The role of refugia plants to the eggs yellow rice stem borer (Scirpophaga incertulas Walker) parasitoids parasitisation rate

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Abstract. The yellow rice stem borer (Scirpophaga incertulas Walker) is one of the obstacles in increasing rice production. Refugia plant is one of the pest control solutions based on the concept of IPM that provides a source of feed for natural enemies, especially parasitoids. In this study, the type of egg parasitoid S. incertulas dan parasitoid parasitoid egg S. incertulas on paddy fields with the surrounding refugia plants. This research uses Non-Factorial Random Factor (RAK) consisting of R0 (Rice plant without refugia / control plant), R1 (Rice plant with refugia white), R2 (Rice plant with yellow refugia), R3 (Rice plant with red refugia) , R4 (Plants with rice with refugia white, yellow and red). This study found 3 species of S. incertulas parasitoid eggs namely Tetrastichus schoenobii Ferriere (Hymenoptera: Eulophidae), Telenomus rowani Gahan (Hymenoptera: Scelionidae), and Trichogramma japonicum Ash (Hymenoptera: Trichogrammatidae). This research had a significant effect on the treatment of R1 (white refugia) 4th week to parasitoid level T. rowani 51.78%, but refugia plant had no significant effect on T. schoenobii 55.56% and T. japonicum 4.47% parasitation level.

1. Introduction
The yellow rice stem borer (Scirpophaga incertulas) is an important pest in rice crops that can significantly lead to a decrease in yield. S. incertulas is the most famous borer in rice and permeates the entire season of cropping with varying degrees of attack ranging from mild to very severe. In 2012, the Directorate of Plant Protection Indonesia reported that rice damage in 2011 reached 146,315 ha and 391 ha of which were melted. The damage that occurred in the areas of West Java and Central Java reached 26.9% and 18.4% of total damage in Indonesia. In 2012, S. incertulas attack occurred in West Java, especially in Karawang regency estimated at 15,000 ha of broken rice [1].

Habitat manipulation is a technology in biological control that promotes biodiversity and leads to the stability of agroecosystem sustainability. Habitat manipulation focuses on increasing the natural enemy population. This can be achieved by increasing plant diversity and providing shelter in agroecosystems [2].

The function of refugia plants as microhabitat is expected to contribute to natural enemy conservation efforts [3]. Wild plants growing around crops not only serve as shelters and displacement of natural enemies when environmental conditions are not appropriate but also provide alternative hosts and additional food for parasitoid imago such as pollen and nectar [4]. Planting refugia plants is
a pest control solution based on the concept of IPM that provides a source of feed for natural enemies, especially parasitoids that can increase abundance and parasitoid parasitic levels in rice plants especially *S. incertulas*.

This study aims to determine the types of parasitoid *S. incertulas* eggs and the level of parasitization on paddy fields planted with plants surrounding refugia.

2. Materials and Methods

The research was conducted in May 2017 - October 2017 in the area of rice cultivation of farmers in Desa Terang Bulan, Kec. Aek Natas, North Labuhanbatu District. The ingredients used in this research are miko ngga varieties, small sunflower (*Melampodium americana*) flower yellow flower paper (*Zinnia elegans*) red flowers, flower at eight (*Turnera subulata*) white flowers, straw compost fertilizer, NPK Phonska fertilizer, KCl, urea. The tools used in this research were hoe, hand sprayer, label paper, brush, collection bottle, 70% alcohol, test tube, digital camera, microscope, and identification book.

The method used in this research was Randomized Non-Factorial Randomized Block Design with R0 (Rice Plant without refugia / Control), R1 (Rice Plant with refugia White), R2 (Rice Plant with refugia Yellow), R3 (Rice Plant with refugia Red), R4 (Plants with rice with refugia white, yellow and red). Rice planted on rice field with size 3 m x 3 m with legowo system 4: 1 with spacing 25 cm x 12.5 cm. The refugia plant was planted at a distance of 50 cm x 50 cm in accordance with the prescribed treatments.

To find out the type of egg parasitoid was done by collecting the group of stem borer eggs found on each treatment plot. The group of eggs found inserted into the test tube are labeled and covered with cotton maintained until parasitoids or stem borer larvae appear. The emerging parasitoid was recorded in number and put into a collection bottle containing 70% alcohol then identification up to the species refers to [5] at the Laboratory of Center for Biological Research, Indonesian Institute of Sciences (LIPI) Cibinong, West Java.

3. Results and Discussion

3.1. Level Parasitization of Parasitoid *Tetrasictus schoenobii*

The observation result showed the highest parasitoid level of *T. schoenobii* at 6th week at treatment R0 (control) which was 55.56% and the lowest 7 weeks after planting was 5.58% in the treatment of R2 (white refugia) can be seen in table 1.

| Treatment       | 1-2th week | 3th week | 4th week | 5th week | 6th week | 7th week | 8-10th week |
|-----------------|------------|----------|----------|----------|----------|----------|-------------|
| R0 (control)    | 0.00       | 0.00     | 40.00    | 7.50     | 55.56    | 0.00     | 0.00        |
| R1 (white)      | 0.00       | 0.00     | 34.11    | 0.00     | 40.00    | 0.00     | 0.00        |
| R2 (yellow)     | 0.00       | 20.00    | 20.00    | 0.00     | 20.00    | 5.58     | 0.00        |
| R3 (red)        | 0.00       | 0.00     | 20.00    | 18.11    | 37.87    | 0.00     | 0.00        |
| R4 (white, yellow, red) | 0.00 | 0.00 | 50.67 | 14.54 | 31.24 | 0.00 | 0.00 |

The results showed that the treatment was not significantly different, the highest parasitoid level of *T. schoenobii* on the R0 (control) was 55.56% on 6th week, this was because the treatment of R0 (control) did not use pesticide so that *T. schoenobii* can live well.
Weeds that lived around the rice plant and live among the treatment blocks were also the parasitoids. Types of weeds around the rice cultivation were Purun tikus (Eleocharis dulcis), rumput bulu babi (Eleocharis retroflata), and other wild plants that are the parasitoids.

According [4,6] suggests that habitats around farm land such as weeds and different types of wild plants in rice terraces could be a source of feed, shelter and breeding for many predators and parasitoid insects and can be used for preserving predators and increasing diversity of parasitoid insects. [7] also explains that wild flowers as feed stocks of parasitoids.

The distance between treatment block R0 (control), R1 (white refugia), R2 (yellow refugia), R3 (red refugia), R4 (white, yellow, red refugia) was 5 m. It can also cause the study insignificant. In this study, T. schoenobii was the dominant parasitoid compared with the T. rowani and T. japonicum that can be seen from the parasitation level every week. (Table 2, Table 3). T. schoenobii is a parasitoid that has a flying distance for more than 5 m.

3.2. Level Parasitation Parasitoid Telenomus rowani
From table 2 it is seen that treatment of R1 at 4th week with a mean rate of 51.78% parasitic level indicates that plants with white refugia (R1) differ significantly.

| Treatment       | Average parasitation parasitoid Telenomus rowani (%) |
|-----------------|------------------------------------------------------|
|                 | 1-3th week | 4th week | 5th week | 6th week | 7th Week | 8-10th week |
| R0 (control)    | 0.00       | 0.00     | 0.00      | 0.00      | 0.00      | 0.00        |
| R1 (white)      | 0.00       | 51.78    | 0.00      | 6.81      | 18.09     | 0.00        |
| R2 (yellow)     | 0.00       | 8.44     | 0.00      | 2.56      | 2.79      | 0.00        |
| R3 (red)        | 0.00       | 0.00     | 20.64     | 4.25      | 0.00      | 0.00        |
| R4 (white, yellow, red) | 0.00        | 18.67   | 4.85      | 22.32     | 6.60      | 0.00        |

Description: The numbers followed by the same notation in the same column show No significant difference at $\alpha = 5\%$ according to BNT.

The treatment of R1 (white refugia) at 4th week had significant effect on T. rowani parasitic level of 51.78%. This was because R1 (white refugia) of Turnera subulata attracted T. rowani compared with treatment R0 (control), R2 (yellow refugia), R3 (red refugia) and R4 (white, yellow, red refugia).

According to [8], flowering plants of T. subulata are known to attract the presence of some Hymenoptera species parasitoids. Six species of which come with a total of more than 30 in 30 days of observation. T. rowani’s interest in the T. subulata flower may be due to the white color and the slightly mixed yellow flowers and nectar present in the flower or metabolite backward from the flower.

Explanation from [9], the high potential of T. rowani depends on agroecosystems related to the specific nature of the parasitoid plant life, such as long flowering, secondary metabolites. The interactions between plants, insects and parasitoids are aspects that should be further studied in biological control. T. rowani is an oligofag parasitoid so that its ability to remain in a region is higher and able to spread and adapt to agricultural ecosystems in various regions [10,11].

3.3. Level Parasitation Parasitoid Trichogramma japonicum
From table 3 the highest parasitic level was observed in the treatment of R1 (white refugia) at 4th week with an average value of 4.47% and the lowest 1.72% in treatment R4 (white, yellow, red refugia) 6th week of this study had no significant effect.
Table 3. Average parasitoid parasitoid parathyroid rate *Trichogramma japonicum* (%) for some treatments of refugia plants at 1-10 weeks

| Treatment      | Average parasitation parasitoid *T. japonicum* (%) |
|----------------|--------------------------------------------------|
|                | 1-3<sup>th</sup> week | 4<sup>th</sup> week | 5<sup>th</sup> week | 6<sup>th</sup> week | 7<sup>th</sup> week | 8-10<sup>th</sup> week |
| R0 (control)   | 0.00                | 0.00               | 0.00                | 0.00               | 0.00               | 0.00               |
| R1 (white)     | 0.00                | 4.47               | 0.00                | 0.00               | 0.00               | 0.00               |
| R2 (yellow)    | 0.00                | 0.00               | 0.00                | 0.00               | 0.00               | 0.00               |
| R3 (red)       | 0.00                | 0.00               | 0.00                | 1.72               | 0.00               | 0.00               |
| R4 (white, yellow, red) | 0.00 | 0.00 | 0.00 | 1.72 | 0.00 | 0.00 |

At 4<sup>th</sup> week observation, *T. japonicum* highest parasitic level was on R1 (white refugia) treatment with mean of parasitization level 4.47% and the lowest on R4 treatment with mean of parasitization level 1.72%. This showed the interest of *T. japonicum* on white flower (R1) that is *T. subulata* flower and flowers with a mixture of white, yellow, red (R4). The presence of *T. japonicum* on treatment R4 (white, yellow, red refugia) may be due to a white refugia in the treatment because at other treatments R0 (control), R2 (yellow refugia) and R3 (red refugia) were not found parasitic eggs *S. incertulas*.

In this study, the level of *T. japonicum* parasitization was quite low compared to the other two parasitoids namely *T. schoenobii* and *T. rowani*. In line with the study of [11]. The average parasitization level of *T. japonicum* was only 8%, in the study [11], the mean rate was 1.47%, and in the study [12] the mean rate was 0.63%. Result study [13], also mentioned the overall low level of parasitism found in the study by showing a parasitization level of *T. japonicum* 8.35% tested on yellow stem borer eggs for biological control.

The texture of the egg group covered with fine hair (scales) is less preferred by *T. japonicum* thus affecting the degree of parasitization. The short life span of *T. japonicum* 1-2 is also an indicator of the low level of parasites [14]. The low level of parasitoid *T. japonicum* is also due to the availability of hosts that are not supportive for survival. *Trichogramma* parasitoids can assess the availability of nutrients in host eggs for the availability of hereditary growth [12].

4. Conclusion

1. Treatment of R1 (white refugia) significantly affect the level of parasititation of *T. Rowani* on 4<sup>th</sup> week for 51.78%
2. Treatment of refugia plants did not significantly affect the level of parasititation of *T. schoenobii* and *T. japonicum*.
3. The highest parasitoid level of *S. incertulas* egg group namely *T. schoenobii* was 55.56 % on 6<sup>th</sup> week.

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