Potential use of Natural Pesticide to Control of Orseolia oryzae and Leptocorisa oratorius in Saline Paddy Ecosystem in Percut Northern Sumatera

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Abstract. Rice and fish are an important source of protein for the people of North Sumatra that can be produced from saline paddy cultivation. The research was conducted started from March 2017 to September 2017 using group random design method on two plots of rice plantation in Paluh Merbau Sub-district, Percut Sei Tuan district, North Sumatera. Comparison between IR 64 paddy types with nila tilapia (Tilapia mosambicca) on two plots, in the control area and tidal area is predicted to show a comparison of fish composition and diversity of species of insects identified to family/species levels categorized into 4 groups (Predators, Parasites, Pests, Parasitoids). Yellow Sticky Trap (YST) more effective used than Sweep Net (SN) and Core Sampler (CS) in Paddy of Percut. The calculation of richness index of Margallef (R1), Index Jaccard, Shannon-Wiener Diversity Index (H') in saline paddy fields were done. Dominant pests such as Orseolia oryzae and Leptocorisa oratorius are controlled using by environmentally friendly bioinsecticides, such as P1(Neem leaf extract 100 ml), P2 (Papaya leaf extract 100 ml), and P3 (100 ml poison yam plant extract). T-Test, Kruskal-Wallis test and correlation test showed significant differences between the abundance and the dominance of insects in the control and saline areas; the effectiveness of insect trap testing and the most effective use of vegetable pesticides. Furthermore, differences in insect biodiversity during the sampling period and phase of paddy were affected by physical, chemical, and biological factors in Percut Sei Tuan, Northern Sumatra.

1. Introduction
Efforts to increase agricultural production, especially rice crops are done, among others by the use of superior varieties. The use of improved varieties has consequences for the increase of pesticide applications as pest populations increase, biodiversity decreases. This can threaten sustainable agriculture systems. The facts on the ground suggest that rice plant pests have various types of natural enemies. Among the natural enemies, there are various types of arthropods as parasitoids and predators. The role of increasing natural enemy populations is necessary to achieve sustainable agricultural systems. Biodiversity prior to Integrated Pest Management (IPM), especially in the IPM implementation area is simpler (less) than after IPM, especially biological agents as the main control of the primary pest of rice crops. The main pests of rice plants, among others plant hopper and rice stem borer. Prior to IPM implementation, natural enemies were unable to suppress both populations of the pests. Conversely after the implementation of Integrated Pests Management (IPM), natural enemies can reduce pest populations. The natural enemies of rice gall midge, such as Lycosa pseudoannulata, Coccinella sp., Paederus sp., Ophionea sp., Cytorhinus lividipennis, Oligosita sp., Anagrus sp., and Gonatocerus sp.
Natural enemies of rice stem borer among others Trichogramma japonicum, Telenomus rowani and Tetrastichus schoenobii. The potential of natural enemies, especially parasitoids and predators is large enough to decrease pest populations, in terms of growth rate and prey ability. To enhance and sustain natural enemies, carried out by means of preservation of biological agents, weed management and crop residue and provision of artificial feed.

It is known that various types of natural enemies are divided into 3 groups, namely parasitoids, predators, and pathogens. There are 79 types of natural enemies of brown planthopper pest (Nilaparvata lugens “WBC” in local name), among which 34 parasitoids, 37 predators, and 8 pathogens [1]. There are 3 types of white stem borers as parasitoids, namely: Tetrastichus schenobii, Telenomus rowani, and Trichogramma japonicum [2,3]. To date, 36 species of insect pathogenic fungi (JPS) have been observed in rice plants [4]. Among these pathogens, Hirsutella citriformis, Metarrhizium anisopliae and Beauveria bassiana have the potential to control the WBC. Parasitoids and predators are able to degrade pest populations, whereas JPS infections can kill and affect pest development, decrease reproductive capacity, and decrease pest resistance against predators, parasitoids and other pathogens [5].

The paddy ecosystem is theoretically an unstable ecosystem. The stability of the paddy ecosystem is not only determined by the diversity of community structures, but also by the nature of the components and the interactions between ecosystem components. The results of the study on habitat studies showed that no less than 700 insects including parasitoids and predators were found in the paddy ecosystem under no pest plant conditions, notably the WBC. The results show that rice farming communities are diverse [6]. If inter component interactions can be managed appropriately, the stability of agricultural ecosystems can be maintained. Thus it is possible that the agricultural ecosystem can create a stable state. To maintain a stable rice farming ecosystem, the concept of IPM can be applied. Insecticides are the last alternative and their use is highly selective. In the rice fields, natural enemies clearly function, resulting in a biological balance [7]. This biological balance is sometimes accomplished, but it can be otherwise. This is due to other factors that affect, namely agronomic treatment and the use of insecticides. The Orseolia oryzae and Leptocorisa oratorius are quiet diverse in saline paddy cultivation in Percut, Northern Sumatra.

2. Methodology
The sampling of insect pests and their natural enemies was carried out in rice field of saline paddy at Percut, North Sumatera in May 2017 until August 2017. The sampling method was done by the relative method by using 3 traps (Stick yellow trap, Sweep net and Core sampler) for observation was determined 5 plots as randomly selected stations with each area. The land is about 15x20 m2. Sampling is conducted once a week during vegetative phase and generative phase of saline paddy field to directly observe and collect of insects in the control and fish farming sites. Catching insects performed at 08:00 to 10:00am. Observations made include counting the number of insects caught at a given number of points used [9,10,11].

This study used Randomized Block Design (RBD) on rice farming and controlled with several types of vegetable pesticides, consisting of 4 treatment levels in which each treatment received 0.03 ml MOL snail mas, while 4 treatment levels and each treatment on repeated 3 times with 5 plant samples. Factors studied in the study include Combination of vegetable pesticide consisting of: P0 = Control, P1 = Neem leaf extract 100 ml, P2 = Papaya leaf extract 100 ml, P3 = 100 ml poison yam plant extract. Total samples of plants observed were 60 plants for each land, namely control and paddy fields. Data obtained on each capture were calculated and identified and then analysed by calculating Richness Margalef's index (R1), Evenness index (E) and Jaccard Index.

According to Ref. [12,13], the diversity of Shanon-Weaner (H) species was recorded as follows: Diversities index is low if H < 1; Diversities index is moderate if 1≤ H ≤ 3; and Diversities index is higher if H >3. Soil physical measurements taken are pH measurement, temperature measurement, light intensity, wind speed, soil DHL, number of fertilization and leaf color measurement.

3. Results and Disussions
The calculations of insects, such as the order, family, genus/species, number, insect status collected in Percut, Sumatera Utara can be seen in Table. Insects are categorized into 4 groups (Predators, Parasites,
Pests, Parasitoids). In the research location of rice cultivation were recorded 23 species of predators (Lycosa sp, Tetragenatha sp, Coccinella septempunctata, Hydrobius sp, Hydrophilus sp, Leptispa sp, Paederus sp, Comonatus sp, Formocaratus sp, A. femina, Agriocnemis pygmaea, Ischnura senegalensis, Pseudagron rubriceps, Crocothemis servilea, Diplocoides trivialis, Neurothromis ramburi, N. terminata, N.tullia, Orthetrum sabina, Pantala flavescens, Tholymis aurora, T. tillarga, Atractomorpha lata); 2 parasites (Anisop sp and Culex sp), 11 pests (Orseolia oryzae, Hydrellia sp, N. terminata, N.tullia, Orthetrum sabina, Panta Paederus sp, Componatus sp, Formocarfatus sp, A. femina, Agriocnemis pygmaea, Ischnura senegalensis, Pseudagron rubriceps, Crocothemis servilea, Diplocoides trivialis, Neurothromis ramburi, N. terminata, N.tullia, Orthetrum sabina, Pantala flavescens, Tholymis aurora, T. tillarga, Atractomorpha lata); 2 parasites (Anisop sp and Culex sp), 11 pests (Orseolia oryzae, Hydrellia sp, Atherigon sp, Leptocoris orotarius, Nephotettix sp, Nilaparvata lugens, Cnaphalocrocis medinalis, Pelopide sp, S. incertulas, S. inonata, Pomacea sp), 2 parasites (Aphis sp, Tabanus sp), and 2 species cannot identified status, such as Battilaria sp and Stanicophora sp (Table 1).

The Figure 1 described the dominant the percentage of insects caught in the entire experimental field in the generative phase can be seen in Figure 2. There are L. orotarius, O. oryzae. Formocartus sp, Lycosa sp and N. lugens were distributed, while the less of insects recorded from 4 species (Anisop, C. servilea, T. aurora, Gyrrulus) (Figure 1).
In the generative phases of paddy, many insect caught, such as Leptocorisa oratorius (2877 individuals), Orseolia oryzae (2431 individuals), Fomacarfatus sp (318 individuals), Lycosa sp (313 individuals) and Nilaparvata lugens (310 individuals). Meanwhile the less of insects collected from Anisop sp (1 individual), but C. servilea, Tholymis aurora and Gryllus sp each 2 individuals (Figure 1). According to [13, 14, 15] described species of L. oratorius undergoes a simple metamorphosis whose development begins from egg stadia, nymph and imago. Imago shaped like a ladybug, slim, antenna and legs are relatively long. Body color green brownish yellow and long ranged between 15 - 30 mm. Eggs: Eggs are shaped like dark red discs and are placed on a regular basis in groups. The egg group usually consists of 10-20 grains. The eggs are usually placed on the top surface of the leaf near the mother's leaf bone. Laying eggs generally done at the time of flowering rice. Eggs will hatch 5 - 8 days after being laid. The development from egg to imago is 25 days and one generation reaches 46 days. Nymph: The nymph is yellowish, sometimes the nymph is invisible because of its color same with leaf color. Stadium nymph 17 - 27 days consisting of 5 instars. Imago: Imago of L. oratorius that live on rice plants, ventral part the abdomen is brownish yellow and living on the grass of parts ventral abdomen is whitish green. Spawn on the top leaf surface rice and other grasses in groups in one to two rows. Active attack in the morning and afternoon, while in the daytime shelter under a damp and cold tree. A good development for L. oratorius pests occurs at temperatures between 27° - 30°C.

The development of L. oratorius has been known to be the symptoms of attack and damage caused at the time of moderate temperatures, low rainfall and sunlight bright. The L. oratorius can breed in lowland plains and in the plains high [16]. Symptoms of attack and damage: the nymph and imago suck the grain of the rice in the milk cooking phase, otherwise it can also suck liquid rice stalk. The blinds are sucked into a hollow and are blackish brown. The L. oratorius suck the rice bleed liquid by piercing the stylet. Nymph is more active than imago, but imago can damage more because of his life longer [17]. The loss of seed fluid causes the paddy seed to shrink if the fluid is in the seed not spent. In the absence of mature grain, it can attack grains of rice that begin to harden, so that when the stylet is stuck out enzyme which can digest carbohydrates [18]. Species of L. oratorius is due low-intensity rainfall conditions, inconsistent planting, and around the land many weed plants. According to [17, 18], symptoms of L. oratorius attack can be seen. This is assumed because rice varieties are planted resistant against N. lugens attack. Then in table 2 showed the potential used of physical (traps) such as Yellow Sticky Trap (YST) more effective used than Sweep Net (SN) and Core Sampler (CS) in saline paddy of Percut.
Table 2. The potential used of physical (traps) in Paddy of Percut. Noted: 1 = paddy cultivation, 2 = paddy-fish farming

| Name trap          | Df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | Confidence | Interval |
|-------------------|----|----------------|-----------------|------------------------------------------|------------|----------|
| Yellow sticky trap | 4.582 | 59 | 0.07 | 43218 | 8.2410 | 40.5321 |
| Sweep net         | 3.012 | 59 | 0.05 | 72500 | 6.5117 | 19.9420 |
| Core sampler      | 1.958 | 59 | 148 | 6.47078 | -7.215 | 5.6016 |
| Yellow sticky trap | 3.748 | 59 | 006 | 25.56716 | 7.1630 | 39.4732 |
| Sweep net         | 2.975 | 59 | 004 | 13.90000 | 5.4217 | 19.3523 |
| Core sampler      | 1.724 | 59 | 169 | 4.58078 | -5.215 | 5.4011 |

Many insects are trapped in SN traps, namely Cnaphalocrocis medinalis, Hydrellia sp and C. servilea (Table 2). These species are commonly found in rice plants, especially in the vegetative phase. In the yellow glue trap (YST), many insects are caught from the O. oryzae, L. oratorius, and Anisop sp. In the core trap device (CS), the most widely caught insects from Lycosa sp, Tetragrantha sp, Scatinophora sp.

An index of diversity of insect pests in tidal ricefield of Percut, North Sumatra in the two phases can be seen in Table 3. Based on the data it is known the genera is similar between vegetative and generative phases, but that the index of diversity of insect pests in paddy fields at each observation time is always changing. Then the diversity of insects obtained on both experimental estates is between medium to high. In the vegetative phase the highest diversity index was 3.98 and the lowest was 2.87, while in Generative recorded from \( H' = 3.65 \) and lowest with values \( H' = 2.30 \). The use of three tools can control the pest of rice plants in tidal ricefield of Percut, Sumatera Utara. Changes in the diversity index of insect pests in Paddy fields at each time the observation occurs because the population of each organization on every ecosystem is never the same from time to time but there is an increase and decline supported by [19,20,21].

Table 3. Calculation of Biological indices during vegetative and generative in saline paddy of Percut

| Yield           | Order | Family | Genera/ Species | E   | Je  | H'  |
|-----------------|-------|--------|-----------------|-----|-----|-----|
| Paddy Cultivation | 10    | 23     | 40/10.337       | 3.98/ | 3.65 |
| Fish farming    | 10    | 27     | 42/8275         | 2.87/ | 2.30 |

The application of chemicals such as fertilizers (urea, nitrate, phosphate, potassium), herbicides (H-Ally XP) and insecticides (imidacloprid, rhodamine) in rice cultivation in Percut are applied routinely assumed to affect the enrichment of surface water nutrition [22], especially after application at the end of the young phase and the beginning of the seedling phase [23,24]. Abundance of aquatic organisms, such as ephemeropterans, odonates, coleopterans and dipterans are influenced by application of rice mina in paddy fields in Purwosari Village, Simalungun. The negative effects of pesticides on aquatic organisms are reported by various researchers [23,24].

3.1. Biodiversity Of Artropoda At Rice Cultivation
Seasonal plant ecosystems are less stable which is characterized by low biodiversity. The composition of feed tissue in the ecosystem of simple crops causes the pest population to be in an unbalanced state, making it easy for pest population explosions [12, 25]. The stability of wetland or seasonal crop ecosystems can be achieved by enhancing and consolidating biodiversity in ecosystems through ecosystem management, inter alia by optimizing cultivation and enhancing the role of natural enemies. According to Ref. [23,25], in Indonesia, wetland rice ecosystems are fertile organic matter and are not polluted by pesticides, rich in biodiversity. The wetland rice ecosystem contains 765 species of insects and artificial artropods. The biodiversity consists of detrivora and plankton-eating groups (Culicidae and Chironomidae larvae), herbivores (including insect pests), parasitoids, and predators (Table 4).
Table 4. Composition of fauna biodiversity in ricefields of Indonesia

| Detrivore and plancton feeders | Total of Species |
|-------------------------------|------------------|
| Herbivore                     | Parasitoid       | Predator | Total |
| 145 (19%)                     | 127 (17%)        | 187 (24%)| 306 (40%)| 765 (100%)|

Obligations by [26, 27] in irrigated rice field-rice-rice-planting ecosystems, without insecticidal treatment showed that natural enemies were more numerous than pests. In 1 hectare paddy field, there are 29 natural enemies, 16 species of pests, and 11 non-status species. In this study, it was revealed that rice cultivation without the use of pesticides, the biodiversity of arthropods is quite higher.

3.2. Artificial Feed
Parasitoids and adult predators generally eat honey, other sugar compounds and pollen to make ends meet. The availability of feed can increase the population of parasitoids and predators. The feed can be provided by direct administration (spraying of artificial food). According to [28,29,30] The application of WBC extract in the field increases the parasitization of Anagrus sp., whereas the application of liquid sugar increases the percentage of parasitization of Oligosita sp. Application of sugar liquids and WBC extract can also increase the population of Cyrtorhinus sp., Ophionea sp., Lycosa sp., Coccinella sp., and Paederus sp. The use of a 5% sugar solution may increase the parasitoid population of rice stem borer [29].

4. Conclusions
Different types of arthropods present in wetland rice ecosystems play a role in biological balance to achieve environmentally friendly pest control towards sustainable agriculture. The potential of various types of natural enemies, especially the parasitoids and predators of brown planthopper pests and rice stem borer and preservation methods can be used as a case study of biological agents for the control of other rice plant pests.

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