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Diversity of Ground Predatory Arthropods In Organic and Conventional Rice Farming

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ABSTRACT

Pest control in paddy agriculture program have been applied by farmers using synthetic that could potentially harm for environtment, examples are pest resurgence, environmental pollution, and residual hazard. People are aware the impact of these synthetic chemical then applying organic farming which do not use synthetic chemical for controlling the pest. This study aimed to compare the level of diversity ground predatory arthropods in organic and conventional rice farming. This study was conducted at organic and conventional rice farming, which located at Desa Bakalrejo, Kecamatan Susukan, Kabupaten Semarang. Predatory arthropods were sampled by using pit fall trap methode and were identified. The result shows nine arthropods which act as predator, Linypiidae, Lycosidae, Salticidae, Carabidae, Staphylinidae, Carcinophoridae, Forficulidae, Formicidae and Gryllidae. The diversity of ground predatory arthropods in organic farming were not different with conventional rice farming but the abundance of predatory arthropods generally higher in organic rice farming than conventional rice farming.

Keywords : *Diversity,organic farming,predatory.arthropods*

1. INTRODUCTION

Rice has a very important role in human life. According to references [3] , rice is the staple food for more than 2.4 billion people in Asia and the hundreds of millions of people in Africa and Latin America. Efforts to improve the quality and quantity of rice often find a lot of obstacles, partly due to disruption of pests and diseases. Various attempts have been made in controlling pests such as the brown plant hopper, especially the use of insecticides, which in turn led to a variety of very harmful impacts. The situation thus automatically making insecticides are less effective and potentially harm the environment if the use is not in accordance with the instructions for use, followed references [11] in [9]. Insects and spiders are natural enemies of the greatest role in suppressing the population of brown plant hopper and stem borer in agricultural ecosystems. Predatory arthropods that have proven effective in controlling rice pests that spider huntsman spider Pardosa pseudoannulatadan beetles Carabidae, [2] in [1]. Application of pesticides in conventional farming is not entirely on target. Approximately only 20% of these chemicals on target, while the other 80% falls to the ground. Application of chemical pesticides to kill pests in addition can also be lethal arthropod predators to control pest populations. Entering the 21st century, the world became aware of the dangers posed by the use of synthetic chemicals in agriculture, so that people applying organic farming where the farm does not use synthetic chemical applications. This study aimed to compare the diversity and abundance of predatory arthropods in organic and conventional rice farming.

2. MATERIALS AND METHODE

The study was conducted in September to December 2011 in the fields of organic and conventional rice farming the land area of each field approximately 1000 m2 located at Desa Bakalrejo,Kecamatan Susukan, Kabupaten

Semarang. Sampling was conducted at IR 64 rice varieties at vegetative stage (40 days after planting), the reproductive phase (80 days after planting), the maturation phase (120 days after planting) and after harvest (130 days).

3. SAMPLING

Sampling is done by using pit fall traps. Plastic cups that have been provided initially filled with a solution of 70% alcohol and a little detergent. 70% alcohol solution intended to allow insects into the trap of death, while the detergent to reduce surface tension so that the insects can drown and die instantly, followed references [10]. Plastic cups mounted as many as 25 pieces in 3 mapped fields. In each plot contained 8 pieces trap fields. The plastic cups mounted at each sample point and the distance between a point 5 meters of land along the sample. Plastic cups filled with alcohol and detergents have grown in paddy fields and left from morning to evening. Pitfall planted sought to be flush with the ground surface, followed references [1]. Pitfall trap device installed for 3 days, each day the glass is collected in plastic sample bottles and then replaced with a new solution. Sampling in each field observations were made four times the corresponding age span of rice. Identification of soil arthropods conducted in the Laboratory of Ecology and Biology majors Biosistematika UNDIP, Laboratory of Entomology and Zoology Division LIPI (Indonesian Institute of Sciences) Cibinong, Bogor.

4. RESULTS AND DISCUSSION

4.1. Abundance of Arthropod Predator

The results showed that arthropod predators found in organic and conventional rice farming consists of 9 families, among which Linypiidae, Lycosidae, Salticidae, Carabidae, Staphylinidae, Carcinophoridae, Forficulidae, Formicidae, and Gryllidae. The number of arthropod predators in general more in organic rice farming as compared to that in conventional farming. However, when compared according to age of rice, there is a number of arthropods whose value is higher than conventional rice farming in organic agriculture. At the age of organic rice farming 40 days total arthropods found as many as 547 individuals, whereas the conventional total arthropod predators found slightly lower at 516 individuals. The low number of arthropod predators in conventional rice farming allegedly because of the application of synthetic chemicals in agriculture, so that the number of arthropod predators decreases. At the age of organic rice farming 80 days the number of individuals found that as many as 486 individuals, while in the conventional total arthropods were found slightly higher at 507 individuals. The number of arthropod predators in rice farming is higher compared to conventional organic rice farming. This happens because of the possible age of 80 days in the rice paddy farming conventionally there are also an increasing number of non-predatory arthropods are thought to act as a target prey of predatory arthropods, resulting in improvements to the arthropod predators.

120 days old rice plants is characterized by yellowing of the rice grains. At the age of 120 days of rice as the rice age 40 days, the number of individuals arthropod predators in organic farming is high, 483 individuals and in conventional farming slightly lower at 413 individuals. This happens because of the possible use of insecticides or synthetic chemicals in conventional rice farming, so the number of arthropod predators to be lower compared to those in organic agriculture. This is consistent with research references [8] which suggests that a decline in the number of arthropods in agriculture onion in the application of synthetic insecticides.

Similarly, at the age of rice 130 days (after harvest) in organic farming found 395 individual arthropods whereas conventional farming arthropod predators found slightly lower at 345 individuals. The low number of arthropod predators during post-harvest (130 days) is possible because of the presence of insects herbivor as the prey of predatory arthropods. Rice crop has been cut after harvest will indirectly decrease the insect population herbivor, so insect herbivor will search its food sources elsewhere. It can also indirectly affect the number of arthropod predators. References [1] shows that insect predators can move from one place to another that still provide a food source for the insect arthropod predators.

Family predatory arthropods abundance highest value of the Formicidae. Insects are abundant in conventional rice farming rice at the age of 40 days, 80 days and 130 days. This value is higher than the one in organic rice farming presumably because the level of resilience of the family Formicidae were relatively strong. According to references [6], states that the Formicidae is one of arthropods are relatively resistant to synthetic insecticides. When compared with other arthropod predators, the relative abundance of each age paddy Formicidae always higher. It seems that age has no effect on the presence of rice Formicidae, so the number is always high. This is

possible because the characteristics of arthropod predators that do not rely on just one type of prey. In contrast to parasitoids that depend on a particular type of prey, so any age paddy per family parasitoid abundance of different follow certain availability of prey. This is consistent with the statement in references [12] that predators can prey on more than one host to complete one cycle of life and are generally polyfag, so predators could go on without depending on a single host.

Table 1. Number of individuals (Σ), diversity (H '), Evenness (E) Predatory Arthropods in Organic and Conventional Rice Farming.

Order	Family	Vegetative 40 days		Reproductive 80 days		Maturation 120 days		Post Harvest 130 days	
		O	K	O	K	O	K	O	K
Araneae	Linypiidae	24	19	18	13	14	10	10	4
	Lycosidae	176	144	152	162	149	165	142	127
	Salticidae	0	0	2	4	3	0	0	0
Coleoptera	Carabidae	36	29	26	27	21	14	18	12
	Staphylinidae	23	25	34	21	28	15	14	8
Dermaptera	Carcinophoridae	23	17	21	10	13	6	5	2
	Forficulidae	4	0	0	1	2	1	0	0
Hymenoptera	Formicidae	243	260	221	249	237	183	198	180
Orthoptera	Gryllidae	18	22	12	20	16	19	8	12
	Σ	547	516	486	507	483	413	395	345
	t	8	7	8	9	9	8	7	7
	H’	1,46	1,38	1,44	1,35	1,38	1,27	1,20	1,11
	E	0,70	0,70	0,69	0,61	0,62	0,61	0,61	0,60

Lycosidae is a family who has a relative abundance value of the second highest after the Formicidae. Lycosidae abundant in conventional rice farming rice at age 80 days, 120 days and 130 days. This value is higher than the value of the abundance of Lycosidae in organic rice farming rice the same age. Lycosidae spiders are active hunters on the surface, the abundance of spiders Lycosidae possible because of the structure of the conventional rice farming embankment filled with grasses that are thicker than the grass on an organic rice field. References [7] shows that the spider lives in the litter or soil surface mounting dramatically increased when the thick litter layer as more places available to hide. It also could be due to the presence of prey from the Lycosidae.

Lowest relative abundance found in the family Salticidae and Forficulidae. Relative abundance Salticidae Salticidae low as possible because of the nature of the active jumper so hard to get caught in the trap pit fall traps. Forficulidae also low relative abundance, it is presumably because these insects actively feeding at night and during the day is not too active. This is consistent with the statement references [13] that Forficulidae active at night and during the day they tend to hide under the plants.

Table 2. Relative Abundance of Arthropod Predator Family in Rice Organic and Conventional Farming (in%)

Order	Family	(vegetative) 40 Days		(reproductive) 80 Days		(maturation) 120 Days		(post harvest) 130 days	
		O	K	O	K	O	K	O	K
Araneae	Linypiidae	4,40	3,70	3,70	2,60	2,90	2,40	2,50	1,20
	Lycosidae	**32,20**	**27,90**	**31,30**	**32,00**	**30,80**	**40,00**	**35,90**	**36,80**
	Salticidae	0,00	0,00	0,40	0,80	0,60	0,00	0,00	0,00
Coleoptera	Carabidae	6,60	5,60	5,30	5,30	4,30	3,40	4,60	3,50
	Staphylinidae	4,20	4,80	7,00	4,10	5,80	3,60	3,50	2,30
Dermaptera	Carcinophoridae	4,20	3,30	4,30	2,00	2,70	1,50	1,30	0,60
	Forficulidae	0,70	0,00	0,00	0,20	0,40	0,20	0,00	0,00
Hymenoptera	Formicidae	**44,40**	**50,40**	**45,50**	**49,10**	**49,10**	**44,30**	**50,10**	**52,20**
Orthoptera	Gryllidae	3,30	4,30	2,50	3,90	3,30	4,60	2,00	3,50

4.2. Diversity of Predatory Arthropods

Overall arthropod predator diversity values at ground level is generally higher in organic rice farming as compared to conventional rice farming. More high value predatory arthropod diversity in organic rice farming than conventional rice farming allegedly due to the influence of synthetic insecticide applications on conventional rice farming, so many arthropods that died or did not like it then leave conventional rice farming that decreases the number of arthropod predators on land. According to references [4] that the value of diversity is likely to be lower in physically controlled ecosystems (synthetic insecticide application) and the value of diversity will be higher in a biological ecosystem regulated.

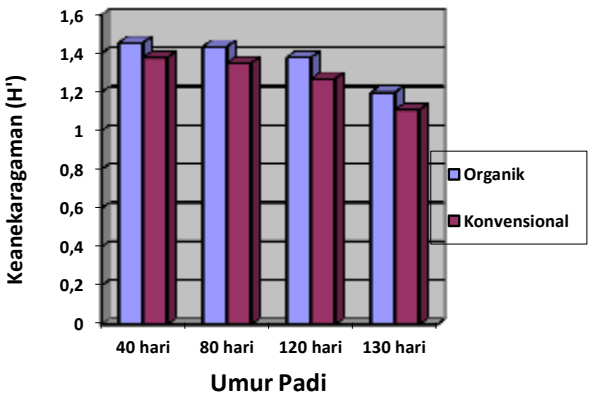

Figure 1. Comparison of Predatory Arthropods Diversity in Organic and Conventional Rice Farming

However, the diversity of predatory arthropods ground between organic rice farming and conventional rice farming is not real different. It can be proved that the entire value of the index Hutcheson showed no significant values. No difference in the diversity of arthropod predators in both fields may be due to the location of both the adjacent farmland.

Level of evenness in both paddy fields at each age showed a relatively high value. Evenness values arthropod predators on organic and conventional rice farming ranged from 0.60 to 0.70. References [4] shows that the equity index were high because it has a value of more than 0.6. This means that on both land between organic and conventional rice farming has a high uniformity.

The entire value of the similarity arthropod predators showed values close to 1. This means that there are similarities in the two habitats community. Communities may be due to the similarity lies between organic and conventional rice farming near, so help spread the soil surface arthropod predators from one land to another land. Individuals of a population can be scattered out from one place to another due to competition for food, light, shelter and a place to lay eggs, followed by references [5]. It also may be influenced by the type of crops grown on both habitat and planting the same time.

Table 3. Similarity Index (Sorenson) on Organic and Conventional Rice Farming

K / O	*(vegetative)* *40 days*	*(reproductive)* *80 days*	*(maturation)* *120 days*	*(post harvest)* *130 days*
40 days	*0,93*	-	-	-
80 days	-	*0,94*	-	-
120 days	-	-	*0,94*	-
130 days	-	-	-	*1*

Note: O = Organic K = Conventional

5. CONCLUSION

Arthropod predators found in surface soils of organic and conventional rice farming is Linypiidae, Lycosidae, Salticidae, Carabidae, Staphylinidae, Carcinophoridae, Forficulidae, Formicidae and Gryllidae. Value diversity of arthropod predators on organic farms ranged from 1.20 to 1.46 while the value of agricultural biodiversity in conventional rice ranged from 1.11 to 1.35. Formicidae and Lycosidae a predatory arthropods that have a value that is high enough relative abundance. Evenness index value (E) in organic rice farming ranged from 0.61 to 0.70, while in conventional farming ranged from 0.60 to 0.70. The similarity index value in organic and conventional rice farming ranged from 0.93 to 1.00, this means that there are similarities between the soil surface arthropod predators organic and conventional rice farming.

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