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International Workshop on Sustainable Management of Lowland for Rice Production

Banjarmasin, 27-28 September 2012

Editors: Edi Husen, Dedi Nursyamsi, Muhammad Noor, Arifin Fahmi, Irawan, and I G.P. Wigena

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Edi Husen (Chair)
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I G.P. Wigena (Member)

MANAGING EDITOR

Widhya Adhy
Wahid Noegroho

Published in 2013:

Indonesian Agency for Agricultural Research and Development Ministry of Agriculture
Jl. Ragunan 29. Pasar Minggu
Jakarta Selatan 12540. Indonesia
Telp (021) 7806202
Fax (021) 7800644
e-mail: info@litbang.deptan.go.id
www.litbang.deptan.go.id

Funded by DIPA Balai Penelitian Pertanian Lahan Rawa TA 2013

ISBN 978-602-8977-65-4

FOREWORD

In Indonesia, there are about 33.4 million ha of wetlands, 9.5 million ha of which are suitable for agriculture. Approximately 5 million out of 9.5 million ha of the land have been reclaimed and used by farmers, government, and private sectors for crop production, such as in Sumatera and Kalimantan. This wetland becomes more important in the future as an alternative land for food production due to an increase growth of human population and accelerated reduction of fertile land. However, the uniqueness of wetland properties, its utilization for agriculture requires a proper management to ensure the sustainability of the ecosystem and productivity of the land for crop production.

So far, a lots of learning and experience gained from the development of wetland areas. For example, today we see a large and growing number of cities such as Palembang, Banjarmasin, Palangkaraya, Pontianak, Pekanbaru, and Jambi was originally developed from wetlands, which previously flooded during rainy season. Some provinces such as South Kalimantan, Jambi, West Kalimantan, and South Sumatera, their sources of food supply, especially rice, were produced from wetlands. Likewise for other crops, especially coconut, oil palm and rubber, were also cultivated extensively in wetlands. This shows a significant contribution of wetland to the development of the region with a strong base in agriculture, especially for food security and farmer's livelihoods.

In the future, swamplands will be a basis for the development of agriculture, especially foodcrop, because of the difficulties in finding fertile land and the increase demand for food supply. The potential use of swamp land is huge, both in terms of coverage areas and its capacity and opportunity to increase the productivity of existing land, primarily through increasing cropping index. Stagnation of swampland development in recent years, in addition to a low adoption of technological and social aspects, also due to the issues related to resource diversity and climate change. The productivity of rice in the swampland is still relatively low (2 to 3 t dry grain ha^{-1}), whereas the productivity in some areas with good management can reach 5 to 7 t dry grain ha^{-1}.

Based on the issues, the papers in this proceedings illustrate the important of wetland for future food production and the potential use of various appropriate technology innovations to overcome the complexity of contraints in developing wetlands. The papers presented and discussed in the workshop are the results of research and development as well as the concept and experience of researchers from various research institutions and academia, as well as a success story associated with wetlands management in Indonesia, Vietnam, and Africa.

Upon completion of the preparation of these proceedings, I thank to all those who contributed and participated in the organization of workshops, and particularly to the hard work and creativity of the editorial team.

Hopefully this proceedings is useful for all of us.

Director General of IAARD,

Haryono

TABLE OF CONTENT

Page

Page

35 THE POTENCY OF INDIGENOUS RICE CROPPING SYSTEM IN CONSERVING THE NATURAL ENEMIES OF PEST (PREDATORS AND PARASITOIDS) IN BACK SWAMPLAND, SOUTH KALIMANTAN

[1] Helda Orbani Rosa, Mariana, and Dewi Fitriyanti

Plant Pest and Disease Department, Agriculture Faculty, Lambung Mangkurat University, Jl. Jend. A. Yani, Kotak Pos 1028, Banjarbaru, Telp & Fax. 0511-4777392
*Corresponding Author (e-mail: helda_hptunlam@yahoo.com)

Abstract. The objective of this research was to study potency of indigenous rice cropping system in conserving natural enemies of pests (predators and parasitoids) in back swampland of South Kalimantan. The research was begun with a field survey of the major pest intensity of rice plant in back swampland, either from indigenous or conventional cropping systems. Collection of natural enemies was done three times on each research location i.e; at the time of taradak, lacak, and planting in the field. Result showed that the major pest of rice plant on back swampland was brown plant hopper with attack intensity of 42.5%. Species richness of predators on indigenous cropping system tended to be higher, with values of 1,573; 2,275; and 3,119 for taradak, lacak, and planting time, respectively, compared with the conventional one of 1,559; 1,737; and 3,069, respectively. Similarly for species richness values of parasitoid on the indigenous cropping system were 2,232; 2,569; and 2,597, respectively compared with the conventional as 0,736; 1,674; and 2,552, respectively. Generally, it could be concluded that the indigenous cropping system had the potency to conserve the natural enemies (predators and parasitoids) that rolled as control agents, especially in the implementation of Integrated Pest Management program in rice field.

Keywords: Conservation, natural enemies, indigenous cropping system, back swampland

INTRODUCTION

The swampland is an agro ecosystem which is very typical and unstable. There are always problems that are faced in managing this land, so that a special care is needed to solve it, such as a site-specific solution, including the management of pest attacking rice plant. Various technological invasion in rice cropping and pest control such as the use of high yielding varieties that require high inputs of synthetic fertilizers and pesticides was known harmful to the environment and our next generation. Biological control is then considered to be the best solution. However, the application of this technology must be integrated with the swamp land agro ecosystem as stated in the principles of IPM.

Local wisdom in rice plant cropping hasn't yet been learnt before. Rice farmers in back swampland usually use a cropping/planting system based on the water tidal, known as three planting time system. This condition may have produced the good plant growth and also will empower the natural enemies, so that the pest management can be naturally occurred. This condition may affect the existence of the local insects, either from pest group or their natural enemies like predators or parasitoids. These natural enemies as natural control agents must be optimized among others by the conservation of these natural enemies in order to maintain these populations so that they could be sustainably used. Likewise, soil tillage for weed sanitation will produce green manure. The condition of high organic matter content is an alternative feed source for neutral insect populations that can be used as a preyfor predators, so as to achieve a balance between pests and their natural enemies. In addition, the rolled-weeds can also serve as shelter or hiding place for predators, such as spider nymphs and adults of spider cannibalism which is common in populations of Lycosa. Lycosa likes moving and colonizing the wet rice field or the newly-prepared dry rice field. They've been on the field since very early planting and preyed pest just before the population increased to the destructive level. Based on the facts and analysis, it was necessary to investigate the potency of the indigenous rice cropping system in conserving the natural enemies of pest (predators and parasitoids) in back swampland of South Kalimantan.

MATERIAL AND METHODS

Time and Place

The main pest field survey and the collection of the natural enemies took place in back swampland area of Banua Rantau village, Banua Lawas subdistrict, Tabalang Regency, South Kalimantan. The identification of its natural enemies was done in Biological Control Laboratory of Plant Pest and Diseases Department, Faculty of Agriculture, Lambung Mangkurat University. This research had been done since April to September 2012.

Main Pest Survey

The survey of the main pest was done in rice field using indigenous and conventional cropping systems. The intensity of the pest was calculated by taking the sampling plant in each field diagonally as many as ten clumps. Pest intensity was counted by taking each of sampling plant on each field. The intensity calculations was based on Abbot’s formula (*in* Hamed *et al*. 2012). For non-systemic attacking plant pest, the formula proposed by Townsend and Heuberger (1943) was used (*in* Adria, 2010).

Planting Preparation

This research was performed in back swampland using two rice cropping systems i.e; field planted with indigenous cropping system and conventional system. Both lands were separated by 500 m distance. Rice variety used in the conventional system was Ciherang and for the indigenous was Siam Unus variety which was commonly planted by local farmers. The indigenous rice cropping was done based on customs of the local farmers that was three shifting seedlings. It began with teradak (nursery). It was done at high place of land. Seeds were then transferred to low part of the place (lacak). While waiting for rice to become a bit high and strong (vigor), soil tillage was prepared. Weeds were cut using a type of sickle trowel (tajak) applied in water. The cut-weeds were then rolled and brought up to embankment. The rolled weeds were left to rot and then chopped (sliced small) and applied in the field. After that the lacak seedlings were ready for planting. For the conventional rice cropping system, nursery (teradak), lacak, and planting in the field were the same as the indigenous cropping systems, except for tillage using herbicides.

Collection and Identification of Predators and Parasitoids

Collection of the natural enemies was conducted in three stages of each rice cropping system: at the time of taradak, lacak, and when the rice was grown in the field. The collection of insect natural enemies was using nets, traps, and yellow light trap. The caught-insects were then kept in collection bottles filled with 70% alcohol for further identification at laboratory. Identification was done to level of family referred to Borror *et al*. (1992) and then counted. The observations on diversity and abundance of predator and parasitoid species were done every two weeks, beginning from nursery (teradak) until generative phase (16 weeks after planting).

Observation

In this research, a descriptive method was used to directly observe the research objects, i.e. insect species and parasitoid. Data obtained from the observation were then analyzed by using formula of Species Richness (R) proposed by Margalef (Ludwig and Reynolds, 1988) and Dominance Index (C) by Simpson (Southwood, 1978 *in* Soegianto(1994); Ludwig and Reynolds, 1988).

Results and Discussion

The result of survey showed that the main pest found in back swampland was brown plant hopper with the attack intensity as much as 42.5% (medium category).

Whereas, the natural enemies identified during the study were as many as 17 kinds of predators belonging to Formicidae, Staphylinidae, Coccinellidae, Coenagrionidae, Lycosidae, Araneidae, Tetragnathidae, Thomisidae, Oxyopidae, Microphysidae, Miridae, Gryllidae, and Tettigoniidae families, and 13 kinds of parasitoids belonging to Chalcidoidea, Bethylidae, Ichneumonidae, Eulopidae, Vespidae, Diapriidaae, Pteromalidae, Platygastroidea, Cucujidae, Pipunculidae, and Lygaeidae families.

The diversity of predators and parasitoids in rice produced values of species richness (R) and dominance (C) indices that also varied among each stage of planting and cropping systems. Data analysis can be seen at Table 1 and 2.

Species Richness (R) and Dominance (C) Indices of Predator and Parasitoid

The values of Species Richness (R) and Dominance (C) Indices of predators in each planting time and cropping system are shown in Table 1, whereas for the parasitoid the values are shown in Table 2.

Table 1. Species Richness and Dominance Indices of Predators in the Indigenous and conventional cropping system

Transplanting stages	Species richness(R)		Dominance index (C)	
	Conventional	Indigenous	conventional	Indigenous
Taradak	1,559	1,573	0.254	0.469
Lacak	1,737	2,275	0.219	0.185
Planting	3,069	3,119	0.125	0.171

Table 2. Species Richness and Dominance Indices of Parasitoids in the Indigenous and conventional cropping system

Transplanting stages	Species richness(R)		Dominance index (C)	
	conventional	Indigenous	conventional	Indigenous
Taradak	0.736	2,232	0.709	0.222
Lacak	1,674	2,569	0.278	0.184
Tanam	2,552	2,597	0.300	0.124

Species Richness Index of predators/parasitoids is an indicator of the wide variety of predators/parasitoids in an ecosystem. This index values in the indigenous cropping system were higher than those in all phases of conventional planting. These higher values were probably caused by the tillage method that was using a trowel to remove weeds at the time water flooded and produced weeds that could be used as green manure. The condition of high organic matter content was analternative feed source for neutral insect populations that could be used as a prey for predators. In addition, the rolled-weeds could also serve as shelter or hiding place for predators from their enemies or even cannibalism of their own kinds. Whereas, in conventional, herbicide was generally used in soil tillage practices. Beside that in the indigenous cropping system, each planting stage took a longer time compared with the conventional, allowing their natural enemies associated significantly longer in rice ecosystems.

Most of the predators and parasitoids found in rice field were predators and parasitoids of rice pests (including brown plant hoppers), among others were *Cyrtorhinus lividipennis, Micraspis sp., Agriocnemis femina, Goniozus nr. triangulifer, Pipunculus javanensis*, so that the presence of the predators and parasitoids was able to suppress the attack of pests, including the main pest, rice brown plant hopper.

The dominance index of predator/parasitoid describes the type of predator/ parasitoid that prevailed in a community of each habitat. This index in the indigenous cropping systems ranged from 0.171 to 0.469 and in the conventional cropping it ranged from 0.125 to 0.254 (Table 1). According to Odum (1983) *in* Son (2012), the criteria of the dominance values in both cropping systems were included to low category, because the values were below 0.5. This suggested that each species in it had nearly the same amount.

The dominance index of parasitoid in the indigenous cropping system ranged from 0.124–0.222 and in the conventional it ranged from 0.278-0.709 (Table 2). The criteria of the dominance value of indigenous system were included to low category, whereas for the conventional it was included to medium category, it was because it was on the range 0.5-0.75. It showed that there was one dominant species, namely Goniozusnr.triangulifer (in taradak stage), although still in the medium rate.

CONCLUSSION

Generally, it could be concluded that the presence of both natural enemies, either predators or parasitoids, were important and also had the potential in managing pest in rice ecosystems. The values of species richness and dominance indices showed that the indigenous cropping system was capable of conserving the natural enemies in rice ecosystems in the back swampland.

ACKNOWLEDGEMENT

We would like to thank to Directorate General of Higher Education, Ministry of National Education, Republic of Indonesia for funding this research via Fundamental grant research program so that all activities in this research were well-accomplished.

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