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Submission date: 21-Jul-2022 04:49PM (UTC+0700)

Submission ID: 1873349230

File name: The_potential_of_B_bassiana.pdf (678.89K)

Word count: 2667

Character count: 14518

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To cite this article: T Abdullah *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **681** 012037

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The potential of *Beauveria bassiana* Vuill to control rice leaf roller *Cnaphalocrocis medinalis* Guenee

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Abstract. The pest presence and environmental condition is very important factor on agricultural production especially manage rice growth in wetland. The purpose of the research is to study the role of *Beauveria bassiana* Vuill as entomopathogenic fungi against rice leaf roller *Cnaphalocrocis medinalis* Guenee (Lepidoptera: Pyralidae) in wetland rice field. Experimental research was held in Pest Laboratory, Plant Pests and Diseases Department, Faculty of Agriculture Hasanuddin University in March to August 2018. The source of *C. medinalis* larval from rice field in Moncongloe Bulu village, Maros district, South Sulawesi. *B. bassiana* isolate from Disease Laboratory collection in applied concentration 106 cfu to all of the treatment. The result showed in five days after applied *B. bassiana* the effective treatment control is P4 = *C. medinalis* sprayed and dipped rice leaves as food of larvae (100%) then P3 = dipped rice leaves into *B. bassiana* (90%); P2 = sprayed *B. bassiana* to body of *C. medinalis* larval (50%) and P1 = control (30%), respectively. The total mortality of *C. medinalis* after application *B. bassiana* started at five days in P4, faster than another treatment. The result of research, *B. bassiana* is very useful and safety manage population of *C. medinalis* in rice field.

1. Introduction

Rice (*Oryza sativa* L.) family Poaceae is an agricultural famous important crop for half world population. Rice was growth approximately on 145 million hectares in 110 country. About 90% rice were growth in wetland and more consumption in Asia. Overall, rice to be an important staple food for 2 billion people on development country [1–3]. In 2014, Indonesian rice productivity was reduced 0.63% than 2013. In the recent years, the decreasing of rice harvest because reduced of productivity amount 0.33% [4]. Commonly the main factor reduced of rice harvest is insect-pest and diseases incidence. The one of human effort against insect-pest is insecticides application. Unfortunately, synthetic insecticides as the plant protection material has a negative effect. Synthetic insecticides playing important role as the source of poison in ecosystem, increasing insect-pest resistance, resurgence and endangered status of natural enemies.

In Indonesia, especially in South Sulawesi as the producers of rice, presence the white rice stem borers (*Scirpophagainnotata* Walker), rice plant hoppers (*Nilaparvatalugens* Stål), rice leaf roller (*C. medinalis*) and grasshoppers are key pests of the rice in the wetland [5–7]. The rice leaf roller, *Cnaphalocrocis medinalis* Guenee (Lepidoptera: Pyralidae), gained the status of a major pest that may cause 30–40% leaf infestation and 20 – 30% yield losses to the rice crop [8–10]. The effective insecticides available to cope with insect-pest incidence, but this solution is not a long-term strategy because their impact to health and environmental hazards, exposure risks, residual perseverance and



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development of resistance [11]. Therefore, in recent years, the focus of *C. medinalis* has been shifted towards biological control. Earlier researches suggested the possibility of the successful use of *Beauveria bassiana* Vuill [12,13]. *B. bassiana* as famous entomopathogenic fungi controlled insect-pest in crops around the world. Application of entomopathogenic fungi as the safety way controlled insect-pest development. These biofungicides are valued tools for non-chemical pest management strategies. The advantages apply of *B. bassiana* is: safety for mammals, human health and environment, improve plant health, cheaper and easy to apply [10,14]. Rizwan et al. [15] reported that *B. bassiana* or white muscardine fungi as the important biological control agent for insect-pest on the tropic. *B. bassiana* have been effectively used for biological control of aphids, lepidopteran caterpillars and other pests. *B. bassiana* are active agents against different stages of insect pests. Sivasundaram et al. [12] reported the application of *B. bassiana* have been decrease number of several insect-pest species with reduced cells and protein synthesis on body of insect target. The purpose of research is to study the role of *B. bassiana* as important entomopathogenic fungi against rice leaf roller *C. medinalis* in wetland rice field.

2. Methods

2.1. This site of research.

Experimental research was held in Pests Laboratory, Plant Pests and Diseases Department, Faculty of Agriculture Hasanuddin University in March to August 2018.

2.2. Source of *C. medinalis*.

C. medinalis larval as object of research was collected from rice field in Moncongloe Bulu village, Moncongloe district, Maros Regency, South Sulawesi Indonesia.

2.3. Source of isolate and pathogenicity test of *B. bassiana*.

The research used *B. bassiana* isolate from Phytopathology Laboratory collection, Plant Pests and Diseases Department, Faculty of Agriculture, Hasanuddin University Makassar. The available concentration [1×10^6 colony-forming unit/gram (cfu/g)] of *B. bassiana* used in order to study the pathogenicity of *B. bassiana* against the two instar larval of *C. medinalis*. The tested larval were collected from wetland rice field, starved for 3 h and apply for each treatment [16].

The research conducted in four treatment such as: P1= control (sterilized distilled water); P2 = sprayed *B. bassiana* suspension to body of *C. medinalis* larval. Every larval sprayed with 2 ml of *B. bassiana* suspension with concentration 106 cfu/g inside petridish; P3 = dipped rice leaves into *B. bassiana* with concentration 106 cfu/g. Treatment used rice young leaves at the food source of *C. medinalis*. Before dipped in the *B. bassiana* suspension, the leaves cutting to be small pieces (length 5 cm), cleaning with water and drying. After dipped, the leaves dried and put inside petridish contain *C. medinalis* larval; P4 = *C. medinalis* larval and dipped rice leaves as their food were put together inside a petridish. The treatment used dipping rice leaves similar treatment with P3. After 24 hours, *C. medinalis* larval sprayed with 2 ml of *B. bassiana* suspension with concentration 106 cfu/g. Ten larval put into every petridish (diameter 8 cm) and used in each treatment. Mortality counts started after 24 hours and recorded for 10 days [13].

2.4. Data analysis

All of data treatment of *C. medinalis* was collected and tabulation. The performance of research data used Analysis of Variance (ANOVA) with DMRT level 95% ($\alpha = 0.05$) randomly.

3. Results and discussions

The result showed in five days after applied *B. bassiana* the effective treatment control is P4 = *C. medinalis* sprayed and dipped rice leaves as food of larval (100%) then (90%); P2 = sprayed *B. bassiana* to body of *C. medinalis* larval (50%) and P1 = control (30%), respectively.

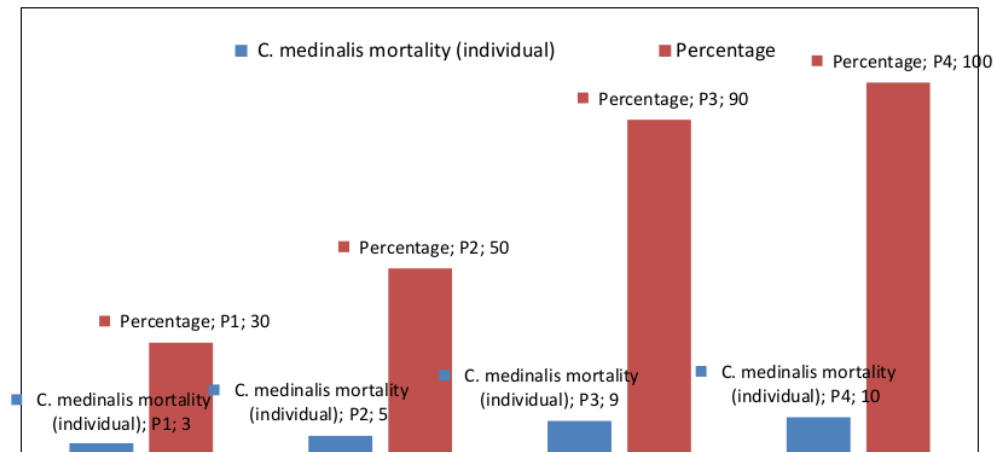


Figure 1. Mortality of *C. medinalis* larvae after five days application of *B. Bassiana* (individual)

Figure 1 showed in five days after applied *B. bassiana* the effective treatment control is P4 = *C. medinalis* sprayed and dipped of rice leaves as food of *C. medinalis* larval (100%) then P3 = dipped rice leaves into *B. bassiana* (90%); P2 = sprayed *B. bassiana* to body of *C. medinalis* larval (50%) and P1 = control (30%), respectively. The total mortality of *C. medinalis* after application *B. bassiana* started at five days in P4, faster than another treatment. The combination treatment sprayed and dipped of larval food showed the best treatment in control development of *C. medinalis* larval. The total mortality after application of *B. bassiana* showed in Figure 2.

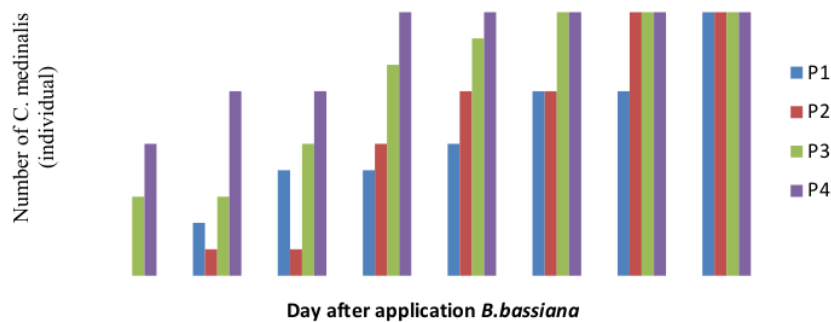


Figure 2. Total mortality *C. medinalis* larval after application of *B. bassiana*

Figure 2 showed in nine days after applied of *B. bassiana*, all of *C. medinalis* larval from P2, P3 and P4 died. The finding of research showed treatment combination sprayed and dipped of larval food showed the best treatment in control development of *C. medinalis*. After 48 hours the application of *B. bassiana* was visually *C. medinalis* larval began in-active moved for P2, P3 and P4. It seems *C. medinalis* in dehydration condition. In the treatment using *B. bassiana*, suspected that *B. bassiana* suspension contains *beauvericine* toxin has been invasion of *C. medinalis* cell body. The dipping leaves treatment is an effective way to against *C. medinalis* because *B. bassiana* contain in larval food then enter to digestive tract. Sun *et al.*[17] state that *beauvericine* as toxin from *B. bassiana* will effective and damage cells at low pH mainly in insect stomach. The visual symptom is *C. medinalis* larval become in-active after apply the entomopathogenic fungi.

Commonly rice leaf roller *C. medinalis* hatched from the egg will produce silk thread used to fold leaves of their host plant. During the development, *C. medinalis* living in scroll and form pupae inside leaves. In addition, rice leaves function as protective leaf folding *C. medinalis* from predators and sunlight. This is a problem controlling presence *C. medinalis* in rice field because *C. medinalis* protected by rice leaves. Drop of synthetic pesticides application against *C. medinalis* will stay more at leaves surface. If larval eating leaves, it will contaminated and caused death [18].

The result of research is microbial insecticides contain *B. bassiana* have shown promising better action against *C. medinalis* larval. The data is accordance with finding Ambethgaret *al.* [19] reported that *B. bassiana* was the most efficient for biological control of *C. medinalis* under laboratory condition. *B. bassiana* as entomopathogenic fungi that recommended in IPM program. Feng *et al.* and Saravanakumaret *al.*[20,21] state that the isolated was found easy to culture, cheap and effective control insect-pest in different crop including in wetland.

4. Conclusions

The result of research showed *B. bassiana* is very useful as entomopathogenic fungi and effective decrease population of *C. medinalis* larval. However, further studies are required evaluate their efficacy and compatibility against *C. medinalis* larval under field condition in various wetland zones at South Sulawesi.

References

- [1] de Carvalho R O, Machado M B, Scherer V S, Fuentes G C, da Luz C A S and da Luz M L G S 2015 Hydroponic lettuce production and minimally processed lettuce *Agric. Eng. Int. CIGR J.*
- [2] Heriqbaldi U, Purwono R, Haryanto T and Primanthi M R 2016 An Analysis of Technical Efficiency of Rice Production in Indonesia An Analysis of Technical Efficiency of Rice Production in Indonesia *Asian Soc. Sci.* **11** 91–103
- [3] Haryanto T, Talib B A and Salleh N H M S 2016 Technical efficiency in Indonesian paddy farming : Study in Java Island *J. Ekon. Malaysia* **50** 143–54
- [4] Sunaryo Y, Purnomo D, Darini M T and Cahyani V R 2018 Effects of goat manure liquid fertilizer combined with AB-MIX on foliage vegetables growth in hydroponic *IOP Conference Series: Earth and Environmental Science* **129** 1-8
- [5] Okemwa E 2015 Effectiveness of aquaponic and hydroponic gardening to traditional gardening *Int. J. Sci. Res. Innov. Technol.* **2** 21–52
- [6] Karim T, Qadir K and Aziz S 2013 Rate of soil aggregates disintegration as affected by type and rate of manure application and water quality *Int. J. Plan. Anim. Environ. Sci* **3** 94–102
- [7] Saleem M, Ramzan M, Manzoor Z and Ali I 2004 Effect of various tillage practices on the population of hibernated stem borer larvae in rice-wheat cropping systems *J Anim Pl Sci* **14** 14–5
- [8] Wakil W, Akbar R and Gulzar A 2001 Evaluation of different insecticides against rice stem borer and rice leaf folder *Pakistan J. Agric. Sci.* **38** 49–50
- [9] Pathak M D and Khan Z R 1994 *Insect pests of rice* (International Rice Research Institute)

- :Philippines)
- [10] Prakash A, Rao J and Nandagopal V 2008 Future of botanical pesticides in rice, wheat, pulses and vegetables pest management *J. Biopestic.* **1** 154–69
 - [11] Ramaraju K and Natarajan K 1997 Control of leaf folder under extreme weather conditions *Madras Agric J* **66** 252–4
 - [12] Sivasundaram V, Rajendran L, Muthumeena K, Suresh S, Raguchander T and Samiyappan R 2008 Effect of talc-formulated entomopathogenic fungus *Beauveria* against leaf folder (*Cnaphalocrosis medinalis*) in rice *World J. Microbiol. Biotechnol.* **24** 1123–32
 - [13] Ullah M I, Arshad M, Abdullah A, Khalid S, Iftikhar Y and Zahid S M A 2018 Use of the entomopathogenic fungi *Beauveria bassiana* (Hyphomycetes: Moniliales) and *Isaria fumosorosea* (Hypocreales: Cordycipitaceae) to control *Diaphorina citri* Kuwayama (Hemiptera: Liviidae) under laboratory and semi-field conditions *Egypt. J. Biol. Pest Control* **28** 75
 - [14] Shepard B M, Barrion A T and Litsinger J A 1987 *Friends of the rice farmer: helpful insects, spiders, and pathogens* (International Rice Research Institute :Philippines)
 - [15] Rizwan M, Atta B, Sabir A M, Yaqub M and Qadir A 2019 Evaluation of the entomopathogenic fungi as a non-traditional control of the Rice leaf roller, *Cnaphalocrosis medinalis* (Guenee) (Lepidoptera: Pyralidae) under controlled conditions *Egypt. J. Biol. Pest Control* **29** 10
 - [16] Negasi A, Parker B L and Brownbridge M 1998 Screening and bioassay of entomopathogenic fungi for the control of silverleaf whitefly, *Bemisia argentifolli* *Int. J. Trop. Insect Sci.* **18** 37–44
 - [17] Sun J, Fuxa J R and Henderson G 2003 Effects of virulence, sporulation, and temperature on *Metarhizium anisopliae* and *Beauveria bassiana* laboratory transmission in *Coptotermes formosanus* *J. Invertebr. Pathol.* **84** 38–46
 - [18] Fujiyoshi N, Noda M and Sakai H 1980 Simple mass-rearing method of the grass leaf roller, *Cnaphalocrosis medinalis* Guenee, on young rice seedlings [*Oryza sativa*]. *Japanese J. Appl. Entomol. Zool.*
 - [19] Ambethgar V, Swamiappan M, Rabindra R J and Rabindran R 2007 Pathogenicity of certain indigenous isolates of entomopathogenic fungi against rice leaf folder, *Cnaphalocrosis medinalis* (Guenee). *J. Biol. Control* **21** 223–34
 - [20] Feng M-G, Pu X-Y, Ying S-H and Wang Y-G 2004 Field trials of an oil-based emulsifiable formulation of *Beauveria bassiana* conidia and low application rates of imidacloprid for control of false-eye leafhopper *Empoasca vitis* on tea in southern China *Crop Prot.* **23** 489–96
 - [21] Saravanakumar D, Muthumeena K, Lavanya N, Suresh S, Rajendran L, Raguchander T and Samiyappan R 2007 *Pseudomonas*-induced defence molecules in rice plants against leaf folder (*Cnaphalocrosis medinalis*) pest *Pest Manag. Sci. Former. Pestic. Sci.* **63** 714–21

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