. If $S^2/\bar{X} = 1$, lichens have a random distribution; if it is >1 : lichens have a group distribution (clumped); and if it is <1 : it has a uniform distribution. The distribution patterns of lichens in the study sites are presented in Table 3.

Table 3. Distribution Pattern of Lichens at the Study Sites

No	Name of Species/Genus	Location I		Location II		Location III	
		S^2/\bar{x}	DP	S^2/\bar{x}	DP	S^2/\bar{x}	PD
1	<i>Graphis scripta</i>	-	-	20.25	Group	7.23	Group
2	<i>Lepraria incana</i>	19.82	Group	9.68	Group	32.76	Group
3	<i>Lepraria sp.</i>	-	-	10.09	Group	-	-
4	<i>Opegrapha atra</i>	-	-	5.20	Group	4.09	Group
5	<i>Parmelia glabratula</i>	-	-	8.00	Group	19.00	Group
6	<i>Parmelia saxatilis</i>	18.32	Group	10.00	Group	-	-
7	<i>Parmelia sp.</i>	-	-	1.60	Group	3.15	Group
8	<i>Pertusaria amara</i>	3.00	Group	7.71	Group	9.50	Group

Note : Location I of Jl. Yos Sudarso, Medan; Location II of Jl. Sudirman, Medan; and Location III of Jl. Cik Ditiro, Medan. DP = Distribution Pattern;

Based on the values in Table 4 above, it can be seen that all types of lichens on Jl. T. Cik Ditiro, Medan; Jl. Sudirman, Medan and Jl. Yos Sudarso, Medan have a distribution pattern of clumped group. In the location of Jl. T. Cik Ditiro, Medan the species that has the highest value (group) is *Lepraria incana* (32.76), and the lowest score is for the *Parmelia sp.* (3.15). In Jl. Sudirman, Medan the species that has the highest value is *Graphis scripta* (20.25), and the lowest value is for *Parmelia sp.* (1.60). Moreover, in the location of Jl. Yos Sudarso, Medan the species that has the highest value is *Graphis scripta* (19.82), while the lowest value is for *Parmelia sp.* (3.00).

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the research conducted, it can be concluded that there are 8 species of lichens in Medan, North Sumatra, and it is divided into 5 genera, 5 families and 2 types of thallus i.e. Crustose and Foliose types. Lichens types which are unidentified include *Lepraria sp.* and *Parmelia sp.* The index values of lichens diversity in the areas of Jl. Yos Sudarso,

Medan; Jl. Jend. Sudirman, Medan and Jl. Cik Ditiro, Medan. Medan are $H' = 0.787$ (low), $H' = 1,674$ and $H' = 1,366$ (medium) respectively. The distribution pattern of the groups with the highest variance value occurs in *Lepraria incana* type, and the smallest one occurs in *Parmelia caperata*.

Further research should be conducted to be used comparative references for lichens on mahoni stands as a bioindicator of air pollution. Further identification for the unidentified lichens should be conducted in a more specific way.

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