

ASSOCIATION BETWEEN DOMINANT TREES SPECIES IN LOWLAND TROPICAL FOREST (EDUCATION FOREST OF JAMBI UNIVERSITY)

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ABSTRACT

Lowland forest vegetation can still be found on the Jambi University Campus, namely at the Jambi Mendalo University Educational Forest (HPUJM). Jambi University Educational Forest is administratively located in Mendalo Indah Village, Jambi Luar Kota District, Muaro Jambi Regency, Jambi Province. Vegetation communities are formed by the presence and interaction of the various types of plants that compose them. The form of interaction between plant species in a community is called an association. Associations can be in the form of positive associations and negative associations. This research was conducted to know the association between dominant tree species. This study used a purposive sampling method by determining a sampling area of 9600 m² or 0.96 ha measuring 160m x 60m, divided into 24 sub-plots, each measuring 20m x 20m. Species having an Importance Value Index (IVI) of $\geq 10\%$ were used as the association analysis. The 2x2 contingency table was used to analyze whether or not associations were present between tree species. The results showed, of 15 dominant tree combinations, there were only 4 associated combinations, namely the association between *Aporosa lucida* and *Vitex pinnata*, the association between *Endospermum diadenum* and *V.pinnata*, the association of *Litsea ferruginea* with *Gironniera diadenum*, the association of *L. ferruginea* with *V.pinnata*.

Key words: association, dominant tree, lowland forest

INTRODUCTION

Lowland tropical rain forest is a habitat of diverse plant species including trees. The main characteristics of lowland tropical rain forest ecosystem are that there is an enormous bunch of tall trees in a wide area and many of them are rare trees, especially from the *Dipterocarpaceae* family that is mostly categorized as species threatened with extinction (Clark et al., 1999). Biodiversity on tropical forest is influenced by biotic and abiotic factors such as humidity and air temperature, chemical and physical properties of soil, fertility status of soil, sunlight intensity, topography, and parent material of soil. The biotic factors include the presence of other types of plants including lianas, epiphytes, stranglers, parasitic plants, shrubs, herbs, etc. The types of trees that grow in lowland tropical rain forests can still be found on Jambi University Campus, that is at the Education Forest of Jambi Mendalo University (HPUJM). This education forest area is a habitat for the protected primate that is gray langur (*Presbytis cristata*) (Subagyo et al., 2008) as well as habitats for 46 species of birds from 18 families (Putra, 2016).

A community will be formed by the presence of various types of plants that is interacting and forming symbiosis with each other. One of the forms of interaction between plant species in a community is called association. Association in an ecological system is a distinctive and unique form of community. Association between two types of trees can be categorized into positive association or negative association. If a type of

flora is not present together, then it is called as negative association (McNaughton and Wolf, 1992).

A plant community that is consisted of various types of plants allows for the interaction between species in the community. For example, there are plants that compete for food and light, or plants living in symbiosis with other plants for nutrition or shade, such as various types of parasites or semi-tolerant plants that need shade during their seedling and sapling stages, but they need light when entering the pole and sapling stage.

Several previous studies that have been carried out in the HPUJM area are studies on population and daily behavior of primate, studies on bird species diversity, studies on indigenous mycorrhizae, and studies on microclimate and carbon content. This area is a habitat of the protected primate group, gray langur (*Presbytis cristata*) (Subagyo, 2008) as well as habitats for 46 species of birds from 18 families (Putra, 2016).

Vegetation studies, especially on association of tree species composition in the HPUJM area have not been carried out, so it is important to conduct this study to collect basic data for general knowledge enrichment and HPUJM management in particular. The objective of this study is to identify the association between dominant tree species in HPUJM.

RESEARCH METHOD

This study was carried out in a lowland tropical rain forest ecosystem in the Education Forest area of the University of Jambi, on Mendalo Campus, at Jalan Lintas

Jambi-Muaro Bulian Km 15. HPUJM is administratively located in Mendalo Indah Village, Jambi Outer City District, Muaro Jambi Sub District, Jambi Province. In general, the topography of HPUJM area ranges from flat to wavy. The air temperature ranges from 30 – 31degrees Celcius with air humidity of 54 – 65 % during the day time (Nursanti and Swari, 2013). Vegetation data collection was carried out in April 2020.

Materials in this study were trees in HPUJM with a diameter at breast height (*dbh*) of ≥ 10 cm or categorized as pole and tree pests (*stadia*) (Soerianegara and Indrawan, 1983), 70% alcohol, newspaper, clear plastic, masking tape, and label. Tools used included ladder, scissors, sample presses, oven, spray bottle, and camera.

Sampling was done using the purposive sampling method in HPUJM where the condition of the tree composition represents the parameters of the structure and tree composition of lowland forest. Vegetation analysis used a single plot method (Rugayah et al., 2005), with a study plot size of 9600 m², which is a permanent plot of the Jambi University Forestry Study Program. The plot was divided into 24 plots of 20 x 20 meters each. The HPUJM area as a population is 11 Ha, while the sample unit area was 9600 m² or 0.96 Ha. Therefore, the sampling intensity was 8.7%.

The vegetation data collected consisted of the scientific name of each tree species, the number of individuals of existing each species, the number of plots found by tree species, and the breast at height diameter (*dbh*). All tree species samples were sent to ANDA Herbarium, Faculty of Biology, Andalas University, Padang to be identified by plant sample identification experts. The Herbarium making referred to Partomihardjo et al. (2004).

The Importance Value Index described the dominant tree species in the study area.

The formula for calculating IVI is as follows:

$$INP = FR + KR + DR$$

$$INP = \text{Importance Value Index (\%)}$$

$$FR = \text{Relative Frequency (\%)}$$

$$KR = \text{Relative Density (\%)}$$

$$DR = \text{Relative Dominance (\%)}$$

- Density of a species used the formula:

$$K (\text{btg/ha}) = \frac{\text{Number of a species (individual/Ha)}}{\text{Total area sampled}}$$

- Relative density (KR) formula :

$$KR (\%) = \frac{\text{Density of a species}}{\text{Density of all species}} \times 100 \%$$

- Frequency of as species used the formula:

$$F = \frac{\text{Area of plots in which a species occurs}}{\text{Total area sampled}}$$

- Relative Frequency (FR) formula :

$$FR (\%) = \frac{\text{Frequency of a species}}{\text{Total frequency of all species}} \times 100 \%$$

- Dominance of a species used the formula:

$$D (\text{m}^2/\text{ha}) = \frac{\text{Total basal area of a species}}{\text{Total area sampled}}$$

- Relative Dominance (DR) formula :

$$DR (\%) = \frac{\text{Dominance of a species}}{\text{Total Dominance of all area}} \times 100 \%$$

The association analysis of tree species dominating the study area was carried out on the main composing tree species of lowland tropical rain forest in HPUJM having the Importance Value Index score of 10%. Analysis of the presence or absence of association was done using the Contingency Table 2x2 formulated by Greig-Smith (1983). The presence and absence of association between the dominant tree species in the forest area was then calculated using *Chi-square* (χ^2) (Ludwig and Reynolds, 1988). If the value of χ^2 count $> \chi^2$ table, it means the association is significant. If χ^2 count $< \chi^2$ table, it means (the association is not significant). The χ^2 table, where the free degree is 1 (one) at the significance level of 5% has a value of 3.84. *Chi-square Test* formulation is as follows:

$$\text{Chi-square } (\chi^2) \text{ count} = \frac{N(ad-bc)^2}{(a+b)(a+c)c+d)(b+d)}$$

a = number of observation points containing type A and type B

b = number of observation points containing type A only

c = number of observation points containing type B only

d = number of observation points do not contain type A and type B

N = number of observation points

Next, the strength of an association is calculated using the following formula:

$$E(a) = \frac{(a+b)(a+c)}{N}$$

The notation used has the same meaning as the previous formulation. Based on this formula, there are two types of associations, positive association and negative association.

(1) An association is + (positive), if an a value $> E(a)$.

(2) An association is – (negative), if an a value $< E(a)$.

The degree of association strength between the two tree species in the study location was measured using Jaccard Index. The strength of association as measured by the association index value was within the range of 0-1. If the association index value approaching 1, it means that the relationship between the two dominant tree species is stronger (Ludwig and Reynold, 1988).

RESULT AND DISCUSSION

The results of data analysis showed that *E. diadenum* from the *euphorbiaceae* family dominated HPUJM stands, with Importance Value Index (IVI) of 17.09% (Table 1), HPUJM is a representative of the lowland tropical rain forest ecosystem whose floristic composition is consisted of 32 families of trees. In addition to *E. diadenum*, there were six other trees dominating with IVI ≥ 10 %, which were pulai / *Alstonia scholaris* (INP 16.47%), siluk / *Gironniera nervosa* (INP

15.29%), leban / *Vitex pinnata* (INP 14.77%), pelangas / *Aporosa lucida* (INP 13.65%), *Litsea ferruginea* (13.55%) merapuyan / *Rhodamnia cinerea* (INP 11.80%), respectively. Other tree species with an INP above 5% were *Aglaiia* sp 001 (9.41%), *Aidia racemosa* (5.64%), *Bhesa paniculata* (6.71%), *Garcinia parvifolia* (9.69%), *Ixonanthes icosandra* (5.46%), *Koompassia malaccensis* (5.36%), *Litsea firma* (7.24%), *Santiria*

griffithii (7.11%), *Porterandia anisophylla* (6.86%), and *Syzygium* sp 001 (5.85%).

Based on Table 1. regarding the types of composing trees in the HPUJM, the followings are some pictures of these tree types. The calculation results of X^2 to determine the presence and absence of association between dominant trees in HPUJM are presented in Table 2.

Table 1. Density, frequency, dominance and importance value index (INP) of tree composition in Education Forest of Jambi Mendalo University.

No	Latin Name	Family	Relative Density	Relative Frequency	Relative Dominance	IVI
1.	<i>Endospermum diadenum</i> (Miq.) Airy Shaw	Euphorbiaceae	3.94	4.76	8.39	17.09
2.	<i>Alstonia scholaris</i> (L.) R.Br.	Apocynaceae	5.51	5.36	5.60	16.47
3.	<i>Gironniera nervosa</i> Planch.	Cannabaceae	6.30	4.76	4.23	15.29
4.	<i>Vitex pinnata</i> L.	Lamiaceae	6.69	4.17	3.91	14.77
5.	<i>Aporosa lucida</i> (Lindl.)Baill.	Phyllanthaceae	6.30	4.76	2.59	13.65
6.	<i>Rhodamnia cinerea</i> Jack	Myrtaceae	4.72	3.57	3.51	11.80
7.	<i>Aidia racemosa</i> (Cav.) Tirveng.	Rubiaceae	2.76	2.38	0.50	5.64
8.	<i>Aglaiia</i> sp 001	Meliaceae	4.33	3.57	1.52	9.42
9.	<i>Antidesma ghaesembilla</i> Gaertn.	Phyllanthaceae	0.39	0.60	0.30	1.29
10.	<i>Antidesma</i> sp 002	Phyllanthaceae	0.39	0.60	0.08	1.07
11.	<i>Antidesma</i> sp 004	Phyllanthaceae	0.39	0.60	0.16	1.15
12.	<i>Aporosa frutescens</i> Blume	Phyllanthaceae	0.39	0.60	0.22	1.21
13.	<i>Aporosa villosa</i> (Lindl.)Baill.	Phyllanthaceae	1.18	1.79	1.06	4.03
14.	<i>Archidendron</i> sp 004.	Leguminosae	0.79	0.60	0.28	1.67
15.	<i>Artocarpus odoratissimus</i> Blanco	Moraceae	0.79	1.19	1.33	3.31
16.	<i>Barringtonia lanceolata</i> (Ridl.) Payens	Lecythidaceae	1.18	1.79	1.47	4.44
17.	<i>Bhesa paniculata</i> Arn.	Centroplacaceae	2.36	2.38	1.96	6.70
18.	<i>Blumeodendron kurzii</i> (Hook.f.) J.J.Sm.ex Koord. &Valeton	Euphorbiaceae	0.39	0.60	0.09	1.08
19.	<i>Canarium patentinervium</i> Miq.	Burseraceae	0.39	0.60	0.12	1.11
20.	<i>Canarium</i> sp 001	Burseraceae	1.18	1.79	0.86	3.83
21.	<i>Connarus odoratus</i> Hook .f.	Connaraceae	0.39	0.60	0.08	1.07
22.	<i>Cyatochalyx magnifructus</i> R.J.Wang & R.M.K.Saunders	Annonaceae	0.39	0.60	0.05	1.04
23.	<i>Diospyros</i> sp	Ebenaceae	0.39	0.60	0.50	1.49
24.	<i>Elaeocarpus mastersii</i> King	Elaeocarpaceae	1.18	1.79	0.91	3.88
25.	<i>Elaeocarpus serratus</i> Linnaeus	Elaeocarpaceae	0.39	0.60	0.50	1.49
26.	<i>Ficus</i> sp.	Moraceae	0.39	0.60	0.91	1.90
27.	<i>Ficus</i> sp 003	Moraceae	0.39	0.60	0.11	1.10
28.	<i>Galearia filiformis</i> (Blume) Boerl.	Pandaceae	0.39	0.60	1.80	2.79
29.	<i>Garcinia parvifolia</i> (Miq.) Miq.	Clusiaceae	3.15	2.98	3.57	9.70
30.	<i>Ginotroches axillaris</i> Blume	Rhizophoraceae	0.79	1.19	0.31	2.29
31.	<i>Gonystylus</i> sp 001	Thymelaeaceae	0.39	0.60	0.23	1.22
32.	<i>Gymnacranthera forbesii</i> (King) Warb.	Myristicaceae	0.39	0.60	0.20	1.19

33.	<i>Gymnacranthera sp 001</i>	Myristicaceae	1.57	1.19	1.70	4.46
34.	<i>Ixonanthes icosandra</i> Jack.	Ixonanthaceae	1.57	2.39	1.50	5.46
35.	<i>Koompassia malaccensis</i> Maingay ex Benth.	Leguminosae	0.79	1.19	3.38	5.36
36.	<i>Lindera sp 001</i>	Lauraceae	0.79	1.19	1.82	3.80
37.	<i>Lithocarpus bennetii</i> (Miq.) Rehder	Fagaceae	0.39	0.60	0.80	1.79
38.	<i>Litsea ferruginea</i> Blume	Lauraceae	3.15	2.38	8.03	13.56
39.	<i>Litsea firma</i> (Blume) Hook.f.	Lauraceae	0.79	1.19	5.26	7.24
40.	<i>Litsea grandis</i> (Nees) Hook.f.	Lauraceae	0.79	0.60	0.68	2.07
41.	<i>Litsea monopetala</i> (Roxb.) Pers.	Lauraceae	1.97	1.79	0.64	4.40
42.	<i>Litsea sp 002</i>	Lauraceae	0.39	0.60	0.12	1.11
43.	<i>Litsea sp 001</i>	Lauraceae	1.39	0.60	0.06	1.05
44.	<i>Memecylon caeruleum</i> Jack.	Melastomataceae	0.39	0.60	0.23	1.22
45.	<i>Nephelium ramboutan-ake</i> (Labill.) Leenh.	Sapindaceae	1.97	1.79	1.19	4.95
46.	<i>Nephelium cuspidatum</i> Blume	Sapindaceae	0.79	0.60	0.24	1.63
47.	<i>Ochanostachys amentaceae</i> Mast.	Olacaceae	0.79	0.60	0.64	2.03
48.	<i>Palaquium sp 001</i>	Sapotaceae	0.39	0.60	0.22	1.21
49.	<i>Pimelodendron griffithianum</i> (Mull.Arg.) Benth.ex Hook.f.	Euphorbiaceae	0.39	0.60	0.61	1.60
50.	<i>Popowia pisocarpa</i> (Blume) Endl. Ex Walp.	Annonaceae	0.39	0.60	0.09	1.08
51.	<i>Porterandia anisophylla</i> (Jack ex Roxb.) Ridl.	Rubiaceae	2.76	2.97	1.14	6.87
52.	<i>Psychotria viridiflora</i> Reinw. Ex Blume	Rubiaceae	1.18	0.60	0.96	2.74
53.	<i>Pternandra sp 001</i>	Melastomataceae	0.79	0.60	0.93	2.32
54.	<i>Santiria griffithii</i> Engl.	Burseraceae	2.36	1.19	3.55	7.10
55.	<i>Santiria mollis</i> Engl.	Burseraceae	0.79	0.60	1.14	2.53
56.	<i>Santiria rubiginosa</i> Blume	Burseraceae	0.79	0.60	0.63	2.02
57.	<i>Santiria tomentosa</i> Blume	Burseraceae	0.39	0.60	1.34	2.33
58.	<i>Santiria laevigata</i> Blume	Burseraceae	0.39	0.60	0.37	1.36
59.	<i>Shorea leprosula</i> Miq.	Dipterocarpaceae	0.79	0.60	0.11	1.50
60.	<i>Shorea parvifolia</i> Dyer	Dipterocarpaceae	0.79	0.60	0.09	1.48
61.	<i>Sindora coriacea</i> Baker) Prain	Leguminosae	0.79	0.60	1.51	2.90
62.	<i>Strombosia javanica</i> Blume	Olacacea	1.18	0.60	0.38	2.16
63.	<i>Swietenia macrophylla</i> King	Meliacea	1.18	0.60	0.72	2.50
64.	<i>Symplocos sp 001</i>	Symplocaceae	0.39	0.60	0.19	1.18
65.	<i>Syzygium acuminatissimum</i> (King) Merr. & L.M. Perry	Myrtaceae	0.39	0.60	3.32	4.31
66.	<i>Syzygium attenuatum</i>	Myrtaceae	0.79	0.60	0.33	1.72
67.	<i>Syzygium garciniifolium</i>	Myrtaceae	0.39	0.60	0.06	1.04
68.	<i>Syzygium sp 002</i>	Myrtaceae	0.79	0.60	0.73	2.10
69.	<i>Syzygium sp 001</i>	Myrtaceae	0.79	1.19	3.88	5.85
70.	<i>Timonius flavescens</i> (Jacq.) Baker	Rubiaceae	0.39	0.60	0.06	1.05
71.	<i>Timonius wallichianus</i> (Korth.) Valetton	Rubiaceae	0.39	0.60	0.11	1.10
72.	<i>Eugenia sp</i>	Myrtaceae	0.39	0.60	0.73	1.72
73.	<i>Macaranga gigantea</i> (Reichb.f & Zoll.) Mull.Arg.	Euphorbiaceae	0.39	0.60	0.13	1.12
74.	<i>Syzygium sp 003</i>	Myrtaceae	0.39	0.60	0.32	1.31
75.	Unidentified	Centroplacaceae	0.39	0.60	1.18	2.17
76.	Unidentified	Myrtaceae	0.39	0.60	0.18	1.17

77	<i>Unidentified</i>	<i>Rubiaceae</i>	0.39	0.60	0.10	1.09
78.	<i>Garcinia sp 001</i>	<i>Clusiaceae</i>	0.39	0.60	0.18	1.17
79	<i>Cratoxylon sumatranum</i> (Jack) <i>BL.</i>	<i>Hypericaceae</i>	0.79	1.19	0.28	2.26
80	<i>Urophyllum arboreum</i> Reinw. Ex Blume Korth	<i>Rubiaceae</i>	0.39	0.60	0.32	1.31
81.	<i>Vitex sp001</i>	<i>Lamiaceae</i>	0.39	0.60	0.16	1.15
82	<i>Xanthophyllum flavescens</i> Roxb.	<i>Polygalaceae</i>	0.39	0.60	0.28	1.27

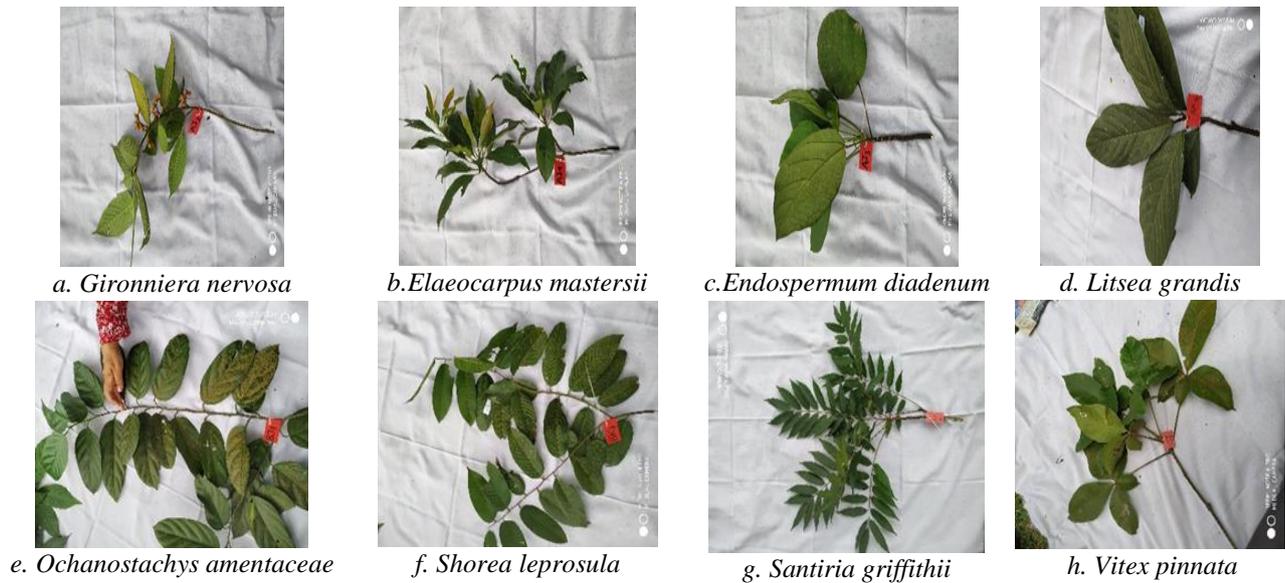


Figure 1. Several types of trees in Education Forest of Jambi Mendalo University
(Source : Nursanti dan Hardiyanti, 2020)

Table 2. Association value and association coefficient between dominant tree species in HPUJM

No	Latin name	X ² Table		X ² Count	Association	Jaccard Index
		5%	1%			
1.	<i>A.scholaris</i> and <i>A. lucida</i>	3.84	6.63	0.18	Not significant	0.31
2.	<i>A.scholaris</i> and <i>E.diadenum</i>	3.84	6.63	0.00	Not significant	0.21
3.	<i>A.scholaris</i> and <i>G.nervosa</i>	3.84	6.63	0.00	Not significant	0.21
4.	<i>A.scholaris</i> and <i>R.cinerea</i>	3.84	6.63	2.90	Not significant	0.36
5.	<i>A.scholaris</i> and <i>V.pinnata</i>	3.84	6.63	1.63	Not significant	0.33
6.	<i>A.lucida</i> and <i>E,diadenum</i>	3.84	6.63	3.00	Not significant	0.11
7.	<i>A.lucida</i> and <i>G.nervosa</i>	3.84	6.63	0.00	Not significant	0.25
8.	<i>A.lucida</i> and <i>R.cinerea</i>	3.84	6.63	0.89	Not significant	0.29
10.	<i>A.lucida</i> and <i>V.pinnata</i>	3.84	6.63	5.04	• +	0.46
11.	<i>E.diadenum</i> and <i>G.nervosa</i>	3.84	6.63	2.34	Not significant	0.07
12.	<i>E.diadenum</i> and <i>R.cinerea</i>	3.84	6.63	0.00	Not significant	0.17
13.	<i>E.diadenum</i> and <i>V.pinnata</i>	3.84	6.63	4.94	• -	0.00
14.	<i>G.nervosa</i> and <i>R.cinerea</i>	3.84	6.63	1.00	Not significant	0.08
15.	<i>G.nervosa</i> and <i>V.pinnata</i>	3.84	6.63	2.52	Not significant	0.36
16	<i>L. ferruginea</i> and <i>A.scholaris</i>	3.84	6.63	0.32	Not significant	0.18
17	<i>L. ferruginea</i> and <i>A. lucida</i>	3.84	6.63	1.2	Not significant	0.20
18	<i>L. ferruginea</i> and <i>E,diadenum</i>	3.84	6.63	2.4	Not significant	0
19	<i>L. ferruginea</i> and <i>G. nervosa</i>	3.84	6.63	9.6	** +	0.50
20	<i>L. ferruginea</i> and <i>R.cinerea</i>	3.84	6.63	0	Not significant	0.10
21	<i>L. ferruginea</i> and <i>V.pinnata</i>	3.84	6.63	11.6	** -	0.20

Source : Primary data processing, 2020

Description : + : positive association, - : negative association, • : significantly different at the test level of 5%,
** : significantly different at the test level of 1%

E. diadenum was the dominant tree in HPUJM with the highest IVI reaching 17.09%. This species also had the highest relative dominance according to the morphological character of the trunk as a tree with medium to large diameter. The crown of *E. diadenum* is slightly rounded wide with large branches. It also has single oval leaf that is wider at the base. The local name of *E. diadenum* in Jambi Province is *medang labu*, *kayu labu*, or *medang sendok*. This tree is a source of commercial timber under the trade name 'Sesendok' which is harvested for local or commercial use. According to Suhartati et al., 2012 *E. diadenum* or *medang labu* generally grows in old secondary forest or in open spaces in primary forest, on sandy and dry soil or slightly calcareous white sandy clay. This species is a pioneer species in former fields and logged forest, and grows very fast in places with showering sun light.

Ecologically, the association between two types of plants originates from growing together in the same ecological niche. This indicates that association is not absolutely influenced by the density of each species, but by many other factors, which may provide random effects. Association can occur because the physiological and morphological suitability of a plant with other plants, but it can also occur because physical factors of the habitat such as the need for shade, microclimate such as light and temperature (Sirami et al., 2016).

The results show that from the 21 dominant tree combinations, there were only 4 positive associated combinations, such as association between *A. lucida* and *V. pinnata*, *E. diadenum* and *V. pinnata*, *L. ferruginea* and *G. nervosa*, *L. ferruginea* and *V. pinnata*, *A. lucida* and *V. pinnata*, as well as *L. ferruginea* and *G. nervosa*. It means that the two trees always present together spatially and adapt to each other (Barbour et al., 1987). It also shows that the two species can live together and are dependent on one another. The togetherness of the two types is because they have the same or almost the same responses to extreme changes in environmental factors.

Based on the results of the study, the opportunities of *A. lucida* and *V. pinnata* as well as the opportunities of *L. ferruginea* and *G. nervosa* to be planted and grown together in one very large area is greater. This is because both types have the potential to produce a positive relationship between one species and another. The positive association between the two types of trees occurs due to several possibilities. The research results by Windusari et al., 2011 shows that the association between the two tree species is because the two tree species like places with almost the same environmental parameters, for example, they like wet habitats or habitats with high sunlight intensity. It is further explained that species association can affect species diversity in successional forests.

In addition to combinations with positive associations, there were also dominant tree combinations with negative associations between *E. diadenum* and *V. pinnata*, as well as between *L. ferruginea* and *V. pinnata*. According to Whittaker (1975) negative association indicates that the species are less likely to be found together or cannot want to live side by side. Another suggestion is that the negative association is caused by environmental modifications and certain types producing toxins. Sofiah et al., 2013 explained that species pairs do not always result in a positive association. Pratama et al., (2012) stated that negative association shows a lack of tolerance for living together in the same area, or the absence of mutually beneficial relationships, especially in the division of growth space. *E. diadenum* is a fast-growing tree species from the Euphorbiaceae family with slightly rounded crowns (Figure 2b), while *V. pinnata* is an intolerant tree species or requires light but slow growth (Figure 2a). *V. pinnata* seeds cannot germinate under shade. Ecological and morphological characteristics of *V. pinnata* cannot tolerate the morphological characteristics of fast-growing *E. diadenum* whose crowns can grow quickly to create shade.



Figure a



Figure b

Figure 2. a) *V. pinnata* and b) *E. diadenum* in Education Forest of Jambi University (Source: Nursanti dan Hardiyanti, 2020)

Based on the results of the study, there were 17 combinations of dominant tree species that were not associated. The existence of tree species is not associated with other plants because the presence of these species is not influenced by the presence of other species, and these plants have a high tolerance for various environmental conditions. In this study, *A. scholaris* is not associated with other dominant tree species in HPUJM. This result supports the previous research data by Hidayat and Juhaeti (2013) who stated that the *A. scholaris* in Ujung Kulon National Park is not associated with other tree species composing its habitat. It shows that *A. scholaris* is a species that is resistant to various habitat conditions.

CONCLUSION

The results of the study showed that from 21 dominant tree combination in HPUJM, there were only 4 combinations with significance association ; they were *A. lucida* and *V. pinnata* with positive association, *E. diadenum* and *V. pinnata* with negative association, *L. ferruginea* and *G. nervosa* with positive association, and the last was *L. ferruginea* and *V.pinnata* with negative association.

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