Density of Population Test of Yellow Stem Borer S. incertulas (Walker) (Lepidoptera: Pyralidae) and Varieties Rice to Preferences and Levels of Crop Damage on SRI Cultivation

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ABSTRACT

Research has been carry out to study the density of population test of yellow stem borer S incertulas and varieties Rice to preferences and levels of deadheart and whiteheart attack on SRI cultivation is done in the home screen Experimental Station Department of Plant Pests and Diseases Jatinangor Faculty of Agriculture, Padjadjaran University, from October 2011 until January 2012. The design used was a randomized block design with two factors factorial pattern and replicated three times. The first factor is the density population of yellow stem borer consists of four levels ie p_1: 5 pairs of moth, p_2 : 10 pairs of moth, p_3: 15 pairs of moth, and p_4 : 20 pairs of moth. Second factor is a rice varieties consists of four levels, namely: v_1: Inpari-1 varieties, v_2 : Inpari-13 varieties, v_3 : Sarinah varieties, and v_4 : Ciherang varieties. The results showed that 5 pairs moth of yellow stem borer can caused deadheart and whiteheart attack on the varieties Sarinah lowest and the varities Inpari-1 highest.

***Keywords** : S. incertules, density population , SRI cultivation*

INTRODUCTION

Increasing rice production has been continued to offset the increase in consumption, due to population growth still high. Pests and diseases are one of the obstacles to increase rice production program. Pests and diseases of rice is one of the biotic stresses causing yield gap between potential yield and actual results and also causes unstable production. In Southeast Asia rice yields averaged 3.3 t ha^{-1}, whereas the results of which can be reached 5.6 t ha^{-1}. The yield gap caused by pests about 15.2% and diseases about 12.6% (Oerke *et al*, 1994). In Indonesia, the potential results are released rice varieties ranged from 5-9 t ha^{-1} (Suprihatno *et al*., 2006), while the results of the new national reached an average of 4.32 t ha^{-1} (BPS, 2001).

Rice stem borer is one of the major insect pests that cause damage and yield loss of rice in Indonesia and some Asian countries. Yield losses due to insect pests ranges from 10% to more than 60% (Pathak and Khan, 1994). In Indonesia, a stem borer pests second widest after rat attack, the attack rate in the last ten years to reach 84952 ha (Directorate of Food Crop Protection, 2007). Insect attack rice stem

borer spread throughout the province with the intensity of the attack fluctuates between 0.5%-90% (Hendarsih, *et a*l., 2007). *S. incertulas* is the type most widely spread and the most dominant in Java, Bali, Lampung, and South Kalimantan, followed by the type of *S. inferens*, *C. suppressalis*, and *S. innotata*. In South Sulawesi, the dominant species is *S. innotata*, followed by the type of *C. suppressalis*, *S. inferens*, *C. polychrysus* ., and *C. auricilius* (Soejitno, 1991; Kusdiaman and Kurniawati, 2008).

In connection with the insect host plants, a variety of factors influence the development of pest populations and the extent of damage by insect pests. In recent years changes in rice cultivation methods, such as the use of new varieties, plant spacing, and nitrogen fertilizer. These changes affect the development of insect pest populations and damage levels from time to time. The development of yellow stem borer populations are influenced by plant age, variety and soil fertility. To lay eggs, yellow stem borer moth prefers young plants than older plants. Yellow stem borer attack on the vegetative growth phase caused heavier damage than the generative growth phase. Instead of yellow stem borer attack at the age of the older plants more light damage. In old age plants occur knowl-violence stems so many larvae failed broaching into the rice stem (Soejitno, 1991). According to Pathak and Kahn (1994), yellow stem borers lay eggs and are able through the life cycle for a generation for each family of plants. Average of the yellow stem borer larvae can damage the three stems of rice paddy saplings. Under the Directorate General of Food Crops (2007), the research of the laboratory showed that the inoculation of two yellow rice borer larvae per plant resulted in four clumps of yield loss of 5% -10%. According to the field test showed that the economic damage threshold is presumably located on the population density of the three groups of eggs per square meter of rice plants. Food Directorate of Plant Protection (2002) set a control threshold based on the vegetative stage of crop damage by 6% and 10% in the generative stage. While Reissig *et al*. (1985) assign 20% at vegetative stage and 10% in the generative stage.

The purpose of this study was to determine the density population of yellow stem borer and several varieties of rice against the rice stem borer moth preference and rate of deadheart and whiteheart attack on SRI cultivation.

MATERIALS AND METHODS

The experiments were conducted at the home screen Experimental Department of Plant Pests and Diseases Jatinangor Faculty of Agriculture, Padjadjaran University in October 2011 until January 2012. Experimental material consists of a rice field, rice seed varieties Inpari-1, Inpari-13, Sarinah, and Ciherang, yellow stem borer was taken from the Central Rice Research Sukamandi, Subang regency, Petroganik organic fertilizer. Experimental tool consists of laboratory equipment used to measure the characteristics of the yellow stem borer and potted plants with a capacity of 20 kg soil/pot, the screen size of 12 m x 3 m.

The experimental design used a factorial randomized block design with two factors pattern that was repeated three times. The first factor is the population density of yellow stem borer consists of 4 levels, namely p_1 : 5 pairs of moths, p_2 : 10

pairs of moths, p_3 : 15 pairs of moths, p_4 : 20 pairs of moths. Second factor is varieties of rice composed of four levels as : v_1 : Inpari-1 varieties, v_2 : Inpari-13 varieties, v_3 : Sarinah varieties, v_4 : Ciherang varieties.

The observations are: 1) The number of larvae and pupae are living, weight of larvae and pupae weight is done by splitting the stem of rice and observed 28 days after infestation (DAI) larvae-1 instar. Based on the results of these observations can be calculated the percentage of larvae endurance formula (Heinrichs *et al*., 1985), 2) Percentage deadheart attack (vegetative period) and whiteheart attack (reproductive period), calculated by the formula (National Program for Training and Development of Integrated Pest Management, 1993). The percentage of deadheart and whiteheart observed in the whole plant sample, both infested with first-instar larvae or not infested with first-instar larvae, 3) The level of plant damage caused by deadheart and whiteheart, 4) Components of the results and outcomes include the number of productive tillers per hill, grain weight per panicle, grain weight pe clumps, grain weight and grain hollow pithy, 1000 grain weight of seeds, seed weight per panicle and per plot. To determine the effect of the treatment performed univarian analysis of variance (ANOVA/Analysis of variance), and to distinguish the effect of the average do on the response variable used Duncan's Multiple Test Force (Duncan's Multiple Range Test/DMRT) at 5% level (Steel and Torrie,1989). Software used for statistical tests were Statistic Analysis System (SAS) version 6.2.

Experiments conducted on the experimental pots measuring 20 kg of paddy mud. Used mud paddy soil derived from mud village's rice farmers Ciparanje, Jatinangor. A total of 20 kg of paddy mud put in pots experiment. Basic fertilizer used is organic fertilizer Petroganik of 500 kg ha^{-1}, equivalent to 31.25 g of organic fertilizer per pot Petroganik. Planting and maintenance of rice plants in accordance with SRI cultivation. The seeds of each variety sown in plastic tubs the size of 40 cm x 30 cm. Young seedlings which is about 8 days after seedling ready for planting in each pot as much as one seedling per pot. 29 days after planting, yellow stem borer were obtained by collecting both male and female moths from the field, is released into the home screen according to the population density and the number of treatments allowed to copulate in the home screen. After copulate, the female moth will lay groups of eggs at the ends of the upper surface of rice leaves. Group of eggs will be placed on the first night until the night of the first instar. First night after laying eggs that have hatched then infested potted plants on one example. To be uniform, the five of tillers in each plant sample and a larvae per seedling per pot are used. Larvae placed near auricle leaf with a brush. Each potted plant that has infested first instar larvae caged with a mylar plastic cage that larval instar-1 are already infestation leaf surfaces of each auricle potted plants do not move to other examples. Plants examples that have been infested by the larvae instar-1 will be grow until visible symptoms deadheart attack. The percentage of damage deadheart computed at 14 DAI, and 28 DAI. After 28 DAI, plants were harvested and counted the number of instances of larvae and pupae were alive, larval weight, pupal weight by splitting each stem of rice. The number of larvae and pupae were counted and weighed live to know the percentage of larvae durability. Other plants observed remaining until harvest. If the plant is not attacked by the yellow stem borer can be observed

throughout the yield components and yield. If the plants attacked by yellowstem borer then calculated the percentage of deadheart and whiteheart.

RESULTS AND DISCUSSION

A. Characteristics of Rice Yellow Stem Borer

Characteristics of yellow stem borer is the number of groups of eggs, number of eggs hatched, number of larvae and pupae were alive, larval weight and pupal weight, percentage of larvae durability, and the percentage of deadheart and whiteheart. The results was no interaction between density population of yellow stem borer and rice varieties on SRI cultivation on the number of groups of eggs and the number of eggs that hatch. Based on Table 1, the population density of yellow stem borershowed no significant difference, while the rice varieties showed the characteristic yellow rice stem borer were significantly. Stem borer moth infestations done when the age of plant 29 DAP. Observations and taking eggs laid performed for 3 days, the age of 30 DAP, 31 DAP and 32 DAP. Observation of the number of eggs that hatch into larvae was conducted from 30 DAP until 37 DAP. The eggs hatch on day eight (37 DAP) after laying the first egg. The number of eggs laid groups were significantly different. At a population density of 10 heads of yellow rice stem borer moth significantly different and the smallest at age 30 with 32 HST HST until the 1:08 row of fruit, fruit 0.67, and 0:33 fruit moth population density than the other. Group of eggs laid by the female moth eggs as much as 1.08 group has exceeded the threshold control for the yellow rice stem borer eggs 2 groups per 20 clumps of plants or 1 group of 10 eggs per plant clump of rice before panicle initiation or the group's next egg on stage her (Reissig *et al*., 1985).

The smallest number of eggs in the age group of 30 DAP observations up to 32 DAP contained in Sarinah variety although not significant with other varieties. But Ciherang va rity which has the shortest length of 4.50 µ trichomes is elected by the yellow stem borer moths to

Table 1. Effect of Population Density Rice Yellow Stem Borer *S. incertulas* (Walker) (Lepi-doptera: Pyralidae) and Rice Varieties on SRI Cultivation to Total Number of Eggs and Larvae

Treatments	Number of Eggs Laid			Number of Larvae		
	30 DAP (eggs)	31 DAP (eggs)	32 DAP (eggs)	37 DAP (larvae)	38 DAP (larvae)	39 DAP (larvae)
Moth Populations						
p_1 = 5 pairs	1.08 a	0.67 a	0.33 a	48.42 a	33.50 a	17.33 a
p_2 = 10 pairs	2.25 ab	1.00 a	0.83 ab	57.08 a	37.33 a	29.25 a
p_3 = 15 pairs	2.58 ab	0.92 a	1.00 ab	41.92 a	47.67 a	32.67 a
p_4 = 20 pairs	3.25 b	2.00 b	1.42 b	41.58 a	50.33 a	34.92 a

Rice Varieties						
v_1 = Inpari-1	2.25 b	0.83 a	0.83 a	32.17 a	47.75 a	30.00 a
v_2 = Inpari-13	2.08 ab	1.17 a	0.92 a	55.00 ab	41.25 a	31.83 a
v_3 = Sarinah	0.83 a	0.58 a	0.50 a	38.33 a	30.25 a	19.92 a
v_4 = Ciherang	4.00 c	2.00 b	1.33 a	63.50 b	49.58 a	32.42 a

Description : The average number followed by the same letter in the same column not significant by Duncan's Multiple Range Test at the 5% significance level

Lay eggs about 4.00 at 30 DAP and 2.00 eggs at 31 DAP. Yellow stem borer moth select varieties that are anatomically facilitate moths lay eggs. Varieties with a shorter length of trichomes was selected by female moths to lay eggs. The different densities and different varieties give different effects and do not significantly affect the number of larvae. Five pairs of moth population density generates successive 48.42 larvae, 33.50 larvae, and 17.33 larvae on 37 DAP to 39 DAP were not significant with other moth population density. Similarly, the effect of rice varieties to the real number of larvae did not differ in 38 DAP and 39 DAP, but in Ciherang varieties are significantly different and most larvae as many as 63.50. This is supported by long trichomes (4.50 µ) and the shortest amount of trichomes (2.25 per 50 m) at least on Ciherang indicating that Ciherang preferred by yellow rice stem borer larvae as a food source for the life and survival his life. The smallest number of larvae obtained at significantly different on Inpari-1 and Sarinah respectively were 32.17 and 38.33 larvae on 37 DAP. The number of larvae were found in Sarinah respectively were 30.25 and 19.92 larvae at 38 DAP and 39 DAP although not significant compared with other varieties. This suggests that the Sarinah varieties disliked by the yellow stem borer larvae as a place to live and food sources.

In addition to the number of eggs laid and the number of larvae, the characteristics of yellow stem borer another is observed larval weight, pupal weight, number of larvae and pupae, percentage of larvae durability, and the percentage of deadheart attack. The observation was conducted on the four rice varieties tested after the four rice varieties are infested by first instar larvae derived from eggs which hatch in a test tube. Each pot is planted with different rice varieties have 5 puppies were then infested stems by a first instar larvae of each stem, so that each pot for each variety of rice diinfetasi by 5 first instar larvae were placed in rice leaf auricle. The results of the analysis of the influence of the characteristics of rice varieties against yellow stem borer which has been infested by larval instar-1 are listed in Table 2.

Table 2. Characteristics of Yellow Stem Borer S. incertulas (Walker) (Lepidoptera : Pyralidae) and Deadheart Attack in Rice Varities On SRI Cultivation

Rice Varieties	Weight of Larvae (g)	Weight of Pupae (g)	Number of Live Larvae and Pupae	Persentage of Resistance of Larvae (%)
v_1 = Inpari 1	0.03 a	0.03 b	3.00 b	60.00 b
v_2 = Inpari 13	0.03 a	0.03 b	2.83 b	56.67 b
v_3 = Sarinah	0.03 a	0.01 a	1.58 a	31.67 a
v_4 = Ciherang	0.03 a	0.04 b	3.17 b	63.33 b

Rice Varities	Persentage of Deadheart (%)	
	14 DAI	28 DAI
v_1 = Inpari 1	76.39 a	93.45 a
v_2 = Inpari 13	71.11 a	87.10 a
v_3 = Sarinah	68.89 a	83.73 a
v_4 = Ciherang	74.17 a	92.46 a

Description : The average number followed by the same letter in the same column not significant by Duncan's Multiple Range Test at the 5% significance level

Weight of yellow stem borer larvae on each of the different varieties of rice are not real. The weight of yellow rice stem borer larvae on the four different varieties are not real with a weight of 0.03 g per larvae. But at Sarinah varieties, pupal weight (0.01 g), number of larvae and pupae were alive (1.58 pupae) and durability larvae (31.67%) and the smallest was significantly different compared with other varieties. This suggests that the varieties Sarinah less favored as a place to live and food source for the growth and development of yellow stem borer larvae as rice straw at Sarinah many varieties containing silicate (8.14%) and crude fiber (7.64%) and water content (79.46%) were little. This is in line with the opinion of Pathak and Kahn (1994) which states that a high silicate content in rice straw will reduce the intensity of yellow stem borer attack. As a result, the number of larvae and pupae were able to survive on Sarinah varieties respectively 1.58 larvae and pupae with percentage resistance of larvae by 31.67% with deadheart attack about 68.89% at 14 DAI and 83.73% at 28 DAI. This situation gives one of the advantages for the farmers in the area that Sarinah varieties have anatomical and physiological characteristics are able to defend themselves from the attack of yellow stem borer.

B. Plant Damage by Yellow Stem Borer

Based on the statistical analysis of the results of rice varieties on SRI cultivation have not significant effect on plant damage. Based on Table 3, plant damage caused by deadheart are not infested by first instar larvae in the treatment

of different varieties of rice are not significant in the range of between 61.61% to 65.56%, but plant damage caused by whiteheart is significant on Sarinah varieties is equal to 89.16% compared to other varieties ranged from 93.20% to 94.58%.

Table 3. The Effect of Rice Varieties on SRI cultivation to Plant Damage without Infested by First Instar Larvae

Rice Varieties	Plant Damage	
	Deadheart (%)	Whiteheart (%)
v_1 = Inpari 1	65.56 a	94.58 b
v_2 = Inpari 13	64.64 a	93.74 b
v_3 = Sarinah	61.61 a	89.16 a
v_4 = Ciherang	65.26 a	93.20 b

Description : The average number followed by the same letter in the same column not significant by Duncan's Multiple Range Test at the 5% significance level

Based on observations on plants that are not infested by first instar larvae, the symptoms of deadheart more slowly than the whiteheart. This shows that the rice plants are planted with other rice plants infested by firts instar larvae, although the plants confined by a cage mylar, can be attacked by yellow stem borer because the infested larvae on plants can be moved from one plant to other plants. At the time of infested first instar larvae with a brush, no larvae were dropped so that the damage of plant can be expanded from one plant to another plant. It is seen that crop damage can be increase by the grown of plants eventhough the plants have entered the reproductive period and already formed panicles. Panicles turns into a vacuum, so that all treatments tested did not produce at all.

CONCLUSION

Based on the experimental results can be obtained that the moth population density of yellow stem borer moth as much as 5 pairs per plot can cause the lowest deadheart and whiteheart on Sarinah varieties and the highest on Inpari-1 varieties.

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