Jurnal Perlindungan Tanaman Indonesia, Vol. 25, No. 2, 2021: 148–159
DOI: 10.22146/jpti.67557
Available online at http://jurnal.ugm.ac.id/jpti
ISSN 1410-1637 (print), ISSN 2548-4788 (online)

Research Article

Characterization and Pathogenicity of *Rhizoctonia solani* Kühn Associated with Sheath Blight in Local Rice Varieties (*Oryza sativa* L.) of Special Region of Yogyakarta

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Received July 20, 2021; revised October 15, 2021; accepted December 11, 2021

ABSTRACT

In Indonesia, rice is used as the first strategic and priority food commodity in agricultural development. However, in practice, efforts to increase it still experience various obstacles, one of which is caused by the attack of pathogen *Rhizoctonia solani*. This study aimed to determine the characters of *R. solani* and observe its pathogenicity on some local rice varieties in the Special Region of Yogyakarta. Four isolates of *R. solani* were used, namely RS MS2, RS MKP2, RS UMB, and RS PN, as well as six varieties of local rice varieties, which were Menthik Susu, Cempo Merah, Cempo Hitam, Segreng, Menoreh, and Hitam Makaryo, and national rice varieties IR 64 and Ciherang. Morphological characterization was carried out based on the cultural characteristics of the colony, hyphae, and sclerotia. A pathogenicity test was carried out using the Detached Leaf Inoculation method. The result showed that *R. solani* characters vary from whitish-brown, yellowish-brown, and light brown colonies; moderate and fast growth rates; abundant-aerial, moderate-aerial, and slight-aerial growth patterns; 90° hyphae branching, narrowing of hyphae at the branching point, and presence of sclerotia. The pathogenicity test gave the results of all isolates having varying pathogenicity levels on each rice variety. Menthik Susu, Cempo Hitam, and Hitam Makaryo were resistant to *R. solani.* Cempo Merah and Segreng were considered as moderately resistant varieties, whereas Menoreh was categorized as moderately susceptible. Ciherang and IR64 were susceptible varieties to *R. solani.*

Keywords: pathogenicity; *Rhizoctonia solani*; rice; sheath blight; Yogyakarta

INTRODUCTION

Rice plants (*Oryza sativa* L.) are a member of the family Poaceae, a cultivated plant and a national strategy commodity, and is used as a staple food of one-third of the world's population, including Asia. In Indonesia, rice is used as the first strategic food commodity and a priority in agricultural development (Somantri, 2001). Most of the land in Indonesia is planted with rice paddy, both superior varieties and local varieties. Local rice varieties are varieties that have been grown by farmers for decades and selected by nature. Although the production is not as high as superior rice varieties, local rice has various advantages such as good adaptability to the environment, good and fragrant rice, and are resistant against pest and disease attacks. The Special Region of Yogyakarta has approximately 20 varieties of local rice that spread throughout the district and city (Munandar *et al.*, 1996; Hidayat, 2002; Bahagiawati *et al.*, 2005; Kristamtini *et al.*, 2018).

Various varieties of rice can be infected by fungal diseases. Attack of pathogens that cause disease on rice plants can decrease rice production in terms of quality and quantity (Shadily, 1984). One of the diseases that infect rice is sheath blight disease. In Indonesia, sheath blight is a disease that is easy to find and grows more severe from season to season, especially in areas of intensive rice farming (Nuryanto, 2011). This disease develops with varying severity and is thought to be closely related to the intake of technologies applied in farming by farmers (Nuryanto, 2003). Early symptoms of blight disease are oval or round brown patches on the leaf fronds (Utama, 2015). Planting short-life rice varieties with many seeds showed to be not resistant to sheath blight disease. This is thought to be triggered by the environmental conditions surrounding the plants which are warmer and moister (Eizenga *et al.*, 2002).

Sheath blight is a rice disease that is caused by the fungus *Rhizoctonia solani* Kühn. The *R. solani* species have a fairly high diversity in terms of colony morphology, biochemical and molecular markers, pathogenicity and aggressiveness (Ajayi-Oyetunde & Bradley, 2018). High variability is an obstacle in managing *R. solani* because it provides a great opportunity for the emergence of new strains that are able to survive well and have high pathogenicity (Ou, 1985). Some varieties of rice in Indonesia showed moderate resistances to sheath blight caused by *R. solani* such as Inpara 3, Ciherang, Mekongga, whereas Indragiri and Inpari 13 were moderately susceptible (Muslim *et al.*, 2012). Exploring resistances of local rice varieties from Special Region of Yogyakarta against *R. solani* or sheath blight disease has not been done and is required as an effort to minimize the decrease in productivity of rice yields. One effort that can be done is to find resistant varieties of rice to sheath blight. This study aimed to determine the characters of *R. solani* and observe its pathogenicity on some local rice varieties from Special Region of Yogyakarta

MATERIALS AND METHODS

Morphological Characterization of *R. solani*

The isolates *R. solani* used was obtained from rice plants that showed symptom of sheath blight disease from fields in Special Region of Yogyakarta. Four isolates used were RS MS2 (Sleman), RS MKP2 (Kulon Progo), RS UMB (Yogyakarta), RS PN (Gunung Kidul). The four isolates were maintained and grown on Potato Dextrose Agar (PDA). This research was conducted in the Plant Systematics Laboratory, Faculty of Biology, Universitas Gadjah Mada. The observed cultural characteristics included macroscopic and microscopic observation. Macroscopic characters were colony diameter, colony growth rate and pattern, colony color, and sclerotia formation, including sclerotia size and shape. The microscopic characters observed were hyphae branching, hyphae size, and microscopic characteristics of the formed sclerotia. Microscopic observations were made by preparing slide preparations using tryphan blue and safranin dyes. Semi permanent slides were observed under light microscopes and optilabs with an objects magnification of 400×. The results were obtained then compared to related references. The growth rate of *R. solani* were measured and categorized as fast (>20 mm/day), moderate (15–20 mm/day), and slow (<15 mm/day) based on colony growth reaching a size of 9 cm or meet petri after incubation 48 hours (fast), 72 hours (moderate), and 96 hours (slow) (Mishra *et al.,* 2014).

Pathogenicity Test of *R. solani* on Local Rice Varieties from Special Region of Yogyakarta

Pathogenicity test was conducted using the Detached Leaf Inoculation method from Jia *et al.* (2013). This research uses a Completely Randomized Design (CRD) that consists of 8 treatments (rice varieties) with 4 repetitions (*R. solani* isolates), so there were 32 in total. The rice seeds of six local varieties, consisting of Menthik Susu (Special Region of Yogyakarta), Cempo Merah (Sleman), Cempo Hitam (Sleman), Segreng (Gunung Kidul), Menoreh (Kulon Progo), and Hitam Makaryo (Bantul), and two superior national rice varieties (IR46 and Ciherang) were used in this experiment, sterilized and sowed. Then selected seedlings that showed uniform growth were planted in pots. After the plant was four weeks old, the second youngest leaf of each variety of rice plants was taken and cut to a size of 16 cm. The pieces of leaves with three replication of each treatment were placed on a plastic tray (31×24 cm) with a sterile tissue base that has been moistened with sterile water before. The leaves were inoculated by attaching 7-day-old *R. solani* mycelia with a diameter of 0.5 cm on each middle part of the rice leaf surface. After that, the tray was tightly closed with plastic wrap and incubated for 72 hours. The length of lesion was measured at 72 hours after incubation. The standard for evaluating disease score was set as 0 = no infection, disease area 0%, 1 = infection restricts at sites of inoculation, disease area <10%, 3 = restricted infection occurs at the site and within 2 cm of the site of inoculation, disease area 10.1–30%, 5 = unrestricted infection within 4–5 cm of the total infected areas, disease area 30.1–50%, 7 = expanded infection is greater than 5 cm length of the inoculated area, disease area 50.1–70% and 9 = the complete destruction of infection is greater than 6 cm length of the inoculated, disease area >70% (Jia *et al.*, 2013). Disease Score (DI) was calculated using the following formula: sum of disease score x number of leaves within that score divided by the total number of leaves within treatment (Hua *et al.*, 2014 with slight modification). Measurements were taken on the length of the lesions that appear later to determine the final reaction of the disease that appears on each variety. The reaction of the disease was determined based on the length of the lesion as resistant (R, <3.0 cm), moderately resistant (MR, 3.0–5.0 cm), moderately susceptible (MS, 5.1–6.5 cm), dan susceptible (S, >6.5 cm) (Jia *et al.*, 2013).

The data was analyzed using the SPSS 25.0 program with one-way anova variance analysis based on F-test. If the data differs significantly, then followed by Duncan Multiple Range Test (DMRT) at 5% level.

RESULTS AND DISCUSSION

Morphological Characterization of *R.solani*

Morphological observations showed that the four isolates (RS MS2, RS MKP2, RS UMB, and RS PN) had macroscopic and microscopic characteristics similar to *R. solani* fungi. Macroscopic observations (Figure 1, Table 1) showed that the color colony of all four isolates varied from light brown color in RS MS2, brownish-yellow color in RS MKP2 and RS UMB, and withish-brown in RS PN isolates. Two isolates had moderate growth rates (RS MS2, RS UMB) and the other had fast growth rates (RS MKP2 and RS PN). Colony growth patterns were showed as moderate-aerial (RS MS2 and RS UMB), abundant-aerial (RS MKP2), and slight-aerial (RS PN). Growth pattern characteristic of the cultures were recorded based on visual observation according to the growth of hyphae. These were classed as abundant-aerial mycelium, which obscured surface

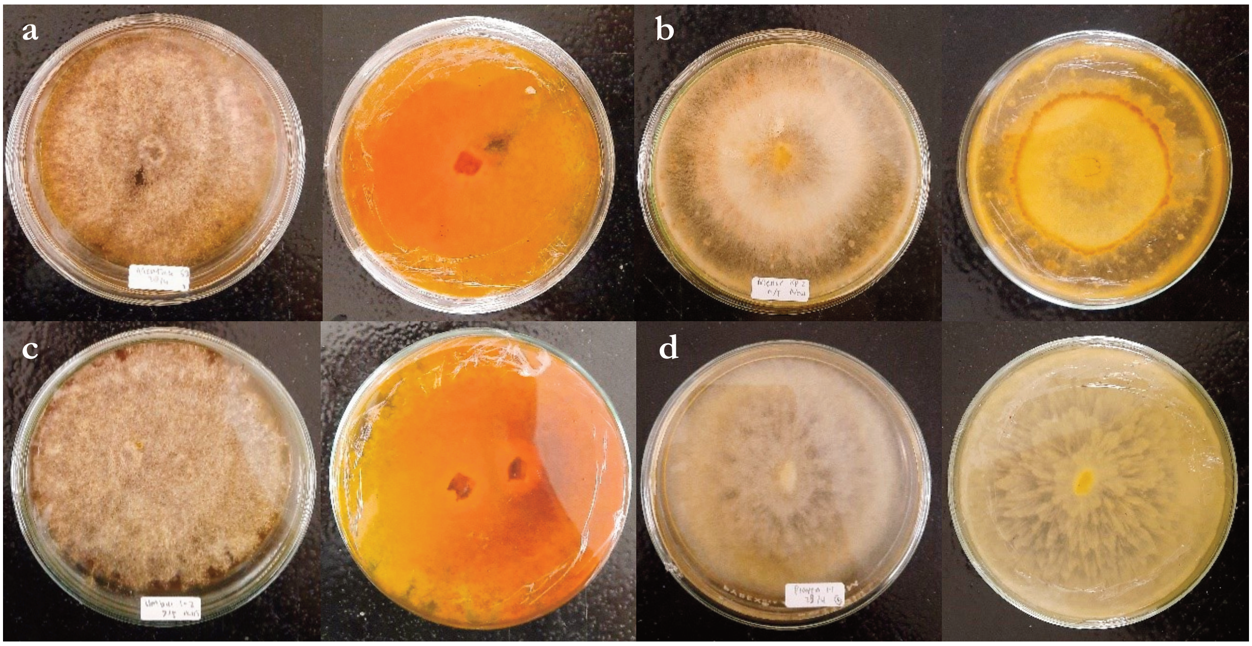


Figure 1. Morphology of *Rhizoctonia solani* isolates on PDA medium showing upper and reverse colonies; RS MS2 (a), RS MKP2 (b), RS UMB (c), RS PN (d)

Table 1. Macroscopic characters of *Rhizoctonia solani* isolated from sheath blight symptoms

Isolates	Macroscopic Characters				
	Growth Rates(mm/day)	Growth Patterns	Colony Colors	Sclerotia Colors	Sclerotia Number
RS MS2	Moderate(19.4)	Moderate-aerial	Lightbrown	-	-
RS MKP2	Fast (26.3)	Abundant-aerial	Yellowish-brown	Deep dark brown	40–60
RS UMB	Moderate(17.7)	Moderate-aerial	Yellowish-brown	-	-
RS PN	Fast (24.5)	Slight-aerial	Whitish brown	-	-
References	Fast (>20), Moderate (15–20), Slow (<15)[3]	Abundant- aerial, Moderate- aerial, Slight-aerial[3),4)]	Light brown,yellowish-brown, whitish brown, brown, darkbrown, verypale yellow[1),2)]	Light brown, brown, dark brown, deep dark brown[5)]	26–92[3)]

[1)]Sunder *et al.* (2003); [2)]Lal & Kandhari (2009); [3)]Mishra *et al.* (2014); [4)]Debbarma & Dutta (2015); [5)]Gopireddy *et al.* (2017).

mycelium and touched the Petri dish's cover. Moderate-aerial mycelium obscured the surface mycelium, but without touching the cover, slight-aerial mycelium did not obscure the surface mycelium. Several studies of *R. solani* morphology (Sunder *et al.,* 2003; Lal & Kandhari, 2009; Mishra *et al.*, 2014; Debbarma & Dutta, 2015; Gopireddy *et al.*, 2017) showed that three-day-old young colonies of *R. solani* tend to be white and will turn brown as the colonies age. It is also mentioned that the colonies of *R. solani* had various colors: light brown, yellowish-brown, whitish brown, brown, dark brown, very pale yellow.

Microscopic observations (Figure 2, Table 2) showed that the four isolates had hyphae diameters ranging from 6.20 µm to 8.62 µm, hyphae branches form 90° angles, narrowing occured at branching points, formation of monilioid cells (RS MS2, RS UMB, RS PN) and the formation of sclerotia in RS MKP2 isolates. There were several studies that showed diameter measurement results of hyphae varied. Hyphae width of *R. solani* isolated from maize in Andhra Pradesh, India ranged between 5.02–7.98 µm (Gopireddy *et al.,* 2017). Singh *et al.* (2014) found that the hyphae width of maize isolates ranged from 5.418 to 10.764 µm while from rice isolates ranged between 7.338 to 10.036 µm. Lal and Kandhari (2009) and Kuiry *et al.* (2014) reported that the hyphae width of isolates from rice ranged from 4.73 to 7.43 µm and from 2.25 to 13.08 µm. The width of the hyphae of *R. solani* are generally larger than binucleate *Rhizoctonia* hyphae, and both hyphae can be easily distinguished by their size (Kasiamdari *et al.*, 2002). The sclerotia of RS MKP2 were found on both the upper surface and the lower surface of the colony with a deep dark brown color. The number of sclerotia in each culture varied considerably in the range of 40–60 sclerotia with the size was 1–3 mm, and the shape was globose (Figure 3). In general, sclerotia is not formed in the culture medium as it considered as the survival propagule of *R. solani* (Mishra *et al.*, 2014), sclerotia is reported as early inoculum of sheath blight in the rice field (Groth & Bond, 2007). The characteristics of the pathogen that grows quickly and produce sclerotia may increase the chances of a pathogen to survive and infect host plants. High sclerotial aggregation, though hinder in quick dispersal, helps in increasing the chances of germination because of the enhanced surface area (Madhavi *et al.,* 2015). Basu *et al.* (2004) stated that there was no correlation between the mycelial growth of an isolate and its virulences on hosts. It was the abundance and size of the sclerotia that determined the virulences of an isolate. In older cultures, *R. solani* form the formation of monilioid cells (Andersen & Rasmussen, 1996).

Pathogenicity Test of *R. solani* on Local Rice Varieties from Special Region of Yogyakarta

Observation of pathogenicity tests were conducted on leaves from local varieties of rice inoculated with RS MS2, RS MKP2, RS UMB, and RS PN isolates at 72 hours after inoculation. Symptoms that appeared on the inoculated leaves showed varying results on each variety. The symptoms observed were grayish-white to brown color oval

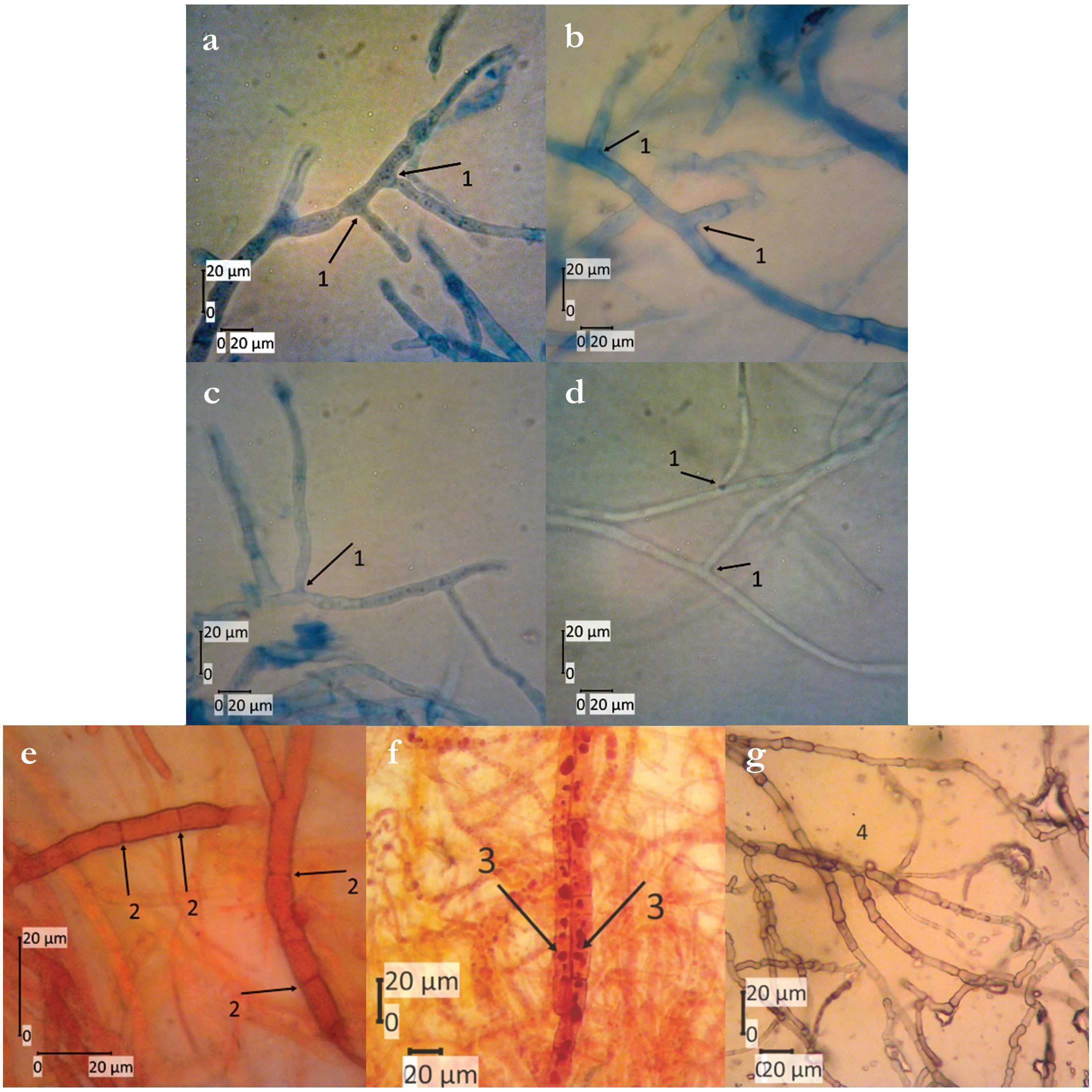


Figure 2. Microscopic characters of *Rhizoctonia solani* in RS MS2 (a), RS MKP2 (b), RS UMB (c), RS PN (d), septum (e), nucleus (f), monilioid cell (g) (1 = hyphae narrowing at 90° branches, 2 = septum, 3 = multinucleate, 4 = monilioid cell)

Table 2. Microscopic characters of *Rhizoctonia solani* isolated from sheath blight symptoms on rice

Isolates	Characters			
	Diameter (µm)*	**Septum**	**Hyphae narrowing**	**Hyphae branching at 90°**
RS MS2	8.62 ± 1.77^{b}	+	+	+
RS MKP2	8.50 ± 0.95^{b}	+	+	+
RS UMB	7.36 ± 0.95^{ab}	+	+	+
RS PN	6.20 ± 0.63^{a}	+	+	+
Reference	4.73–7.43[1], 2.2–13.08[2] and 7.338–10.764[3]	+	+	<90° or 90°[3]

*The numbers followed by the same letter in one column show no difference based on the Duncan Multiple Range Test at a significance level of 5%.

[1]Lal & Kandhari (2009); [2]Kuiry *et al.* (2014); [3]Singh *et al.* (2014).

Figure 3. Structure of sclerotia in RS MKP2

and or irregular spots (Figure 4). The eight varieties of local rice from Special Region of Yogyakarta showed symptoms of sheath blight disease after 72 hours inoculated with *R. solani* isolates. The development of sheath blight disease on rice plants begin with the propagule of *R. solani* germinating and infecting the rice leaf part, which then develops in to the inner tissue and infect the rice stem. The damage that occurs on the stem segments causes rice plants to easily break down and inhibit the flow of water and nutrients (Inagaki, 2001). Infections can reach all parts of the leaf and cause symptoms of blight that can extend to the flag leaf (Nuryanto, 2017).

As shown in Table 3, the leaves of Menthik Susu, Ciherang, IR64, Cempo Merah, Cempo Hitam, Segreng, Menoreh, and Hitam Makaryo responded differently to the infection of four isolates of *R. solani* (RS MS2, RS MKP2, RS UMB and RS PN). For each plant species, a wide variation of symptom severity induced by different *R. solani* was observed. The only *R. solani* isolates that did not cause disease on leaves tested was RS UMB inoculated on Hitam Makaryo variety. *R. solani* most severely infected Ciherang and IR 64 with a Disease Index (DI) of 3.19, followed by Menoreh with a DI of 1.08–1.13 with moderately disease infection. Compared to other rice varieties, Hitam Makaryo appeared to be the most resistant to *R. solani* isolates.

The pathogenicity studies on local rice varieties have shown that the virulence of *R. solani* isolates has a wide variation. A similar finding was reported by Taheri *et al.* (2007) that different *R. solani* isolates showed different pathogenicity on the specific cultivar of rice *Oryza sativa* cv. Zenith as shown in our study on Menthik Susu, Cempo Merah, Segreng, Menorah and Hitam Makaryo varieties. The difference in the degree of pathogenicity of *R. solani* isolates tested on six local varieties rice and two superior national rice can be influenced by the color of the colony. Colony color that are more concentrated (not white) tends to contain more melanin in cell walls and is related to the pathogenic ability. Isolates of pathogenic fungi that did not produce melanin were less pathogenic than those that produce a lot of melanin (Budiarti *et al.*, 2020). It can also be associated with the growth rate of each isolate where the growth rate was moderate in RS MS2 and RS UMB and fast in RS MKP2 and RS PN. The rapid growth rate in isolates would support the occurrence of infection in plants.

To our knowledge, the resistance of local rice varieties against sheath blight disease used in this study has never been reported, except for Segreng (*Dinas Pertanian dan Ketahanan Pangan Daerah Istimewa Yogyakarta* [DPKP DIY], 2021). Results on the resistance of local rice varieties from Special Region of Yogyakarta (Table 4) showed that in the laboratory experiment, varieties of Hitam Makaryo, Menthik Susu, and Cempo Hitam were categorized as resistant with the length of lesion between 0–2.97 cm. In the field experiments, Hitam Makaryo was classified as resistant to fall, long-lived 172 days after sowing (dos) with the number of productive tiller 17 stems, Menthik Susu was classified as resistant to fall, long-lived 130–140 dos with the number of productive tiller 17 stems, and Cempo Hitam was classified as resistant to fall, long-lived 120 dos with the number of productive tiller 15 stems (Suharsono, 2018; *Balai Pengkajian Teknologi Pertanian Jawa Timur*, 2019; Nurhidayah & Umbara, 2019). Cempo Merah and Segreng were categorized as moderately resistant with the length of lesion 3.9–4.7 cm. Cempo Merah was classified as resistant to fall, medium-aged 109 dos with the number of productive tiller 10 stems and Segreng was classified as medium to fall, short-lived 100 dos with the number of productive tiller 9 stems (*Balai Pengkajian Teknologi Pertanian Yogyakarta*, 2006; DPKP DIY, 2021). The resistance of local rice Segreng has also been reported as moderately resistant to *R. solani* (Rustam, 2011; DPKP DIY, 2021). Menoreh was categorized as moderately susceptible with lesion

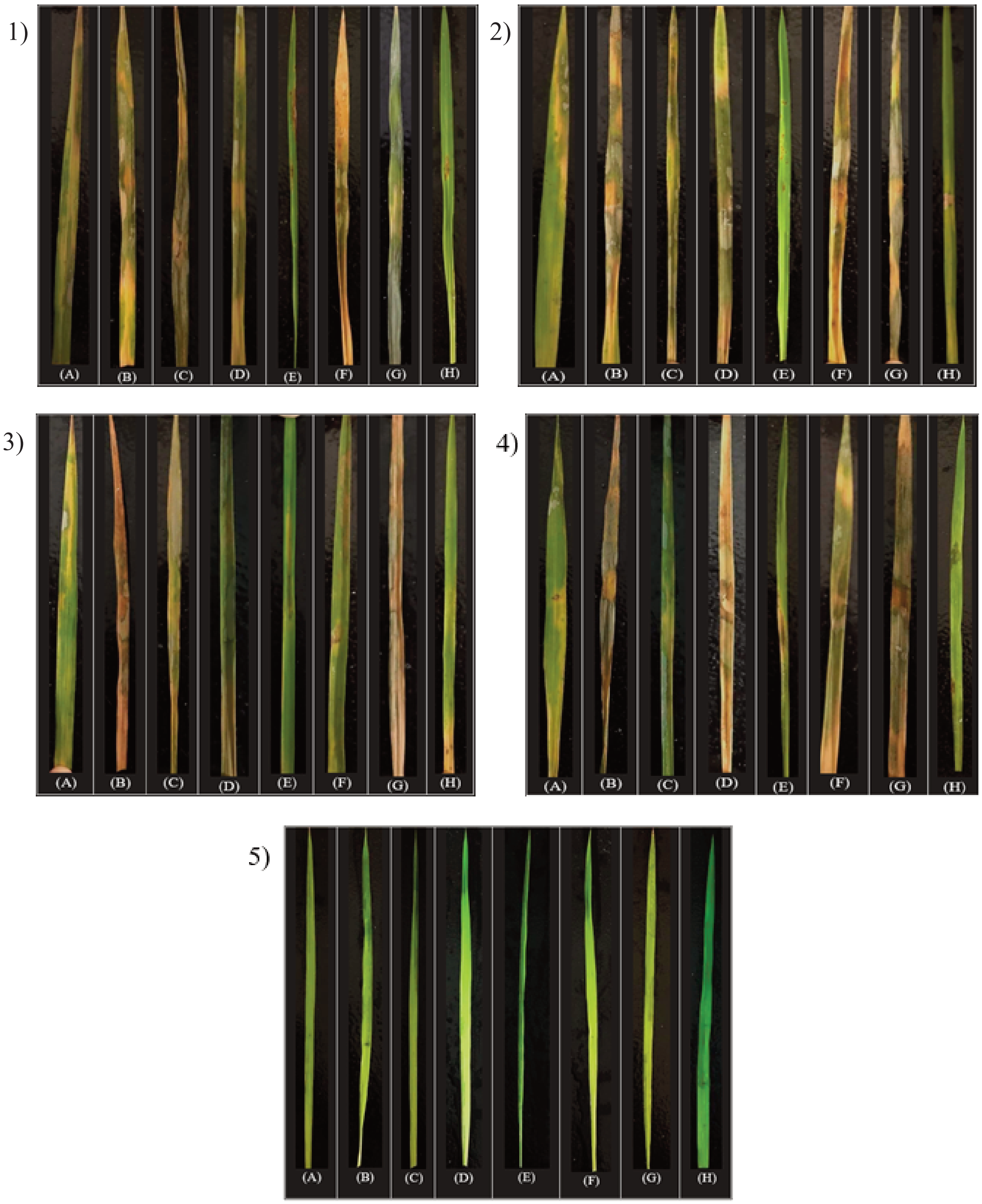
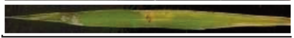
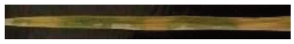
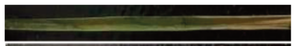


Figure 4. Pathogenicity test of RS MS2 (1), RS MKP2 (2), RS UMB (3), RS PN (4), Control on local rice varieties at 72 hours after inoculation (5); A = Menthik Susu, B = Ciherang, C = IR64, D = Cempo Merah, E = Cempo Hitam, F = Segreng, G = Menoreh, H = Hitam Makaryo

Table 3. Pathogenicity of *Rhizoctonia solani* isolates on the local rice varieties of Special Region of Yogyakarta

Rice Variety	**Disease Score (Disease Index)**			
	RS MS2	**RS MKP2**	**RS UMB**	**RS PN**
Control	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Menthik Susu	1 (0.09)	3 (0.09)	1(0.09)	1(0.09)
Ciherang	9 (3.19)	9 (3.19)	9 (3.19)	9 (3.19)
IR 64	9 (3.19)	9 (3.19)	9 (3.19)	9 (3.19)
Cempo Merah	3–5 (0.51)	5 (0.42)	3–5 (0.51)	3–5 (0.51)
Cempo Hitam	3 (0.44)	3 (0.44)	3 (0.44)	3 (0.44)
Segreng	5–7 (0.56)	5–7 (0.56)	3–5 (0.51)	5 (0.42)
Menoreh	7–9 (1.08)	9 (1.13)	7–9 (1.08)	9 (1.13)
Hitam Makaryo	1 (0.09)	1 (0.09)	0 (0.00)	1 (0.09)

Table 4. Resistance of local rice varieties of Special Region of Yogyakarta to sheath blight caused by *Rhizoctonia solani*

Rice Variety	*R. solani* Isolate	Length of lesions (cm)*	Resistance**	Symptoms
Menthik Susu	RS MS2	1.27 ± 0.30^{b}	Resistant	
	RS MKP2	2.47 ± 0.25^{b}	Resistant	
	RS UMB	1.07 ± 0.11^{b}	Resistant	
	RS PN	1.33 ± 0.15^{b}	Resistant	
Ciherang	RS MS2	7.87 ± 0.23^{f}	Susceptible	
	RS MKP2	7.67 ± 0.76^{f}	Susceptible	
	RS UMB	6.70 ± 0.46^{f}	Susceptible	
	RS PN	8.13 ± 0.47^{f}	Susceptible	
IR64	RS MS2	7.13 ± 0.60^{e}	Susceptible	
	RS MKP2	7.03 ± 0.25^{e}	Susceptible	
	RS UMB	6.60 ± 0.53^{e}	Susceptible	
	RS PN	6.37 ± 0.15^{e}	Moderately Susceptible	
Cempo Merah	RS MS2	4.13 ± 0.30^{d}	Moderately Resistant	
	RS MKP2	4.13 ± 0.11^{d}	Moderately Resistant	
	RS UMB	3.90 ± 0.26^{d}	Moderately Resistant	
	RS PN	4.03 ± 0.15^{d}	Moderately Resistant	
Cempo Hitam	RS MS2	2.93 ± 0.11^{c}	Resistant	
	RS MKP2	2.27 ± 0.30^{c}	Resistant	
	RS UMB	2.80 ± 0.26c	Resistant	
	RS PN	2.97 ± 0.21^{c}	Resistant	
Segreng	RS MS2	4.87 ± 0.40^{d}	Moderately Resistant	
	RS MKP2	4.97 ± 0.35^{d}	Moderately Resistant	
	RS UMB	4.03 ± 0.25^{d}	Moderately Resistant	
	RS PN	4.23 ± 0.21^{d}	Moderately Resistant	
Menoreh	RS MS2	6.13 ± 0.40^{e}	Moderately Susceptible	
	RS MKP2	6.33 ± 0.30^{e}	Moderately Susceptible	
	RS UMB	6.00 ± 0.20^{e}	Moderately Susceptible	
	RS PN	6.47 ± 0.15^{e}	Moderately Susceptible	
Hitam Makaryo	RS MS2	1.37 ± 0.15^{a}	Resistant	
	RS MKP2	0.73 ± 0.21^{a}	Resistant	
	RS UMB	0 ± 0^{a}	Resistant	
	RS PN	1.13 ± 0.30^{a}	Resistant	
References				
Ciherang[1)]	*Rhizoctonia solani*		Moderately Susceptible	
IR64[1)]			Moderately Susceptible	
Segreng[2)]			Moderately Resistant	

*The numbers followed by the same letter in one column show no significant difference based on the Duncan Multiple Range Test at a significance level of 5%.

**Resistant (R, <3.0 cm), Moderately Resistant (MR, 3.0–5.0 cm), Moderately Susceptible (MS, 5.1–6.5 cm), and Susceptible (S, >6.5 cm) (Jia et al., 2013).

[1)]Rustam (2011), [2)]*Dinas Pertanian dan Ketahanan Pangan Daerah Istimewa Yogyakarta* [DPKP DIY] (2021).

length between 6.13 cm to 6.47 cm, while IR64 was categorized as moderately susceptible to susceptible with the length of lesion 6.37–7.13 cm. Menoreh was classified as medium to fall, short-lived 85 dos with the number of productive tiller 16 stems (DPKP DIY, 2020). IR64 was released in 1986 by the Center of Rice Research that becomes a choice for farmers because it was categorized as resistant to the dwarf grass virus transmitted by brown planthopper (*Nilaparvata lugens*), but moderately susceptible to sheath blight (Rustam, 2011). Ciherang was the most severe rice variety of *R. solani* infection with the length of lesion range between 6.70 to 8.13 cm and categorized as susceptible. Ciherang was released by the Center of Rice Research in 2000 and categorized as moderately susceptible to sheath blight disease (Rustam, 2011), but resistant to leaf blight bacteria and pest aphrodisiacs. The information on the pathogenicity of *Rhizoctonia solani* to local rice varieties of the Special Region of Yogyakarta could be beneficial and new information for farmers and society in general.

The disease severity of sheath blight was high on short-type rice varieties with a large number of productive tillering and lower in tall-type rice varieties with a small number of productive tillering (Nuryanto *et al.*, 2014). A large number of tillering will affect the microclimate under the canopy of plants causing warmer and moister condition that are suitable for supporting disease development, such as blight caused by *R. solani* (Kardin *et al.*, 1988). Irawati and Hartati (2011) research shows that local varieties have good resistance to *R. solani* attacks.

CONCLUSIONS

The morphological characteristics of four isolates of *Rhizoctonia solani* (RS MS2, RS MKP2, RS UMB, and RS PN) isolated from sheath blight disease of rice showed variety in the colony, growth rates, growth patterns and can be recognized by its 90° branching, the production of monilioid cell and sclerotia. The four isolates of *R. solani* showed different pathogenicity on each local rice variety. New findings of the resistance of local rice varieties in the Special Region of Yogyakarta were shown in Hitam Makaryo, Menthik Susu, and Cempo Hitam that were categorized as resistant; Cempo Merah and Segreng were categorized as moderately resistant, and Menoreh were moderately susceptible. The rice variety of IR 64 was moderately susceptible to susceptible, while Ciherang were susceptible to sheath blight. These findings can be used as a reference for farmers to select sheath blight resistant local rice varieties for improving rice production.

ACKNOWLEDGEMENTS

This research was funded by Lecturer and Student Collaboration Research Grant 2021 (No. 993/UN1/FBI/KSA/PT.01.03/2021) granted by the Faculty of Biology, Universitas Gadjah Mada. The authors thank the technician staff of Plant Systematics Laboratory, Faculty of Biology, Universitas Gadjah Mada, for their help in supporting the experiments. The manuscript is part of M.N thesis under supervision of R.S.K.

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