Control of Pests in Saline Paddy of 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 tidal rice 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, North of Sumatra. Comparison between IR 64 paddy types with nila tilapia (*Tilapia mosambicca*) on two plots, in the control area and tidal area are 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. Calculation of richnesse index of Margallef (R1), Index Jaccard, Shannon-Wiener Diversity Index (H ') in tidal rice fields. Dominant pests such as *Orseolia oryzae* and *Leptocorisa oratorius* are controlled using environmentally friendly bioinsecticides, such as . T-Test, Kruskal-Wallis test and correlation test showed significant differences between the abundance and the dominance of insects in the control and tidal 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, North of Sumatra.

Keywords: Potential used, natural pesticide, O. oryzae, L.oratorus, Percut

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 planthopper and rice stem borer. Prior to IPM implementation, natural enemies were unable to suppress both populations of the pests. Conversely after the implementation of IPM, natural enemies can reduce pest populations. The natural enemies of the apes are Lycosa pseudoannulata Boes. Et Berg., *Coccinella* sp.

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Paederus sp., *Ophionea* sp., *Cyrtorhinus lividipennis* Reuter., *Oligosita* sp., *Anagrus* sp., and *Gonatocerus* sp. Natural enemies of rice stem borer, among others *Trichogramma japonicum* Ashm., *Telenomus rowani* Gah, and *Tetrastichus schoenobii* Ferr. 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 (WBC), among which 34 parasitoids, 37 predators, and 8 pathogens (Chiu, 1979). The potential natural enemy for rice stem borer (PBP) is the parasitoid. There are 3 types of PBP parasitoids, namely: *Tetrastichus schenobii* Ferr., *Telenomus rowani* Gah., and *Trichogramma joponicum* Ashm (Jepson, 1954; Soehardjan, 1976). To date, 36 species of insect pathogenic fungi (JPS) have been observed in rice plants (Carruthers & Hural, 1990). 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 (Wardojo, 1986).

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 (Untung, 1992). If intercomponent 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 (Baehaki, 1991). 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 quites diversies in saline paddy cultivation in Percut.

2 Methodology

The sampling of insect pests and their natural enemies was carried out in ricefield of tidal rice 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 tidal ricefield 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 (Preap et al., 2001; Khan et al, 1991; Alonzo et al, 1994).

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 = Pepaya 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 analyzed by calculating Richnesse Margalef's index (R1) and Evenness index (E) and Jaccard Index. While the diversity of Shanon-Weaner (H) (12,13,14,15) 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 Discussion

The calculations of insects, such as the order, family, genus / species, number, insect status collected in Percut, Sumatera Utara can be seen in table 1 below. 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, *Tetagrantha* sp, *C. septempunctata, Hydrobius* sp, *Hydrophilus* sp, *Leptispa* sp, *Paederus* sp, *Componatus* sp, *Formocarfatus* sp, *A. femina, A. pygmaea, I senegalensis, P rubriceps, C. servilea,D. trivialis, N. ramburii, N. terminata, N.tullia, O. sabina, P.flavescens, T. aurora,T. tillarga, A. lata);* 2 parasites *(Anisop* sp *and Culex* sp*), 11 pests (Orseolia oryzae, Hydrellia* sp, *Atherigon* sp, *L.orotarius* sp, *Nephotettix* sp, *N.lugens, Cnaphalocrocis medinalis, Pelopide* sp, *S.incertulas, S.inonata, Pomacea* sp), *2 parasitoids (Aphis* sp, *Tabanus* sp) *and 2 species without status, such as Battilaria* sp *and Stanicophora* (Table 1).

Table 1. Composition and distribution of insects in paddy of Percut

Orders	Families	Genera/spesies	Status	Local name	Total paddy cultivation	Total Fish farming
Aranea	Lycosidae	*Lycosa sp*	Predator	Laba-laba	730	245
Aranea	Lycosidae	*Tetagrantha sp*	Predator	Laba-laba	434	195
Cerithio	Battilaridae	*Battilaria sp*	-	Kecoak air	290	134
Coleoptera	Coccinellidae	*Coccinella septempunctata*	Predator	Kumbang	174	51
Coleoptera	Hydrophilidae	*Hydrobius sp*	Predator	Kumbang	23	21
Coleoptera	Hyrophillidae	*Hydrophillus sp*	Predator	Kumbang	37	32
Coleoptera	Chrysomelidae	*Leptispa sp*	Predator	Leptispa	71	17
Coleoptera	Staphylidae	*Paederus sp*	Predator	Tomket	57	56
Diptera	Anisopodidae	*Anisop sp*	Parasit	Agas	2436	7
Diptera	Cecidomylidae	*Orseolia oryzae*	Pests	Ganjur	8217	7.104
Diptera	Culicidae	*Culex sp*	Parasit	Nyamuk	21	91
Diptera	Ephydridae	*Hydrellia sp*	Pests	Lalat bibit	247	241
Diptera	Muscidae	*Atherigon sp*	Pests	Lalat bibit	172	35
Diptera	Tabanidae	*Tabanus sp*	Parasit	Lalat	36	18
Hemiptera	Alydidae	*L.orotarius sp*	Pests	Walang sangit	2880	51
Hemiptera	Chrysomelidae	*Nephotettix sp*	Pests	Wereng hijau	87	247
Hemiptera	Delphacidae	*N.lugens*	Pests	WBC	87	84
Hemiptera	Pentatomidae	*Scatinophora sp*	-	Kepinding	329	42

Orders	Families	Genera/spesies	Status	Local name	Total paddy cultivation	Total Fish farming
				tanah		
Hymenoptera	Apidae	*Aphis sp*	Parasitoid	Lebah	290	40
Hymenoptera	Formicidae	*Componotus sp*	Predator	Semut	72	25
Hymenoptera	Formicidae	*Fomocarfatus sp*	Predator	Semut merah	177	78
Lepidoptera	Pyralidae	*Cnaphalocrocis medinalis*	Pests	Hama Putih	576	358
Lepidoptera	Crambinidae	*Pelopida sp*	Pests	Ngengat	144	17
Lepidoptera	Crambidadae	*S.incertulas*	Pests	Ngengat	61	59
Lepidoptera	Crambidae	*S.inonata*	Pests	Ngengat	41	32
Mesogastro poda	Ampullaridae	*Pomacea sp*	Pests	Keongmas	54	54
Odonata	Coenagrionidae	*A.femina*	Predator	Capung	85	78
Odonata	Coenagronidae	*A.pygmaea*	Predator	Capung	26	12
Odonata	Coenagrionidae	*I.senegalensis*	Predator	Capung	92	24
Odonata	Coenagrionidae	*P.rubiceps*	Predator	Capungbiru	125	15
Odonata	Libellullidae	*C.servillia*	Predator	Capung	212	9
Odonata	Libellulidae	*D.trivialis*	Predator	Capung	87	6
Odonata	Libellulidae	*N.ramburii*	Predator	Capung	31	0
Odonata	Libellulidae	*N.terminata*	Predator	Capung	5	0
Odonata	Libellulidae	*N.tullia*	Predator	Capung	3	0
Odonata	Libellullidae	*O.sabina*	Predator	Capung	96	0
Odonata	Libellullidae	*P.flavescen*	Predator	Capung	46	0
Odonata	Libellulidae	*T.aurora*	Predator	Capung	7	0
Odonata	Libellullidae	*T.tillarga*	Predator	Capung	72	0
Orthoptera	Tetrigidae	*Atractomorpha lata*	Predator	Belalang	29	0

The table above 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. oratorius*, *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, Gyrllus*) described into Figure 1.

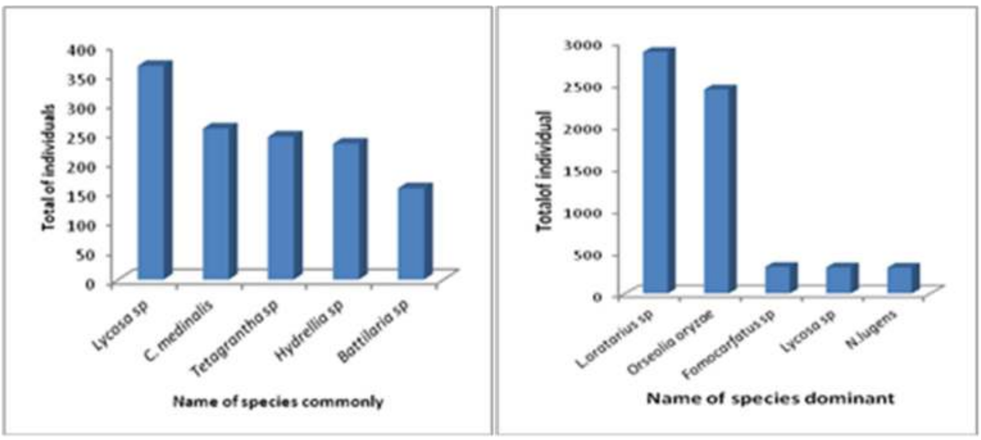

Fig.1. The Dominant Pests in Paddy of Percut

In the generative phase of many caught insect pests are *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 2). Spesies 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 (Bonhoff et al., 1997). 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 (Uphoff, 2004; Alonso et al., 1994; Kandibane et al., 2005; Asahina, 1979). 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 (Bonhof et al., 1997). Imago: Imago of *L.oratorius* that live on rice plants, ventral part the abdomen is brownish yellow and living on the grass of parts v, 1979entral abdomen is whitish green. Spawn on the top leaf surface rice and other grasses in groups in one to two rows (18). Active attack in the morning and afternoon, while in the daytime shelter under a damp and cold tree (Uphoff, 2004). 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 (Barlow et al., 1982). 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. 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 (Alonso et al., 1994). Species of *L. oratorius* is due low-intensity rainfall conditions, inconsistent planting, and around the land many weed plants (Barrion and Litsinger, 1994). 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 Paddy of Percut.

Table 2. The potential used of physical (traps) in Paddy of Percut

T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference		
YST paddy cultivation	4.582	59	0.07	27.43218	8.2410	40.5321
SN paddy cultivation	3.012	59	0.05	14.72500	6.5117	19.9420
CS paddy cultivation	1.958	59	.148	6.47078	-.7215	5.6016
YST fish farming	3.748	59	.006	25.56716	7.1630	39.4732
SN fish farming	2.975	59	.004	13.90000	5.4217	19.7523
CS fish farming	1.724	59	.169	4.58078	-.5215	5.4011

Table 2 shows that many insects are trapped in SN traps, namely *Cnaphalocrocis medinalis*, *Hydrellia* sp and *C.servilea*. 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 4. 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 (Pinheiro e al, 2002).

Table 3. Calculation of Biological indices in Paddy of Percut

Yield	Order	Family in Vegetative and Generative	General/ Species	R1	E	Jc	H' Vegetative and Generative
Paddy Cultivation	10	23	40/10.337 individuals	1.81	0.65	0.89	3.98/3.65
Fish farming	10	27	42/8275 individuals	1.93	0.72	0.95	2.87/2.30

The application of chemicals such as fertilizers (urea, nitrate, phosphate, pottasium), herbicides (H-Ally XP) and insecticides (imidacloprid, rhodiamine) in rice cultivation in Percut are applied routinely assumed to affect the enrichment of surface water nutrition (Roja, 2009; Suyamto, 2005), especially after application at the end of the young phase and the beginning of the seedling phase (Borror, Siregar, 2014; Fortunately, 2006). 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 (Riasari 2005, Saikia et al, 2015).

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 (Andrewartha & Birch 1982, Southwbod & Way 1980). 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 Settle et al. (1996), 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. By Soenarjo (2000), the composition of fauna biodiversity in wetland ecosystems, based on the findings of Settle et al. (1996) is simplified in tabular form as presented in Table 4 below.

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%)

3.2 Making Biopestisida

Plants of attractant as a biopesticide used is the core of betel endosperm washed with water and dried for 1 week to reduce water content and then pounded into a powder then filtered with a filter (filter) so as to obtain a powder that is ready to dried. Each of the neem leaves, tobacco leaf, and papaya leaf used is a wide-sized, not too hard, not too young, washed with water, dried for 1 week, then ground into powder. The powder is then filtered with a flour filter. Mengkudu used is the fruit washed, then washed with water and cut into small pieces and dried for 1 week to reduce water content and then pounded into a powder, then each powder dried in the sun so that. In each plot of land placed neem attractiveness (Azadirachta indica) as much as 500 gr, then around the rice plants that dominate the attack O.oryzae and L.oratorius sprinkled powder attractiveness of neem leaves, papaya leaves and toxic leaves according to application 130 gr per plot land.

4 Conclusion

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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