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The Diversity of Arthropods Predator on Wild Plant of Rice Field with and without Pesticides

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Abstract

Contaminated- agro ecosystem influences abundance and diversity of arthropods. The aims of this study were to analyze the diversity and abundance of pre-planting arthropod predators on wild plants in rice field with and without application of pesticides. The survey and direct observation of wild plants at the rice filed were conducted from January to March 2015, at 1 ha in Pemulutan and 1 ha in Musi 2 Palembang. Sampling of arthropod predator was conducted 8 times before the rice was grown, using insect nets. On the land without pesticide application was found 14 arthropod families which consists of 28 species and 15 families of wild plant consists of 25 species. On the land with pesticide application was found 8 arthropod families consists of 16 species and 15 wild plant families with 23 species. On the land without pesticide application was found High index of diversity (H'=3.121) and low dominance (D=0.095), while on the land with pesticide application low index of diversity (H'=2.602) and high dominance (D=0.171). It is the indicators of arthropods predator more varieties at the land without pesticide application compare to the land with pesticide application. This finding is very important for biological pest management in South Sumatra.

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INTRODUCTION

Application of synthetic pesticides intensively giving the negative impact on agro-ecosystems (Meidalima, 2014). One of the effects of the use of synthetic pesticides is low abundance and diversity of arthropods (Meidalima & Meihana, 2013), especially parasitoids and predators (Wanger et al., 2010). The increase of pest population indicates that predatory arthropods and parasitoid are not function optimally (Khodijah et al. 2012) due to the use of synthetic insecticides indiscretion (Herlinda et al. 2010). Likewise, the use of herbicides indirectly affect the natural enemies.

Suryawan (1999) reported that spraying herbicides to control weeds has been increasing the population of brown planthopper and green leafhopper, decrease the predator population. Habitat for natural enemies are not only the main crop, but also weeds found around the agro-ecosystems (Meidalima, 2013). Weeds around the plants act as a provider of food (nectar, honey dew and pollen) for arthropod predators (Rusch et al., 2012, Winkler et al., 2010; Belz et al., 2013). In addition, weeds around the agro-ecosystem can serve as a shelter from natural enemies when conditions are not suitable (van Emden, 1991). The wild plant can also serve as sinks for arthropod predators when the plants are not available in agro-ecosystems, after the harvesting or the application of pesticides. While the next planting season, weeds may be a source of natural enemies that will invade the crop (Herlinda & Irsan, 2011). The aims of this study are to identify and analyze the species diversity and abundance of arthropod predators pre-planting found in weeds in the rice field with and without pesticide application.

METHODS

The research was conducted in the swampy lowland rice cultivation at Pemulutan Ogan Ilir and Musi 2 Palembang, South Sumatra. Laboratory observations was conducted at the Laboratory of Agro Technology College of Agricultural Sciences Sriwigama Palembang. The study was conducted since January to March 2015. One hectare rice field observation area in low land of Pemulutan Ogan Ilir as rice intensively applied pesticides, and one hectare at Musi 2 Palembang as representing rice without pesticides applied.

Sampling method for pre planting artrhopoda predator on wild plants in the field with and without pesticed application. The observation plot for the field with pesticide application was in Pemulutan since the local farmers use synthetic pesticides on a regular basis, while around Musi 2 Palembang as site for the field without pesticide application.

Sampling method for arthropods predator was conducted 8 times at the time of pre planting on the wild plants at the rice filed. The predator artrhopods were taken visually and directly at wild plants on rice field. To identify and calculate diversity index, sampling Antropoda predator was traped with insect net. Artrhopoda predator insects that were caught in the net were calculated and collected for further identification. This method is carried out as by Khan *et al*. 2006.

Identification of arthropods predator

Identification of arthropods predator are based on morphologic characteristics, at the Laboratory of Agro Technology College of Agricultural Sciences Sriwigama Palembang. Identification using reference books Kalshoven (1981) and Barrion & Litsinger (1994).

Observations of abundance of arthropods predator in swampy rice fields. After all species of arthropods predator trapped insect nets are identified, then grouped and calculated. Grouping species of arthropod predators based on the location of the observation plots.

Data analysis

Arthropod predators of insect species found in weeds in the lowland rice fields in the application and without application of synthetic pesticides, analyzed descriptively. Data on the composition of species and number of individuals of arthropod predators are used to analyze the abundance and diversity of species. Size diversity value is used Shannon-Wiener species diversity index, Berger-Parker dominance index and species evenness index of Pielou (Price 1984; Fachrul, 2007). Assessment of the diversity of arthropod predators based describe raised by Fachrul (2007) as follows:

H'<1: low diversity
1<H'<3: intermediate diversity, and
H'>3: high diversity.

RESULTS AND DISCUSSION

The results show that arthropods predator in the rice fields without pesticide application in Musi 2 Palembang were 14 families of arthropods predator consisting of 28 species. While on location Pemulutan with wetland conditions are applied periodically synthetic pesticides, predator

found as many as 8 family consists of 16 species (Table 1).

Table 1. Arthropods predator diversity on Wild Plant

Class/Ordo	Family/ Species	Number of Species	
		Without Pesticides	Pesticides
Insecta/ Coleoptera	Coccineliidae		
	Harmonia axyridis	87	-
	Harmonia sp A	79	-
	Coelaphora inaequalis	108	-
	Coccinella transversalis	141	27
	Coccinella septempunctata	196	11
	Staphylinidae		
	Faederus littoralis	38	-
Insecta/ Hymenoptera	Formicidae		
	Polyrhachis ammon	221	-
Insecta/ Odonata	Libellulidae		
	Crocothemis servilia	61	18
	Crocothemis sp. A	-	21
	Diplacodes trivialis	-	17
	Neurothemis terminate	86	-
	Neurothemis ramburii	19	-
	Neurothemis sp A	47	-
	Orthetrum cancellatum	29	-
	Orthetrum coerulescens	58	11
	Aeshnidae		
	Aeshna cyanea	102	57
	Coenagrionidae		
	Ischnura verticalis	93	22
	Ischnura elegans	201	23
	Agriocnemia sp A	118	28
	Agriocnemia femina	104	29
	Ceriagrion glabrum	91	31
	Platycnemididae		
	Platycnemis pennipes	89	17
	Mantidae		
	Mantis religiosa	17	1
Arachnida/ Araneae	Araneidae		
	Argiope catenulate	11	-
	Araneus inustus	-	8
	Nephilidae		
	Nephila pilipes	41	-
	Linyphiidae		
	Atypena formosana	19	-
	Salticidae		
	Phidippus sp	21	-
	Oxyopidae		
	Oxyopes javanus	78	-
	Tetragnatidae		
	Tetragnatha verniformis	91	-
	Tetragnatha virescens	72	13
	Number of specimens	2318	334
	Number of spesies	28	16
	Index Shannon (H')	3.121	2.602
	Index Berger-Perker (d)	0.095	0.171
	Index Pielou (E)	0.937	0.938

Overall the number of families arthropods and species of arthropod predator on land without pesticides applications were more than the number and species on the land which was applied pesticides intensively. Predator arthropods dominance index were high and evenness index were low occurred on land which applied pesticides intensively. The high degree of dominance of arthropod predators on land that applied pesticides showed that the imbalance population among insects species. It means that very high domination of certain species compared to other species.

This condition proved that synthetic pesticides affect the abundance of arthropods predator. The application of pesticides directly affect the existence of natural enemies (Hall & Nguyen, 2010). Some research results prove the effects of pesticides on natural enemies, such Carmo et al. (2010) reported that pesticides, herbicides and fungicides are very harmful to parasitoids *Telenomus remus* Nixon. The use of broad-spectrum pesticides can also kill other insects that are beneficial (Amirhusin, 2004; Kartohardjono, 2011). Diversity index on the land without pesticides applied, indicating the level of arthropod predators high diversity (H' = 3.121), being land applied pesticides, predatory arthropods moderate levels of diversity (H' = 2.602).

The existence of weeds that are around rice fields affect the abundance and diversity of arthropods. The results of interviews with farmers in Pemulutan Ogan Ilir, to control pests and weeds they use synthetic pesticides. This condition is very different with farmers in the area Musi 2, they aren't spraying pesticides to control pests and weeds around their fields. The result observation of weeds that exist in the area Musi 2 as much as 15 families consisting of 25 species. While in the area Pemulutan Ogan Ilir,

weeds found as many as 15 families and 23 species. Based on the number of families and species found at both sites is almost the same, but based on observations, weeds in the Musi 2 higher than in Pemulutan Ogan Ilir. Presumably it is this which influenced the abundance and diversity of arthropod predators in the two study sites. Weeds species were found in both sites are presented in Table 2. These weeds in Musi 2 provides a source of food, shelter and more alternative host for arthropods. When the conditions are not suitable, the wild plants around crops can serve as a shelter and the place for escaping from natural enemies (van Emden, 1991). Wild plants can also provide an alternative host or prey that acts as a "bridge natural enemies" that connects two growing season, can also serve as a sinks of natural enemies that comes from freshly harvested paddy crop. The weeds can be a source of natural enemies in the next planting season (Herlinda & Irsan, 2011).

Table 2. Wild Plants in Causeway Rice

Family/Species	Status Location	
	Without Pesticides	Pesticides
Amaranthaceae:		
Alternanthera philoxeroides	+	-
Amaranthus gracilis	+	+
Asteraceae		
Ageratum conyzoides	+	+
Eclipta alba	+	+
Eclipta prostrate	-	+
Spilanthes paniculata	+	-
Mikania micrantha	+	+
Vernonia cinerea	+	+
Butomaceae		
Limnocharis flapa	+	+
Capparidaceae		
Cleome rutidosperma	+	+
Convulvulaceae		
Ipomoea pandurata	+	-
Cyperaceae		
Cyperus flavipus	+	+
Cyperus tenuiculmis	+	-
Cyperus kyllingia	+	-
Cyperus eragrostis.	+	-
Fimbristylis littoralis	-	+
Euphorbiaceae		
Phyllanthus virgatus	+	+
Fabaceae		
Cassia tora	+	+
Indigofera endecaphylla	+	-
Malvaceae		
Sida rhombifolia	-	+
Nyctaginaceae		
Boerhavia erecta	+	-
Onagraceae		
Ludwigia adscendens	+	+
Passifloraceae		
Passiflora foetida	+	+
Poaceae		
Axonopus compressus	+	-
Cynodon dactylon	+	+
Digitaria ciliaris	-	+
Eragrotis unioloides	-	+
Rubiaceae		
Mitracarpus villous	+	+
Richardia scabra	-	+
Scrophulariaceae		
Lindernia crustacean	+	-
Solanaceae		
Solanum torvum	-	+
Sturculiacaea		
Melochia corchorifolia	+	+
Verbenaceae		
Stachytarpheta indica	-	+

Description: + : found, - : not found

The results reported by Winasa and Rauf (2005), a decrease in the abundance of arthropods ground of family Lycosidae, Lyniphiidae, Carabidae and Formicidae in ecosystems that applied deltamethrin. Decrease fitofag insects and arthropods predator also occurs in ecosystems that applied profenofos and deltamethrin (Purwata et al., 1997). While the research by Rizali et al. (2002), in the rice fields in the Mist is found Carabidae which are bio-indicators of agricultural land management (Kromp, 1990) and Formicidae for indicators of the condition of agro-ecosystems in a region (Peck et al., 1998). This means that in the Mist has not been polluted by chemicals, such as pesticides.

Ecosystem that is not in applications with

insecticides, the abundance of arthropods predator, such as Carabidae (Purwanta et al., 1997), and spiders are much higher than the ecosystem sprayed (Tulung, 1999). The use of pesticides is a major cause of low diversity and abundance of macroinvertebrate communities (such as Ephemeroptera, Plecoptera and Trichoptera) in paddy fields (Uwimana, 2011; Bambaradeniya et al., 2004).

The number of wild plant species and arthropods predator in the rice field without pesticides application (Musi 2) more than its number and species on the research location which was applied pesticides intensively (Pemulutan Ogan Ilir) (Figure 1).

This show that synthetic pesticide take effect on wild plant and arthtopods predator abundance. The information of diversity, abundance, and arthropods predator species in an ecosystem are the important factors biological control in integrated pest managements (IPM).

This study found that diversity index of arthropod predator is higher at the land without pesticide application compare to the land with pesticide application. It is the indicators of arthropod predators more varieties at the land without pesticide application compare to the land with pesticide application. This finding is very important for biological pest management in South Sumatra.

CONCLUSION

On land without pesticides application found arthropods predator are 14 families consisting of 28 species, and weeds are 15 families consisting of 25 species. While on the land with pesticides application were found arthropod predators are 8 families consisting of 16 species and weeds are 15 families consisting of 23 species. The value of diversity index (H'= 3.121) and dominance (D = 0.095) on the land without the application of pesticides, while on land application of pesticides value diversity index was 2.602 and dominance index was 0.171.

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