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Effectiveness Of Bioherbicide Kiambang (*Salvinia molesta)* on Growth of Gogo Rice *(Oryza sativa L.)*

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ABSTRACT

The main problem of upland rice cultivation is the presence of weeds, which cause a decrease in the quantity and quality of crop yields. Generally, farmers use synthetic herbicides to control weeds. One way to reduce the use of synthetic herbicides is by using kiambang extract bioherbicides which are applied to weeds. Currently, there is no research to determine the effect of kiambang extract on upland rice germination. The purpose of this study was to determine the effect of kiambang bioherbicide on the germination phase of upland rice by giving several concentrations of kiambang bioherbicide. This study used a completely randomized design (CRD) with 5 concentration treatments, namely 2,4-D herbicide, 20%, 40%, 60%, and 80% bioherbicide. Kiambang extract concentration was repeated 3 applicate for each replication; each experimental unit consisted of three petri dishes containing 25 rice seeds. The research parameters were the percentage of germination, germination rate, length of the plumule, and radicle. Observational data obtained were analyzed using analysis of variance (F test) at a level of 5% and continued with the Least Significance Different (LSD) test at a level of 5% to determine the difference between treatments. The results showed that the bioherbicide extract of kiambang (*Salvinia molesta*) 20% did not inhibit seed germination, but the seeds grew abnormally, while concentrations of 40%, 60%, and 80% inhibited germination.

Keywords*: bioherbicide, kiambang, upland rice, germination.*

1. INTRODUCTION

Food crops are an important sector in development as determined, the main targets are strengthening food supply and diversifying food consumption. Rice is an important food crop in Indonesia, because approximately 90% of the population consumes it as a daily staple food (Donggulo et al., 2014). The main problem in rice cultivation is the presence of weeds which cause a decrease in the quantity and quality of crops. A decrease in the quantity of yields is in the form of a reduction in the amount of yield that can be harvested and a decrease in the number of individual plants harvested (Kilkoda et al., 2015).

Generally farmers use synthetic herbicides to control weeds. Excessive use of synthetic pesticides can cause environmental damage. According to Haryatun (2008) and Lestari (2018) that controlling weeds using synthetic herbicides has negative effects, including: environmental pollution, temporary to permanent death of some natural enemies, high maintenance costs, and causes weeds to become difficult to control because they are resistant to herbicides. According to Jarot (2018) and Kadir (2007) all types of rice weeds are classified as broad leaf weeds, grasses and puzzles which are the main problems in cultivation.

One of the techniques used in rice weed control is chemical control using herbicides. The use of herbicides is effective in controlling weeds, although they are proven effective but are suspected to have an effect on the growth of the main crops. Herbicides commonly used in rice have active ingredients ametrine, diuron, 2,4-D (selective active ingredients), metal metsufuron, Penoxsulam (a broad spectrum active ingredient, absorbed by weeds through leaves, roots and translocated.) and so on (Alfredo et al., 2012). The use of 2,4-D and Penoxsulam herbicides in the study of Budhiawan et al. (2016) and Apriadi et al. (2013) showed good results on the growth and production of rice plants. The results of several studies can be concluded that the use of herbicides on main crops shows good results agronomically (post-plant growth) however there is no research that examines the side effects of using herbicides on pre-growth and physiological growth of rice plants.

The way to reduce the use of synthetic pesticides is by using bioherbicides. Bioherbicides are organic compounds that can control weeds, organic compounds derived from natural ingredients that are environmentally friendly and safe for human health (Krisno, 2017). Bioherbicides derived from plants have secondary metabolites that are allelopathic, so they have similarities with synthetic herbicides in the mechanism of plant growth inhibition (Syakir et al., 2008). Bioherbicide application of Imperata cylindrica rhizome extract contains alkaloid compounds 0.42-0.45%, tannins 9.2-9.3%, saponins 1.3-1.4%, flavonoids 0.32% and phenols 0.05% (Krishnaiah et al., 2009; Ayeni and Yahaya, 2010), groups of organic acids, sugars, amino acids, pectic, gibberellic acid, terpenoids (Yanti et al., 2016) with a concentration of 28.8 g/l can control babadotan weeds (Martiana, 2018). The results of another study showed that a solution of the mempelas plant extract (Tetracera indica) contains flavonoids and their derivatives (Fitrya et al., 2009) with a concentration of 250 g/l can reduce the number of tillers and the total number of babadotan weeds (Pramahdiyan, 2017).

Kiambang plants can be used to control babadotan weeds because the extract contains secondary metabolites such as phenols, flavonoids, alkaloids, tannins, saponins (Nithya et al., 2016). This plant has the potential as a raw material that is easy to obtain in the surrounding environment, namely, rice fields, ponds, rivers, puddles, brackish lakes, and waterways (Soerjani et al., 1987). This plant has the ability to reproduce itself quickly because it does not depend on sexual propagation and can grow from a small piece of plant (CRC Weed Management, 2003).

Based on the results of Yanti's research (2020), using a dose of 60% kiambang extract bioherbicide applied to babadotan weed is the best dose. The use of a dose of 60% causes a percentage of weed mortality of 50%, and has a percentage of phytotoxicity levels in weeds of 72.8%. However, it is not yet known whether the use of kiambang extract bioherbicide on weeds will have a negative effect on rice plants. The aim of this study was to determine the effect of kiambang bioherbicide on the germination phase of rice plants which can be seen based on germination percentage, germination rate, plumule and radicle length of upland rice plants by administering several concentrations of kiambang bioherbicide.

2. MATERIALS AND METHODS

The research was conducted at the Laboratory of Natural Materials and Minerals, Chemical Engineering Study Program, University of Riau and the Ecophysiology Laboratory, Faculty of Agriculture, University of Riau. The research time is for a month in January. The materials used were bioherbicidal kiambang extract 20%, 40%, 60% and 80%, 2,4-Dichlorophenoxyacetate herbicide, local upland rice seeds of the Kuok variety, aquadest, ethanol and laboratory analysis supporting chemicals. in this study included: dry blender, vacuum rotary evaporator, silica gel desiccator, UV-Vis spectrophotometer, digital balance, 40 mesh sieve, handsprayer, filter paper, aluminum foil, petri dish, funnel, beaker glass, measuring cup, ruler, pipette drops, spatula, test tube, thermometer and stationery.

This study used a completely randomized design (CRD), with treatment of 5 types of bioherbicide doses of kiambang herbicide 2,4-D, bioherbicide 20%, 40%, 60% and 80%. The concentration of kiambang extract was repeated 3 times for each repetition, each 1 experimental unit consisted of 3 petri dishes containing 25 rice seeds. Obtained observational data were analyzed using analysis of variance (F test) at 5% level to determine the effect of treatment. If the results are real, then proceed with the BNT test with a level of 5% to find out the differences between treatments.

The kiambang plant was obtained from several swamps in Kota Baru village, Keritang District, Indragiri Hilir Regency, Riau Province. Kiambang plants are taken manually using a fish tank. The wet weight of the kiambang plant used was 15 kg which consisted of all parts of the plant, which were not damaged by pests and did not show any signs of disease. Kiambang that has been prepared is washed and air-dried for 7 days (without being exposed to sunlight), then grinded with a dry blender to obtain a powder (dry weight) of 2.7 kg. Then it was macerated with 96% ethanol for 2 x 24 hours and stored in a glass jar. During the maceration process, stirring is carried out every day so that macerate is obtained. The maserate obtained was filtered and evaporated with a vacuum rotary evaporator until all the extract was thick. The extract obtained was stored in a silica gel desiccator (Kurniawati et al., 2018).

The test method used is the Test on Paper (UDK) (Sutopo, 2002). 3 sheets of paper substrate were placed on the petri dish base, then the application of the kiambang extract was carried out by dripping the extract as much as 3 ml/petri dish according to the treatment at the start of seed planting (Andriyani, 2017). Furthermore, the petri dish that already contains the seeds and is closed is placed in the seed germination tool. Re-dropping application is done when the paper looks dry with distilled water.

Observation parameters include:

1. The germination percentage, calculated on the 10th day (10 HSA) by counting all the growing rice sprouts. The germination percentage can be calculated using the germination percentage formula

$$\text{Germination percentage (\%)} = \frac{\text{"Number of germinated seeds"}}{\text{"Whole rice seed"}} \times 100\%$$

2. The germination rate can be measured by calculating the number of days it takes for the radicle or plumula to appear (Sutopo, 2002).

$$\text{Average day} = \frac{N1T1+N2T2+ \ldots +NXTX}{\text{"Number of seeds germinated"}}$$

3. Plumula length (cm), plumula length was measured on the 10th day (10HSA), starting on the embryonic axis to the tip of the prospective leaf.
4. Radicle length (cm), radicle length was measured on day 10 (10 HSA), starting from the embryonic axis to the tip of the root.

3. RESULTS AND DISCUSSION

Based on the variability analysis, bioherbicides significantly affected the percentage of germination, germination rate, plumule length and plant radicle. The results of the BNT follow-up test at the 5% level can be seen in Table 1.

Table 1. Percentage of germination, germination rate, plumule length, and rice radicle 10 HSA in concentration treatment of bioherbicide kiambang extract

Concentration of bioherbicide kiambang (%)	Percentage germination (%)	Germination Rate (hari)	Plumule length (cm)	Radicle Length (cm)
Herbisida 2,4-D	84,4 b	2,3 b	0,66 a	0 b
20	95,1 a	4,4 a	0,68 a	0.014 a
40	0 c	0 c	0 b	0 b
60	0 c	0 c	0 b	0 b
80	0 c	0 c	0 b	0 b

Information : The numbers followed by the same lowercase letters in the same column are not significantly different according to the LSD test at the 5% level; HSA: Days After Application.

The test results in Table 1 showed that rice seeds were able to germinate in the 2,4-D herbicide treatment and a concentration of 20%. The best growth was shown at a concentration of 20% with a germination percentage of 95.1%, although it showed the highest germination percentage, this was still low at 2.9% compared to the percentage of rice germination without using synthetic herbicides, which was 98% (Barus, 2022).

At a concentration of 20%, the seeds were able to germinate. In line with the opinion of Chung et al. (2001) the higher the concentration of secondary metabolites are given to plants, the greater the emphasis on plant growth. whereas in the 2,4-D herbicide treatment the percentage of germination was 84.4%, the germination rate was 2.3 days, the length of the plumula was 0.66 cm but no radicles grew in this treatment.

Concentration of 40%, 60% and 80% kiambang bioherbicide applied to rice plants caused the seeds to be unable to germinate which was indicated by the absence of radicle and plumule appearance in the seeds. This is because the phenolic compounds contained in bioherbicides are able to interfere with the germination process in seeds. Phenolic compounds are secondary metabolite compounds that can inhibit seed germination. According to Kusuma et al. (2017) compounds that are thought to affect growth are 2-methoxy-4-vinylphenol;2,6-dimethoxy; and 2-furanmethanol. According to Darabi et al. (2007) the process of inhibition of germination in wheat seeds is caused by natural compounds belonging to 2-methoxy-4-vinylphenol.

Another factor causing delays in seed germination is the toxicity of phenolic compounds. According to Einhellig (1995) and Pebriani et al. (2013) plant seeds that absorb a toxic phenolic compound will cause inhibition of root and stem cell division. Some phenolic compounds and their groups such as coumarins, benzoic acid, and cinnamic acid can cause inhibition of root cell division, reduce cell membrane permeability which can cause the results of the overhaul of food reserves from the endosperm to the point of growth to be disrupted, and inhibit enzyme activity and damage IAA hormones and gibberellins.

Gibberellin hormone is one of the factors that play an important role in the germination process. Phenolic compounds that inhibit the synthesis of the gibberellin hormone will reduce the transcription of the coding gene for the α-amylase enzyme which plays a role in converting starch into glucose which causes the seeds to be unable to germinate (Taiz and Ziger, 2007; Kristanto, 2006).

4. CONCLUSION

The conclusion of this study was that 20% bioherbicide extract of kiambang (Salvinia molesta) did not inhibit seed germination but the seeds grew abnormally, while concentrations of 40%, 60% and 80% inhibited germination.

REFERENCE

Alfredo, N., N. Sriyani dan D. R. J. Sembodo. 2012. Efikasi herbisida pratumbuh metil metsulfuron tunggal dan kombinasi dengan 2,4-D, ametrin, atau diuron terhadap gulma pada pertanaman tebu (*Saccharum officinarum* L.) Lahan Kering. *Jurnal agrotropika*. Vol. 17 (1) : 29-34.

Andriyani, Y. 2017. Identifikasi zat alelokimia pada ekstrak daun *Eucalyptus pellita* f. Muell dan potensinya sebagai bioherbisida. Skripsi. Institut Pertanian Bogor.

Apriadi, W., R. J. S. Dad., dan S. Herry. 2013. Efikasi herbisida 2,4-D terhadap gulma pada budidaya tanaman padi (*Oryza sativa* L.). Jurnal Agrotek Tropika.Vol 1 (3) : 269-276.

Ayeni, K.E., and S.A. Yahaya. 2010. Phytochemical screening of three medicinal plants neem leaf (*Azadirachta indica*) hibiscus leaf (*Hibiscus rosasinensis*) and spear grass leaf (*Imperata cylindrical*). Continental J. Pharmacetical Sciences. Vol (4) : 47 – 50.

Barus, R.A.K. 2021. Tidak dipublikasikan.

Budhiawan, A., G. Bambang, dan N. Agung. 2016. Aplikasi herbisida 2,4-D dan penoxsulam pada pertumbuhan dan hasil tanaman padi sawah (*Oryza sativa* L.). Jurnal Produksi Tanaman. Vol 4 (1) : 23-30.

Chung, I.M., J.K. Ahn., and S.J. Yun. 2001. Identification of allelopathic compounds from rice (*Oryza sativa* L.) straw and their biological activity . Canadian Journal of Plant Science.Vol 81 : 815-819

CRC Weed Management., 2003, Salvinia (*Salvinia molesta*) weed management guide, Department of the Environment and Heritage and the CRC for Australian Weed Management.

Darabi, H.R., S. Mohandesi., and Y. Balavar. 2007. A structure-activity relationship study on a natural germination inhibitor, *2-methoxy-4-vinylphenol* (MVP), in wheat seeds to evaluate its mode of action. Chemistry and chemical engineering research center of iran. Vol 62c : 694-700.

Donggulo, V., I. M. Chandra., M. Lapanjang., dan Usman. 2017. Pertumbuhan dan hasil tanaman padi (*Oryza sativ*a L.) pada berbagai pola jajarlegowo dan jarak tanam. Jurnal Agroland. Vol 24(1): 27-35.

Einhellig, F.A. 1995. Allelopathy: Current status and future goals. In: Inderjit, Dakhsini KMM, Einhellig FA (eds). Allelopathy, Organism, Processes and Applications. American Chemical Society, Washington DC.

Fitrya, L., F. Anwar., dan Sari. 2009. Identifikasi flavonoid dari buah tumbuhan Mempelas. Jurnal Penelitian Sains. Vol 12(3) : 1-5.

Haryatun. 2008. Teknik identifikasi jenis gulma dominan dan status ketersediaan hara Nitrogen, Fosfor dan Kalium terhadap beberapa jenis gulma di lahan rawa lebak. Buletin Teknik Pertanian. 13 : 1.

Jarot, W. 2018. Kendalikan gulma. Bayer Indonesia Luncurkan Herbisida Council Complete.

Kadir, M. 2007. Efektivitas berbagai dosis dan waktu aplikasi herbisida 2,4 dimetilamina terhadap gulma *Echinocloa colonum* L, *Echinocloa crus-galli* L, dan *Cyperus iria* L pada padi sawah. J. *Agrisistem*. Vol 3(1): 43-49.

Kilkoda, A.K., T. Nurmala, dan D. Widayat. 2015. Pengaruh keberadaan pajale (*Ageratum conyzoides* dan *Boreria alata*) terhadap pertumbuhan dan hasil tiga pengukuran varietas kedelai (*Glycine max* L.) pada percobaan pot bertingkat. J Kultivasi. Vol.14 (2) : 1-70.

Krishnaiah, D., T. Devi, A. Bono, and R. Sarbatly. 2009. Studies on phytochemical constituents of six Malaysia medicinal plants, Journal of Medicinal Plants Research Vol. 3(2), pp 067-072.

Krisno, A. 2017. Herbisida Organik. Universitas Muhammadiyah Malang Press: Malang. 71 Hal.

Kristanto, B.A. 2006. Perubahan karakter tanaman jagung (*Zea mays* L.) akibat alelopati dan persaingan teki (*Cyperus rotundus* L.). *J.Indon.Trop.Anim.Agric*. Vol 31 (3): 189-194.

Kurniawati, E., E. Rusmiyanto., dan Mukarlina. 2018. Pengaruh ekstrak daun paku resam (*Gleivhenia linearis* Burn) terhadap pertumbuhan pajale putri malu (*Mimosa pudica*). Jurnal Protobiont, Vol. 7(1) : 31-37.

Kusuma, A.V.C., M.A. Chozin,. dan D. Guntoro. 2016. Senyawa fenol dari tajuk dan umbi teki (*Cyperus rotundus* L.) pada berbagai umur pertumbuhan serta pengaruhnya terhadap perkecambahan gulma berdaun lebar. Jurnal Agron Indonesia. Vol 45(1) : 100-107.

Lestari, C.G. 2018. Potensi ekstrak bawang merah (*Allium ascalonicum* L) sebagai bioherbisida. Skripsi. Institut Pertanian Bogor.

Martiana, F.A. 2018. Potensi alelokimia ekstrak rimpang Alang-alang (*Imperata cylindrica*) untuk mengendalikan pajale Babadotan (*Ageratum conyzoides*), Skripsi, Universitas Sanata Dharma.

Nithya, T.G., J. Jayanthi, dan M.G. Ragunathan. 2016, Antioxidant activity, total phenol, flavonoid, alkaloid, tannin and saponin contents of leaf extracts of *Salvinia molesta* D.S Mitchell, *Asian Journal of Phamaceutical and Clinical Research*, Vol. 9, Issue 1.

Pebriani., R. Linda., dan Mukarlina. 2013. Potensi ekstrak daun sembung rambat (Mikania micrantha H.B.K) sebagai bioherbisida terhadap gulma maman ungu (*Cleome rutidosperma* D.C) dan rumput bahiam (*Paspalum notatum* Flugge). Jurnal Protobiont. Vol 2 : 32-38.

Pramahdiyan, B. 2017. Potensi ekstra pajale *Tetracera indica* (L) Merr. pada beberapa tingkat konsentrasi sebagai bioherbisida pratumbuh dan pascatumbuh. Skripsi. Institute Pertanian Bogor.

Sutopo, L. 2002. Teknologi Benih. Raja Grafindo Persada. Jakarta.

Soerjani, M., A.J.G.H. Kostermas, and G. Tjitrosoepomo. 1987. Weed of rice in Indonesia. Balai Pustaka. Jakarta.

Syakir, M., M.H. Bintoro, H. Agusta, dan Hermanto. 2008. Pemanfaatan limbah sagu sebagai pengendalian gulma pada lada perdu. Jurnal Littri. Vol. 14 (3) : 107-112.

Taiz, L., dan E. Zeiger. 2007. Plant Physiology (4th ed.). Sinauer Associates.

Yanti, M., Indriyanto., dan Duryat. 2016. Pengaruh zat alelopati dari alang-alang terhadap pertumbuhan semai tiga spesies akasia. BIOMA. Vol. 11 (2) : 54-58.

Yanti, Y. D. 2020. Uji Efektivitas alelopati kiambang (*Salvinia molesta*) sebagai bioherbisida dalam pengendalian gulma babadotan (*Ageratum conyzoides*) pada perkebunan kelapa sawit. Tesis. Fakultas Pertanian, Universitas Riau, Riau.