Sys Rev Pharm 2020; 11(2): 289 – 291
A multifaceted review journal in the field of pharmacy
E-ISSN 0976-2779 P-ISSN 0975-8453

Sclerotium rolfsii Sacc Control Causes of Stem Rot Disease in Soybeans with Mycorrhizal Biological Agents

[1]Marlina, [1]Lukman Hakim, [1]Alfizar, [2]Sufardi
[1]Department of Plant Protection Faculty of Agriculture, Syiah Kuala University
[2]Department of Soil Science, Faculty of Agriculture, Syiah Kuala University
Jl. Tgk Hasan Krueng Kalee No. 3 Banda Aceh Kopelma Darussalam

Article History: *Submitted: 28.11.2019* *Revised: 18.01.2020* *Accepted: 16.02.2020*

ABSTRACT
Soybean (Glycine max, L Merr) is one of the food crops that has long been cultivated by the people of Indonesia. Constraints that are often found in the cultivation of soybean plants, among others, are disease infection factors. One of the harmful diseases is stem rot that is caused by the fungus Sclerotium rolfsii Sacc. Therefore an alternative must be sought to control this pathogen by utilizing mycorrhizal biological agents that can be symbiotic with plant roots. The study used a completely randomized design (CRD) factorial pattern of 2 factors. The first factor is mycorrhizal fungi, consisting of 4 dose levels, namely 0 gram per plant, 5 gram per plant, 10 gram per plant, and 15 gram per plant. The second factor was soybean cultivar, consisting of 2 namely Anjasmoro and Kipas Merah. Thus there are 8 treatment combinations. Each treatment was repeated 3 times and each experimental unit consisted of 4 experimental pots, so that the total number of pots was 8x3x4 = 96 pots. The observation variable is the incubation period (days), the length of the lesio at the base of the stem. The intensity of the attack, calculated by the formula: P = a / b x 100%. P = intensity of disease attack, a = number of plants attacked, b = total number of plants. The results showed that the Kipas Merah cultivar soybean was more resistant to stem rot disease caused by Sclerotium rolfsii Sacc than Anjasmoro cultivars. Inoculation with mycorrhizal fungi of 10 to 15 g per plant decreases the percentage of soybean plants affected by stem rot, prolongs the incubation period, and inhibits the development of lesions. This shows that mycorrhiza can suppress soil-borne pathogens or can control Sclerotium rolfsii Sacc which causes stem rot disease in soybeans.
Keywords: Soybean, mycorrhizal, stem rot
Correspondance:
Marlina
Department of Plant Protection Faculty of Agriculture,
Syiah Kuala University
Email id : marlina.fpunsyiah@gmail.com
DOI: 10.5530/srp.2020.2.45

INTRODUCTION

Soybean (Glycine max, L Merr) is one of the food crops that has long been cultivated by the people of Indonesia. This plant has an important meaning to meet food needs in order to improve community nutrition, because it is a source of vegetable protein that is relatively inexpensive compared to other protein sources such as meat, milk and fish. In Aceh Province soybean plants have even been designated as one of the leading food commodities. Therefore soy has a good prospect to be developed as food and animal feed.

Constraints that are often found in the cultivation of soybean plants, among others, are disease infection factors. Diseases caused by various types of microbes such as fungi, bacteria, and viruses often result in economic losses due to the low quality and quantity of the crop. One of the harmful diseases is stem rot that is caused by the fungus Sclerotium rolfsii. This disease is often found in soybean plants both dry land, rainfed and tidal with attack intensity of 5 - 55%. The case in Aceh Besar district, Nanggroe Aceh Darussalam province, damage to soybean plants at the age of 4 weeks after planting due to this disease reached 33.03% (Marlina et al, 2008). S. rolfsii attack on soybean plants causes damage to roots, stems, leaves and fruit.

Various ways have been carried out to control stem rot disease in soybeans, including planting resistant cultivars, seed treatment, systemic fungicides, field sanitation, crop rotation that is not a host of pathogens, controlling weeds, and using fungicides. However, it has not given satisfactory results. This is due to the pathogen can survive in soil or plant debris, and alternative hosts, so that at any time can make a primary infection in soybean plants. Therefore an alternative must be sought to control this pathogen, namely by utilizing mycorrhizal biological agents that can be symbiotic with plant roots.

Arbuscular mycorrhizal fungi (AMF) play an essential role as one of the primary mutualistic plant-microbe symbiose s. Plants benefit from root endophytes that extend their zo ne of activity beyond the rhizosphere (Feddermann et al., 2010; Hohmann et al., 2011, 2012). The main known bene fits of mycorrhiza involve nutrient mobilisation (mainly p hosphorus), improved tolerance against abiotic (mainly dr ought) and biotic stresses (mainly soil-borne pathogens) (Azcón-Aguilar & Barea, 1996; Parniske, 2008).

Mycorrhizal plant roots can function longer than those without mycorrhizal and are less likely to be attacked by certain pathogens (Listiyowati, 1989). Earlier Gerret (1960), reported that mycorrhizal fungi in addition to having physiological functions in plants can also protect the roots of fibers that are not fertilized against pathogens.

MATERIALS AND METHODS

The study was carried out in a plastic house in the experimental garden of the Faculty of Agriculture, Syiah Kuala University, Banda Aceh. The research location is at an altitude of 10 m above sea level.

The ingredients used are Anjasmoro and Kipas Merah cultivar soybean seeds, mycorrhizal fungi (in the form of microphones), Blang Krueng entisol soil, S. rolfsii mushroom inoculants, plastic buckets, PDA media, pesticides, and NPK fertilizer. Equipment used includes scales, ovens, petridis, and Shepherds. The study was conducted using a completely randomized design (CRD) factorial pattern of 2 factors. The first factor Is mycorrhizal fungi (micofer) consisting of 4 dose levels, namely 0 g per plant , 5 g per plant , 10 g per plant, and 15 g per plant-1 (m3). The second factor was soybean cultivar, consisting of 2 namely Anjasmoro, and Kipas Merah. Thus there are 8 treatment combinations. Each treatment was repeated 3 times and each experimental unit consisted of 4 experimental pots, so that the total number of pots was 8x3x4 = 96 pots.

Planting Media Preparation

The sample of entisol soil from Blang Krueng village, Baitussalam sub-district, was taken in a composite at a depth of 0-40 cm. The soil is air dried in a greenhouse for 1 week. Next filtered with a 4 mm sieve. Aerated soil is put into an experiment pot or 8 kg polybag.

Determination of the Wet Pot weight of the experiment that will be maintained

The wet pot weight of the experiment that will be maintained throughout the study is based on the condition of the field capacity. Moisture capacity of the field is determined by the titration method, which is by taking a sample of 8 kg of dried soil and putting it in a test pot. The soil was saturated with water by adding 5 liters of water to the test pot and left for 2 x 24 hours. Water seeping out through the hole of the experiment pot is collected using a bucket and obtained as much as 3, 3 liters. Thus the water retained in the soil at the field capacity is 5 liters - 3.3 liters = 1.7 liters or 1.7 kg. The wet pot weight of the experiment that was maintained in the field capacity condition during the study was 8 kg + 1.7 kg = 9.7 kg. This weight is maintained by the weighing method which is done every day by watering as much water loss through evapotranspiration.

Provision of mycorrhizae and NPK fertilizer

Mycorrhizae are given into the planting hole at the same time as planting with the appropriate dosage of treatment. Then thinly covered with earth. Soybean seeds are planted in the same planting hole on mycorrhizae that have been restricted to soil cover and covered again with soil. NPK fertilizer is given when the plant is 2 weeks after planting as much as 2 g per plant according to the recommended dosage.

Propagation of inoculum

S. rolfsii mushroom was isolated from soybean plants with symptomatic base of stem rot from Blang Krueng village farmers' land. Then grown and purified on PDA media in the Plant Disease Laboratory of the Unsyiah Faculty of Agriculture. Inoculums from pure cultures were cultured on PDA media in test tubes for ± 1 month to form sclerotia.

Inoculation of Sclerotium rolfsii mushrooms

Pathogen inoculation was carried out on soybean plants 4 weeks after planting, by immersing S. rolfsii inoculum near the base of the stem as much as two sloping test tubes containing mycelia and ten sclerotia. Then watered until it reaches the field capacity to maintain moisture so that it stimulates the growth of sclerotia.

Observed variables

The incubation period (days), the development of the incubation period begins to be observed after inoculation of pathogens (*S. rolfsii fungus*) until the appearance of the initial symptoms of stem rot disease. Length of lesion at the base of the stem. The intensity of the attack, calculated by the formula: P = a / b x 100%. P = intensity of disease attack, a = number of plants attacked, b = total number of plants

Statistical analysis

The data were subjected to analysis of variance (F-test). Means were compared using Fisher's least significant difference (LSD) test (Gomez and Gomez, 1983).

RESULTS AND DISCUSSION

Anova test results showed that there was no interaction between soybean cultivars tested with mycorrhizal biological agents. This shows that the influence of mycorrhiza in controlling Sclerotium rolfsii Sacc. causes of stem rot disease in soybeans do not depend on cultivars. The percentage of plants attacked by stem rot disease caused by *Sclerotium rolfsii* Sacc in Anjasmoro cultivars was higher at 40.83%, whereas in the Kipas Merah cultivar was lower at 31.90% (Table 1). The incubation period of stem rot disease was significantly faster in Anjasmoro cultivars (8.03 days after inoculation) compared to the incubation period of the disease in Kipas Merah cultivars (10.98 days after inoculation). The longest lesion length obtained in the Anjasmoro cultivar (2.73 cm) is longer than the length of the lesion in the Kipas Merah cultivar (1.60 cm). Thus it can be interpreted that the Kipas Merah cultivar exhibits better endurance because the percentage of plants affected by the disease is lower than that of Anjasmoro cultivars.

Table 1. Percentage of plants affected, incubation period, length of lesio according to cultivar and mycorrhizal dose

Treatment	Percentage of plants attacked	Incubation period (days)	Lesio length (cm)
Cultivars			
Anjasmoro	40,83 a	8,03 a	2,73 a
Kipas Merah	31,90 b	10,98 b	1,60 b
Mycorrhiza (g/plant)			
0	45,84 a	7,17 a	2,68 a
5	42,67 a	8,02 a	2,00 a
10	29,50 b	10,97 b	1,59 b
15	25,67 b	11,87 b	1,56 b

The numbers followed by the same letter do not differ at the 5% level of the LSD test

Inoculation with mycorrhizal fungi of 10 to 15 g per plant decreases the percentage of soybean plants affected by stem rot, prolongs the incubation period, and inhibits the development of lesions (Table 1). This shows that mycorrhiza can suppress soil-borne pathogens or can control Sclerotium rolfsii Sacc which causes stem rot

disease in soybeans. This can occur because mycorrhizae can provide physical protection to plants. Therefore, the roots of plants with micororiza are less likely to be attacked by pathogens so that they can function longer. Such protection according to Sabine et al., (2002) occurs because of the formation of thin hyphal layer structures on the root surfaces of plants with micororrhizal. In line with this Djunaedy (2008) suggests that mycorrhizal is able to form a physical barrier and remove certain antibiotics to prevent the development of soil borne pathogens.
The indirect role of mycorrhizae in increasing plant resistance to disease occurs through increased uptake of phosphorus by the roots of plants infected with mycorrhizal fungi. Gottstien and Kuc, 1989 in Tuzun and Kuc, 1991) reported that an increase in the absorption of phosphorus by the root can induce systemic cucumber plant resistance. Mycorrhizal fungal infections in plant roots can reduce the level of root pathogen infections due to the closure of the "Infection Site" by Hartiq Sheat (Brown, 1992). Wrap it up root surface by mycorrhizae causes the roots to avoid pests and diseases, root pathogen infections are inhibited. In addition, mycorrhizae use all the excess carbohydrates and other root exudates, thus creating an environment that is not suitable for pathogens.

CONCLUSION

Kipas Merah cultivar soybean was more resistant to stem rot disease caused by Sclerotium rolfsii Sacc than Anjasmoro cultivars. Inoculation with mycorrhizal fungi of 10 to 15 g per plant decreases the percentage of soybean plants affected by stem rot, prolongs the incubation period, and inhibits the development of lesions. This shows that mycorrhiza can suppress soil-borne pathogens or can control Sclerotium rolfsii Sacc which causes stem rot disease in soybeans.

REFERENCES

1. Azcón-Aguilar C & Barea J (1996) Arbuscular myco rrhizas and biological control of soil-borne plant pat hogens an overview of the mechanisms involved. Mycorrhiza 6: 457–464.
2. Djunaedy A. 2008. Application of systemic fungicides and mycorrhizal utilization in order control of soil borne pathogens in soybean plants (Glicyne max L.). J Embryo. 2 (5): 149-157.
3. Feddermann N, Finlay R, Boller T & Elfstrand M (20 10) Functional diversity in arbuscular mycorrhiza th e role of gene expression, phosphorous nutrition an d symbiotic efficiency. Fungal Ecol 3: 1–8.
4. Gerret., S.D.1960. Biology of root-infecting fungi. University Press.Canbridg
5. Gomez, K.A and A.A. Gomez. 1983. Statical Procedures for Agricultural Research. Second Edition, John Wiley and Sons, New York
6. Hohmann P, Jones EE, Hill RA & Stewart A (2011) Understanding Trichoderma in the root system of Pi nus radiata: associations between rhizosphere coloni sation and growth promotion for commercially gro wn seedlings. Fungal Biol 115: 759–767
7. Hohmann P, Jones EE, Hill RA & Stewart A (2012) Ecological studies of the bio-inoculant Trichoderma hamatum LU592 in the root system of Pinus radiata. FEMS Microbiol Ecol 80: 709–721
8. Listiyowati, E. 1989. Effectiveness of mycorrhizae on phosphorus uptake and soybean growth given two phosphate sources in the red-yellow podzolic soil of Jasinga. Department of Soil Science of Faculty of Agriculture, Bogor Agriculture University
9. Marlina, Alfizar, Fikrinda, 2008. Application of Arbuscular Mycorrhizal Fungi (CMA) for Controlling Pole Stem Rot Disease in Soybeans in Blang Krueng Village, Baitussalam District, Aceh Besar Regency. Science and Technology Application Program Report. Faculty of Agriculture. Syiah Kuala University, Banda Aceh
10. Parniske M (2008) Arbuscular mycorrhiza: the moth er of plant root endosymbioses. Nat Rev Microbiol 6 : 763–775
11. Tuzun, S and J. Kuc. 1991. Plant Immunization: An Alternative Pesticide for Control Plant Desease. Proc. Int. Semi Biol. Control of Plant Disease and Virus Vector. September 17-21 Thukuba Japan. Kuo Thai Color Printing Taiwan
12. Daly, A., Arnavut, F., Bohorun, D., Daly, A., Arnavut, F. and Bohorun, D., The Step-Down Challenge. International Journal of Psychosocial Rehabilitation, Vol 22(1) 76, 83.
13. Knapen, J., Myszta, A. and Moriën, Y., 2018. Augmented individual placement and support for people with serious mental illness: the results of a pilot study in Belgium. International Journal of Psychosocial Rehabilitation, Vol 22(2), pp.11-21.
14. Monterosso, D.M., Kumar, V. and Zala, K., 2019. Spiritual Practices in The Era of Smartphones & Social Networking: A Comparative Study. International Journal of Psychosocial Rehabilitation. Vol 22 (2) 45, 57.
15. Shafti, S.S. and Ahmadie, M., 2018. Improvement of Psychiatric Symptoms by Cardiac Rehabilitation in Coronary Heart Disease Vol 22 (2) 80, 89.
16. Bonsaksen, T., Opseth, T.M., Misund, A.R., Geirdal, A.Ø., Fekete, O.R. and Nordli, H., 2019. The de Jong Gierveld Loneliness Scale used with Norwegian clubhouse members: Psychometric properties and associated factors Vol 22 (2) 88, 100.