International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.11 No.10, pp 01-07, 2018

The Usage of Fruit Extract of Lanta *(Excoecaria agallocha* L.) for Pest Control of *Paraeucosmetus* sp. (Hemiptera: Lygaeidae) on Rice Plant *(Oryza sativa* L.)

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Abstract : The aims of this research were to know the spread of population and pest infestation of *Paraeucosmetus* sp. in paddy rice in South Minahasa and Minahasa Districts, and the usage of *lanta* fruit extracts to control *Paraeucosmetus* sp. The experiment was conducted in farmer rice fields in the two districts of Minahasa and South Minahasa of North Sulawesi Province, Indonesia. Observations of population and *Paraeucosmetus* sp. attacks were conducted by surveying in each district that has rice crops aged of 2 to 2.5 months. For pest populations, samplings were carried out 5 times by double sweeping, and repeated 4 times. Pest attacts were calculated on area of 1 square meter, and it repeated 4 times. The experiments to control *Paraeucosmetus* spwere done by diluted the pure *lanta* extracts with aguades, consisting of 5 treatments with diffrent variations of concentration, and were repeated 3 times. Each treatment consist of 20 imago *Paraeucosmetus* sp. put inside four clumps of rice paddy and covered with mosquito net. Variation of concentration were 5%, 10%, 15%, 20% and 0% (contrrol). The results showed that *Paraeucosmetus* sp.spread across along the rice paddy in Minahasa District and South Minahasa District. Population of *Paraeucosmetus* sp. in South Minahasa District was higher than Minahasa District. The average population was 7.75 pests / 5 sweeps and the attack was 6.83 clump per 1 m^2 in South Minahasa District, while in Minahasa District the average population was 2.75 pest / 5 sweeping, and the attack was 4.11 clumps per 1 m^2 of rice crops. Increased mortality of *Paraeucosmetus* sp. was directly proportional to the increase of the concentration of *lanta* fruit extracts. Concentrations of lanta fruit extracts that effectively killed *Paraeucosmetus* sp. were concentrations of 15% (15 cc of pure extract and 85 cc distilled water) and 20% (20 cc of pure extract and 80 cc distilled water), because each had a mortality more than 50%, namely 60.0% and 73.3%, respectively.

Keywords : *lanta* fruit extract, *Excoecaria agallocha*,Pest Control, *Paraeucosmetus sp.*, *Oryzae sativa.*

I. Introduction

Agricultural in Indonesia and in other developing countries aim to improve agricultural production as quickly as possible in order to meet the food requirement of the increasing population, also it intends to

DOI= http://dx.doi.org/10.20902/IJCTR.2018.111001

generate revenue for national development in all fields. Rice is the main food ofthe people of Indonesia, therefore, the majority of the Indonesian population is dependent on rice for a source of carbohydrate. Rice is a commodity that has diverse aspects; from the social aspects, enough rice stock can avoid food shortages and famine. Also, rice needs to be available continuously at a the affordable price for people to buy[1,2,3,4].

The availability of rice for the needs of people, it depends on the production generated by the rice paddy production. Many factors affect the growth and development of rice crops from planting to harvest, and pests and plant diseases are important limiting factors. It has been documented there were 22 species of pests that attack rice crops in North Sulawesi, and *Pareucosmetus* sp. spread in paddy rice fields in North Sulawesi[5]. Among those pests on rice paddy, *Pareucosmetus* sp. is one of the important pests. Adult of *Pareucosmetus* sp. has a black elongated and somewhat hard body. In a severe attack they can cause a significant loss[6].

According to [7], approximately 70 species of pests that damage the rice plants and about 20 species are major pests. Those pests attack the roots, stems, leaves, flowers, and fruit. In the opinion of[1] that the pest of rice belong to beetles, stem borers and caterpillars, and the biggest damage are caused by bug of Lygaeides. In Southeast Asia several members of Lygaeide bugs that attack rice plants are *Nysius plebejus* Distant, C*ymus tabidus* Stal, *Dimolphopterus pallipes* (Distant), *Pachybrachius lateralis* (Scott), *P. luridus* (Hahn), *Togo hemipterus, Graptopeltus albomaculatus* (Scoot), *G. angustatus* (Montandon) and *Neolethaeus dallasi*[2,8].

Research on population distribution, and level of attacks of *Pareucosmetus* sp. had been done by [9]. The results showed that the pest has been found in almost all lowland rice planting area in Minahasa District, with the population and the attacks that were alarming. The survey results of the research team of the Faculty of Agriculture Sam Ratulangi University in 2012 showed that this pest has spread in Minahasa Distric and become a potential pest with a population of 1-2 pests per 5 time sweepings. The presence of this pest in the field are always found together with pest of *Leptocorixa acuta*[5].

Control of *Pareucosmetus* sp. pests are still done conventionally which relies on a single control measures, by using pestisida. This method is found in the field, in whice farmers are still spraying with insecticide, because the results can be seen quickly and it is easily applied and accessible. It is also because there is no other control, except by using insecticide to reduce the populations of *Pareucosmetus* sp. Control by insecticides requires a considerable cost and unwise use can cause a variety of adverse side effects, including emergence of resistant pests to insecticides, emergence of a second pest, killing natural enemies, and environmental pollution[10,3,11,12].

Other way to control that does not give a bad influence on environment and consumers of agricultural product is using the environmentally friendly materials derived from plants that can kill plant pests, it is a botanical pesticide or pesticide from plant. There have been many types of plants that are known to kill pests. One type of plants that can be used to control several kinds of crop pests is *lanta (Excoecaria agallocha* L.). Extracts of leaves and fruits of *lanta* have been known to kill golden snail *(Pomacea canicullata),* caterpillar *(Spodoptera litura),* and the caterpillar crop *(Crocidolomia binotalis*)[13,14,4,15,16,17]. The research objectives were to determine the distribution, population and pest infestation of *Paraeucosmetus* sp.in paddy rice field in Minahasa and South Minahasa Districts, and the usage of *lanta*fruit extracts to control pests *Paraeucosmetus* sp.

II. Research methods

1. Population observation and attacks of *Paraeucosmetus* sp.

The research was conducted in farmer rice fields in Minahasa and South Minahasa Districs. Population observations and attacks of *Paraeucosmetus* sp. were conducted by surveys in the each district that had rice crops aged 2 to 2.5 months. Samplings of pest population were carried out by 5 times double sweepings, and it repeated 4 times. Calculations of pest attack were carried out in area of 1 square meter, and repeated 4 times.

2. Experiment to control *Paraeucosmetus* sp. by*lanta* fruit extracts

On this experiment, pure extracts of *lanta* fruit were diluted with aguades. One kilogramn *lanta* fruit was crushed by a blender to get pure juice that mixed with 1 liter distilled water. Five treatments with 4

variations of concentration and control were used on this experiment, and it repeated 3 times. Each treatment were used 20 imagoes of *Paraeucosmetus* sp. that put inside four clumps of rice paddy, and covered with mosquito nets. Variations of concentration as follows:

0%Concentration : 0 cc + 100 cc of pure extracts distilled water
5%Concentration : 5 cc of pure extract + 95 cc distilled water
10%Concentration : 10 cc of pure extract + 90 cc distilled water
15%Concentration : 15 cc of pure extract + 85 cc distilled water
20%Concentration : 20 cc of pure extract + 80 cc of distilled water.

Applications weredone by spraying the solution of fruit extracts of*lanta* according to the treatment concentrations, with dose of 15 – 20 cc of each treatment. Previously, the rice plants had been introduced with 20 imagoes of *Paraeucosmetus* sp.

Data observed in this experiment were population of *Paraucosmetus* sp., plant damage caused by the *Paraucosmetus* sp. and the mortality of *Paraucosmetus* sp. because of the application of *lanta* fruit extract.

The data were statistically analyzed by using a computer program of SPSS 17.0 for Windows.

II. Results and Discussion

1. Populations of *Paraeucosmetus* sp. in the rice field

The resultsby research team of the Faculty of Agriculture Sam Ratulangi University, in February 2015 survey regarding the pest population of *Paraeucosmetus* sp. in paddy rice fields in Minahasa and South Minahasa Districs of North Sulawesi can be followed on Table 1

Table 1. Population density of *Paraeucosmetus* sp. in Minahasa and South Minahasa Districs of North Sulawesi

No.	Location Observations		Population	Attack
1	Minahasa District	Tondano	3.0 pests / 5 x sweepings (3, 2,4,3)	3.67 clumps attacked / 1 m^2 (4,2,2,3)
		Kakas	2.75 pests / 5 x sweepings (1,3,2,5)	5.0 clumps attacked / 1 m^2(3,3,4,5)
		Langowan	2.5 pests / 5 x sweepings (5, 2.1, 3)	3.67 clumps attacked / 1 m^2 (2,2,4,3)
Average			2.75 pests / 5 x sweepings	4.11 clumps attacked / 1 m^2
2	South Minahasa District	Tumpaan	10.25 pests / 5 x sweepings (9 13,11,8)	9.25 clumps attacked / 1 m^2 (9,9,11,8)
		Amurang	7.25 pests / 5 x sweepings (7,5,8,9)	6.5 clumps attacked / 1 m^2(8,6,7,5)
		Tompaso Baru	5.75 pests / 5 x sweepings (6, 4,7,6)	4.75 clumps attacked / 1 m^2 (5,4,6,4)
Average			7.75 pests / 5 x sweepings	6.83 clumps attacked / 1 m^2

Data on Table 1 showed that the average population of *Paraeucosmetus* sp. in rice plants in Minahasa district was 3.0 pests / 5 x sweepings (range 2- 4 pests) in Tondano regency was 2.75 pests / 5 time sweepings (range 1- 5 pests), in Kakas regency was 2,75 pests / 5 time sweep (range 1 – 5 pests), in Langowan regency was 2,5 pests / 5 time sweepings, and the average population of *Paraeucosmetus* sp. in Minahasa district was 2.75 / 5 x sweep (range 2.5-3.0 pests). *Paraeucosmetus* sp. attack in paddy rice field were 3.67 clumps (range 2-4 clumps), 5.0 clump (range 3- 5 clumps), 3.67 clumps (range 2-4 clumps), in Tondano, Kakas and Langowan regency, respectively. The average attack of *Paraeucosmetus* sp. in Minahasa district was 4.11 clumps / 1 m^2 (range 3.67 to 5.0 clumps).

The average population of *Paraeucosmetus* sp. on rice fields in Tumpaan regency was 10.25 pests / 5 time sweep (range 8- 13 pests), in Amurang regency was 7.25 pests / 5 time sweep (range 7 – 9 pests), in

Tompaso Baru regency was 5.75/5 time sweep (range 4–7 pests) and the average population of *Paraeucosmetus* sp. in South Minahasa District was 7.75 pests / 5 x sweep (range 5.75 to 10.25 pests). The damage of *Paraeucosmetus* sp. in paddy rice field in Tumpaan Regency were 9.25 clumps / 1 m ^{2} (range 8-11 clumps), in Amurang Regency was 6.5 clumps / 1 m ^{2} (range 5- 8 clumps), in Tompaso Baru Regency was 4.75 / 1 m ^{2} (range 4- 6 clumps), and average attack of *Paraeucosmetus* sp. in South Minahasa District was 6.83 clumps attacked / 1 m ^{2} (range 4.75 to 9.25 clumps).

The survey results of the research team in February 2015 showed that the population and infestation of *Paraeucosmetus* sp. in Minahasa and South Minahasa Districts already spread and are found at all observation sites with varying populations and damage. According to [6,18,5] that pest *Pareucosmetus* sp. had spread in paddy rice fields in North Sulawesi and Gorontalo Provinces.

Population of *Paraeucosmetus* sp. and the damages in the rice fields in South Minahasa and Minahasa Districts and can be followed on Figure 1.

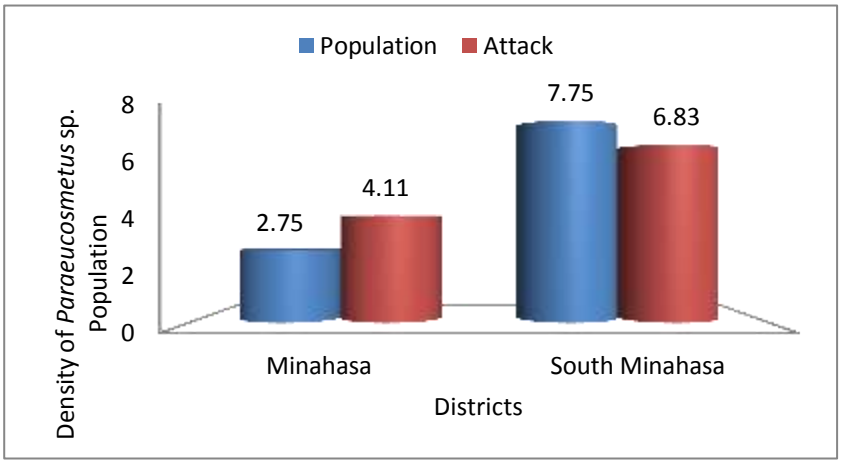


Figure 1. The diagram of population and the attack of *Paraeucosmetus* sp. in rice paddy fields in Minahasa and South Minahasa Districts

Figure 1 showed that the population density and pest infestation *Paraeucosmetus* sp. in rice crops in South Minahasa District were higher than the Minahasa District. The average population and attacks of *Paraeucosmetus* sp. in the District of South Minahasa, respectively, were 7,75 pests / 5 x sweep (range 5,75-10.25 pests) and 6.83 clumps attacked / 1 m ^{2} (range 5.75 to 9.25 clumps); in Minahasa District, the average population and attack, respectively, were 2.75 pests / 5 x sweep (range 3.0 2,5 pests) and 4.11 clumps attacked / 1 m ^{2} (range 3.67 to 5.0 clumps).

The high population and pest infestation of *Paraeucosmetus* sp. in South Minahasa District compared to Minahasa because of time and distance that affect the distribution of the pest from areas of origin, Gorontalo Province and Bolaang Mongondow. Distance of South Minahasa District and Boloaang Mongondow were closer, compared to Minahasa and Bolaang Mongondow. Over time,also it can cause the population *Paraeucosmetus* sp. to develope. In Minahasa District, in accordance with the theory of population dynamics of organisms and the suitable environment, it is possible that the pest population will develop and cause significant damage in the future.

According to Pelealu[6,18,9,5], the presence of this pest in North Sulawesi was first discovered in the rice paddy in Toraout, District of Dumoga, Bolaang Mongondow in 1985. Now, *Pareucosmetus* sp. has spread to all the rice paddy in North Sulawesi Province. This pest attacks rice crop by sucking fluid of grain, young and nearly ripe. As the result, this pest causes the grains to become hollow or empty, alsothe leave can be attacked. This insectpest usually hides on the part of the crops so that it is difficult to notice. Symptom attack of *Pareucosmetus* sp. similar to symptom caused by*Leptocorixa acuta*, the grains of rice become hollow and found brown spots on the grains.

B. The Effects of *lanta* fruit extract to pest population

The results showed that *lanta* fruit extracts affected the mortality of *Paraeucosmetus* sp. in the rice fields, those data can be seen on Table 2.

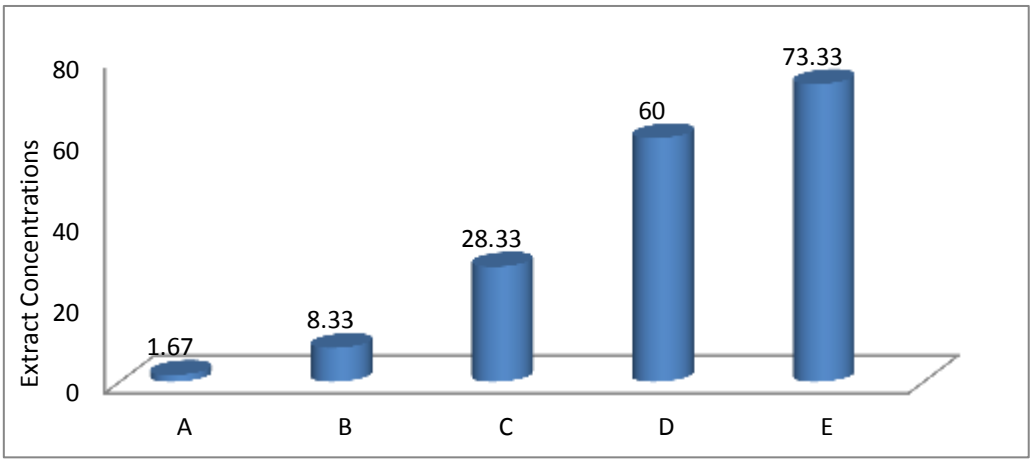
Table 2. Effect of *Lanta* Fruit Extract with Different Concentrations on the Mortality of *Paraeucosmetus* sp. in the Rice Field

No.	Treatment (Extract Concentrations)	Population of *Paraeucosmetus* sp. (Total Number)	Mortality (%)	Notation
1	0%	20	1.67	a
2	5%	20	8.33	a
3	10%	20	28.33	b
4	15%	20	60.00	c
5	20%	20	73.33	d
			BNT 5% = 9:40	

Remarks: Figure followed by the same letter was not significantly different.

The data on Table 2 showed that the highest mortality of *Paraeucosmetus* sp. occurred on the treatment with concentration extract of 20% (20 cc of pure extract + 80 cc distilled water) of 73%, followed by concentration of 15% (15 cc pure extract + 85 cc distilled water) of 60%, than concentration of 10% (10 cc of pure extract + 90 cc distilled water) of 28.3%, and the the lowest mortality wason the concentration extract of 5% (5 cc and 95 cc of pure extract distilled water) which was 8.33%), while controls (100 cc distilled water) was 1,66%.

Increased mortality of *Paraeucosmetus* sp. was directly proportional to the concentration of fruit extracts, greater extract concentrations gave greater mortality to *Paraeucosmetus* sp. (Figure 2).Bar chart (Figure 2) showed that higher *lanta* fruit extract concentration, affected directly proportional to the mortality of *Paraeucosmetus* sp. pests. This means that the greater the concentration of *lanta*fruit extracts the higher the mortality of *Paraeucosmetus* sp. The mortality of *Paraeucosmetus* sp. is caused by the chemicals content or compounds that are toxic (active ingredient) found in *lanta* fruit, diterpene (C3OH4O6).



Remarks: A = 0 cc pure extract + 100 cc distilled water; B = 5 cc of pure extract + 95cc distilled water; C = 10 cc of pure extract + 90 cc distilled water; D = 15 cc pure extract + 85 cc distilled water; E = 20 cc of pure extract + 80 cc distilled water.

Figure 2. Diagram of the effect of *lanta*fruit extract with different concentrations to the mortality of *Paraeucosmetus* sp. in the rice field

According to [19,20,21]that some aspects of pest control with botanical insecticide involve inhibition of feeding process or antifeedant, rejection of nesting activity, inhibition of growth and development activities, as well as the effects of the death of the target pest. Furthermore, according to [22,23,24] that the ability of botanical insecticide in killing insect pests is influenced by three factors: the ability of penetration of insecticides through the integument or the absorbtion through wall of the digestive tract, the translocation of the active ingredient to

the target, increasing and storage in tissues of the body, metabolism by section enzyme decomposition in the body and exhaust out of the body and penetrate through the protective layer. As reported by [25,26,27,28] that diterpene compounds contained in plant *Excoecaria agallocha* include *Excoecaria phorbol* compounds and *agallochin* M, N and O.

Lanta fruit extract with concentration of 15% and 20% showed effective concentrations because, those concentrations had caused the death of test insects above 50%, which already meet or exceed the effective concentration or lethal concentration, 50% of test insects (LC 50%). According to [13,29,4], the lanta fruit extract was able to control golden snails, the pests on paddy rice plants. As stated by [14] that lanta fruit extract, effectively controlled *Spodoptera exigua*, pest on onion leaves. Further research[17] showed that extracts of leaves and fruit of *Lanta* effectively killed the Cabbagehead Caterpillar*(Crocidolomia binotalis)*of the white mustard plant *(Brassica chinensis)*.

Iv. Conclusions

Results of the survey and experimental usage of *lanta* fruit extracts to control *Paraeucosmetus* sp. can be concluded as follows:

1. *Paraeucosmetus* sp. pest spread across the rice paddy in Minahasa and South Minahasa Districts.
2. Population and pests attack of *Paraeucosmetus* sp. in South Minahasa District were higher than Minahasa District, in which average population of 7,75 pests / 5 x sweep and attack of 6.83 clumps per 1 m^2 found in South Minahasa District, while in Minahasa District the average population were 2.75 pests / 5 x sweep and the attack were 4.11clumps per 1 m^2 rice crops.
3. Increased mortality of*Paraeucosmetus* sp. was directly proportional to the increase of the concentration of *lanta*fruit extracts.
4. Concentrations of *lanta* fruit extracts that effectively killed *Paraeucosmetus* sp. were the concentration of 20% (20 cc of pure extract + 80 cc distilled water) and the concentration of 15% (15 cc pure extract + 85 cc distilled water) because those concentration caused mortality of 73, 3 and 60%, respectively.

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