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Ability Test of Botanical Pesticide Formulation in Pressing Rice BUG (*Leptocorixa Oratorius* L.) PEST ON RICE PLANT

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Abstract
More than 400 thousand plant species have been identified as chemical ingredients and 10 thousand of them contain secondary metabolites that can be used as botanical pesticides. This research is experimental and aims to determine the effectiveness of botanical pesticide formulations on rice bugs in rice plants. The plant material used was maja flesh, galangal, and tobacco. The dose used is 20% with a water solvent. Botanical pesticides were applied in the shelf life of 0, 1, 3, 5, 7 and 9 weeks. The results showed that a 20% dose of plant-based pesticides made by heating could kill 100% of stinky bugs if the pesticide is directly used or stored for 3 weeks. Dosage 20% of botanical pesticides made by fermentation can kill 100% rice bugs when the pesticide is used immediately or stored for 5 weeks. Vegetable pesticides from a mixture of tobacco leaves, maja flesh, and galangal made with fermentation have longer effectiveness than those made by heating.

***Keywords :** botanical pesticide formulation, rice bug, storability, dosage*

INTRODUCTION

Rice plants in their growth are disturbed by abiotic and biotic factors. This factor has the potential to reduce rice productivity. Abiotic factors can include low soil fertility, drought and unfavorable conditions from climate and weather factors. Biotic factors in the form of plant-disturbing organisms, namely pests, diseases, and weeds. Plant pests such as insect pests were among the rice plant population actually part of a community of agricultural ecosystems. Agricultural ecosystems were originally natural ecosystems that were in balance, the organism's population was in a stable state.

But along with advances in agriculture with a variety of technological inputs that use synthetic chemicals have caused modern agricultural ecosystems to become unstable. In the agricultural production process there are production inputs in the form of land management, use of seeds / superior varieties, use of fertilizers, irrigation, use of pesticides and several other inputs. With these processes and inputs, agricultural ecosystems become unbalanced or turn into semi-natural (Untung, 1996).

Rice pest disorders are quite prominent from the beginning of the growth period until the harvest, even after becoming grain stored in warehouses. Important pest attack symptoms such as stem borer, brown planthopper, green planthopper, stinky rice pest and so on, must be watched out for proper control so that it does not cause heavy damage and even loss of yields. To reduce pest attacks that appear in the field, it is necessary to conduct monitoring so that the presence of pests can be known early.

Rice bugs (*L. oratorius*) is one of the important pests that attack rice paddy plants. These pests generally attack rice plants in the ripening phase by sucking the liquid rice grains that are still in the process of filling, causing rice grains to become empty or filling is not perfect. In Indonesia, rice bugs are potential pests which in certain conditions, turn into important pests and can cause yield losses of up to 50%.

The results of previous studies showed that the population of rice bugs 5 tails / 9 clumps of rice would reduce yields by 15%. The relationship between the population density of rice bugs and the decrease in yields shows that a single attack of rice bugs in one week can reduce rice yield by 27% (Feriadi, 2010). Chemical control is carried out based on the level of the population of rice bug in rice plantations. If in 20 clumps of rice found 10 rice bugs or 6 rice bugs per m2 need to be applied insecticide. Until now, there are no rice varieties that are resistant to rice bugs. Based on the rice bug life cycle, planting in one large expanse is a highly recommended control method. when the rice plants are flowering, the rice bug will immediately move from the grass or plants around the rice fields to the first flowering rice crop. So if rice planting is not synchronous, the earliest flowering will be attacked first and used as a breeding ground. Planting the slowest will have a relatively heavier attack because rice bugs have been breeding in crops that flower earlier. Planting is recommended in a single stretch of no more than 2.5 months.

Pest life is greatly influenced by various factors; among them are internal factors such as life cycle, peridian, fertility, and external factors such as physical factors, dietary factors and biological factors. knowledge of the factors that influence the life of the pest is very important to know in its control efforts (widnyana, 2011). Botanical pesticides are an excellent way to control plant pests cheaply and easily, cheaply because the materials used can be obtained around farmers. Besides being cheap, it is also very safe for humans and other living things, so it is very supportive of the safety of the environment (ecosystem). Easy because botanical pesticide formulations can be made directly by farmers without sophisticated equipment, using very simple technology, done alone or in groups or on a certain scale. Various types of plants that can be obtained in the environment around farmers can be used as plant-based pesticides. The results of previous studies show that three of the topical plants, such as citronella grass (Cymbopogon nardus), lemongrass (Cymbopogon citratus), neem (Azadirachta indica), were done in this experiment to utilize it as botanical pesticide. The experiment result shown at the concentration 10%, all of the essential oils are effective to kill the caterpillar (90-100%).(Adnyana, *et al*. 2012)

This research utilizes potential plants as plant-based pesticides around farmers' gardens. These plants are tobacco, galangal, and maja flesh. This research is focused on examining the effect of plant pesticide formulations from these three plant materials on rice bug (*L. oratorius*) on rice plants at a dose of 20% with different storage times so that simple vegetable pesticide formulations with certain storability can be made and utilized by farmers.

RESEARCH METHODS

Time and place of research

This research is an experimental research conducted in the laboratory of the Faculty of Agriculture, Mahasaraswati University Denpasar Bali Indonesia. Rice bugs found on rice plants in the field. Research carried out for 8 months from January 2019 to September 2019.

Materials and tools

The tools used are pans, stoves, petri dishes, large buckets, boxes, jerry cans of storage, blenders, chopper knives, funnels, masks, gloves. Ingredients used: Tobacco Leaves, Maja flesh, Galangal, alcohol, cotton, tissue, and Em4 (effective microorganisms)

Plant-based biopesticide preparation

Plant-based biopesticides are made by heating and fermentation methods. Plant materials used are maja flesh, tobacco, and galangal with the following comparisons: maja flesh 3 grains (2 kg), 0.5 kg tobacco, 0.5 kg galangal, and 10 liters of water. For heating pesticides the three plant materials are chopped to get a size of about 0.5 cm and then boiled simultaneously until it boils for 1 hour. The results of boiling the material are then cooled, drained and stored in jerry cans as preparation in application to rice bugs. For the preparation of a botanical pesticide that is fermented, the same amount of material is immersed in 10 liters of water, kneaded and added with 0.5 l EM4 and stored for 1 week before being used for application.

Preparation of insect testing (rice bugs)

This type of test insect is rice bugs, which are endemic pests on lowland rice on the island of Bali and many attack rice in the initial filling phase of rice grains, especially in the planting season April-October 2019. The location of searching for pests is done in 4 (four locations), namely in rice fields in Kertalangu Village (Denpasar), Medahan Keramas Village (Gianyar), Yeh Embang Village and Tukadaya Village (Jembrana). At least 192 rice bugs are needed for research carried out according to treatment.

Plant-based biopesticide treatment

As for the treatment of plant-based pesticides, both those made by heating and fermentation are 20% (20 liters of pesticides in 100 liters of water). The shelf life of the plant-based pesticides used is the shelf life of 0, 1, 3, 5, 7 and 9 weeks. The treatment is given by spray method directly to the target insect as many as 8 animals per replicate with a concentration of 20% pesticide in water.

Observation and data analysis

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The parameters observed were the number of deaths of rice bugs for 2 hours, > 2 - 4 hours, > 4 - 6 hours of botanical pesticides that had been stored for 0, 1, 3, 5, 7, and 9 weeks. This research is a simple experiment so that a simple analysis is a comparison of the data obtained in the form of a percentage.

RESULTS AND DISCUSSION

The prepared rice bugs are then placed in a porcelain container and each container is filled with 8 rice bugs as a test. The treatment was carried out as a contact poison with a direct spray method on the target insect with a concentration of 20% pesticide with a water solvent. Observations were made for 24 hours to count the number of dead rice bugs. The results of these treatments are presented in Table 1.

Table 1. The number of deaths of rice bugs in 24 hours after application at a different shelf life from heatingbotanical pesticides

Repetition	The shelf life of heating botanical pesticides					
	0 week	1 week	3 weeks	5 weeks	7 weeks	9 weeks
1	8	8	8	5	3	0
2	8	8	8	6	2	1
3	8	8	8	6	2	0
4	8	8	8	5	3	1
Average (%)	8 (100%)	8 (100%)	8 (100%)	5.5 (68.75%)	2.5 (31.25%)	0.5 (0.06%)

The death of rice bugs in heating biopesiside treatment at the shelf life of 0-3 weeks is 100%. After a shelf life of 3 weeks there was a decrease in the ability to kill rice bugs at 68.75%, and after storing 9 weeks of botanical pesticides heating seemed to be no longer effective. When viewed from the duration of death of stinky rice pest, the results of the study show that for heating botanical pesticides results can kill 100% of the test pests within <2 hours; this ability will decrease along with the length of storage of the vegetable pesticides (as presented in Table 2)

Table 2. The number of rice bugs deaths on the different shelf life of heating botanical pesticides

Time of death	The shelf life of heating botanical pesticides					
	0 week	1 week	3 weeks	5 weeks	7 weeks	9 weeks
<2 hours	32	28	25	13	2	0
>2 – 4 hours	0	4	5	9	2	0
>4 – 6 hours	0	0	2	6	3	0
>6 hours	0	0	0	4	3	2
Total	32	32	32	32	10	2

The results showed that heating botanical pesticides remain effective when stored for no more than 5 weeks.At the shelf life of 7 and 9 weeks, they were only able to kill 41.7% and 0.08%, respectively. This can clearly be seen in Figure 1.

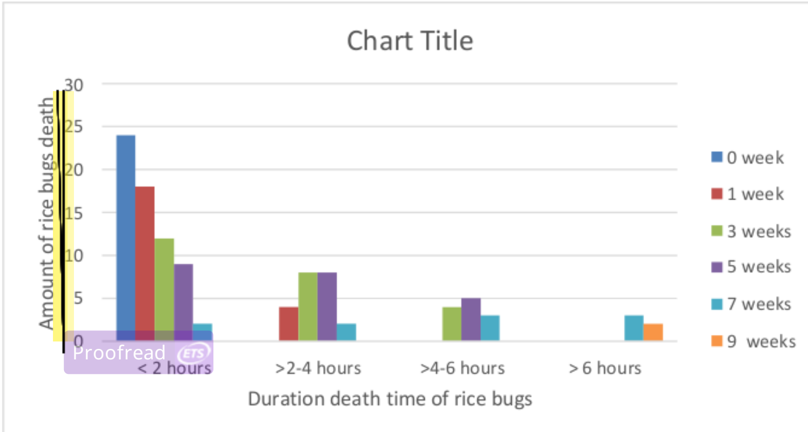

Figure 1. Relationship between botanical pesticide storage and the ability to kill rice bugs

Similar to the heating botanical pesticides, the treatment of the pesticide fermentation was also given by the method of spray directly to the target insect as many as 8 tails per replication with a concentration of 20% pesticides with water solvents. The results are presented in Table 3.

Table 3. The number of deaths of rice bugs in the shelf life is different from the fermentation botanical pesticides

Repetition	Shelf life of fermented botanical pesticides					
	0 week	1 week	3 weeks	5 weeks	7 weeks	9 weeks
1	8	8	8	8	7	7
2	8	8	8	8	8	6
3	8	8	8	8	6	6
4	8	8	8	8	7	7
Average (%)	32 (100%)	32 (100%)	32 (100%)	32 (100%)	28 (87.50%)	26 (81.25%)

The results of the study in Table 3 show that the botanical fermentation pesticide has a better ability than the healing botanical pesticide. At the shelf life of 0 - 5 weeks, the botanical pesticide fermentation can kill 100% of rice bugs. The effectiveness of the botanical pesticide fermentation began to decline after being stored 7 and 9 weeks but was still able to kill 87.5% and 81.25% of rice bugs, respectively.

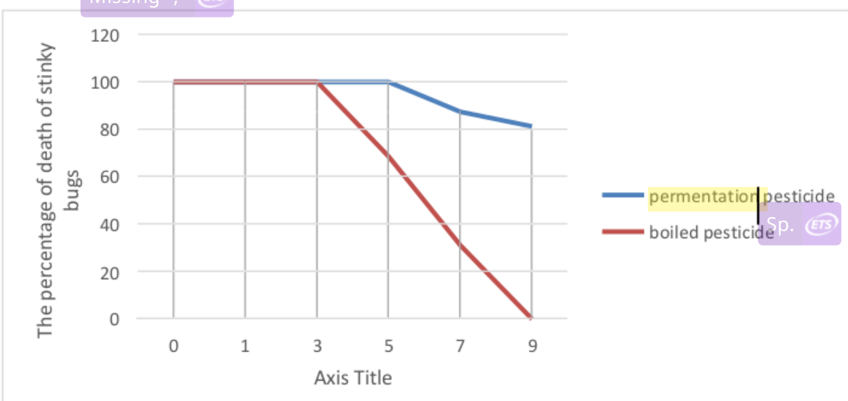

Figure 2. Relationship between the effectiveness of heating and fermentation botanical pesticides with their shelf life

The relationship between the effectiveness of heating botanical pesticides and fermentation is presented in Figure 2. It is shown that the heating botanical pesticides have a shorter shelf life than the fermentation

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botanical pesticides. Fermentation botanical pesticides are still effective in 9 weeks shelf life and the effectiveness of heating botanical pesticides can only last 5 weeks. Table 2 shows that the fermentation botanical pesticides have a longer shelf life than the heating botanical pesticides. Fermentation botanical pesticides are still active after being stored for up to 9 weeks and can still kill rice bugs up to 81.25%.

Table 4. The number of deaths of rice bugs according to the shelf life of fermented botanical pesticides

Time of death	Shelf life of fermented botanical pesticides					
	0 week	1 week	3 weeks	5 weeks	7 weeks	9 weeks
<2 hours	32	32	32	28	20	16
>2 – 4 hours	0	0	0	4	4	6
>4 – 6 hours	0	0	0	0	2	2
>6 hours	0	0	0	0	2	2
Average	32	32	32	32	28	26
(%)	100%	100%	100%	100%	87.5%	81.25%

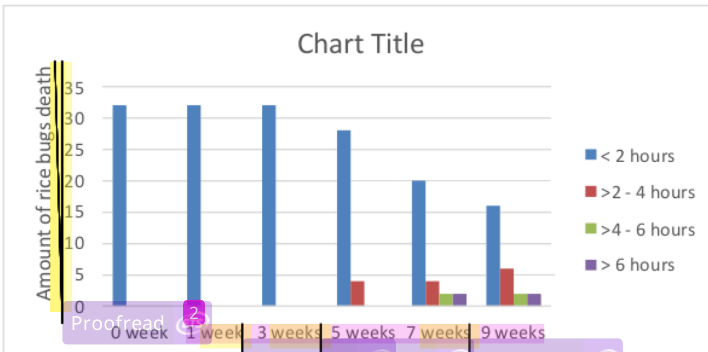

Figure 2. Graph of the number of dead rice bugs within a certain time duration of the botanical fermentation pesticide that is stored 0 to 9 weeks.

The effectiveness of botanical pesticide fermentation is still effective until 9 weeks of shelf life, 0 to 5 weeks of shelf life can kill 100% of rice bugs with death less than 4 hours, and after 7 weeks of storage can kill 87.5% of rice bugs, at the shelf life of 9 week is able to kill 81.25% rice bugs. This shows that the botanical fermentation pesticide is more effective than the heating botanical pesticide. The results also prove that botanical pesticides should be used immediately after they are made to guarantee their effectiveness, and if stored so that they are not more than 5 weeks for heating botanical pesticides, and 9 weeks for botanical pesticides for fermentation.

In this research, the botanical pesticide in question is a pesticide made from plant material. Botanical pesticides are classified as biochemical pesticides because they contain biotoxins. Biochemical pesticides are substances that occur naturally to control pests by non-toxic mechanisms. In evolution, plants have developed chemicals as a natural defense tool against existing disorders. Plants contain many chemicals that are secondary metabolites and are used by plants as a means of defense from invading organisms.

Plant-based biopesticide active ingredients are natural products derived from plants that have secondary metabolite groups that contain thousands of bioactive compounds such as alkaloids, terpenoids, phenolics, and other secondary chemical substances. The bioactive compounds when applied to plants infected with the pest, does not affect the physiological aspects of photosynthesis or growth of other plants, but the effect on the nervous system of muscles, balance hormones, reproduction, behavior such as towing, anti dining and respiratory system of pest (Setiawati *et al*. 2008).

In Indonesia there are actually very many types of plants producing biopesticides; it is estimated that around 2400 species of plants belonging to 235 families (Asmaliyah *et al*., 2010). The use of botanical pesticides in addition to reducing environmental pollution is also cheaper than chemical pesticides (Wiratno *et al*. 2011). Plants contain chemicals in the form of secondary metabolites, which function in the process of plant metabolism is still unclear. However, this compound group turned out to play a role in the process of interacting or competing, including protecting themselves from competitors' disorders (Kardinan, 2011). The secondary metabolite product can be used as an active ingredient of botanical pesticides (Dubey *et al*. 2008). Although only about 10 thousand types of secondary metabolites have been identified, the number of chemicals in plants that are potential as plant pesticides is estimated at 400 thousand species (Aranillewa *et al*. 2006). It is estimated that there are about 1,800 types of plants that contain active ingredients of pesticides that can be used for pest control. In Indonesia, plant species producing vegetable pesticides are distributed in 235 families with 2,400 plant species (Kardinan 2011).

The advantages of botanical pesticides are many including; manufacturing technology is very easy and inexpensive, so it can be made on a household scale, relatively safe to use because it does not cause negative effects on the environment or other living things, safe for plants because it does not contain harmful chemicals, so plants will be healthier, safe for the balance of the ecosystem because it does not cause immunity or resistance and the most important thing is agricultural products are healthier and free of chemical residues (Hidayanti and Ambarwati, 2016). There are several disadvantages of botanical pesticides including slower work, not resistant to direct sunlight so that it is easily damaged, storability is relatively short, so it must be used immediately after it is produced, it needs to be sprayed repeatedly so that in terms of economy is less efficient (Hidayanti and Ambarwati, 2016).

Plants contain chemicals in the form of metabolite compounds whose function in plant metabolic processes is less clear, but the group of compounds contained plays an important role in the process of interacting or competing, including protecting themselves from competitors' disturbances. The active metabolite product can be used as an active ingredient of botanical pesticides (Dubey *et al*. 2008).

The great diversity of natural resources (biodiversity) of plants such as tobacco, galangal, liligundi and maja fruit, soursop, lemongrass, temulawak, brotowali, garlic, cloves, betel leaves, bandotan and others as a source of botanical pesticides, are still not maximally utilized even though the potential is huge. (Asmaliyah *et al*. 2010)

CONCLUSION

1. Plant-based biopesticides from a mixture of tobacco leaves, maja flesh and galangal are useful in controlling hrice bugs that attack rice
2. Plant-based biopesticides from a mixture of tobacco leaves, maja flesh, and galangal made with fermentation have a longer effectiveness than those made by heating.
3. At a dose of 20% of heating botanical pesticides can kill 100% of rice bugs if the pesticide is directly used or stored for a maximum of 3 weeks
4. At a dose of 20% of the fermentation botanical pesticides can kill 100% of rice bugs if the pesticide is directly used or stored for a maximum of 5 weeks

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