Biodiversity Insects Used Three Traps Of Upland Rice Fields In Simalungun District,

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Abstract: Rice and fish are the main food source for the peoples of Indonesia, especially in Northern Sumatra. This research was done to determine biodiversity insects used by purposive random sampling from March until July 2016 which 3 traps (yellow trap, sweeping net, and core sampler) repeated five times in control and fish farming sites in Purwosari village, Pematang Bandar, Simalungun District, Northern Sumatra, Indonesia. The results showed the insects were caught on land fish-rice farming consist of 9 orders, 40 families and 42 species, 2028 individuals identified. From the research, the fish farming has been done obtained the highest number of individuals insects caught used yellow trap are 1111 individuals, followed by sweep net (800 individuals) and the lower used the core sampler (117 individuals). Meanwhile, 1288 individuals are highest of insects collected use by yellow trap, followed by Sweep net (704 individuals) and Core sampler (137 individuals). The value of species richness in rice-fish farming 5.384 (index Margalef) and 0.932 (index Menhinick) more than a value of species richness in control 5.089 (index Margalef) and 0.866 (index Menhinick). The result value Index of Evenness in rice-fish farming 0.80 and control 0.78. The suitable traps for detected of biodiversity insects in paddy plantation and fish farming used the yellow trap..

Index Terms: fish farming, insects, traps, upland, ricefield, Simalungun, Northern Sumatra, Indonesia

1 INTRODUCTION

Rice is the main source of staple food in Indonesia. Production of paddy during the last three years shows the development of fluctuating. Production of rice in 2013 increased by 3.32 percent (11.735 ton) compared to production in 2012 (3) but in 2014 rice production decreased by 2.58 percent (96 210 ton) than in 2013 (4). Rice has several phases which transplanting of seedling, vegetative phase, generative phase and harvesting phase. Pests in the seedling phase consist of the brown planthopper, green leafhopper, fake white pests, snails and mouse. Pests in the vegetative phase include stem borers, green leafhoppers, rice borer pests and snails. In the generative phase usually recorded from brown planthopper, green leafhopper, stem borers, insect that releases a pungent smell, rice borer pest, armyworm, pest fake white, field mouse and snails. Pest on the harvesting phase, a common pest is stinky, mouse and birds (5, 18). In every phase of the rice crop has a different ecosystem levels. The population will be affected by the availability of food and the environment that may lead to the emergence of various families of insects. Diversity of insect family of an ecosystem can be taken to indicate the number of families of insects in a given area or part number of families among the total number of individuals that exist on the entire family there. This relationship can be expressed numerically as diversity index (12,19,20). Rice cultivation activities regulate the abundance of aquatic organisms in rice fields, such as *Anopheles and Culex* are high during ploughing of the field, while Anisoptera, Dysticidae and Zygoptera are more abundant in tiller or mature fields. The corixids, gastropods, hydrophilid, and ostracods, succinate during in the fallow phase (6,18,20). In the plough phase, chironomids, dipterans, oligochaete worms, Baetidae, Belostomatidae, ephemeropteran hemipterans and *Micronecta*, coleopterans *Berosus* (Hydrophilidae), *Laccophilus*, *Hydrovatus* (Dysticidae), Elmidae and Odonata are abundant in rice fields (7,9,25,26). Currently there are several systems that often do rice planting the planting of rice with legowo system, planting intercropping rice and rice planting along with the fish. Planting rice together with fish often called fish-farming system. The purpose of integrated aquaculture is to maximize the utilization of land and water resources, streamline capital,energy and time to produce lebih and one commodity.Livestock and fish farming along with agriculture (rice-fish) has longknown and practiced fish farming in Indonesia. Otherwise, the systems of rice fish is being practiced in Thailand (3 million ha), Bangladesh, India (23) Indonesian (138.000 ha), Republic of Korea, Vietnam (40.000 ha), and Madagascar (13000 ha (24). The fish farming consisting of carp, catfish, tilapia, mujahir and others. The common carp (*Cyprinus carpio* L.) is probably the first fish species whose distribution was widely extended by human introduction in Indonesia (10). Fish-farming system can produce two major benefits for human health. Because produce protein of food and animal in a single growing season. It also can increase the income of farmer and families (5,17, 26). The research was aim to determine biodiversity insects in the Pematang Bandar Village, Purwosari, North Sumatra to support advancement of science in today, it can be developed fish farming in rice fields.

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RESEARCH METHODS

Place and Time Research

The study was conducted in the Purwosari Village , Pematang Bandar, Simalungun District, North Sumatra with a height of ± 30 meters above sea level. Starting in March 2016 until July 2016 used by purposive random sampling method to directly observe and collect of insects in the control and fish farming sites. Insects sampling using three traps, such as Sweep Net, Yellow Trap, and Core Sampler. Catching insects performed at 08:00 to 10:00 or 16:00 to 18:00p (26).

Materials and Tools
The materials used in this research such as paddy, imago insects, aquadest destilate, transparant plastic, yellow colored paper, glue, formaldehyde, alcohol 70% and common carp (*Cyprinus carpio*). The tools used in this study is killing bottle, Sweep Net, Core Samplers, cameras, microscopes, identification books, namely the identification of (2), (9), (10), (12), and as well as stationery (29).

Implementation Research

The survey was conducted in paddy field
Survey wetland has extensive experiments ± 1 ha (0.5 ha and 0.5 ha of control and fish farming sites with the same variety paddy is IR64.

Catching of Insects
Catching insects using insect nets (sweep net) which has a handle 100 cm long, 2.5 cm diameter grip, netting 42 cm diameter and 56 cm length of fabric webs. Yellow traps (yellow traps) with a size of 30x20 cm. Insect traps in the ground (core sampler) adopted on cans of paint cans of 10 kg with a diameter of 17 cm and 20 cm tall cans.

Measurements of Physico-Chemical Water Parameters
On each sampling occasion, measurements of physico-chemical parameters, such as air temperature, wind velocity, rainfall and humidity (23, 25) were recorded. Air temperature at the rice field was recorded by hanging a thermometer on a pole at the centre of the rice plots. Wind speed was recorded using a Davis Anemometer (Figure 2e: Davis Instrument Manufacturing Co., U.S.A) at three randomly selected locations at each sampling site, while rainfall and humidity were collected from BMKG (Metereology and Climatology Society Department)

Data Analysis
Variables observations made is the number and types of insects caught, the value of the absolute density, relative density, absolute frequency, relative frequency at each observation and insect species diversity index value. Composition of insects were analyzed using t-test (at $P<0.05$) for normally distributed data to determine differences among sampling occasions, environmental variables and rice cultivation phases. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 22.00 for Windows®.

RESULTS AND DISCUSSIONS

A. Richness Indices
The measurement of various indices, such as richness, and eveness indices are done in Purwosari village, Pematang Bandar, Simalungun, Northern Sumatra. The calculated of species richness of each species in each community can be seen in Table 1.

Table 1. *The values of species richness index*

No	Yield	∑ Genus	∑ Individual	Indeks Margalef	Indeks Menhinick
1	Rice farming	42	2028	5.384	0.932
2	Control	40	2129	5.089	0.866

From Table 1 shows that the value of Margalef species richness inex on fish farming sites is 5,384, while Menhinick Index is higher (0.932) than the value recorded from the control such as 5.089 (Margalef index) and 0866 (Menhinick Index). This resulted show biodiversity species in the fish-farming sites and control does not differ greatly. This is due to the distance between fish-farming sites and control sites are close enough, so that the spread of insects in each sites are almost the similar. The distance between the two sites ranges from 20 meters. So insects will find food and will do its life cycle in a safe place for its development. This is supported by the statement of (1), (10) and (16), which states that the high value of richness index on both of sites caused by adjacent sites, besides the type of habitat is homogeneous (rice field) make the biodiversity in the fish farming and control do not quite differences. It is assumed that the distance between two adjacent lands will have a same index of the same community.

B.Evenness Indices
Evenness Indices is determine the evenness of each type in every community encountered. The values are calculated:
a.
b. A. Fish-farming
E = H'/ln S
E = 3.007/ln 42
E = **0.80**
a.
b. B.Control
E = H'/ln S
E = 2.898/ln 40
E = 0.78

From the evenness indices calculation results obtained evenness indices value of fish-farming is 0.80 and on control sites is 0.78. This proves of the value evenness indices did not significant similarity in both of sites. This is supported by statement of (14) and (26) which says that diversity is synonymous with the stability of an ecosystem, an ecosystem that is if diversity is high, then the condition of the ecosystem tends to be stable(23).

C. Comparison tool in Sampling at Fish Farming
From the researchin the fish farming has been done obtained the highest number of individuals insects caught used yellow trap are 1111 individuals, followed by sweep net (800 individuals) and the lower used the core sampler (117 indviduals). These results can be seen in Table 2.

Table 2. *Biodiversity Insects Used Three traps in tne Fish Farming Sites*

Fish-Farming Sites	Traps			Total
Ordo/famili/genus(spesies)	**SN**	**YT**	**CS**	
Orthoptera/Tettigoniidae/Antracomorphacrenulata	2	0	0	2
Orthoptera/Acrididae/Valanga nigricornis	5	2	0	7
Araniae/Tetragnatidae/Tetragnatha sp	124	86	0	210
Araniae/Tomisidae/Thomisius sp	14	0	0	14
Araniae/Lycosidae/Lycosa sp	16	1	0	17
Lepidoptera/pyralidae/Cnaphaclosis medinalis	69	65	0	134
Lepidoptera/ Hesperiidae/Hesperia sp	10	140	0	150
Lepidoptera/Nyimphalidae/Melantis	1	1	0	2
Lepidoptera/Pyralidae/Scircophaga sp	3	0	0	3
Lepidoptera/Noctuidae/Naraenae	1	1	0	2
Lepidoptera/Pyralidae/Nympulahdefuncalis	0	7	0	7
Odonata/Coenegrionidae/A.femina	79	0	15	94
Odonata/Coenegrionidae/A.pygmae	48	0	0	48
Odonata/Coenegrionidae/Pseudagrion	31	0	14	45
Odonata/Coenegrionidae/A.rubescens	12	0	0	12
Odonata/Libelluidae/Orthetrum sabina	0	0	10	10
Odonata/Coenegrionidae/Ceriagrion	8	0	4	12
Diptera/Muscidae/Atherigona oryzae	14	21	0	35
Diptera/Cucilidae/Anopheles sp	114	226	38	378
Diptera/ Sciaridae	62	66	12	140
Diptera/ Chironomidae	8	5	14	27
Diptera/ Cecidomyiidae	4	27	0	31
Diptera/ Tachinidae	5	3	0	8
Diptera/Tipulidae	2	14	0	16
Diptera/Ephryidae	1	5	0	6
Diptera/Sarcophagidae/Sarcophaga sp	0	4	0	4
Diptera/Pipunculidae/Tomosvaryella subvirescens	0	20	0	20
Hyemenoptera/Ichneumonidae/Temelucha sp	9	7	0	16
Hyemenoptera/Ichneumonidae/Amauromorpha accepta	0	74	0	74
Hyemenoptera/Ichneumonidae/Xanthopimpla sp	2	0	0	2
Hymenoptera/Braconidae/Cardiochiles philippinensis	0	1	0	1
Hymenoptera/Formicidae/Camponotus consobrinus	0	2	0	2
Hymenoptera/Spechidae/Scliphron sp	0	1	0	1
Hymenoptera/Elasmidae/Elasmus sp	0	28	0	28
Hymenoptera/Pteromalidae/Panstenon sp	0	7	0	7
Hymenoptera/Pteromalidae/Telenemus sp	0	9	0	9
Hymenoptera/Apididae/Apis sp	0	2	0	2
Coleoptera/ Coccinilidae/Verania lineata	23	11	0	34
Coleoptera/ Coccinilidae/Chilocorus sp	1	0	0	1
Coleoptera/ Carabidae/Ophioneani nigrofasciata	9	2	0	11
Coleoptera/Staphylinidae/Paedorus fuscipes	6	2	0	8
Coleoptera/Tenebrionidae/Tenebrio sp	3	5	0	8
Cole optera/Salpingidae/Lissodema sp	0	2	0	2
He Hemiptera/Miridae/Cyrthorinus sp	27	17	0	44
Hemiptera/Alydidae/Leptocorisa acuta	4	2	0	6
Hemiptera/Pentatomidae/Scotinophara coarctata	0	1	0	1
Hemiptera/Gerridae/Limnogonus fossarum	0	2	10	12
Homoptera/Cicadellidae/Recilia dorsalis	48	201	0	249
Homoptera/Cicadellidae/Nephotettix spp	9	19	0	28
Homoptera/Delphacidae/Nilaparvata sp	14	12	0	26
Homoptera/Delphacidae/Sogatella sp	12	10	0	22
T Total	800	1111	117	2028

Note: *SN = Sweep Net; YT = Yellow Trap; CS = Core Sampler*

These results show a combination of the number of constituent species on fish farming with the diversity of rice has not shown any uneven distribution of insect populations. So is the sites did not control all kinds of insects can be found distribution on the same sites. So the level of evenness in the insect population will affect the diversity of insects in the rice field. According to (13) and (25), reinforces the claimed that species diversity index depends on the species richness and evenness. Results evenness indices of less than 1 indicates that dominate the evenness of insect populations in field trials. As in the control area is dominated by leaf hoppers (Recilia dorsalis), Tetragnatha sp and the fish farming sites dominated by Anopheles sp. This is supported (28) which states that the value of the largest equity index is 1 (maximum evenness index). It is claimed that the desert habitat types/bush no insect species dominate (24). From table 2 we can see that many insects caught with sweep net (SN), namely the Order of Araneae, Family Tetragnathidae, Genus Tetragnatha sp by 124 individuals. This insect is a type of spider. These insects were caught in a trap net sweep for spiders used to make nests in leaves of rice plants, so that when sampling is very easy to get these insects (22). From the yellow trap (YT), which caught many insect of the order Diptera, Family Cucilidae, Anopheles (226 individuals). This is due to insect larvae will grow into imago spread to the land and at the moment of capture insects, the life cycle of the imago phase that many caught. In addition, insects are more attracted to yellow light waves reflected from the trap so that the insects

approaching the traps yellow yolk that has been unsealed. This is supported by research Nainggolan (8,15) which states the type of trap yellow (yellow traps) favored by many imago insects, especially insects of the order Diptera types of the coffee plant in Karo highland, North of Sumatra. At the core sampler (CS), an insect that most captured from the order Diptera, Family Cucilidae, genus Anopheles (38 individuals) are diverse than other insects in Purwosari. The Table 3 given description of t-test done. The results of the test T-test used a sweep net in fish-farming shows significant at the 5% level with a value of t = 3.955 (P <0.005), used by yellow trap significant at the level of 5% with a value of t = 3.260 (P <0.005), while in the trap core sampler is not significant at the level of 5% with a value of t = 2,487 (P> 0.005).

Table 3. *T test Score in Fish Farming Sites*

		One-Sample Test Test Value = 0					
		T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Sn Farming	Fish	3.623	54	.001	12.80000	5.7167	19.8833
Yt Farming	Fish	2.885	54	.006	23.41818	7.1428	39.6936
CsFish Farming		1.605	54	.114	2.49091	-.6215	5.6033

D. Comparison Insects in the Control Sites

From the table 3, we can see that many insects caught in sweep net traps (SN), namely the Order Homoptera, Family Cicadellidae, Recilia dorsalis (131 individuals). This species many have encountered in rice plants especially those in the vegetatife phase. In the yellow trap trap (YT), an insect that caught many of the Order Homoptera, Family Cicadellidae, Recilia dorsalis (398 individuals). At the core trap sampler (CS), an insect that most captured from the order Diptera, Family Cucilidae, Anopheles (81 individuals).

Table 3. *Biodiversity Insects Used Three traps in tne Control Sites*

Control Sites	**Perangkap**			Total
Ordo/famili/genus/spesies	SN	YT	CS	
Orthoptera/Acrididae/Valanga nigricornis	2	2	0	4
Orthoptera/Tettigoniidae/Sexava spp	1	0	0	1
Araniae/Tetragnatidae/Tetragnatha sp	116	55	0	171
Araniae/Tomisidae/Thomisius sp	0	8	0	8
Araniae/Lycosidae/Lycosa sp	20	7	0	27
Lepidoptera/pyralidae/Cnaphaclosis medinalis	56	35	0	91
Lepidoptera/ Hesperiidae/Hesperia sp	7	98	0	105
Lepidoptera/Pyralidae/Scircophaga sp	2	2	0	4
Lepidoptera/Noctuidae/Naraenae	1	0	0	1
Odonata/Coenegrionidae/A.femina	57	1	5	63
Odonata/Coenegrionidae/A.pygmae	30	0	0	30
Odonata/Coenegrionidae/Pseudagrion	33	0	2	35
Odonata/Coenegrionidae/A.rubescens	15	0	0	15
Odonata/Libelluidae/Orthetrum sabina	1	2	4	7
Odonata/Libelluidae/Pantala sp	0	1	0	1
Odonata/Coenegrionidae/Ceriagrion	10	10	0	20
Diptera/Muscidae/Atherigona oryzae	8	18	0	26
Diptera/Cucilidae/Anopheles sp	34	185	81	300
Diptera/ Sciaridae	56	19	28	103
Diptera/ Chironomidae	14	18	3	35
Diptera/ Cecidomyiidae	0	8	0	8
Diptera/ Tachinidae	1	4	0	5
Diptera/Tipulidae	0	22	0	22
Diptera/Ephryidae	1	5	0	6
Diptera/Sarcophagidae/Sarcophaga sp	0	7	0	7
Diptera/Pipunculidae/Tomosvaryella subvirescens	0	49	0	49
Hyemenoptera/Ichneumonidae/Temelucha sp	12	7	0	19
Hyemenoptera/Ichneumonidae/Amauromorpha accepta	1	99	0	100
Hyemenoptera/Ichneumonidae/Xanthopimplasp	1	1	0	2
Hymenoptera/Braconidae/Cardiochiles philippinensis	0	1	0	1
Hymenoptera/Formicidae/Camponotus consobrinus	0	22	0	22
Hymenoptera/Spechidae/Scliphron sp	0	3	0	3
Hymenoptera/Pteromalidae/Panstenon sp	8	15	0	23
Hymenoptera/Pteromalidae/Telenemus sp	0	13	0	13
Hymenoptera/Apididae/Apis sp	0	2	0	2
Hymenoptera/Braconidae/Opius sp	0	11	0	11
Coleoptera/ Coccinilidae/Verania lineata	12	11	0	23
Coleoptera/ Coccinilidae/Chilocorus sp	0	3	0	3
Coleoptera/Carabidae/Ophioneani nigrofasciata	6	2	0	8

Coleoptera/Staphylinidae/Paedorus fuscipes	7	4	0	11
Coleoptera/Tenebrionidae/Tenebrio sp	0	1	0	1
Coleoptera/Salpingidae/Lissodema sp	1	1	0	2
Hemiptera/Miridae/Cyrthorinus sp	14	21	0	35
Hemiptera/Alydidae/Leptocorisa acuta	9	6	0	15
Hemiptera/Pentatomidae/Scotinophara coarctata	0	9	0	9
Hemiptera/Gerridae/Limnogonus fossarum	0	0	8	8
Homoptera/Cicadellidae/Recilia dorsalis	131	398	0	529
Homoptera/Cicadellidae/Nephotettix spp	32	35	0	67
Homoptera/Delphacidae/Nilaparvata sp	2	27	6	35
Homoptera/Delphacidae/Sogatella sp	3	40	0	43
Total	704	1288	137	2129

The T-test calculated in the control sites with score such as in Table 4 below. The results of the test T-test use of a sweep net in fish-farming shows significant at the 5% level with a value of t = 3,623 (P <0.005), on the yellow trap is not significant at the 5% level with a value of t = 2.885 (P <0.005), while the trap core sampler is not significant at the level of 5% with a value of t = 1.605 (P <0.005).

Table 4. T test Score in Control Sites

	One-Sample Test Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Sn Control	3.623	54	.001	12.80000	5.7167	19.8833
Yt Control	2.885	54	.006	23.41818	7.1428	39.6936
Cs Control	1.605	54	.114	2.49091	-.6215	5.6033

The application of chemicals such as fertilizers (urea, nitrate, phosphate, pottasium), herbicides (H AllyXP) and insecticide (imidacloprid, rhodiamine) (,1,2,8) in Purwosari Village often leads to nutrient enrichment of surface waters (25; 28), especially after the applications during the end of the young phase and beginning of the tiller phase. The abundance of aquatic organisms, such as ephemeropterans, odonate, coleopterans and dipterans were affected by this application in Purwosari Village. Negative effects of pesticides on aquatic organisms in rice fields were previously reported by various authors (14, 21,23).

CONCLUSIONS

Insects caught in fish-farming land consists of 9 orders, 40 families, 42 species, the number of insect populations identified 2028 individuals. Values of species richness in fish-farming land amounting to 5,384 (Margalef index) and 0932 (Menhinick Index) is higher than the value of wealth in the control of land amounting to 5,089 (Margalef index) and 0866 (Menhinick Index). Results fish-farming evenness index values of 0.80 and 0.78 in the control area. Best traps at catching insects in fish-farming is using yellow traps and pitfalls of the best on the control of land that is using yellow traps.

ACKNOWLEDGMENT

The authors wi sh thank to farmers in Purwosari village, Laboratory Pests and Disseases, Faculty Agriculture, USU. Thanks to Ministry Research and Technology, Directorate General of Higher Education of Republic Indonesian for Grant 2016.

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