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Weed's Vegetation Analysis of Centella (*Centella asiatica* L. Urban) Plantations

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Abstract

Centella (*Centella asiatica* L. Urban) originally is a wild plant that is being cultivated to be medicinal and cosmetics raw material. The process of centella cultivation is relatively easy and can be grown in a variety of altitudes. One obstacle in centella cultivation is weed growth. The proper handling of weeds in centella plantation requires data on the weed types and characteristics. This research aimed to determine the weed types and the amount of weed found in centella cultivation. Sampling was carried out purposively based on the presence of weeds in the cultivation area. Weed inventory was carried out using linear vegetation methods in 12 plantation beds of centella, with a size of 6 m^2 x 2 m^2 each. Observations were made during weeding on one cropping season. Weed inventory was carried out by recording the number of species and number of individual weed and taking documentation of weeds that were recorded for identification purposes. Research data were analyzed by using vegetation analysis. The weed vegetation analysis on centella plantations showed that there were 35 species of weeds identified from 20 plant families. *Cyperus rotundus* L. dominates the weed vegetation in centella plantations because of its high adaptability and its allelochemical exudates. To sustainably cultivate the centella, proper techniques of weed controls need to be applied by considering the nature of *Cyperus rotundus* L.

Keywords: centella; vegetation analyze; weed community

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INTRODUCTION

Centella (*Centella asiatica* L. Urban) is a perennial medicinal plant of the *Apiaceae* family. Centella grows creeping and it is a bit aromatic. The dispersion area of centella is quite extensive, including tropical and subtropical regions (Hashim, 2011; Jahan et al., 2012). Centella usage in food and drinks increased because of its antioxidant, antimicrobial, cytotoxic, neuro-protective and its other properties. There are studies related to the nature and action mechanism of the bioactive constituents of centella plants namely triterpenic acid (asiatic acid madekasat acid), triterpenic saponins (madecassoside and asiaticoside), flavanoids and other phenolic compounds (Januwati et al., 2002; Seevaratnam et al., 2012). Centella is also used in the drugs and cosmetics industry because of its variety of properties (Sari and Diana, 2017). The increasing demand of centella as an industrial raw material requires standardization in the medicinal plant cultivation system that meets the requirements of the Good Agriculture Practice (GAP) (Menkes RI, 2013).

In the cultivation of medicinal plants, external or environmental factors need to be considered

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to produce a product with the required quality and quantity (Susanti and Safrina, 2018). Obstacle of medicinal plants cultivation are weeds or plants that interfere with plant growth and development. Weed is a competitor for the main plants in utilizing nutrients, water, light and space. It reduces the efficiency of fertilizer; interferes with and reduces the production of major crops (Suryaningsih et al., 2011). The presence of weeds causes competition between weeds and plants to get the same growing medium where the amount is limited. The type and density of weeds is a factor causing competition. Depressed growth and low yields of major crops are caused by weeds which able to compete and secrete allelopathic substances that inhibit the growth of plants around them (Oksari, 2014).

Devkota and Jha (2010) research showed that there is an allelopathic effect of aqueous extracts of *Parthenium hysterophorus*, *Chromolaena odorata*, *Ageratum conyzoides* and *Xanthium strumarium* that significantly inhibiting *C. asiatica* seed germination. Several studies related to weeds are the dominant weeds in rubber plantations which included the families of *Graminae*, *Compositae* and *Cyperaceae*, while the dominant weeds in maize plantations are *Asteraceae* and *Poaceae* (Suryaningsih et al., 2011; Sari and Rahayu, 2013). Weeds are the most severe and widespread biological constraint on crop production and cause imperceptible damage until the crops are harvested. There is an inhibitory and stimulatory activity on the percentage of germination of seeds and growth of tomato seedlings (Ali et al., 2014). In sugarcane cultivation, the presence of weeds can reduce sugarcane weight production and sugarcane yield, therefore weed control needs to be done (Pariyanto et al., 2015).

The proper weeding regime for effective and economic weed management needs to be done to obtain high yields and profit. Weeding regime gives effect on rice plant height and yield (Khan et al., 2017). The age of young plants becomes a critical period because the influence of weeds is very visible. Efforts to control weeds must be implemented more intensively by pondering economic threshold factors. Weeding regime is primarily aimed at suppressing the growth of weeds to the limits of economic damage (Barus, 2003). Research conducted by Widayat and Purba (2015), Kilkoda et al. (2015) and Prayogo et al. (2017) on rice and soybean plants proved that weed control efforts can increase yields. Understanding the types of weeds that are common in planted areas and the factors that cause the emergence of these weeds is important as preventive efforts to control weeds. Other important information is related to the methods of reproduction, location of distribution and population dynamics of weeds. Weed diversity on agricultural land is largely influenced by climate and agroecological status.

In sustainable agriculture, farmers need to be aware of the life cycle of the weed species and have knowledge about when and what actions should be taken to control weeds on the cultivated site (Sims et al., 2018). In order to maintain sustainable agriculture, we need to improve knowledge regarding the agriculture system. Production system aspects need to be considered to do the soil management such as leveling field surface, choose the crops by the points of view of production residue, the depth of rooting system, soil nutrition, planning the weed control strategies and also assessing the required machinery (Sims et al., 2009).

Weed population in one region is different from other regions. The weed community pattern changes according to the influencing factors. The types of weeds in an area need to be known for the importance of managing weed vegetation that disturbs the main crops (Faisal et al., 2015). This research was conducted to identify the types of weeds found in centella plantations and to analyze it's vegetation, thereby it can be used as a basic reference in controlling weeds in centella cultivation.

MATERIALS AND METHOD

The research was conducted from October 2018 until May 2019 at the Center of Medicinal Plant and Traditional Medicine Research and Development's Field Station in Tohkuning Village, Karangpandan Sub-district, Karanganyar Regency, Central Java Province of Indonesia (7°36'39.6" South Latitude - 111°03'14.6" East Longitude) using a survey method and Integrated Laboratory.

This research was aimed to determine the weeds types and amount found in centella

cultivation. Sampling was carried out in purposive manners based on the presence of weeds in the cultivation area. Weeds observation was carried out in linear methods on 12 plantation beds of centella, with a plot of 6 m^2 x 2 m^2 in each as observation unit. Individual weed used in this research was collected in seedling level vegetation form which was intersected by the transect line. Individuals with unknown identities will be identified in the laboratory.

Weeds observations were made during weeding on one cropping season. Weeds observation was carried out by recording the number of species and number of individual weeds and taking documentation of weeds that were recorded for identification purposes. The material used in this research was centella cultivation. The tools used in this study were manual counting tools, a camera, a photo mat and books for plant identification. The obtained plants were identified by comparing them with the plant identification book and inquires the experts. However, if it was not possible, they were only identified according to the genus. Identified plants grouped into weed groups using a weed identification book; Hand Book on Weed Identification.

For the estimated parameters were Density (D), Relative Density (RD), Frequency (F), Relative Frequency (RF), Importance Value Index (IVI) and Sum Dominance Ratio (SDR) with the following formulas:

$$D = \frac{\text{abundance of an individual species}}{\text{observation plot area}}$$

$$RD = \left(\frac{\text{density of an individual species}}{\text{density of all species}}\right) x\ 100\%$$

$$F = \frac{\text{number of plots where a species found}}{\text{number of total observation plots}}$$

$$RF = \left(\frac{\text{frequency of an individual species}}{\text{frequency of all species}}\right) x\ 100\%$$

$$IVI = RD + RF \text{ (Gunawan et al., 2011)}$$

$$SDR = \frac{IVI}{2} \text{ (Dahang, 2018)}$$

$$\text{Diversity index (H')} = -\sum\left(\left(\frac{\text{abundance of the i-th species}}{\text{abundance of total species}}\right) x \ln\left(\frac{\text{abundance of the i-th species}}{\text{abundance of total species}}\right)\right)$$

(Mariana and Warso, 2016)

D is the number of individuals per unit area or per unit volume. RD is the ratio of one type of vegetation density to all vegetation types densities in an area. F is a value that indicates the spread of a vegetation type in a number of sample plots under study. RF is the percentage ratio between the frequency of a vegetation type with the frequency of all vegetation types in the area. IVI shows the ecological importance of a plant species and shows its role in a community so that it is known to be influential or not. SDR is the level of dominance of species in a plant community. H' (Shanon-Weiner index) is an index that shows the level of environmental stability in the conditions of interaction between species in the environment (Aditama and Kurniawan, 2013).

RESULTS AND DISCUSSION

Weeds are plants that grow around cultivated plants that can inhibit the growth of Centella plants. The presence of weeds causes competition between weeds and cultivated plants for available soil nutrients. This research needs to be done as a basic reference in weed control in Centella cultivation. Based on the identification results, 35 weed species were found in centella plantations. The identified weeds in centella plantations belong to 20 plant families, while the two species have not been identified (Table 1).

Table 1. Weeds species found in centella plantations in Tohkuning Village, Karangpandan Sub-district, Karanganyar Regency

No.	Plant family	No.	Species name	Number of individuals
1.	*Achantaceae*	1.	*Ruellia napifera* Zoll. and Moritzi (Unresolved name)	2
2.	*Amaranthaceae*	2.	*Alternanthera philoxeroides* (Mart.) Griseb.	99
		3.	*Amaranthus hybridus* L.	9
3.	*Araceae*	4.	*Amorphophallus paeoniifolius* (Dennst.) Nicolson	1
4.	*Brassicaceae*	5.	*Rorippa indica* (L.) Hiern	13
		6.	*Cardamine flexuosa* With	2
5.	*Caricaceae*	7.	*Carica papaya* L.	1
6.	*Caryophyllaceae*	8.	*Drymaria cordata* (L.) Willd. ex Schull.	1
7.	*Cleomaceae*	9.	*Cleome rutidosperma* D.C.	43
8.	*Commelinaceae*	10.	*Commelina diffusa* Burm. f.	26
9.	*Compositae*	11.	*Eclipta prostrata* (L.) L.	145
		12.	*Emilia sonchifolia* (L.) DC. ex DC.	51
		13.	*Ageratum conyzoides* (L.) L.	34
		14.	*Crassocephalum crepidioides* (Benth.) S. Moore	8
		15.	*Sonchus arvensis* L.	3
		16.	*Erigeron sumatrensis* Retz	2
		17.	*Acmella paniculata* (Wall. ex DC.) R.K. Jansen	1
10.	*Convolvulaceae*	18.	*Ipomoea* sp.	1
11.	*Cyperaceae*	19.	*Cyperus rotundus* L.	864
12.	*Euphorbiaceae*	20.	*Euphorbia hirta* L.	10
13.	*Leguminosae*	21.	*Centrosema virginianum* (L.) Benth.	1
		22.	*Desmodium canadense* (L.) DC.	1
		23.	*Mimosa pudica* L.	1
14.	*Linderniaceae*	24.	*Lindernia* sp.	1
15.	*Malvaceae*	25.	*Hibiscus sabdariffa* L.	6
		26.	*Sida alnifolia* L.	1
16.	*Oxalidaceae*	27.	*Oxalis corniculata* L.	4
17.	*Phyllanthaceae*	28.	*Phyllanthus niruri* L.	247
		29.	*Phyllanthus debilis* Klein ex Willd.	7
18.	*Poaceae*	30.	*Eleusine indica* (L.) Gaertn	10
		31.	*Cynodon dactylon* (L.) Pers.	3
19.	*Portulacaeae*	32.	*Portulaca oleracea* L.	89
20.	*Rubiaceae*	33.	*Oldenlandia corymbosa* L.	123
21.	Unidentified	34.	Species 1	1
		35.	Species 2	1

The highest percentage of weed species was found in *Compositae* family by 20%. In addition to *Compositae*, weed species from the *Leguminosae* family are also considerably large at 8.57% (Figure 1). The highest number of individual weeds was found in the *Cyperus rotundus* L. plant species, as much as 864 individuals. Several other species of weeds have quite a number namely *Alternanthera philoxeroides* (Mart.) Griseb. (99 individuals), *Eclipta prostrata* (L.) L (145 individuals), *Oldenlandia corymbosa* L. (123 individuals) and *Phyllanthus niruri* L. (247 individuals) (Table 1).

From the 25 species of weeds found in centella plantations, about 51.43% of weeds only have the number of individuals below 5, namely *Acmella paniculata* (Wall. ex DC.) R.K. Jansen, *Amorphophallus paeoniifolius* (Dennst.) Nicolson, *Cardamine flexuosa* With., *Carica papaya* L., *Centrosema virginianum* (L.) Benth., *Cynodon dactylon* (L.) Pers., *Desmodium canadense* (L.) DC., *Drymaria cordata* (L.) Willd. ex Schull., *Erigeron sumatrensis* Retz.,

Ipomoea sp., *Lindernia* sp., *Mimosa pudica* L., *Oxalis corniculata* L., *Ruellia napifera* Zoll. and Moritzi (unresolved name) and *Sida alnifolia* L. (Table 1).

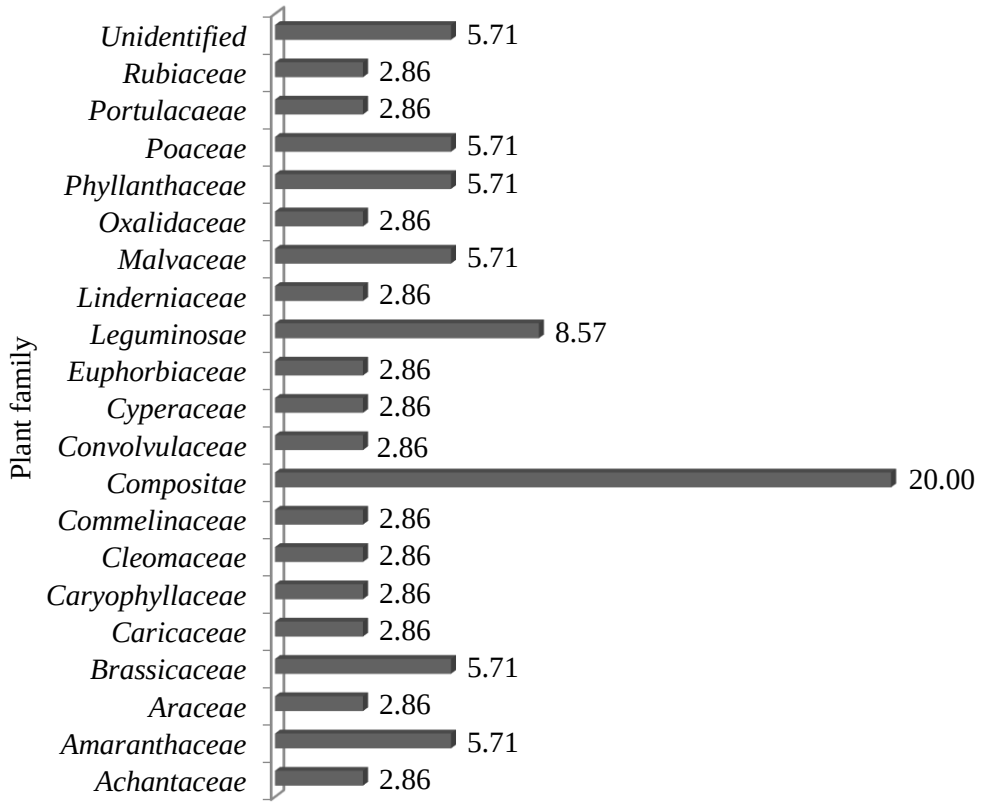


Figure 1. Percentage (%) of weed families in centella plantations

Based on their morphological characteristics, the weeds are classified into 4 groups, namely narrow-leaf weeds (grasses) which include Poaceae; nutgrass (sedges) which include *Cyperaceae*; broad leaf weeds include families other than *Poaceae* and *Cyperaceae*; and ferns (Barus, 2003). In centella plantations, identified weeds are divided into three groups, that is broad leaves, grasses and sedges. The majority of weeds found in broad leaves group by 90.91% (30 species) in centella plantations (Figure 2).

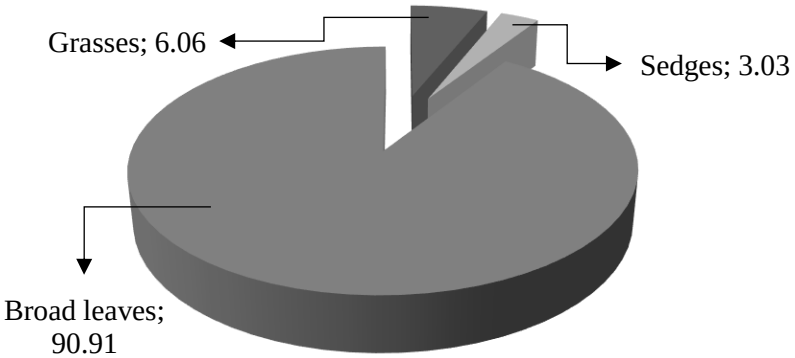
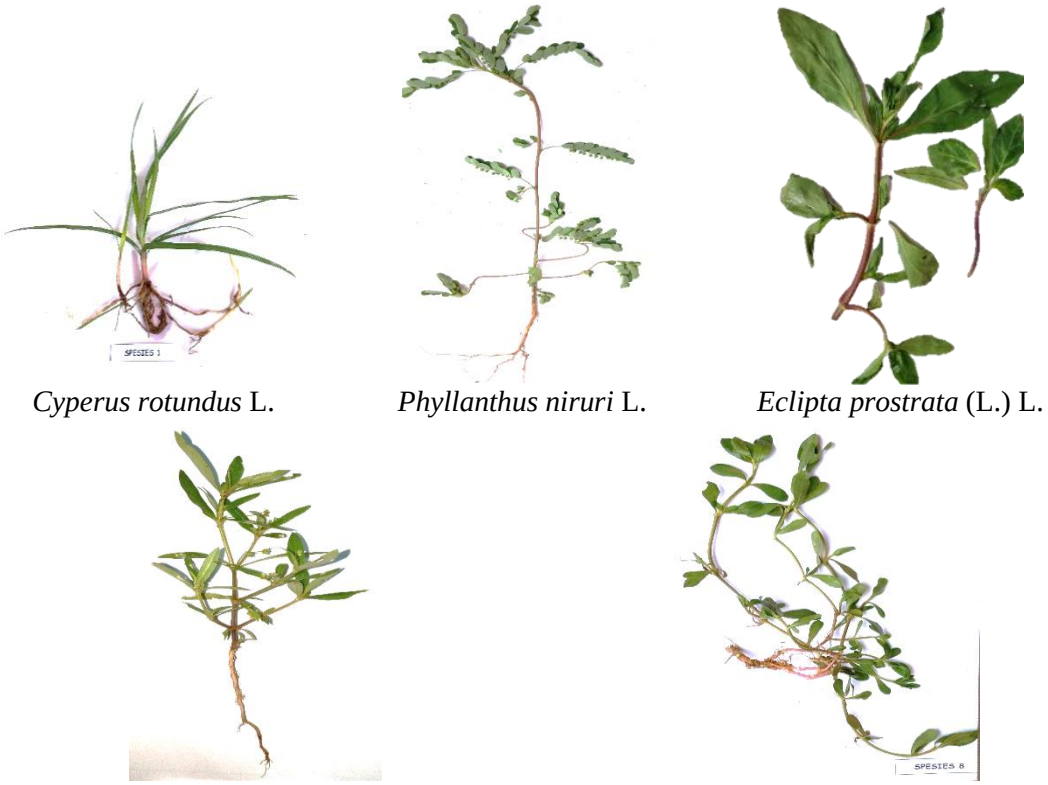


Figure 2. Percentage (%) of centella plantations weed groups based on morphological characteristics

Five weeds with the highest number of individuals belong to the sedges group (*Cyperus rotundus* L.) and broad leaves (*Alternanthera philoxeroides* (Mart.) Griseb., *Eclipta prostrata* (L.) L., *Oldenlandia corymbosa* L. and *Phyllanthus niruri* L. (Figure 3).



Cyperus rotundus L. *Phyllanthus niruri* L. *Eclipta prostrata* (L.) L.

Hedyotis corymbosa L. *Alternanthera philoxeroides* (Mart.) Griseb.

Figure 3. Five dominant weeds in centella plantations

***Alternanthera philoxeroides* (Mart.) Griseb.**

Annual creeping herb with prostrate growth. Prostrate, annual creeping herb. Stem with long crisped hairs on the younger parts. Leaf blade is inverted-lance shaped or spatula shaped, 1.5-2.0 cm long and 0.3-0.5 cm wide, tip obtuse to rounded. Stalkless flower-heads are ovoid to spherical, often hairy at base with white papery flowers. Fruit utricle orbicular. Seed discoid, 1 mm across and fairly reticulate (Naidu, 2012). *A. philoxeroides* is a weed on sugarcane (Hariri and Irsyam, 2019).

***Cyperus rotundus* L.**

A perennial sedge, known as purple nutsedge (Monaco et al., 2002). The stem is hard, fragrant, globose-ovoid tubers, up to 1.2 cm long and 0.3-0.7 cm in diameter. Culms grew solitary or few together, sparsely tufted, erect, 10-75 cm tall, 3-angled at top. Leaves are narrowly linear, shorter or longer than stem, 0.4-0.8 cm wide, dark green above, pale beneath. Inflorescence a simple or compound umbel, rays 2-8, each up to 7.5 cm long, bearing short spikes of 3-10 spreading, red-brown spikelet. *Cyperus rotundus* L. oblong to ovate-oblong, maturing brown, 3-sided, 1.3-1.5 mm long and 0.5-0.7 mm wide (Naidu, 2012). *C. rotundus* is one of the weeds in soybean and tomatoes cultivation (Ali et al., 2014; Imaniasita et al., 2020).

***Eclipta prostrata* (L.) L.**

Erect stem up to 15-50 cm tall, ascending or basal prostrate, strigose-pilose, branched at base or above, nodes rooting while touching ground. Stem color is green or reddish brown, sparsely coarse hairy. Leaves opposite, 3-10 cm long and 0.5-2.0 cm wide. Leaves blades elliptical lanceolate or linear-lanceolate, apex gradually acuminate, base cuneate gradually narrow, densely strigose-pubescent on both surface. Petiolate is sessile or short. Flower with 1-2 capitula, terminal or auxiliary, ovate, 5-10 mm in diameter. Ray florets ligulate, whitish, lamina 2.5-3.0 mm long, 0.4 mm wide, apex bifid or entire, female and fertile. Achenes developing from tubular flowers flatly 4 ribbed, 2.8 mm long, 1.5 wide and margin ribbed. Dark brown seed with truncate apex, 2.5-3.0 mm. Main root inconspicuous, branched, numerous fibrous roots (Xu and Chang, 2017). *E. prostrata*

is one of the weeds in corn cultivation (Budi, 2018).

***Oldenlandia corymbosa* L.**

An annual herb with ascending or erect stem 4 angled. Leaves are linear-oblong or narrowly elliptic, almost stalkless, 1.0-3.5 cm long and 1.5-7.0 mm wide. Midrib of the leaf is prominently visible. White or faintly pinkish-purplish flower, on slender stalks 4-8 mm long. Fruit have the shape of capsule is about 2 mm x 2 mm, flattened at apex, slightly laterally compressed (Naidu, 2012). This plant is one of the weeds in corn cultivation (Suryaningsih et al., 2011).

***Phyllanthus niruri* L.**

A small, erect, annual herb that grows up to 30–40 cm in height. The stem is quite glabrous, stem often branched at the base, leaf bearing branchlets slender and spreading. The bark is smooth and light green. The leaves are numerous, subsessile and distichous. The flowers are small, white to light yellowish. Male flowers in axillary, females in solitary. Fruit form a capsule depressed-globose and smooth scarcely lobed. Seed trigonous and rounded (Naidu, 2012). *P. niruri* is one of the weeds in rice cultivation (Syarifah et al., 2018).

Table 2. Weeds species and vegetation (frequency and density) composition in centella plantation

No.	Species name	RD (%)	RF (%)	SDR (%)	IVI (%)
1.	*Ageratum conyzoides* L.	1.88	4.20	3.04	6.07
2.	*Alternanthera philoxeroide*s (Mart.) Griseb.	5.46	5.59	5.53	11.06
3.	*Amaranthus hybridus* L.	0.50	2.10	1.30	2.59
4.	*Amorphophallus paeoniifolius* (Dennst.) Nicolson	0.06	0.70	0.38	0.75
5.	*Cardamine flexuosa* L.	0.11	0.70	0.40	0.81
6.	*Carica papaya* L.	0.06	0.70	0.38	0.75
7.	*Centrosema virginianum* (L.) Benth.	0.06	0.70	0.38	0.75
8.	*Cleome rutidosperma* D.C.	2.37	7.69	5.03	10.07
9.	*Commelina diffusa* Burm. f.	1.43	2.80	2.12	4.23
10.	*Crassocephalum crepidioides* (Benth.) S.Moore	0.44	5.59	3.02	6.04
11.	***Cyperus rotundus* L.**	**47.68**	**8.39**	**28.04**	**56.07**
12.	*Cynodon dactylon* (L.) Pers.	0.17	1.40	0.78	1.56
13.	*Desmodium canadense* (L.) DC.	0.06	0.70	0.38	0.75
14.	*Drymaria cordata* (L.) Willd. and Schull.	0.06	0.70	0.38	0.75
15.	*Eclipta prostrata* L.	8.00	**8.39**	8.20	16.39
16.	*Eleusine indica* (L.) Gaertn	0.55	2.10	1.32	2.65
17.	*Emilia sonchifolia* (L.) D.C ex Wight	2.81	4.90	3.85	7.71
18.	*Erigeron sumatrensis* Retz	0.11	1.40	0.75	1.51
19.	*Euphorbia hirta* L.	0.55	2.10	1.32	2.65
20.	*Hibiscus sabdariffa* L.	0.33	2.10	1.21	2.43
21.	*Hydeotis corymbosa* L.	6.79	6.29	6.54	13.08
22.	*Ipomoea* sp.	0.06	0.70	0.38	0.75
23.	*Lindernia* sp.	0.06	0.70	0.38	0.75
24.	*Mimosa pudica L.*	0.06	0.70	0.38	0.75
25.	*Oxalis corniculata* L.	0.22	2.80	1.51	3.02
26.	*Phyllanthus debilis* Klein ex Willd.	0.39	2.80	1.59	3.18
27.	*Phyllanthus niruri* L.	13.63	**8.39**	**11.01**	22.02
28.	*Portulaca oleracea*L.	4.91	4.20	4.55	9.11
29.	*Rorippa indica* L.	0.72	4.90	2.81	5.61
30.	*Ruellia napifera* Zoll. & Moritzi	0.11	1.40	0.75	1.51
31.	*Sida alnifolia L.*	0.06	0.70	0.38	0.75
32.	*Sonchus arvensis* L.	0.17	1.40	0.78	1.56
33.	*Spilanthes paniculata*Wall. ex DC.	0.06	0.70	0.38	0.75
34.	*Unidentified*	0.06	0.70	0.38	0.75
35.	*Unidentified*	0.06	0.70	0.38	0.75
	H’		1.93		

In general, the weed that dominates is viewed from the number of individuals compared to other types. The dominant weed in centella cultivation was *Cyperus rotundus* L. with the highest RD, SDR and the IVI compared to 34 other species. The highest RF was found in *C. rotundus* L., *E. prostrata* (L.) L. and *P. niruri* L. weeds at the same value 8.39% (Table 2).

Density

Weed density in centella plantations is in a low category based on the vegetation density category in the research of Hidayat et al. (2017), namely above 12% and below 50%. *Cyperus rotundus* L. had the highest density level compared to other weed species (Table 2).

Frequency

Overall, the presence of a weed species in centella plantations, based on the RF classification according to research conducted by Hidayat et al. (2017) and Sari et al. (2018), was included in the very low category, which was between 1-20% (class A). The highest RF values obtained in *C. rotundus* L., *E. prostrata* L. and *P. niruri* L. showed that these three types were often found in every observation plot (Table 2).

Dominance

Cyperus rotundus L. was dominating in centella plantations because it has very high dominance value compared with other weeds, namely 28.04%. *Phyllanthus niruri* L. was ranked in the second position in centella cropping right after *C. rotundus* L. The lowest dominance was occupied by several weeds (0.38%) (Table 1).

Importance Value Index

The high value of the IVI greatly affects plant communities. The IVI value was described as the influence level of a weed on the environmental ecosystem stability (Hidayat et al., 2017). The IVI categorization of weeds in centella plants was based on criteria according to Hidayat et al. (2017), *C. rotundus* L. occupied a high IVI category (56.07%), *P. niruri* L. had an IVI of the medium category and other weeds were in a low category (Table 2). In centella cropping, *C. rotundus* L. has an important role in the plant community in the planting environment.

Diversity Index

Based on H' criteria in Novelinda et al. research (2014), the H' of centella plantations (1.93) (Table 2) showed that the weeds diversity in centella plantation is at a moderate level. The high and low diversity of organisms in an ecosystem depends on the number of individuals present. The diversity of vegetation in an area is strongly influenced by environmental conditions. Extreme conditions can disturb the stability of life and plant distribution. High species diversity has a role to be an indicator of a growing environment constancy or stability. The high environmental stability shows a high complexity of composing composition with high interaction between the constituents of the environment, which increases the ability of the environment to encounter disturbances (Oksari, 2014).

In centella plantation, *C. rotundus* L. weed was mostly found because it has high adaptability to various main crops. *Cyperus rotundus* L. is classified as a ferocious weed because it can grow in extreme environmental conditions. It also can grow in various types of soil, high temperatures and has broad adaptability to grow and thrive in environments with limiting factors (Pranasari et al., 2012). *Cyperus rotundus* L. is categorized as a dangerous weed which is classified as a noxious weed because it has a detrimental effect on staple crops if it is not controlled properly (Budi, 2018). *Cyperus rotundus* L. can take control of the growing space and can compete with the growth of the main plant. This weed is a perennial plant with a wide distribution, long root systems that form complex networks in the soil and reproduce by seed (Perdana et al., 2013; Perianto et al., 2016). Even research conducted by Cirujeda et al. (2012) states that *C. rotundus* L. is considered a serious weed because it can penetrate polyethylene (PE) mulch plastic which is commonly used in horticultural crops. Also, *C. rotundus* L. belonging to the C4 group has a high light compensation point compared to broadleaf weeds which are mostly included in the group (Marsal et al., 2015).

Aside from being the light, water and nutrients fulfillment competitor, the presence of allelopathic substances released by *C. rotundus* L. also interfering plant growth (Cirujeda et al., 2012; Faisal et al., 2015). The allelochemicals released by the puzzles travel to the target organism by roots exudation. It suppresses the growth and production of cultivated plants and also the growth of other weeds (Andhini and Chozin, 2016; Dewi et al., 2017; Siregar et al., 2017).

In a sustainable medicinal plants cultivation, *Cyperus rotundus* L. weeds management can be carried out by intercropping arrangement to reduce the intensity of sunlight reaching the soil, biodegradable mulches usage and planting medicinal plants that can suppress the growth of *Cyperus rotundus* L. (Cirujeda et al., 2012; Iqbal et al., 2019; Marí et al., 2020). Manual weed control can be done periodically. In addition, bioherbicides from 50% clove extract and 50% ketapang leaves can inhibit the growth of *Cyperus rotundus* L. (Riskitavani and Purwani, 2013; Talahatu and Papilaya, 2015). The oxyfluorfen and post-growth herbicide type glyphosate can be applied to the weeds of the type of puzzle (Widaryanto, 1994; Perkasa, 2016). Bioherbicides from 0.28% pine leaf extract can produce 6.92% phytotoxicity (Siregar and Nugroho, 2020).

CONCLUSIONS

The results of weed vegetation analysis on centella plantations in Tohkuning, Karangpandan showed that weed centella plantations identified as many as 35 species of weeds from 20 families. The weed that dominant in centella plantations is *Cyperus rotundus* L. because it has allelochemical exudates and high adaptability. Sustainable centella cultivation by applying the proper weed control techniques by considering the living nature of *Cyperus rotundus* L. is necessary.

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