



IDENTIFICATION AND ANALYSIS OF WEED VEGETATION AS *Ganoderma* PRESENCE MARKER ON OIL PALM PLANTATION

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Abstract: Weeds on oil palm plantations can also be the host of Basal Stem Rot caused by *Ganoderma*. This study aims to identify and analyze of weed vegetation using visual estimation and squares method as *Ganoderma* presence marker on oil palm plantations. This research was conducted in block 17, 16, and 6 of VII afdeling, Rambutan Estate in Serdang Bedagai Regency on December 2017 to March 2018. This research used survey method with visual estimation and squares. The data used is absolute density, relative density, absolute frequency, relative frequency, important value indeks, Summed Dominance Ratio (SDR) and dry weight. Data analysis using IBM SPSS Statistics 20 software. The results showed that different weed species between oil palm was infected and uninfected by *Ganoderma* with visual estimation method is *Cyclosorus aridus* (14.78%) where as with squares method are *Cyperus rotundus* (10.60%), and *Stenochlaena palustris* (7.76%) with temperature range 28.67 to 30.80°C and moisture amount 60.67 to 77.33%.

Keywords: *Ganoderma*, oil palm plantation, weed.

I INTRODUCTION

Growing weeds on oil palm plantations are disturbing plants that can harm palm oil growth and production. The presence is able to become a major competitor in fighting for nutrients, water, growing space, and sunlight. Weeds in oil palm plantations can also be a host for pests and diseases to grow and develop [1]. Type of plant disease on oil palm plantations is basal stem rot (BSR) caused by *Ganoderma boninense*. The spread of *Ganoderma* attacks is very fast through: (1) root contact between oil palm trees, (2) *Ganoderma* spores spread through the wind, carried by insects, and (3) *Ganoderma* spores can also be spread due to harvesting and estate maintenance. In Indonesia, *G. boninense* was identified as the most common species that attack and causes the death of plants more than 80% from total oil palm populations and causes a decrease in palm oil products per hectare [2]. *Ganoderma* attacks and infects every stage of oil palm plants growth. The symptoms of a disease are slow, but it can reduce production and even kill oil palm to thousands of hectares. BSR causes serious economic losses for the oil palm industry. Therefore, BSR is considered a serious threat to oil palm industry in Southeast

Asian countries. Until now, there is still a need to detect and sustain control of this disease [3]. BSR attacks caused by *G. boninense* on oil palm plantations continue to increase [4]. The highest losses occurred in Indonesia and Malaysia, the lowest was reported in Africa, Papua New Guinea and Thailand [5]. Usually, this disease is present in mature plants. In coastal areas of Malaysia, the average yield loss is 50% of 13-year-old oil palm plantations [6]. This disease has also been reported to have a loss of 30% in 13-year-old oil palm plantations in inland and peat areas [7]. In Indonesia, plantations confront similar problems. In Sumatera Utara Province, when replanting (25 years) 40 to 50% died caused by this disease. When replanting, oil palm plants die more caused by *Ganoderma* to 25% in 7 years. The average decrease in the yield of fresh fruit bunches (FFB) from 0 to 16 ton ha⁻¹ of each dead oil palm and 35% decrease of FFB production in growing plants [8]. Some early detection of *Ganoderma* presence has been carried out through research from various scientific fields. However, there has never been researched that conducted early detection of *Ganoderma* presence based weed populations on oil palm plantations. It is necessary for identification and analysis of weed vegetation as a source of initial information to preventing of

Ganoderma presence. The purpose of this research was to identify and analyze weeds vegetation with visual estimation and squares methods as *Ganoderma* presence marker on oil palm plantations.

II MATERIALS AND METHODS

This research was conducted on block 17, 16, and 6 of VII Afdeling, Rambutan Estate PTPN. III Serdang Bedagai Regency, Sumatera Utara Province. This research was conducted from December 2017 to March 2018. Materials used in this study were weed species originating from oil palm plantations, weed identification book (Flora), data books, hygrometer, and thermometer. Weed species observed from oil palm was infected and uninfected by *Ganoderma* from each block. The method used was survey method in two ways such as (1) visual estimation method and (2) squares method on oil palm plantations was infected and uninfected by *Ganoderma* (Figure 1). The parameters observed in the visual estimation method include Summed Dominance Ratio (SDR). Parameters observed in the squares method include absolute density, relative

density/nisbi, absolute frequency, relative frequency/nisbi, important value index, SDR [9] and dry weight. After weeds are identified, then cut right on the surface of soil from each plot. Then it is drying at 80°C for 48 h [10], to obtain a constant dry weight. Analysis using with IBM SPSS Statistics 20 software.

III RESULT AND DISCUSSION

Based on identification and analysis of weed vegetation that has been carried out with visual estimation methods on oil palm was infected and uninfected by *Ganoderma* (Table 1). Results showed there are 5 from 24 weeds species are dominant from oil palm was infected and uninfected by *Ganoderma* on visual estimation method. Based on the dominant weeds, a different species was obtained that is *Cyclosorus aridus* (14.78%) on oil palm was infected but not found to uninfected by *Ganoderma*. Presence this species is still relatively low. It is assumed the presence of these weed species has the potential as host plants for *Ganoderma* fungal spores.

Absolute Density (AD) = Number of individual specific weed species on sample plots (1)

$$\text{Relative Density (RD)} = \frac{\text{Absolute density of certain species}}{\text{Sum absolute density of all spesies}} \times 100\% \quad (2)$$

Absolute Frequency (AF) = Number of sample plots containing certain species (3)

$$\text{Relative Frequency (RF)} = \frac{\text{Relative frequency of certain spesies}}{\text{sum relative frequency of all spesies}} \times 100\% \quad (4)$$

Important Value Index (IVI) = Relative Density (RD) + Relative Frequency (RF) (5)

$$\text{Summed Dominance Ratio (SDR)} = \frac{\text{Relative Density (RD)} + \text{Relative Frequency (RF)}}{2} \quad (6)$$



Figure 1. Weeds species on oil palm plantations was (a) infected and (b) uninfected by *Ganoderma*

Table 1. Summed Dominance Ratio (SDR) of weed species on oil palm was infected and uninfected by *Ganoderma* with visual estimation method

No.	Summed Dominance Ratio (SDR) (%)			
	Weed Species	Infected by <i>Ganoderma</i>	Weed Species	Uninfected by <i>Ganoderma</i>
1	<i>Ottochloa nodosa</i>	37.58	<i>Ottochloa nodosa</i>	25.15
2	<i>Asystasia intrusa</i>	16.03	<i>Asystasia intrusa</i>	18.83
3	<i>Cyclosorus aridus</i>	14.78	<i>Stenochlaena palustris</i>	16.87
4	<i>Cyperus brevifolius</i>	9.12	<i>Axonopus compressus</i>	7.00
5	<i>Stenochlaena palustris</i>	6.75	<i>Cyperus brevifolius</i>	6.83
6	<i>Axonopus compressus</i>	4.80	<i>Eleusine indica</i>	6.58
7	<i>Mucuna bracteata</i>	2.08	<i>Typhonium blumei</i>	2.92
8	<i>Clidemia hirta</i>	1.65	<i>Cyrtococcum patens</i>	2.17
9	<i>Cyrtococcum patens</i>	1.17	<i>Centotheca lappacea</i>	2.08
10	<i>Setaria plicata</i>	0.88	<i>Mucuna bracteata</i>	1.78
11	<i>Dieffenbachia seguine</i>	0.83	<i>Cyclosorus aridus</i>	1.77
12	<i>Cyperus rotundus</i>	0.67	<i>Clidemia hirta</i>	1.52
13	<i>Eleusine indica</i>	0.67	<i>Setaria plicata</i>	1.47
14	<i>Ageratum conyzoides</i>	0.62	<i>Ageratum conyzoides</i>	1.25
15	<i>Ophioglossum reticulatum</i>	0.58	<i>Cyperus rotundus</i>	1.25
16	<i>Mimosa pudica</i>	0.53	<i>Cleome rutidosperma</i>	0.50
17	<i>Phyllanthus urinaria</i>	0.40	<i>Mimosa pudica</i>	0.47
18	<i>Centotheca lappacea</i>	0.38	<i>Nephrolepis biserrata</i>	0.33
19	<i>Cleome rutidosperma</i>	0.38	<i>Dieffenbachia seguine</i>	0.25
20	<i>Peperomia pellucida</i>	0.08	<i>Ophioglossum reticulatum</i>	0.25
21	<i>Echinochloa colona</i>	0.00	<i>Peperomia pellucida</i>	0.25
22	<i>Imperata cylindrica</i>	0.00	<i>Phyllanthus urinaria</i>	0.20
23	<i>Nephrolepis biserrata</i>	0.00	<i>Echinochloa colona</i>	0.17
24	<i>Typhonium blumei</i>	0.00	<i>Imperata cylindrica</i>	0.17

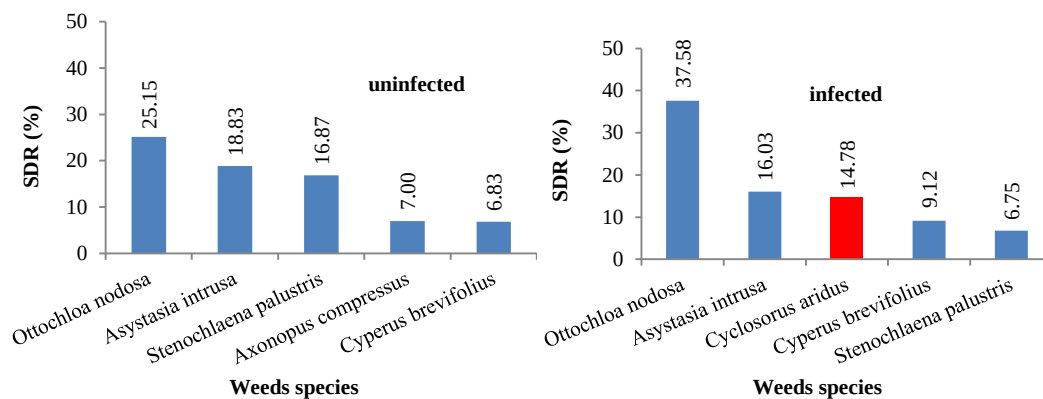


Figure 2. Differences weeds species on oil palm was infected and uninfected by *Ganoderma* with visual estimation method.

The difference in species of weeds on oil palm was infected and uninfected by *Ganoderma* with visual estimation methods (Figure 2). Based on field observations, only *Cyclosorus aridus* species (ferns group) found was infected but not found to uninfected by *Ganoderma*. This can be seen when observing at the field, every available weed population of ferns, there are also *Ganoderma* which grow and develop at the basal stem of oil palm. Observations at the field using the squares method obtained 19 weed species on oil palm was infected and uninfected by *Ganoderma* (Table 2). Results showed there

5 weeds species are dominant on oil palm was infected and uninfected by *Ganoderma* with squares method. Based on dominant weeds there are two different species that is *Cyperus rotundus* (10.60%) and *Stenochlaena palustris* (7.76%) found on oil palm was infected but not found to uninfected by *Ganoderma*. This shows that species are classified as sedges and ferns weeds. This means that visual estimation methods and squares show the same results (ferns weed group). It is assumed the presence of these weed species has potential as host plants for *Ganoderma* fungal spores.

Table 2. Summed Dominance Ratio (SDR) of weed species on oil palm was infected and uninfected by *Ganoderma* with squares method.

No.	Summed Dominance Ratio (SDR) (%)			
	Weed Spesies	Infected by <i>Ganoderma</i>	Weed Spesies	Uninfected by <i>Ganoderma</i>
1	<i>Ottlochloa nodosa</i>	21.10	<i>Asystasia intrusa</i>	28.24
2	<i>Asystasia intrusa</i>	19.09	<i>Ottlochloa nodosa</i>	26.46
3	<i>Paspalum scrobiculatum</i>	15.67	<i>Paspalum scrobiculatum</i>	9.13
4	<i>Cyperus rotundus</i>	10.60	<i>Setaria plicata</i>	6.01
5	<i>Stenochlaena palustris</i>	7.76	<i>Cyrtococcum patens</i>	4.61
6	<i>Typhonium blumei</i>	6.76	<i>Cyperus rotundus</i>	4.01
7	<i>Cyclosorus aridus</i>	2.86	<i>Eleusine indica</i>	3.60
8	<i>Axonopus compressus</i>	2.70	<i>Typhonium blumei</i>	2.68
9	<i>Cyperus brevifolius</i>	2.25	<i>Cyperus brevifolius</i>	2.65
10	<i>Mucuna bracteata</i>	2.21	<i>Imperata cylindrica</i>	2.42
11	<i>Eleusine indica</i>	2.02	<i>Axonopus compressus</i>	1.99
12	<i>Clidemia hirta</i>	1.28	<i>Phyllanthus urinaria</i>	1.50
13	<i>Cleome rutidosperma</i>	1.19	<i>Mucuna bracteata</i>	1.25
14	<i>Ageratum conyzoides</i>	1.16	<i>Peperomia pellucida</i>	1.16
15	<i>Melostona molobathricum</i>	1.01	<i>Nephrolepis biserrata</i>	1.15
16	<i>Centotheca lappacea</i>	0.77	<i>Centotheca lappacea</i>	1.11
17	<i>Echinochloa colona</i>	0.58	<i>Cyclosorus aridus</i>	0.91
18	<i>Phyllanthus urinaria</i>	0.54	<i>Ageratum conyzoides</i>	0.57
19	<i>Lantana camara</i>	0.45	<i>Borreria alata</i>	0.54

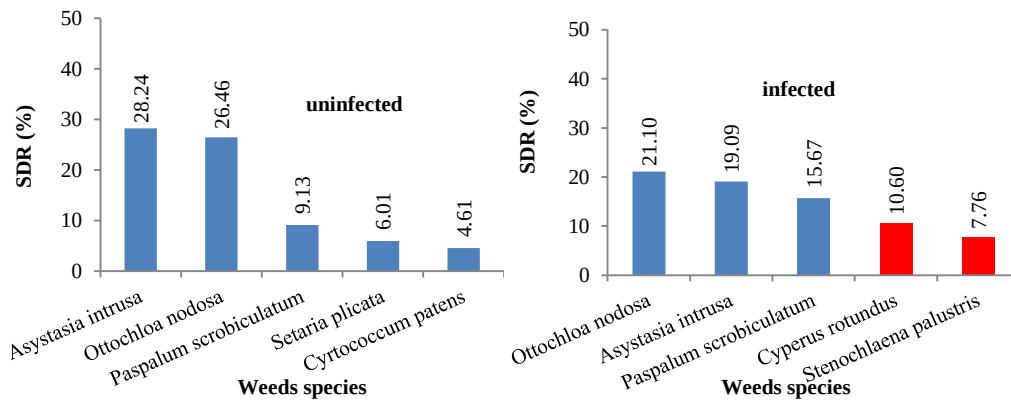


Figure 3. Differences weeds species on oil palm was infected and uninfected by *Ganoderma* with squares method.

The difference weeds species on oil palm was infected and uninfected by *Ganoderma* with squares method (Figure 3). Based on field observations there are *Cyperus rotundus* (sedges), and *Stenochlaena palustris* (ferns) species which contain on oil palm was infected but not found to uninfected by *Ganoderma*. This is caused the condition of land on moist ferns, so it can be assumed the ferns weed have nutrient content that is not balanced between Cu and Zn at leaves. This nutrient imbalance resulted the distribution of *Ganoderma* fungal spores developing on ferns weed leaves and spreading to basal stem of oil palm. This is

consistent with literature [11] which states that high content of Cu and Zn on oil palm leaves significantly lower infected with *Ganoderma*.he relationship between SDR and dry weight of weed species on oil palm was infected and uninfected by *Ganoderma* with squares method (Figure 4). Based on 5 dominant weed species, *Paspalum scrobiculatum* have highest dry weight on oil palm was infected by *Ganoderma* amount 5.71 g. *Asystasia intrusa* species have highest dry weight on oil palm uninfected by *Ganoderma* amount 5.03 g. This relationship occurs where ganoderma spores do not harm growth and development of weeds.

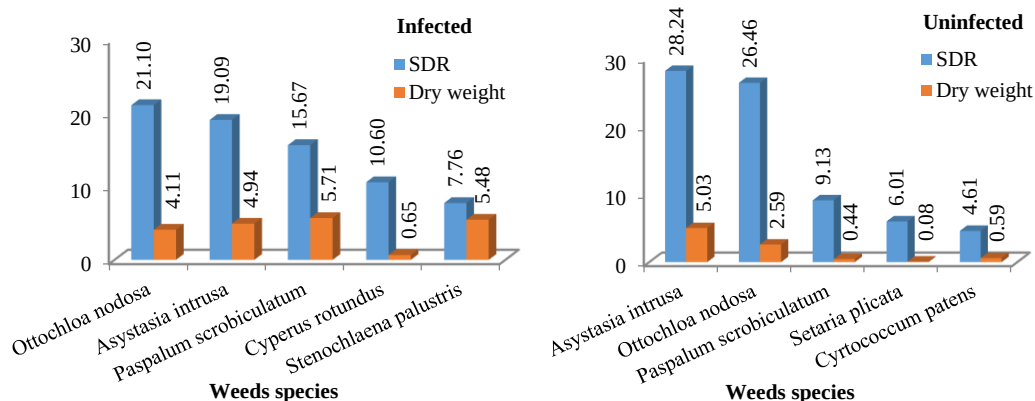


Figure 4. The relationship between SDR and dry weight of 5 weeds species on oil palm was infected and uninfected by *Ganoderma* with squares method.

Table 3. The temperature and moisture factors on oil palm plantations was infected and uninfected by *Ganoderma*.

Block	Category	Sample	Coordinates		Temperature (°C)	Moisture (%)
17 (18 ha)	Infected by <i>Ganoderma</i>	1	99 ⁰ 10.70 B	3 ⁰ 25.88 U	31.0	66
		2	99 ⁰ 10.27 B	3 ⁰ 26.18 U	29.9	70
		3	99 ⁰ 10.37 B	3 ⁰ 25.92 U	28.4	77
	Uninfected by <i>Ganoderma</i>	1	99 ⁰ 10.15 B	3 ⁰ 26.21 U	27.0	79
		2	99 ⁰ 10.17 B	3 ⁰ 26.27 U	27.7	76
		3	99 ⁰ 10.17 B	3 ⁰ 26.20 U	27.3	80
16 (21 ha)	Infected by <i>Ganoderma</i>	1	99 ⁰ 10.33 B	3 ⁰ 25.93 U	32.6	60
		2	99 ⁰ 10.18 B	3 ⁰ 25.87 U	31.0	59
		3	99 ⁰ 10.19 B	3 ⁰ 25.92 U	28.8	63
	Uninfected by <i>Ganoderma</i>	1	99 ⁰ 10.27 B	3 ⁰ 25.88 U	30.1	59
		2	99 ⁰ 09.88 B	3 ⁰ 26.11 U	27.2	70
		3	99 ⁰ 09.88 B	3 ⁰ 26.11 U	27.4	75
6 (6.5 ha)	Infected by <i>Ganoderma</i>	1	99 ⁰ 09.93 B	3 ⁰ 26.32 U	29.0	70
		2	99 ⁰ 09.91 B	3 ⁰ 26.11 U	29.0	79
		3	99 ⁰ 09.78 B	3 ⁰ 26.04 U	28.0	83
	Uninfected by <i>Ganoderma</i>	1	99 ⁰ 09.95 B	3 ⁰ 26.21 U	28.8	67
		2	99 ⁰ 09.91 B	3 ⁰ 26.32 U	28.5	78
		3	99 ⁰ 09.86 B	3 ⁰ 26.23 U	26.7	86

The temperature and moisture factors on oil palm plantations was infected and uninfected by *Ganoderma* (Table 3). Result showed that average temperature/moisture on oil palm was infected by *Ganoderma* at block 17, 16, and 06 amount 29.77°C/71.00%; 30.80°C/60.67%; 28.67°C/77.33% respectively. The density of weed species on oil palm plantations will affect the microclimate such as temperature and moisture that can support growth of *Ganoderma* spores, especially species *Cyclosorus aridus*, *Cyperus rotundus* and *Stenochlaena palustris* which have dominated in research area. Temperatures range from 28.67 to 30.80°C and moisture from 60.67 to 77.33%. This is the ideal condition for *Ganoderma* growing. This is consistent with literature [12] which states that *G. boninense* inhibited at sunlight area (40 to 45°C) while optimal invitro growth is 25 to 30°C.

CONCLUSION

Different weed species between oil palm was infected and uninfected by *Ganoderma* in Rambutan Estate with visual estimation method is *Cyclosorus aridus* (14.78%) while squares method are *Cyperus rotundus* (10.60%) and *Stenochlaena palustris* (7.76%) with temperatures ranging from 28.67 to 30.80°C and moisture amount 60.67 to 77.33%.

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