



Weeds Diversity in Rubber Plant (*Hevea Brasiliensis*) at Perkebunan Nusantara Company, Ciamis, Indonesia

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ABSTRACT: This research aims to analyze the diversity of weeds species in rubber plants at Perkebunan Nusantara Company, Ciamis, Indonesia. We used the survey method with line transects sampling. Weed diversity in rubber plantations was analyzed using Shannon-Wiener Index (H'), while the evenness of plants was analyzed using the Evenness Index (E'). The research results showed that 38 species from 18 weed families were found. The weed species with the highest number is *Ischaemum timorense* (IVI = 36.71%) as a dominant species, while the weed species with the lowest number of individuals was *Cyrtococcum patens* (IVI = 0.48%). Weed diversity in rubber plants has an $H' = 4.66$; its higher diversity value indicates a more stable community in this area.

Keywords: Botany, Dominant Plant, Evenness, Plant Diversity

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INTRODUCTION

Weeds grow around cultivated plants, and their presence is undesirable because they can harm the cultivated plants (Prayogo et al., 2017). The presence of weeds in a plantation area generally harms staple crops because weeds have a high competitive power that allows competition for light, CO₂, water, nutrients, and growing space to be used simultaneously (Ramlan et al., 2019). Weeds, known as nuisance plants, have harmful and positive or beneficial properties. When viewed from these characteristics, weed management always considers two terms: control or eradication (Nugraha & Zaman, 2019).

The rubber plant (*Hevea brasiliensis*) is one of the agricultural commodities in Indonesia as a source of foreign exchange and absorbs much labor. As a latex-producing commodity, the rubber plant is widely used both on an industrial scale and for the benefit of the community (Sari & Rahayu, 2013). Rubber plants originate from the tropical region of the Brazilian Amazon basin with rainfall of 2,000-3,000 mm/year and rainy days between 120-170 days/year. One of the problems with rubber plants is weeds which significantly affect latex yields. Although rubber plants grow tightly, there are still weeds that grow around rubber plants and overcome, and it is necessary to know the weed species that interfere with the growth of rubber plants so that ways to overcome them can be determined (Subrata & Setiawan, 2018).

The Batulawang Plantation is located in the eastern and southern parts of Ciamis Regency, West Java, Indonesia, which is spread over six sub-districts, which is in the area of Perkebunan Nusantara VII Company (Batulawang Plantation Research Team, 2014). One of the most dominant plants in this area is the rubber plant, but no relevant study was conducted to estimate the weeds in those plants. This research aims to determine the diversity of weeds in rubber and the dominant weeds species in rubber plants in this area.

METHODOLOGY

Study Site and Design

The study site was conducted in Perkebunan Nusantara VII Company, Ciamis, West Java, Indonesia, with a specific geographical location in the Batulawang Plantation. The coordinates are between 108.37° and 108.44° East Longitude and between 7.23° and 7.45° South Latitude. The plantation area is about 5,192.00 hectares. The topography of Batulawang Plantation is generally hilly with a slope of about 0-30%. Several afdeling areas have basins, including the Batugajah and Putrapinggan areas, so Batulawang Plantation has an average altitude of 126 m asl (Batulawang Plantation Research Team, 2014).

The study was conducted using a survey method with a line transect sampling technique (Burnham et al., 1980). Each line transect is divided into three sub-transect points with an interval of 50 m, and each sub-transect is placed five squared. Data collection (weeds sample) was carried out on five different squares.

Variables and Parameters

The variables observed in this study were weeds diversity as the dependent variable, while environmental factors were the independent variables. The main parameters observed consisted of the value of diversity and the number of individuals of each weeds species growing on rubber plants – the supporting parameters such as air temperature, humidity, soil pH, and light intensity.

Research Method

Research on weeds was carried out using a survey method with a line transect sampling technique referring to the research of Burnham et al. (1980), namely:

- a) The Line Transect line is made 100 m long and made as many as 25 squares in different places;
- b) Each Line Transect is divided into three sampling points with an interval of 50 m;
- c) Each sampling point made a square plot measuring 1 x 1 m with five squares as replication with a distance of 1 meter;
- d) The total squares used for this study amounted to 75 units;
- e) Obtained samples were calculated for the number of species and individuals of each species in each square;
- f) The identified weeds species using literature from Fadilah (2018), Fang & Staples (1995), Heyne (1987), Megawati et al. (2017), Mugnisiah (1994), Nasution (1986), Pebriani (2013), Plantamor (2012), Rismunandar (1986), Rukmana (2014), Sasmita et al. (2014), Sirait (2017), Steenis (1987, 2005, 2006, 2013), Sudewo (2004), Susanto et al. (2018), Sutedi et al. (2005), Syarif (2009), Tambaru et al. (2019), Tikupair & Lantang (2014), Tjitrosoedirdjo et al. (1984), Tjitrosoepomo (2001, 2007, 2014), Umiyati & Widayat (2017), USDA (2012), and Widyastini (2012).

Environmental factor data collection refers to the research of Wijayanti et al. (2015), such as air temperature and humidity, soil pH, and light intensity. Air temperature and humidity measurements were carried out using a Thermo-Hygrometer. Place the tool in the Batulawang rubber plantation area by measuring the temperature and humidity, then wait for ± 3 minutes to read the scale. The soil pH was measured using a soil tester by plugging the tool's tip into the ground as deep as ± 5 cm, pressing the button, and then recording the scale value. Measurement of light intensity was carried out using a lux meter. Activating the tool directs the light sensor by hand on the surface where the light intensity is measured, then viewing and recording the measurements on the screen.

Data Analysis

Data analysis included diversity index (Shannon-Wiener and Evenness), important value index (IVI), and environmental results. Weed diversity is calculated using the diversity index of Shannon-Wiener (1963) in Fachrul (2007) as follows (1).

$$H = -(\pi \ln \pi); \pi = \frac{n_i}{N} \dots\dots\dots (1)$$

As well as H' = diversity index, pi = ni/N, ni = number of individuals of the first species, and N = number of individuals of all species.

The species' evenness index indicates the evenness level. The evenness index shows the distribution of individual species to be calculated by the formula (2) (Magurran, 1988).

$$E = \frac{H'}{H_{max}} \dots\dots\dots (2)$$

As well as E = evenness index, H' = diversity index, H max = log 2 S = 3.3219 log S, S = number of species. According to Magurran (1988), an evenness value close to one indicates that a community is more evenly distributed, whereas if the value is close to zero, it is increasingly uneven. Weed community criteria based on evenness index: 0.00 < E < 0.50 depressed community; 0.05 < E < 0.75 unstable community; 0.75 < E < 1.00 stable community.

An important value index is an index that is calculated based on the sum of all values of relative density and relative frequency. The important value index is calculated by the formula (3) (Fachrul, 2007).

$$\text{Important Value Index (IVI)} = RD + RF \dots\dots\dots (3)$$

While the density calculation as shown in (5) and frequency calculation can be seen in (7).

$$D = \frac{\sum \text{sample species}}{\text{The area of the entire created plot}} \dots\dots\dots (4)$$

$$\% \text{Relative Density (\%RD)} = \frac{\text{Species density}}{\sum \text{all species density}} \times 100\% \dots\dots (5)$$

$$\text{Frequency (F)} = \frac{\sum \text{plot of the species}}{\text{All plots}} \dots\dots\dots (6)$$

$$\% \text{Relative Frequency (\%RF)} = \frac{\text{Species freq.}}{\sum \text{all species freq.}} \times 100\% \dots\dots (7)$$

The data analysis of environmental factors obtained from the field measurement was analyzed descriptively.

RESULTS

The results of weeds diversity (Shannon-Wiener and Evenness), important value index (IVI), most abundant (dominant) weeds, and environmental factors can be seen in Tables 1, 2, 3, 4, and 5.

Table 1. Weeds diversity result based on Shannon-Wiener Index.

| No. | Species | Family | H' |
|-----|---------------------------|------------|------------|
| 1 | <i>Acmella paniculata</i> | Asteraceae | -0.0438809 |

| | | | |
|-----------------------------------|-----------------------------------|------------------|-------------|
| 2 | <i>Ageratum conyzoides</i> | | -0.2062403 |
| 3 | <i>Emilia sonchifolia</i> | | -0.0219405 |
| 4 | <i>Mikania cordata</i> | | -0.1667475 |
| 5 | <i>Mikania micrantha</i> | | -0.1645534 |
| 6 | <i>Commelina diffuse</i> | Commelinaceae | -0.1645534 |
| 7 | <i>Lepistemon binectariferum</i> | Convolvulaceae | -0.0285226 |
| 8 | <i>Cyperus kyllingia</i> | Cyperaceae | -0.0263286 |
| 9 | <i>Cyperus rotundus</i> | Cyperaceae | -0.1162844 |
| 10 | <i>Scleria sumatrensis</i> | Cyperaceae | -0.1360308 |
| 11 | <i>Cibotium barometz</i> | Citodiaceae | -0.0702095 |
| 12 | <i>Homalanthus populneus</i> | Euphorbiaceae | -0.0307166 |
| 13 | <i>Phyllanthus urinaria</i> | Euphorbiaceae | -0.1316428 |
| 14 | <i>Centrosema pubescens</i> | Fabaceae | -0.1097023 |
| 15 | <i>Gleichenia linearis</i> | Gleicheniaceae | -0.0372988 |
| 16 | <i>Hyptis capitata</i> | Lamiaceae | -0.0548511 |
| 17 | <i>Sida rhombifolia</i> | Malvaceae | -0.0197464 |
| 18 | <i>Clidemia hirta</i> | Melastomataceae | -0.0438809 |
| 19 | <i>Melastoma malabathricum</i> | Melastomataceae | -0.0285226 |
| 20 | <i>Oxalis barrelieri</i> | Oxalidaceae | -0.0351047 |
| 21 | <i>Oxalis corniculata</i> | Oxalidaceae | -0.0351047 |
| 22 | <i>Peperomia pellucida</i> | Piperaceae | -0.3576295 |
| 23 | <i>Centotheca lappaceae</i> | | -0.0658214 |
| 24 | <i>Cynodon dactylon</i> | | -0.0153583 |
| 25 | <i>Cyrtococcum patens</i> | | -0.0109702 |
| 26 | <i>Digitaria ischaemum</i> | | -0.2172105 |
| 27 | <i>Ischaemum timorense</i> | Poaceae | -1.0970229 |
| 28 | <i>Paspalum scrobiculatum</i> | | -0.0680154 |
| 29 | <i>Paspalum conjugatum</i> | | -0.1162844 |
| 30 | <i>Pennisetum purpureum</i> | | -0.0504631 |
| 31 | <i>Setaria palmifolia</i> | | -0.0702095 |
| 32 | <i>Pityrogramma calomelanos</i> | Pteridaceae | -0.1667475 |
| 33 | <i>Pteris ensiformis</i> | Pteridaceae | -0.0614333 |
| 34 | <i>Oldenlandia corymbosa</i> | Rubiaceae | -0.0131643 |
| 35 | <i>Spermacoce Alata</i> | Rubiaceae | -0.3313009 |
| 36 | <i>Cyclosorus aridus</i> | Thelypteridaceae | -0.0438809 |
| 37 | <i>Lantana camara</i> | Verbenaceae | -0.1097023 |
| 38 | <i>Stachytarpheta jamaicensis</i> | Verbenaceae | -0.1996582 |
| Total Diversity Index (H') | | | 4.66 |

Table 2. Weeds diversity results based on the Evenness Index.

| No. | Species | Family | E |
|-----|----------------------------|------------|----------|
| 1 | <i>Acmella paniculata</i> | | 0.02194 |
| 2 | <i>Ageratum conyzoides</i> | Asteraceae | 0.10312 |
| 3 | <i>Emilia sonchifolia</i> | | 0.01097 |
| 4 | <i>Mikania cordata</i> | | 0.083374 |

| | | | |
|----|-----------------------------------|------------------|----------|
| 5 | <i>Mikania micrantha</i> | | 0.082277 |
| 6 | <i>Commelina diffuse</i> | Commelinaceae | 0.082277 |
| 7 | <i>Lepistemon binectariferum</i> | Convolvulaceae | 0.014261 |
| 8 | <i>Cyperus kyllingia</i> | | 0.013164 |
| 9 | <i>Cyperus rotundus</i> | Cyperaceae | 0.058142 |
| 10 | <i>Scleria sumatrensis</i> | | 0.068015 |
| 11 | <i>Cibotium barometz</i> | Citodiaceae | 0.035105 |
| 12 | <i>Homalanthus populneus</i> | Euphorbiaceae | 0.015358 |
| 13 | <i>Phyllanthus urinaria</i> | | 0.065821 |
| 14 | <i>Centrosema pubescens</i> | Fabaceae | 0.054851 |
| 15 | <i>Gleichenia linearis</i> | Gleicheniaceae | 0.018649 |
| 16 | <i>Hyptis capitata</i> | Lamiaceae | 0.027426 |
| 17 | <i>Sida rhombifolia</i> | Malvaceae | 0.009873 |
| 18 | <i>Clidemia hirta</i> | | 0.02194 |
| 19 | <i>Melastoma malabathricum</i> | Melastomataceae | 0.014261 |
| 20 | <i>Oxalis barrelieri</i> | | 0.017552 |
| 21 | <i>Oxalis corniculata</i> | Oxalidaceae | 0.017552 |
| 22 | <i>Peperomia pellucida</i> | Piperaceae | 0.178815 |
| 23 | <i>Centotheca lappaceae</i> | | 0.032911 |
| 24 | <i>Cynodon dactylon</i> | | 0.007679 |
| 25 | <i>Cyrtococcum patens</i> | | 0.005485 |
| 26 | <i>Digitaria ischaemum</i> | | 0.108605 |
| 27 | <i>Ischaemum timorense</i> | Poaceae | 0.548511 |
| 28 | <i>Paspalum scrobiculatum</i> | | 0.034088 |
| 29 | <i>Paspalum conjugatum</i> | | 0.058142 |
| 30 | <i>Pennisetum purpureum</i> | | 0.025232 |
| 31 | <i>Setaria palmifolia</i> | | 0.035105 |
| 32 | <i>Pityrogramma calomelanos</i> | | 0.083374 |
| 33 | <i>Pteris ensiformis</i> | Pteridaceae | 0.030717 |
| 34 | <i>Oldenlandia corymbosa</i> | | 0.006582 |
| 35 | <i>Spermacoce Alata</i> | Rubiaceae | 0.16565 |
| 36 | <i>Cyclosorus aridus</i> | Thelipteridaceae | 0.02194 |
| 37 | <i>Lantana camara</i> | | 0.054851 |
| 38 | <i>Stachytarpheta jamaicensis</i> | Verbenaceae | 0.099829 |

Table 3. Weeds diversity results based on the Important Value Index (IVI).

| No. | Species | Family | Density | RD (%) | Freq. | RF (%) | IVI (%) |
|-----|----------------------------|------------|---------|--------|-------|--------|---------|
| 1 | <i>Acmella paniculata</i> | | 0.26 | 0.92 | 0.13 | 1.77 | 2.69 |
| 2 | <i>Ageratum conyzoides</i> | | 1.25 | 4.43 | 0.2 | 2.73 | 7.16 |
| 3 | <i>Emilia sonchifolia</i> | Asteraceae | 0.13 | 0.46 | 0.06 | 0.81 | 1.27 |
| 4 | <i>Mikania cordata</i> | | 1.01 | 3.58 | 0.25 | 3.41 | 6.99 |
| 5 | <i>Mikania</i> | | 1.00 | 3.54 | 0.29 | 3.96 | 7.50 |

| | | | | | | | |
|----|--|-----------------|-------|------|-------|-------|-------|
| 6 | <i>micrantha</i> <i>Commelina</i> <i>diffuse</i> | Commelinaceae | 1.00 | 3.54 | 0.26 | 3.55 | 7.09 |
| 7 | <i>Lepistemon</i> <i>binectariferum</i> | Convolvulaceae | 0.17 | 0.60 | 0.09 | 1.23 | 1.83 |
| 8 | <i>Cyperus</i> <i>kyllingia</i> | Cyperaceae | 0.16 | 0.57 | 0.10 | 1.36 | 1.93 |
| 9 | <i>Cyperus</i> <i>rotundus</i> | | 0.70 | 2.48 | 0.16 | 2.18 | 4.66 |
| 10 | <i>Scleria</i> <i>sumatrensis</i> | Citodiaceae | 0.82 | 2.91 | 0.26 | 3.55 | 6.46 |
| 11 | <i>Cibotium</i> <i>barometz</i> | | 0.42 | 1.49 | 0.2 | 2.73 | 4.22 |
| 12 | <i>Homalanthus</i> <i>populneus</i> | Euphorbiaceae | 0.18 | 0.64 | 0.05 | 0.68 | 1.32 |
| 13 | <i>Phyllanthus</i> <i>urinaria</i> | | 0.8 | 2.84 | 0.4 | 5.46 | 8.30 |
| 14 | <i>Centrosema</i> <i>pubescens</i> | Fabaceae | 0.66 | 2.34 | 0.26 | 3.55 | 5.89 |
| 15 | <i>Gleichenia</i> <i>linearis</i> | Gleicheniaceae | 0.22 | 0.78 | 0.05 | 0.68 | 1.46 |
| 16 | <i>Hyptis capitata</i> | Lamiaceae | 0.33 | 1.17 | 0.13 | 1.77 | 2.94 |
| 17 | <i>Sida rhombifolia</i> | Malvaceae | 0.12 | 0.43 | 0.05 | 0.68 | 1.11 |
| 18 | <i>Clidemia hirta</i> | Melastomataceae | 0.26 | 0.92 | 0.16 | 2.18 | 3.10 |
| 19 | <i>Melastoma</i> <i>malabathricum</i> | | 0.17 | 0.60 | 0.09 | 1.23 | 1.83 |
| 20 | <i>Oxalis barrelieri</i> | Oxalidaceae | 0.21 | 0.74 | 0.16 | 2.18 | 2.92 |
| 21 | <i>Oxalis</i> <i>corniculata</i> | | 0.21 | 0.74 | 0.13 | 1.77 | 2.51 |
| 22 | <i>Peperomia</i> <i>pellucida</i> | Piperaceae | 2.17 | 7.70 | 0.45 | 6.14 | 13.84 |
| 23 | <i>Centotheca</i> <i>lappaceae</i> | Poaceae | 0.4 | 1.42 | 0.12 | 1.64 | 3.06 |
| 24 | <i>Cynodon</i> <i>dactylon</i> | | 0.09 | 0.32 | 0.04 | 0.55 | 0.87 |
| 25 | <i>Cyrtococcum</i> <i>patens</i> | Poaceae | 0.06 | 0.21 | 0.02 | 0.27 | 0.48 |
| 26 | <i>Digitaria</i> <i>ischaemum</i> | | 1.32 | 4.68 | 0.37 | 5.05 | 9.73 |
| 27 | <i>Ischaemum</i> <i>timorense</i> | 6.66 | 23.61 | 0.96 | 13.10 | 36.71 | |
| 28 | <i>Paspalum</i> <i>scrobiculatum</i> | Poaceae | 0.41 | 1.45 | 0.06 | 0.82 | 2.27 |
| 29 | <i>Paspalum</i> <i>conjugatum</i> | | 0.70 | 2.48 | 0.21 | 2.86 | 5.34 |
| 30 | <i>Pennisetum</i> <i>purpureum</i> | Poaceae | 0.30 | 1.07 | 0.08 | 1.10 | 2.17 |

| | | | | | | | |
|----|-----------------------------------|------------------|------|------|------|------|-------|
| 31 | <i>Setaria palmifolia</i> | | 0.42 | 1.49 | 0.06 | 0.82 | 2.31 |
| 32 | <i>Pityrogramma calomelanos</i> | Pteridaceae | 1.01 | 3.58 | 0.34 | 4.64 | 8.22 |
| 33 | <i>Pteris ensiformis</i> | | 0.37 | 1.31 | 0.16 | 2.18 | 3.49 |
| 34 | <i>Oldenlandia corymbosa</i> | Rubiaceae | 0.08 | 0.28 | 0.04 | 0.55 | 0.83 |
| 35 | <i>Spermacoce Alata</i> | | 2.01 | 7.13 | 0.53 | 7.23 | 14.36 |
| 36 | <i>Cyclosorus aridus</i> | Thelipteridaceae | 0.26 | 0.92 | 0.10 | 1.36 | 2.28 |
| 37 | <i>Lantana camara</i> | | 0.66 | 2.34 | 0.18 | 2.46 | 4.80 |
| 38 | <i>Stachytarpheta jamaicensis</i> | Verbenaceae | 1.21 | 4.29 | 0.13 | 1.77 | 6.06 |

Table 4. Weeds dominancy species found.

| No. | Local Name | Species | Family | Number of Individuals |
|-----|----------------|----------------------------------|-----------------|-----------------------|
| 1 | Jotang | <i>Acmella paniculata</i> | | 20 |
| 2 | Bandotan | <i>Ageratum conyzoides</i> | | 94 |
| 3 | Jonghe | <i>Emilia sonchifolia</i> | Asteraceae | 10 |
| 4 | Mikania | <i>Mikania cordata</i> | | 76 |
| 5 | vines | <i>Mikania micrantha</i> | | 75 |
| 6 | Gewor lalakina | <i>Commelina diffuse</i> | Commelinaceae | 75 |
| 7 | Areuy fur | <i>Lepistemon binectariferum</i> | Convolvulaceae | 13 |
| 8 | Wudelan | <i>Cyperus kyllingia</i> | | 12 |
| 9 | Lading | <i>Cyperus rotundus</i> | Cyperaceae | 53 |
| 10 | keris | <i>Scleria sumatrensis</i> | | 62 |
| 11 | Nail hoop | <i>Cibotium barometz</i> | Citodiaceae | 32 |
| 12 | Kareumbi | <i>Homalanthus populneus</i> | Euphorbiaceae | 14 |
| 13 | Meniran | <i>Phyllanthus urinaria</i> | | 60 |
| 14 | Nuts | <i>Centrosema pubescens</i> | Fabaceae | 50 |
| 15 | Resam | <i>Gleichenia linearis</i> | Gleicheniaceae | 17 |
| 16 | Knob grass | <i>Hyptis capitata</i> | Lamiaceae | 25 |
| 17 | Sadagori | <i>Sida rhombifolia</i> | Malvaceae | 9 |
| 18 | Harendong fur | <i>Clidemia hirta</i> | Melastomataceae | 20 |
| 19 | lonely | <i>Melastoma malabathricum</i> | Melastomataceae | 13 |
| 20 | guide | <i>Oxalis barrelieri</i> | Oxalidaceae | 16 |
| 21 | Calincing | <i>Oxalis corniculata</i> | | 16 |
| 22 | Cecer Kemps | <i>Peperomia pellucida</i> | Piperaceae | 163 |
| 23 | Kidang Jukut | <i>Centotheca lappaceae</i> | Poaceae | 30 |

| | | | | |
|----|---------------------|-----------------------------------|------------------|-----|
| 24 | Grinding | <i>Cynodon dactylon</i> | | 7 |
| 25 | Fish egg | <i>Cyrtococcum patens</i> | | 5 |
| 26 | Field Kerpe | <i>Digitaria ischaemum</i> | | 99 |
| 27 | Mining | <i>Ischaemum timorense</i> | | 500 |
| 28 | Eggs | <i>Paspalum comesonii</i> | | 31 |
| 29 | Jukut Pait | <i>Paspalum conjugatum</i> | | 53 |
| 30 | Mini elephant grass | <i>Pennisetum purpureum</i> | | 23 |
| 31 | Palm grass | <i>Setaria palmifolia</i> | | 32 |
| 32 | silver nail | <i>Pityrogramma calomelanos</i> | Pteridaceae | 76 |
| 33 | Sword spikes | <i>Pteris ensiformis</i> | | 28 |
| 34 | Pearl grass | <i>Oldenlandia corymbosa</i> | Rubiaceae | 6 |
| 35 | Fresh grass | <i>Spermacoce Alata</i> | | 151 |
| 36 | Lizard fern | <i>Cyclosorus aridus</i> | Thelipteridaceae | 20 |
| 37 | smack | <i>Lantana camara</i> | | 50 |
| 38 | Horse whip | <i>Stachytarpheta jamaicensis</i> | Verbenaceae | 90 |

Table 5. Environmental factors result (mean).

| No. | Environmental factor | Station | | | | |
|-----|-----------------------|---------|-----|-----|------|-----|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | Air Temperature (°C) | 29 | 30 | 29 | 28 | 26 |
| 2 | Light intensity (lux) | 700 | 850 | 700 | 1000 | 650 |
| 3 | Humidity (%) | 70 | 72 | 78 | 72 | 84 |
| 4 | Soil pH | 7 | 7 | 7 | 6.5 | 6.5 |

DISCUSSION

Based on observations and identification of weeds at Batulawang Plantation, Perkebunan Nusantara Company, 38 species from 18 weed families were found. These results indicate that the diversity of weed species is higher than Novalinda et al. (2014), there are 27 weeds species from 13 families, while according to Ramlan et al. (2019) showed that the results of observations made in the Liang State Rubber Plantation area contained 11 weed species from 8 families at an altitude of 4 m above sea level, and 14 weed species from 13 families at an altitude of 104 m above sea level.

The weeds species with the highest number of individuals came from the Poaceae (grass) family, namely *Ischaemum timorense* as many as 500 individuals with an IVI of 36.72%, while the weed species with the lowest number of individuals were *Cyrtococcum patens* (L.) from the family Poaceae (grasses) as many as five individuals with an IVI of 0.48%.

Based on the data in Table 1, it can be seen that the weed community's diversity index (H') in the overall square plot has a value of 4.66. The higher the diversity value, the more stable the community in an area is. Ecosystem stability means that the system will return to its original state after a disturbance occurs

that causes the shock not to exist. A community is stable if the number of species present is relatively constant over time (Fitriany et al., 2015).

Based on the data in Table 2, it can be seen that the weed community's evenness index (E') is 0.89. Hilwan et al. (2012) stated that the value of $E < 0.3$ indicates low species evenness, $E = 0.3-0.6$ indicates medium evenness, and $E > 0.6$ means high evenness. Based on these criteria, the evenness index value obtained on rubber plantations at the Batulawang Plantation is classified as having the highest because it is > 0.6 .

Table 3 shows that the highest important value index (IVI) is in the weeds species *Ischaemum timorense*, with an IVI of 36.71%. According to Tjitrosoedirdjo (1984), *Ischaemum timorense* is a tough weeds in the lowlands and is abundant in preferred crops. Species *Ischaemum timorense* is used as feed for animals. It also provides material suitable for composting. These weeds propagate by seed and will not germinate temporarily, even if submerged. After the emergence of sprouts, this weed can proliferate in flood conditions. Species *Ischaemum timorense* can be found in wet conditions, especially in rice fields at the time of direct seed planting, and grows in the open or somewhat sheltered with a height of up to 1600 m above sea level.

The second dominant weeds was *Spermacoce alata*, with an IVI of 14.36%. This weed is classified as a broad-leaved weed with fast growth properties with quite a lot of branching and produces many seeds so that the biomass is high. This weeds is shade-tolerant, has a high density, and is evenly distributed, making it one of the dominant weeds. This high community of *Spermacoce alata* weeds are high absolute density and even distribution with dense vegetation conditions and a weed canopy that covers the soil surface, which can stimulate the growth of this weed to become dominant. Reproduce by seeds and stem segments that come out of the roots. Grows in the open or sheltered up to 1,700 m above sea level (Oksari, 2014).

The third weed that dominates is *Peperomia pellucida*, with an IVI of 13.84%. According to Rosa et al. (2020), the flattened plant (*Peperomia pellucida* L.) is a wild plant widely found in tropical and humid areas. This plant can be found on the edges of ditches, between rocks, cracked walls, fields, and yards. Various studies have shown that the plant has analgesic, antipyretic, anti-inflammatory, hypoglycemic, antibacterial, antifungal, antimicrobial, anticancer, antioxidant, and antidiabetic activities. The advantages of messenger plants cannot be separated from the content of secondary metabolites. This plant is known to contain alkaloid compounds, cardenolides, saponins, and tannins.

Weeds that had the highest IVI were due to their high density and good distribution and were found in every place. It is also supported by the habitat of weeds that generally live in protected areas-under Steenis's (2005) opinion, a weed family can adapt and is suitable for any environment and is found in large or dominant quantities.

Based on Table 4, it can be seen that weed species in Batulawang Plantation, Perkebunan Nusantara Company, contained 38 species from 18 families with a total number of 2,127 individuals. The most abundant species obtained from all observation plots were *Ischaemum timorense*, with a total of 500 individuals. The

species found the least was *Cyrtococcum patens*, with five individuals. The dominant weeds were *Ischaemum timorense*, *Peperomia pellucida*, and *Spermacoce alata* (Fig. 1).



Figure 1. Left to right: *Ischaemum timorense*, *Peperomia pellucida*, *Spermacoce Alata*.

The physical condition of the soil strongly influences the weed species that grow on the plantation, under the theory that air humidity, soil moisture, air temperature, and soil temperature and their elements are climate components that significantly affect the growth of plant species, mainly seasonal plants. The competition between the existing plants can also influence the existence of the dominant plant species. If the environmental conditions are under the plant, such as completeness and the abundance of nutrients in the soil, the number of individual species will increase because the environmental conditions are supportive under the plant (Noorhadi & Utomo, 2002).

In the plantation area, data analysis from five research stations shows an average value for an air temperature of 28°C, an intensity value of light of 825 lux, the value of moisture is 76.5%, and the pH value of the soil is seven which has acidic properties. Based on the data above, it can be seen that the air temperature in the study area is high because it is located in the lowlands. In addition to the air temperature, the light intensity in this rubber plantation is relatively high, making it suitable as a breeding ground for weeds that are so fast. In conditions with environmental factors like this, weed species are more dominant than other plant species. Sastroutomo (1990) explained that weed communities vary from place to place, both on the same plantation or different plantations. In general, weeds will adapt to conditions suitable environment for growth. In addition, abiotic environmental factors such as temperature, humidity, and edaphic factors also affect this.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of research conducted at PT Perkebunan Nusantara VIII (Persero) Kebun Batulawang, it can be concluded that weeds diversity in rubber plantations consists of 38 species with a diversity index (H') = 4.66. The species with the highest IVI is *Ischaemum timorense*. The dominant weeds found in rubber plantations were *Ischaemum timorense*, *Spermacoce alata*, and *Peperomia pellucida*.

The weed diversity data from this study should be used as a basis for weed management to obtain appropriate and efficient weeds management methods. These results can also be used for weeds management and plant ecological situations.

FURTHER STUDY

Based on this research, can propose subsequent studies such as long-term monitoring and weeds ecological study as well as plant biodiversity in the study site.

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