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Incidence of Rice Bug,Leptocorisaoratorius (F.) (Hemiptera: Alydidae) Using White MuscardineFungus Beauveriabassiana (Bals.) Vuill.In Upland Rice

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Abstract

A field experiment was conducted to evaluate the incidence of Rice bug, *Leptocorisaoratorius*(F.) using *B. bassiana* as mycoinsectice under upland conditions. Field population of *L. oratorius* was not significantly affected by *B. bassiana*7 DAS, but significant at 15 DAS. The application of *B. bassiana* did not significantly affect the damage caused by *L. oratorius*on rice grains.The results suggest that *B. bassiana* cannot be used as a sole mortality factor in the management of rice bug under upland conditions. More field experimentations are necessary taking into consideration the influence of environmental factors and how these can be manipulated in favor of the fungal insecticide.

Key Words: *Conidia, substrate, microbial insecticide, upand rice, abiotic environmental factors*

INTRODUCTION

Rice bug, *Leptrocorisaoratorius* (F.) is one of the major insect pests infesting rice in upland areas. Several species of rice bugs occur in the Philippines, but *L. oratorius* is the most prevalent (Reissig et al., 1986; Litsinger et al., 1987). Upland rice is usually cultivated for organic rice or with less application of fertilizer and pesticides. The increasing demand for organically produced foods including rice, has contributed to the adoption of ecologically oriented pest control methods. Consequently, reduced pesticide use has become a strong option to protect the environment and human health. Thus, the use of biological control agents, such as entomopathogenic fungi, has been considered a useful alternative to pest control. One of the widely used entomopathogenic fungi against the management of insect pest is Beauveria*bassiana* (Bals.) Vuillemin.

Several works have been carried out under laboratory and field conditions, aiming at selecting virulent isolates of *B. bassiana*against various insect pests including the rice bug, *Leptocorisaoratorius*(Aguda et al 1987; 1988; Jesusa et al.; Thuy et al. 2001). However, biological control of *L. oratorius*using *B. bassiana*under field conditions especially in the upland areas has not been considered.

This study was conducted at the University of Eastern Philippines, Catarman, Northern Samar, Philippines to evaluate the incidence of *L. oratorius*using*B. bassiana*in upland rice.

MATERIALS AND METHODS

Experimental Design

A Randomized Complete Block Design (RCBD) with three replications was used. Four dosages (1 x 10^{12} conidia/ha), (D1); (1.0 x 10^{13} conidia/ha), (D2) including chemical insecticide (malathion, recommended rate) and control (water only) were evaluated. The treatments were designated as follows:

T1	=	Rice, control
T2	=	Rice + *B. bassiana* (1 x 10^{12} conidia/ha)
T3	=	Rice + *B. bassiana* (1 x 10^{13} conidia/ha)
T4	=	Rice + Insecticide (Malathion)

Land Preparation and Planting

Prior to land preparation, soil samples were taken randomly from the experimental field for chemical and mechanical analysis (Table 1). The field was prepared thoroughly by alternate plowing and harrowing. Double plowing and harrowing was done to make the soil a little finer to achieve a high degree of seed emergence.

Rice furrows were spaced at 30 cm and pre-germinated rice seeds were drilled uniformly over the furrowed surface at 100 kg seeding rate per hectare. The seeds were covered with thin layer of soil using a rake.The crops were maintained following the recommended cultural management practices for upland rice.

Table 1.Chemical and physical properties of the soil at the experimental site, UEP, Catarman, Northern Samar, Philippines.

SOIL CHARACTER	ANALYSIS
pH	4.4
Organic matter	2.57%
Extractable phosphorus	5.27 ppm
Extractable potaqssium	0.34 meg/100 g soil

Application of *B. bassiana* as Myco-insecticide

Two-week-old culture of *B. bassiana*(GLH isolate)was used as myco-insecticie against *L. oratorius*.Application of fungal suspension was done by spraying theplants late in the afternoon 1 week before headingusing a 16-liter capacity knapsack sprayer.

Population count of *L. oratorius* per linear meter was done visually, 7 and 15 days after spraying (DAS). Acid fuchsin test was carried out on 10 randomly selected panicles per plot to determine the efficacy of the treatment. Data were taken at harvest and analyzed statistically using analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Effects of *B. bassiana* on Field Population of *L. oratorius*

Field population of *L. oratorius* was not significantly affected by *B. bassiana*7 DAS, but significant 15 DAS. Highest population at 15 DAS was recorded in the control treatment with 3.48 bugs per linear meter followed in the decreasing order of population number by dose 3 (1.0 x 10^{12} conidia/ha), commercial insecticide and dose 1 (1.0 x 10^{13} conidia/ha),with 1.14; 0.86 and 00.0 bugs per linear meter, respectively (Table 2). No significant differences in field bug population were observed as influenced by *B. bassiana*, dose 3 (1.0 x 10^{12} conidia/ha) and commercial insecticide 15 DAS.

These results agree with previous observations about the regulatory effect of microbial insecticides in the field population of some insect pests (Aguda et al., 1987; Rombach et al., 1986; 1987; Krueger et al., 1991) including *L. oratorius* (Burdeos, 1994). Although in this present study the number of *L. oratorius* was significantly suppressed 15 Days-after-Spraying (DAS). This implied that the bugs could still inflict a considerable or substantial damage on the crop.

Table 2. Field Population of *L. oratorius* as influenced by *B. bassiana*, 7 and 15 days-after-spraying (DAS).

TREATMENT	POPULATION (NO,/LINEAR METER)	
	7 DAS	15 DAS
Rice, control	4.17	3.48^{a}
Rice + *B. bassiana* ($1x10^{12}$ conidia/ha)	2.08	0.00^{c}
Rice + *B. bassiana* ($1x10^{13}$ conidia/ha)	1.42	1.14^{bc}
Rice + Malathion (recommended rate)	0.86	0.86^{bc}

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**Means with the same letters are not significant at 5% level, DMRT.*

In an agro-ecosystem, a disease phenomenon was influenced by three-way interaction that included the susceptible host, virulent pathogens and favorable environment (Carruthers and Soper, 1987). Under such circumstances, unfavorable environment appeared to influence the erratic population density of bugs as affected by the treatment. Suitable insect host plants and movement of insect in and out of an area were also considered as additional factors that influenced population of insect in the field. Morill et al., (1990) observed that although weeds and ratoon rice in fields and bunds provide potential habitats for nymphs after rice is harvested, adults abandoned mature rice plants. This would indicate that insect movement in the field is inevitable which, in turn, would result in increase or decrease in the population. It is worth mentioning that when this field trial was conducted adjoining fields were also planted to rice allowing bugs to migrate to adjacent plants. Burdeos (1994) also mentioned about the decline of insect population as a result of emigration.

Damage caused by *L. oratorius* on Rice Grains

Acid fuchsin test was conducted to determine the damage caused by *L. oratorius* to rice grains. Results of the test are shown in Table 3. The application of *B. bassiana* did not significantly affect the percentage damage on rice grains caused by the rice bug. The results suggest that while the use of *B. bassiana* as microbial insecticide against *L. oratorius* under upland rice environment significantly reduced the field population of the bug, it could not give a significant protection on the grains against *L. oratorius*.

Table 3. Damaged grains caused by *L. oratorius* as influenced by *B. bassiana*.

DOSE (conidia/ha)	DAMAGED GRAINS (%)
Rice, control	48.44
Rice + *B. bassiana* (1x10^{12} conidia/ha)	37.38
Rice + *B. bassiana* (1x10^{13} conidia/ha)	36.28
Rice + Malathion (recommended rate)	36.67

Under field conditions, there are parameters other than pathogenicity that must be considered in the development of a fungal isolate suitable for use as a mycoinsecticide. One of the major constraints in the use of microbial insecticides is its vulnerability to environmental factors. The main abiotic factors that affect entomopathogenic fungi are humidity, temperature and exposure to ultra-violet (UV) radiation (Ignoffo, et al., 1974; Ignoffo et al., 1976; Zimmermann, 1982; Fuxa, 1987;Fargues et al, 1996; Rangel et al., 2005a; Rangel et al., 2006a Lazzarini, 2006; Meyling and Pell, 2006;Quesada-Moraga et al, 2006; Mustafa and Kaur, 2008;

Jackson et al.; Jaronski, 2010; Fargues et al., 2013). The solar radiation, which includes visible light, ultraviolet radiations, infrared rays and radio waves have been the dominant source in which all organisms evolved and adapted. In biological context, the UV radiations acclaim a special mention in terms of their impact on life (Bjorn, 2006). Rice grown under upland environment even during rainy season is characterized unfavorable abiotic factors which may inhibit pathogenicity or causing a disease.

CONCLUSION AND RECOMMENDATIONS

The use of white muscardine fungus, *B. bassiana* as myco-insecticide caused a significant reduction in rice bug, *Leptocorisaoratorius* (F.) population 15 days-after-spraying (DAS) under upland rice environment but failed to provide protection against grain damage. Some environmental factors assumed to be operating in the upland environment probably, humidity, temperature and exposure to direct sunlight inhibit the occurrence of pathogenicity. The results suggest that *B. bassiana* cannot be used as a sole mortality factor in managing the population of rice bug under upland conditions.

More field experimentations are necessary taking into considerations the influence of the above mentioned environmental factors and how these can be manipulated in favor of the mycoinsecticide. Conducting a similar study that will focus under lowland conditions (rainfed and irrigated) and multiple cropping system will help unfold and substantiate the effect of various environmental conditions.

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