DOI :https://doi.org/10.36378/juatika.v4i1.1820
JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL.4 NO. 1 January 2022
eissn 2656-1727
pissn 2684-785X
Hal : 198 – 205

Exploration And Characterization Of Fungi From Oil Palm Rhizosphere (*Elaeis guneensis jacq*) On People's Plantations In Kuantan Singingi Regency

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ABSTRACT

The rhizosphere is an excellent habitat for microbial growth because plant roots provide a variety of organic materials that generally stimulate microbial growth. This study aimed to explore and determine the character of fungi from oil palm rhizosphere (*Elaeis guneensis Jacq*) on smallholder plantations in Kuantan Singingi Regency. This research was conducted at the Islamic University of Kuantan Singingi. The method used was an experimental method carried out in two stages. The first stage was a random sampling survey. The sample was then taken to the Basic Laboratory of the Faculty of Agriculture, Kuantan Singingi Islamic University for analysis. They are Singingi Hilir District, Kuantan Mudik District, Kuantan Tengah District, Benai District, Pangean District and Sintajo Raya District. The most isolates were found in Singingi Hilir sub-district, the plant age was 2 years and the fertile soil was blackish brown. The least number of isolates was found at the age of 10 years, even though the soil was fertile. The age of the plant affected the microbial activity in the rhizosphere. The older the plant the microbial activity decreased. Therefore, it caused the number of isolates found to be small. Characteristics of isolates isolated at a younger plant age were more varied in color.

Keywords : *Fungi*, *Rhizosfer*, *Palm Oil*

1. INTRODUCTION

Palm oil (*Elaeis guineensis* Jacq) is a plantation crop that is in great demand because it can improve the community's economy and foreign exchange. Palm oil plantations have been managed and planted on a small scale by the community or on a large scale by plantation companies (Rosa and Zaman, 2017). Currently, Riau is still ranked first with the largest palm oil plantation area in Indonesia, reaching 2.85 million hectares in 2020. With a production of 9.98 million tons (Central Bureau of Statistics, 2020).

Cultivation of palm oil is inseparable from various disturbances. One of which is pests and diseases. Pests that are often found in oil palm plants are oil palm leaf-eating caterpillars (fire caterpillars and bagworms), and horn beetles. Palm oil leaf-eating caterpillars attacked the immature plant (TBM) and mature (TM) stages.

Bagworms are good to be found on older plants, while fire caterpillars are more commonly found in palm oil plants under the age of three years (Agustina, 2021). High horn beetle attacks on palm oil plantations in TBM 2 and TBM 3 areas (Apriyaldi, 2015). Important pathogens that often attack palm oil plants are *Ganoderma boninense* which causes stem rot disease, *Marasmius palmivorus* can cause bunch rot disease, *Fusarium oxysporum* is a fusarium wilt pathogen. (Kalpajar et al., 2015). The presence of microbes around plants is able to suppress pests and plant diseases. The diversity of microorganisms in the rhizosphere is an indicator of soil health. The abundance of microorganism populations in the soil in particular can be supported by the availability of organic matter, humidity and temperature as well as aeration the good one.

Microbes belonging to the fungus group in the rhizosphere zone play a role in decomposing organic matter and helping plant growth (*Murali et al*., 2012). Most of the rhizosphere fungi have the ability to promote plant development as well as suppress the development of pathogens known as Plant Growth Promoting Fungi (PGPF) such as *Trichoderma spp* and *Rhizoctonia spp*. It is known to be able to stimulate plant growth by producing growth hormones that stimulate plant growth (*Payangan et al*., 2019). Examples of biological agents from the rhizosphere are *Trichoderma*, *Penicillium* and *Aspergillus* which can act as *biopesticides* or *biofertilizers* because they secrete certain antibiotic-like substances or secondary metabolites to suppress the development of pathogens. In addition, it can also act as a decomposer to increase soil fertility so as to trigger plant growth. Ohiwal et al., (2017) stated that the age of the plant and the application of amileoran material affect the number of fungal populations isolated on the rhizosphere of oil palm plants on peatlands.

Many palm oil plantations are cultivated in Kuantan Singi Regency, both on a company scale and smallholder plantations. Smallholder oil palm plantations are palm oil plantations that are managed on a small scale by the community with a land area of 1-6 ha. Differences in the cultivation system of managed palm oil companies and smallholder plantations affect the abundance of microbes in the rhizosphere. Soil conditions and age of smallholder palm oil plants in Kuantan Singingi district are uniform. Exploration of microbial populations in Kuantan Singingi has not been studied before. Therefore, it is necessary to explore and characterize microbes from coconut rhizosphere palm oil specifically on smallholder plantations. Based on research conducted by Ohiwal et al., (2017) stating that on peatland rhizosphere microbial populations are more commonly found in palm oil plants under 6 years of age.

This study aimed to explore and determine the character of fungi from the oil palm rhizosphere (*Elaeis guneensis Jacq*) on smallholder plantations in Kuantan Singingi Regency.

2. RESEARCH METHOD

Place and Time

This research consisted of two stages. They were research sampling and isolation process. Sampling was carried

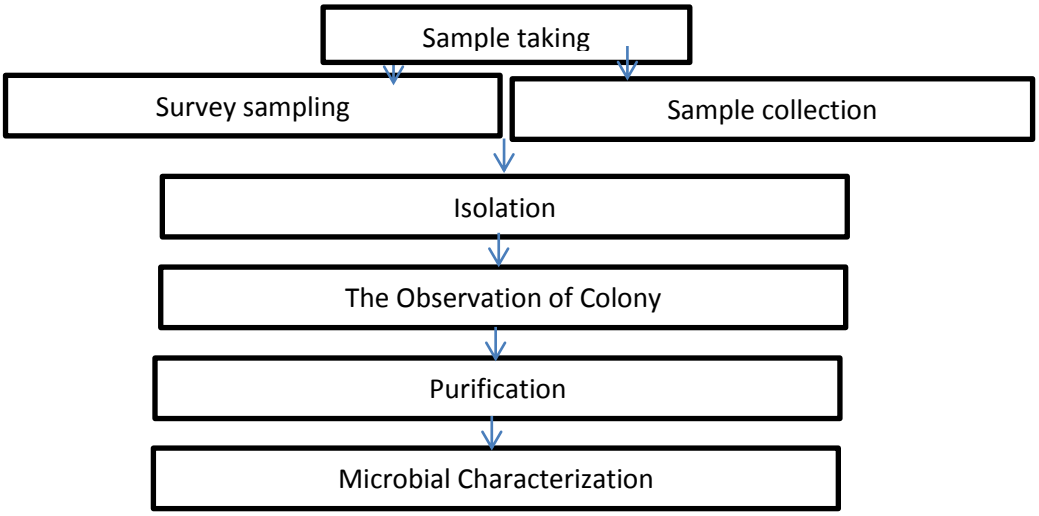
out on smallholder palm oil plantations in several sub-districts in Kuantan Singingi Regency. The isolation process was carried out at the Basic Laboratory of the Faculty of Agriculture. This research was carried out for 5 months started from July 2021 to November 2021.

Tools and Materials

The tools used in this study were plastic bags, paper labels, petri dishes, measuring cups, pans, stoves, Belgian drills and stationery. The materials used in this study included soil samples, Potato Dextrose Agar (PDA) media, NaOCl (Sodium Hypochlorite), sterile distilled water, 70% alcohol, gelatine, mask and aluminum foil.

Research Method

The activities in this study consisted of 2 stages. They are sampling of oil palm rhizosphere soil and isolation in the laboratory. Sampling was carried out by *random sampling* on smallholder plantations in several sub-districts in Kuantan singing Regency. Soil samples were taken on healthy palm oil plants. Soil sampling was carried out on composite plants at a depth of 0-25 cm from 4 cardinal directions in the rhizosphere of palm oil plants (Andryan *et al*., 2017).



Picture 1. Research Flowchart

The soil taken was composited and depreciated up to 250gram quarterly. Then the soil sample was put into a plastic bag and labeled containing information about the origin and environmental conditions, the use of pesticides. Furthermore, the soil sample was cleaned of plant roots, sieved using a coarse sieve and put into a plastic box and ready to be isolated.

Microbial isolation was carried out using the dilution method by making a series of dilutions. The dilutions used are 10-1, 10-2. *Potato Dexrose* AgarPDA media with the addition of antibiotics was used to grow and isolate fungi. The incubation process was carried out at room temperature for 3-7 days. Observations were made on days 3-7 to see the character of the growing colonies.

Observation Parameter

General Conditions for Taking Sample

The general condition of sampling is known by noting the environmental conditions and the cultivation system of the oil palm plantations that are sampled.

Number of Colonies

The number of colonies was obtained by counting each colony that grew in each isolation dilution series. The number of colonies were calculated on day 3 to day 5.

Morphological Characteristics of Isolates

The morphological characteristics of the isolates were obtained by describing the shape, color, and margins of the fungus growing on PDA media. The data obtained was displayed in the form of tables and figures.

3. RESULTS AND DISCUSSION

General Conditions for Samples

Sampling on the rhizosphere of oil palm plant was carried out by doing a survey with random sampling method. Kuantan Singingi Regency has 15 sub-districts, from 15 sub-districts there are 6 sub-districts that were used as a place for sampling the rhizosphere of oil palm plants in smallholder plantations. Sampling was carried out in Benai sub-district, Singingi Hilir district, Kuantan Tengah district, Pangean district, Kuantan Mudik district, and Sintajo Raya district. The general conditions of the sampling locations are presented in Table 1.

Table 1.General Conditions of Oil Palm Rhizosphere Sampling Locations in People's Plantation in Kuantan Singingi Regency

Location Sampling	Plant Age	Soil Condition
Singingi Hilir District	2 years	Fertile soil, yellowish brown with sandy texture, per weed around the plate
Benai District	8 years	Fertile soil, yellowish brown in color with a sandy texture, useful around the plate
Kuantan Tengah District	10 years	The fertile soil is black and loose, the plate is clean from weeds
Pangean District	10 years	The fertile soil is black and loose, the disc is clean from weeds
Kuantan Mudik District	10 years	Fertile soil with a yellowish-brown color, the disc is free of weeds
Sintajo raya District	12 years	Fertile soil with a yellowish-brown color, the plate is free of weeds

Samples that were taken from several sub-districts in Kuantan Singing dominated by TM-producing plants with an age range of 8-12 years and dominated by a plant age of 10 years. Palm oil plantations cultivated in Kuantan Singingi Regency included various ages ranging from nurseries, immature plants and mature plants, but were dominated by mature plants. Based on the plantation statistics of Riau Province (2019), the area of smallholder plantations in Kuantan Regency is 15, 917 Ha, TM (Producing Crops) 65, 547, and 1,039 Ha TTR (Old Plants) spread over all districts in Kuantan Singingi

The general conditions of sampling greatly affected the abundance and diversity of microbes that were available in the rhizosphere. Soil conditions in the garden area sampled with fertile conditions vary in soil color, and were dominated by yellowish brown color. Soil texture in the garden also varied, some were sandy, clayey and loose. Information on general conditions of sampling was very important to support the association with the abundance and diversity of fungal populations found. Microbial activity in young plants was high because the roots were still active producing exudate that serves as nutrition for these microbes. According to (Purwaningsih, 2016), the microbial population varies greatly in each plant root, this is because the development of microorganisms in the soil is strongly influenced by the metabolic activity of plant roots that secrete exudate.

Colony growth and the number of isolates in each sub-district can be seen in Table 2 with a total of 142 colonies and a total of 22 isolates. The highest number of colonies was found in Kuantan Mudik sub-district, which was 91 colonies but there were only 3 isolates. Fungal colonies growing in the Kuantan Mudik sub-district sample grew spread, but the morphology was the same. The least number of isolates was found in isolated samples in Pengan and Sintajo Raya Districts, which were 2 colonies with 1 isolate each. According to Angraeni & Usman, (2015) there are morphological similarities in several fungal colonies isolated from the rhizosphere. Therefore, they are thought to have originated from the same isolate. The number of colonies isolated in the rhizosphere of oil palm plantations in smallholder plantations is presented in Table 2.

Number of Colonies

Table 2. Number of Colonies Growing on Rhizosphere Samples of Oil Palm Plants in People's Plantations in Kuantan Singingi Regency

Location Sampling	Number of Colonies	Number of Isolates
Singingi Hilir District	23 colonies	6 isolates
Benai District	16 colonies	6 isolates
Kuantan Mudik District	91 colonies	3 isolates
Kuantan Tengah District	8 colonies	2 isolates
Pangean District	2 colonies	1 isolate
Sintajo raya District	2 colonies	1 isolate
Total	142 colonies	22 isolates

The condition of the sampling location also affected the number of colonies and the number of isolated isolates. The samples from the lower Singingi sub-district were taken from locations with fertile soil conditions, yellowish brown in color with a sandy texture, weeds around the plate. Fertile soil can be indicated by the large number of isolated microbes because organic matter is available as nutrients for the development of these microorganisms. Fertile soil is also characterized by the presence of vegetation that grows on it, the more and various types of plants that

grow, the better the quality of the soil (Wulandari et al., 2020).

Plant age also affected the abundance and diversity of fungal populations isolated in the rhizosphere of smallholder oil palm plants. The highest abundance and diversity of microbial populations were samples aged 2 and 8 years. According to Ohiwal et al., (2017) The difference in the age of oil palm plants would affect the growth and population of microbes. This happened because the exudate released by oil palm roots was a source of nutrients needed by microbes. The diverse population of soil microbes was caused by environmental factors that were not the same in each area due to different plant ages.

4.3 Characteristics of Fungi Morphological

The morphological charatetristics of the fungal rhizosphere were identified by looking at the color of the colonies, the shape of the surface and the direction of growth of the body 5 days after isolation (Table 3). There were variations in the color of the colonies that grow, with the direction of growth being dominated by a symmetrical growth direction, the shape of the surface of the colony being rough and some being smooth.

Table 3. Morphological Characteristics of Fungi Colonies on Rhizosphere Samples of Oil Palm Plants in People's Plantations in Kuantan Singingi Regency

Location Sampling	Colony Color	Growth Direction	Surface Shape
Benai District	Green	Symmetrical	Smooth
	Greenness	Symmetrical	Rough
	White	Symmetrical	Rough
	Pink	Symmetrical	Smooth
	Greenish white Yellowish	Symmetrical	Smooth
	white	Symmetrical	Smooth
Singingi Hilir District	Yellowish Yellowish	Symmetrical	Rough
		Spread	Rough
	Pink	Symmetrical	Smooth
	White	Symmetrical	Smooth
	Gray	Symmetrical	Smooth
	Green	Symmetrical	Smooth
Kuantan Tengah	White	Symmetrical	Smooth
District	Light Green	Symmetrical	Rough
Pangean District	White	Symmetrical	Smooth
Kuantan Mudik	White	Symmetrical	Rough
District	Yellow	Symmetrical	Rough
	Yellowish white	Symmetrical	Rough
Sintajo Raya	White	Symmetrical	Smooth
District			

The differences in the characteristics of the growing colonies were due to the location of the harvest, the age of the isolated plants and the different soil conditions and planting areas. The more and denser the roots of a plant in the soil, the richer the organic matter content in the rhizosphere, the denser the soil microbial

population (Tambingsila, 2016). The results of Hamdani's research (2009) showed that there was a diversity of fungi in the rhizosphere that acted as entomopathogens in cocoa plantations which were influenced by agro-ecosystem conditions such as types of protective plants and altitude and cultivation techniques. Julyanda, (2011) stated that the diversity and abundance of microorganisms were also influenced by soil conditions. Sandy soils tended to have low diversity of microorganisms.

Rhizosphere fungus is one of the microbial groups that have been reported to induce plant resistance to various diseases including diseases carried from the soil or where the plant grows (Purwantisari, Susiana, 2009). Fungi in the rhizosphere zone play a role in decomposing organic matter and helping plant growth (Murali et al., 2012). Most of the rhizosphere fungi have the ability to promote plant development as well as suppress the development of pathogens known as Plant Growth Promoting Fungi (PGPF) such as *Trichoderma spp* and *Rhizoctonia spp*. It was known to be able to stimulate plant growth by producing growth hormones that stimulate plant growth (Payangan *et al*., 2019)

4. CONCLUSION

There were 22 isolates of rhizosphere fungi isolated from the rhizozfer of smallholder oil palm plants in Kuantan Regency spread over 6 sub-districts. They are Singingi Hilir District, Kuantan Mudik District, Kuantan Tengah District, Benai District, Pangean District and Sintajo Raya District. The highest number of isolates was found in Singingi Hilir sub-district, the plant age was 2 years and the fertile soil was blackish brown. The least number of isolates was found at the age of 10 years, even though the soil was fertile. Plant age and soil conditions affected the abundance and diversity of fungi populations in the rhizosphere area.

ACKNOWLEDGEMENT

The authors would like to thank the Institute for Research, Service and Dakwah Islamiyah which provided funding through competitive grants at the Kuantan Singingi Islamic University.

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