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Behavior of White Rice Stem Borer, *Scirphophaga innotata* and eggs parasitoid, *Telenomus rowani* Gahan on Tidal Plants

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Abstract: ***The aim of research was to know what tested three wild plant species Eleocharis dulcis, Eleocharis retroflata, and Phragmites karka represent selected place also besides paddy for the oviposition of white rice stem borer. This experiment consists of three series that is white rice stem borer imago which come from E. dulcis, and P. karka and paddy. The experiment use Normal Random by 4 treatments and 8 replications. This experiment aim also knew what wild plant E. dulcis, E. retroflata, and P. karka represent egg parasitoid life space of T. rowani which is also selected besides paddy. The experiment consists of two experimental subs. That is: life space without host of insect, and life space with host of insect. From the results of this study can be concluded as follows: a) The most favored habitat by white rice stem borers to lay eggs is purun tikus weed (E. dulcis); b) The long and frequency of visits by the white rice stem borer egg parasitoids were longest and the most frequently in paddy and purun tikus weeds (E. dulcis); c) Parasitism percentage of white rice stem borer eggs by T. rowani largest found in eggs contained in the weed habitat of purun tikus (E. dulcis) and paddy.***

Keywords: Eleocharis dulcis, Tidal plants, Telenomus rowani, White rice stem borer, Scirphophaga innotata

1. Introduction

During the twentieth century, paddy field farming became the dominant form of growing rice. Hill tribes of Thailand still cultivate dry-soil varieties called upland rice. Paddy field farming is practiced in Cambodia, Bangladesh, China, Taiwan, India, Indonesia, Iran, Japan, North Korea, South Korea, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, Sri Lanka, Thailand, Vietnam, and Laos.

One limiting factor is the increase in rice production due to the pressure of abiotic factors and biotic including insect's pests. More than 200 million tons of rice was reported missing each year due to these factors. One of the major insect pests in rice in tidal swamp in South Kalimantan Indonesia is the rice stem borer, with extensive damage during the rainy season in 2004/2005 reached 101.2 acres, and was ranked second after the paddy field mouse (BPTPH VIII, 2005).

The rice stem borer in paddy fields in naturally is controlled by several natural enemies, such as parasitoid of borer eggs. In the tidal area of South Kalimantan, there are three species of parasitoids that have an important role in controlling stem borer populations, namely *Telenomus rowani* Gahan, *Tetrastichus schoenobii* Ferr., And *Trichogramma japonicum* Ashmed (Gazali, 1987). Among these three parasitoid species, parasitism percentage of *T. rowani* first ranks ranged between 23-37%.

Percentage of three parasitoids parasitism are highly volatile depending among other things on the simultaneous harvest, length of fallow, no places of refuge for parasitoids after harvest and declining populations of parasitoid host due to the harvest and fallow. The longer the fallow period, the parasitoid population is very down and difficult to follow the development of stem borer populations. To overcome this problem it is necessary to provide temporary habitat for these parasitoids shelter, survive and reproduce. One temporary shelter natural enemies are wild plants that are around the rice fields. But not all wild plants can serve a particular parasitoid shelter; it is very dependent on the suitability of the habitat (wild herbs) with the parasitoid. So we need a research plant anything that can be shelter, and breeding for natural enemies.

So in general this study aimed to determine the suitability of some wild plants that exist in tidal lands as host plants of white rice stem borer (*Scirpophaga innotata*) and as a habitat for egg parasitoid, *T. rowani* and try to take advantage of one of the wild plant populations to act as a stabilizer of parasitoid *T.* rowani in the field. The purpose of this study is:

1. Compared the effect of wild plants *Eleocharis dulcis, Eleocharis retroflata*, *Phragmites karka* and paddy to the number of eggs laid by white rice stem borer.
2. Studying behavior, the long and the frequency of visits of the egg parasitoid against three wild plant species (*E. dulcis, E. retroflata, P. karka*) and paddy untreated white rice stem borer.
3. Studying the behavior of the egg parasitoid visits on three wild plants (*E. dulcis, E. retroflata, P. karka*) were given white rice stem borer imago as measured by the percentage of parasitism.

2. Methodology

This study was a laboratory experiment, conducted in Entomology laboratory, Department of Plant Pests and Diseases, Faculty of Agriculture, Lambung Mangkurat University since, 2007 until 2012.

2.1. Material and Equipment

In preparation for experiments in laboratory studies, white rice stem borer insects and parasitoid, *T. rowani* collected from tidal paddy cultivation area in sub-district Sungai Tabuk, the district Banjar, South Kalimantan Province, Indonesia. White rice stem borer cultured on *E. dulcis, E. retroflata,* and *P. karka*, as well as in paddy plants in solitary maintenance cage, measuring 50 x 50 x 100 cm. These four types of plants grown and maintained without treatment with insecticide. The wild plants taken from the tidal paddy cultivation land, while the paddy varieties used was IR42. This varieties was growth about 1.5 months.

Parasitoid *T. rowani* cultured on host insects reared on *E. dulcis*, and *P. karka*, and the paddy separately in cages measuring as above. 10% honey solution reserved on cotton used for food of white rice stem borer adult insects and *T. rowani*. Second and third generations of white rice stem borer and parasitoid *T. rowani* resulting from the maintenance of the laboratory is used as an experiment. For laboratory experiments, wild plants used are grown from seedlings were taken from the field, while the paddy is planted by rice cultivation practice procedures in general.

The tools for this study include wood framed experiments cage with batiste and made of transparent plastic measuring 75 cm x 75 cm x 100 cm, plastic jars (diameter 15 cm and height 25 cm) with a ventilation window in the wall that is covered with cloth batis, used to remove insects from cage maintenance, insect dissection devices, binoculars microscope, loupe, aspirator, freezers, ovens, scales Mettler, stopwatch, hand counter, and insect nets.

2.3. Implementation of the Research and Data Analysis

2.3.1. Laboratory Experiment 1. Oviposition preferences of White Rice Stem Borer on Plant Test

The experiment aims to determine whether the three species of wild plants *E. dulcis, E. retroflata*, and *P. karka* tested a selected habitat also besides to paddy for white rice stem borer oviposition. The experiment consisted of three series, namely white rice stem borer imago derived from *E. dulcis, P. karka* and rice. This trial used an experiments cage 75 x 75 x 100 cm containing four treatment plants *E. dulcis, E. retroflata*, and *P. karka* and paddy, and put three pairs of white rice stem borer imago already copulating. Every day the number of eggs observed at the four plants, and each plant was replaced new day. Observations stopped when the female imago dead. The numbers of groups of eggs are used as variables. Experiments using a randomized block design with 4 treatments and 8 replications.

2.3.2. Laboratory experiment 2. Egg Parasitoid preference T. rowani to Habitat

This experiment aims to determine whether the wild plants of *E. dulcis, E. retroflata,* and *P. karka* was an egg parasitoid *T. rowani* habitat were also selected besides paddy. This experiment consists of two sub-experiments, namely: habitat without insect host and habitat by host insects. In experiments without insect host habitat, into the experimental cage (75 cm x 75 cm x 100 cm) placed four plant species *E. dulcis, E. retroflata, P. karka*, and paddy plants each in its own pot. Copulated females imago put in cage for 2 hours. Observation of behavior directed towards, the long, and the frequency of visits. Parasitoids used is that each host kept coming on *E. dulcis, P. karka*, and paddy, so there are three series of experiments. Each of the experiments using a randomized block design with four treatments and eight replications.

In experiments with the insect host habitat, placed in experiments cage four treatment plants namely *E. dulcis*, *E. retroflata*, *P. karka* in one pot and paddy in another pot. Ten pairs of white rice stem borer and three pairs of stem borer parasitoid eggs that have been copulated put in cage for 7 hours. Observations directed towards behavior and the percentage of parasitism by the egg parasitoid release of white rice stem borer, namely by taking the existing eggs on the plant and then stored into a test tube covered with cotton. Parasitoids were used respectively derived from the host's attack on paddy, *E. dulcis*, and *P. karka*. Each of the experiments using a randomized block design with four treatments and eight replications.

3. Results and Discussion

3.1. Oviposition Preferences of White Rice Stem Borer

Based on the results, that the imago of white rice stem borer, *T. innotata* both derived from paddy and *E. dulcis* and *P. karka* lay more eggs on plants of *E. dulcis* compared to Paddy and *P. karka*. Percentage of eggs laid on *E. dulcis* plant was 47.5% (imago derived from paddy), 41.1% (derived from *E. dulcis* imago), and 49.8% (imago derived from *P. karka*. According Asikin *et al*., (2001) Purun tikus, *E. dulcis* is a plant trap for the rice stem borer white and habitat several types of enemies natural, such as predators and parasitoids. The results of research by Asikin dan Thamrin (2011) at 2009 observations on purun tikus (*E. dulcis*) found the most eggs group (7,793groups of eggs / ha) compared to the paddy plants (188 group eggs / ha) and parupuk plants (*P. karka*) (134 group of eggs / ha).

Attraction of white rice stem borer in purun tikus weed to lay eggs due to the weed morphology similar to paddy, for example has a smooth stem surface, while the weeds are not chosen due to *E. retroflata* leaf diameter is too small and so tightly to rice stem borer landed just a bit difficult. According Lestari (1983), the specificity of host states affected by adjustments to its host insect morphology including the host.

According Asikin and Thamrin (2011), white rice stem borer very interested in laying their eggs on weeds of tikus purun groups (*E. dulcis*) is suspected because the chemical of plants, the flowers of *E. dulcis* have odors that can attract adults of white rice stem borer . According Djuwarso *et al.* (1985) insects election of white rice stem borer to host allegedly influenced by physical factors, taxonomy, and secondary chemical makeup that of the weeds of purun tikus.

Table 1: Oviposition preferences of Rice Stem Borer White on Paddy, *Eleocharis dulcis, Eleocharis retroflata*, and *Phragmites karka*

Host Plant	The number of eggs produced by the female imago of white rice stem borer from :		
	Paddy	*E. dulcis*	*P. karka*
Paddy	27.20 b (15,7%)	45.70 b (23,6 %)	25.50 b (19,4 %)
E. dulcis	82.30 d (47,5 %)	79.80 d (41,1 %)	65.50 d (49,8 %)
E. reftroflaxa	0.00 a (0,0 %)	0.00 a (0,0 %)	0.00 a (0,0 %)
P. karka	63.70 c (36.8%)	68.50 c (35,3)	40.60 c (30,8 %)

Description: Numbers in columns followed by the same letters are not significantly different (P = 0.05) by LSD test

3.2. Preference of Parasitoid Telenomus rowani Gahan to Habitat

From the results of research and statistical analysis found that the average length of visit and frequency of visits either adult parasitoids derived from paddy, and *E. dulcis* and *P. karka* did not differ between the habitats of paddy, and *E. dulcis*, also the habitat of *P. karka* , and *E. retroflata*. Visits duration and frequency of visits white rice stem borer egg parasitoid on paddy and *E. dulcis* is longer and more frequently than the habitat of *P. karka*., and *E. retroflata*.

The amount and frequency of visits long visit parasitoid of eggs white rice stem borer highly related to the type and magnitude of the chemical ingredients contained in the purun tikus weeds, *E. dulcis* and also morphological of purun tikus weed (*E. dulcis*) similar to paddy plants also have ability to attract white rice stem borer adults to lay eggs. Based on the research results Wahyuono *et al*. (2003) have found a chemical compound fractions contained in the purun tikus weeds, *E. dulcis* is composed of compounds with the lowest polarity (fraction A) and the compounds with the highest polarity (fraction B). Fraction of compounds with low polarity of the most coveted of white rice stem borer to lay eggs groups. To determine the preference of the existing parasitoid imago on white rice stem borer eggs, then the variables are expressed in percentage of eggs parasitized.

Table 2: The Lenghty and frequency of visits imago of *Telenomus rowani* Gahan on rice plant, *Eleocharis dulcis, Eleocharis retroflata,* and *Phragmites karka*

Host plant	*Telenomus rowani from* white rice stem borer from habitat :					
	Paddy		*E. dulcis*		*P. karka*	
	Visits duration (minutes)	Frequency of visits (times)	Visits duration (minutes)	Frequency of visits (times)	Visits duration (minutes)	Frequency of visits (times)
Paddy	37.40 b	5.30 b	25.90 b	4.80 b	22.00 b	6.00 b
E. dulcis	38.50 b	4.80 b	24.00 b	4.70 b	18.20 b	5.50 b
E. retroflata	14.40 a	2.50 a	8.00 a	2.30 a	8.20 a	2.80 a
P. karka	13.40 a	2.20 a	11.40 a	2.20 a	7.60 a	2.50 a

Description: Numbers in columns followed by the same letters are not significantly different (P = 0.05) by LSD test

The percentage of parasitized eggs on paddy plants and purun tikus weeds habitat (E. dulcis) did not differ either parasitoid from eggs taken from the egg on paddy and purun tikus weeds (*E. dulcis*) and parupuk weeds (*P. karka*), the percentage of parasitism on the second habitat these plants ranged from 24.90% to 33.60%. This is consistent with the research field of Asikin and Thamrin (2012), and Djahab *et al*. (2000) who found that the eggs contained in the purun tikus weeds numerous pasitilized by *T. Rowani*. In the dry season- rainy season 97/98, percentage parasitism of white rice stem borer eggs on purun tikus weed habitats by *T. Rowani* ranged between 14.1% - 66.1%.

Wild plants that grow in around planting not only serves as a shelter place (shelter) and displacement of natural enemies when the environmental conditions are not appropriate (van Emden, 1991), but also provide an alternative host and food supplement for adults of parasitoids such as pollen and nectar from flowering plants and honey dew produced by the order Homoptera (Altieri & Nicholls, 2004).

Table 3: Parasitism percentages of white rice stem borer eggs by *Telenomus rowani* Gahan

Habitat	The percentage of parasitized egg by *Telenomus rowani* parasitoid maintained on host :		
	Paddy	*E. dulcis*	*P. karka*
Paddy	33.60 c	32.10 c	24.90 c
E. dulcis	29.90 c	33.10 c	27.80 c
E. retroflaxa	0.00 a	0.00 a	0.00 a
P. karka	10.20 b	10.60 b	9.30 b

Description: Numbers in columns followed by the same letters are not significantly different (P = 0.05) by LSD test

4. Conclusion

From the results and discussion of this study can be concluded as follows:

a) The most favored habitat by white rice stem borers to lay eggs is purun tikus weed (*E. dulcis*).
b) The long and frequency of visits by the white rice stem borer parasitoid egg were longest and most frequently in paddy and purun tikus weeds (*E. dulcis*).
c) Parasitism percentage of white rice stem borer eggs by *T. rowani* was longest and the most frequently in eggs contained in the weed habitat of purun tikus (*E. dulcis*) and paddy.

5. Future Scope

Habitats of purun tikus (E. dulcis) weed have the potential for conservation of white stem borer eggs parasitoid. Therefore, complete information may only through further research to field research.

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