Identification of Potential Weeds as Refugia Plants on Upland Rice (*Oryza sativa* L.) at Jembayan Kutai Kartanegara

Encik Akhmad Syaifudin[1], Friska Bella[1,*]

[1)]Departement of Agroecotechnology, Faculty of Agriculture, Mulawarman University.
**Corresponding Author::* sempaja@gmail.com

Received: May 28, 2024
Accepted: June 2, 2024
Available online: June 10, 2024

Abstract : *An experiment to study the potential weed as refugia on upland rice was done at Jembayan, Kutai Kartanegara, from October up to December. Species Asystasia gangetica, Synedrela nodiflora, Lantana camara and Cyperus iria were identified as the dominant weeds over the area, but only A. gangetica and S. nodiflora was choosen because of they adequate of the potential criteria as refugia. The experimental design used was Complete Randomized Design, consisted of nine repetitions and three treatments, namely p_0 = without refugia/control, p_1= Synedrella nodiflora, p_2 = Asystasia gangetica. The Least Significant Difference (LSD 5%) was used to compare the averages between two treatments and Pearson Correlation Analysis was used to seen of the two insects population. This study showed that the two weeds can be used as refugia with the results of insect abundance obtained were significantly different in insects pest, and also insect natural enemies. The order of natural enemy insects obtained include the orders Araneae, Hymenoptera, Coleoptera, and Odonata.*
Keywords: Rice Fields, Refugia, Natural Enemies, Pests

1. INTRODUCTION

Rice (*Oryza sativa* L.) is one of the main food staple in the world that is rich in carbohydrates so that it is a staple food by most people, especially Indonesia (Supriyanti *et al*., 2015). It is known how to cultivate lowland rice, as well as upland rice. This rice field is generally practiced by indigenous people in Kalimantan (Yogi, 2018). The obstacle in planting rice in the field is the attack of insect pests, diseases and weeds. The emergence of insect pest attacks on rice plants requires farmers to carry out control. Integrated Pest Management (IPM) is one of the efforts that can be used by farmers in controlling the population or the rate of pest attacks to prevent economic losses and environmental damage.

Optimizing the role of natural enemy insects is one of the principles in Integrated Pest Management (IPM) among the efforts that can be made in maintaining and preserving natural enemy insects that exist in the ecosystem, is to maintain flowering plants that can provide food for natural enemy insects that come in. The role of natural enemy insects can be in the form of predators, parasites or pollinators (Amrullah, 2019). Refugia is a flowering plant that grows around cultivated plants, which serve as a microhabitat for natural enemy insects so that the preservation of natural enemies is well maintained. Some plants that are better known as weeds such as *Ageratum conyzoides, Axonopus compressus, Cosmos caudatus, Wedelia trilobata* function well as microhabitats for natural enemy insects in rice in drylands (Sutriono, et al., 2019). Refugia which has the property of easy growth, fast development and has a distinctive color and aroma so that it is liked by insects is a selection criterion (Septariani et al., 2019). Based on the description above, it is considered important and necessary to carry out an Experiment on the Identification of Potential Weeds as Refugia Plants in Jembayan Village, Loa Kulu District, Kutai Kartanegara Regency.

2. LITERATURE REVIEW AND HYPOTHESIS

According to Amrullah (2019), insects are natural enemies of rice pests that act as parasitoids, predators, and pollinators. According to Kartohardjono (2011), parasitoids of rice pests such as *Tetrastichus schoenobii*, *Telenomus beneficiens*, and *Trichogramma japonicum*. The more active parasitoid is *T. schoenobii*, while the natural enemies of brown stem leafhoppers, including the parasitoids *Anagrus* sp. and *Oligosita* sp, are predators namely spiders (*Lycosa* sp., *Tetragnatha* spp., *Oxyopes* sp., *Callitrichia* sp.), *Paederus fucipes*, *Cyrtorhinus lividipennis*, *Coccinella* spp., *Ophionea* sp., and *Microvelia atrolineata*. Research shows that the predator's ability to prey on adult brown stem leafhopper insects ranges from 1-5 heads. The existence of insects as natural enemies of this pest can be supported by microhabitats by planting refugia. Some flowering plants like common zinnia (*Zinnia elegans* (Jacq) Kuntze), marigold (*Tagetes erecta* Linnaeus), and cockscomb flowers (*Celosia* sp.) have been used as refugia and conservation plants for predators and parasitoids but are still not yet optimal. Planting refugia plants can affect insect diversity and evenness index, affecting the stability and balance of the agroecosystem (Nawir et al., 2021). Some plants that are better known as weeds such as *Ageratum conyzoides*, *Axonopus compressus*, *Cosmos caudatus*, *Wedelia trilobata* function well as microhabitats or refugia for natural enemy insects in rice in drylands (Sutriono, et al., 2019).

The Hypothesis of this research were seem a significant difference between treatments, namely p_0 = rice plants without refugia or control treatment, p_1 = *Synedrella nodiflora*, p_2 = *Asystasia gangetica*

3. MATERIAL AND METHODS

The materials used in this study consisted of: plastic rope, strainer, polybag, styrofoam, wood/bamboo, rubber gloves, plastic cups, detergent, HVS paper, *Synedrella nodiflora* and *Asystasia gangetica* weed saplings and soil. The tools used for this research are cameras, machetes, hoes, swing nets, stationery, and measuring tape.

The procedures for this research are (1) Location Survey which includes the collection of data on land, land conditions, soil conditions, and environmental conditions in the rice fields. (2) Weeds identification began by recording weeds in the field rice to ensure the morphological shape visually, grouping flowering weeds and identifying weeds (3) Refugia planting was carried out by collecting *S. nodiflora* and *A. gangecita* saplings taken directly from the research field and then planted in a polybag measuring 20 x 25 cm. (4) Observation of population and types of natural enemy insects, Observation is carried out every three days during the vegetative period of rice fields. Sampling data was carried out using *pitfall* traps and swing nets. The caught natural enemy insects are further observed to see the role of the insect as a predatory, parasitoid or pollinator insect, respectively.

The experimental design used in this study was a Complete Randomized Design (RAL) using nine replicates and three treatments, namely p_0 = rice plants without refugia or control treatment, p_1 = *Synedrella nodiflora*, p_2 = *Asystasia gangetica*. The data obtained was then processed using Analysis of Variance test where if there was significant difference, it was followed by the Least significant difference test (LSD) at the level of 5%, and a Pearson correlation analysis was carried out to see the relationship between natural enemy insect populations and insect pest populations.

4. DISCUSSION

a. Weeds Identification

From the results of the analysis, four groups of flowering weeds were obtained, consisting of one species of the puzzle weed group, and three species of broad-leaved weed group. Weed species that have the potential as refugia are *A. gangetica* and *S. nodiflora*. This weed species has weed criteria that have the potential to be refugia, namely flowers with striking colors, easy to cultivated and infested with several natural enemy insects such as spiders, wasps and ants. Meanwhile, *Lantana camara* weed is not included in the criteria of weeds that have the potential to be refugia in field rice plants because the weed is a woody weed that can grow 0.5-1.5 m and has many branches and is feared to be able to handle the growth of field rice plants and a relatively longer growing period until flowering. In *C. iria* weeds , there are no natural enemies that land on the weeds, the color of the flowers is inconspicuous, so it is not included in the criteria as a weed that has the potential to be a refugia.

b. Types of insects in rice fields in Jembayan Village

The total number of insects obtained and identified in rice plants in vegetative vases consisted

of 11 orders, 17 families, and 23 species. The order of insects found includes; Araneae, Hymenoptera, Coleoptera, Odonata, Orthoptera, Trichoptera, Diptera, Lepidoptera which are presented in Table 2 below. Various types of insects, pests and natural enemies found in rice fields. Insect pests in rice fields can damage productivity and can even result in crop failure. Meanwhile, natural enemy insects are insects that can control pest populations by eating, disrupting life to cause insect pest to get sick or die, as Amrullah (2019) said, maybe they were predator or parasites insect. Based on observation, the orders of insect natural enemy obtained were Araneae, Hymenoptera, Coleoptera, Odonata.

Asystasia gengetica *Synedrella nodiflora* *Lantana Camara* *Cyperus iria*

Figure 1. Weeds Species identified over the upland rice area

Table 1. Insects obtained and identified in rice plants

Ordo	Famili	Spesies	Status
Araneae	Lycosidae	*Lycosa pseudoannulata*	Predator
	Lycosidae	*Pardosa pseudoannulata*	Predator
Hymenoptera	Formicidae	*Solenopsis*	Predator
	Vespidae	*Vespula vulgaris*	Parasitoid
	Xylocopinae	*Xylocopa sororina*	Parasitoid
Coleoptera	Staphylinidae	*Paederus fuscipes*	Predator
	Scarabaeidaae	*Copris denicularus*	Pest
		Passalidae	Pest
	Carabidae	*Trycondyla*	Pest
		Pheropsophus occipitalis	Pest
		Calathus	Pest
	Coccinellidae	*Menochilus sexmaculatus*	Predator
Odonata	Libellulidae	*Neurothemis fuctuans*	Predator
Orthoptera	Acrididae	*Dissosteria carolina*	Pest
	Grylidae	*Teleogryllus emma*	Pest
		Leptysma marginicollis	Pest
Diptera	Sarkofagina	*Sarcofaga carnaria*	Pest
Lepidoptera	Eribidae	*Baulus nynetera*	Pest
	Nymphalidae	*Junonia orithya*	Pest
Blattodea	Blattelidae	*Blattela germanica*	Pest
Spirobodila	Trigoniulidae	*Trigoniulus corallinus*	Pest

c. Insect Population in Rice Field Crops in Jembayan Village

Natural Enemy Insect Population

The total population of natural enemy insects caught in swing net traps in each treatment is shown in Figure 2. The results of observation of natural enemies insect showed that treatment with weeds *A. gangetica* (p_2) produced the largest population of natural enemies insect, namely with an average gain of 14.44, then treatment with weed *S. nodiflora* (p_1) with an average gain of 9.78, and Control treatment (p_0) with the least yield, which was an average of 4.56.

Insect Pest Population

Insect pests on rice fields obtained through two traps, namely *pitfall traps* and swing nets in each treatment, are shown in the following Figure 3. The results of pest observation showed control treatment (p_0) produced the largest pest population, namely with an average of 3.67 followed by *A*

gangetica weed treatment (p_2) with an average yield of 1.33 and weed treatment *S. nodiflora* (p_1) with the least gain, which is an average of 0.78. These results are similar to Bulawan (2023) findings that refugia affected the whitefly pest population but were not significantly different in each treatment

The results of pest observation (Figure 4) showed control treatment (p_0) produced the largest pest population, which was with an average of 66.78, then treatment with weeds *S. nodiflora* (p_1) with an average yield of 46.44 and the least is the treatment on weeds *A. gangetica* (p_2) with an average gain of 33.33. Based on the results of data calculation with analysis of variance, it is known that the average number of insect populations in rice fields and had no effect on the intensity of the whitefly pest attack. There are seven species of insect natural enemies of whitefly consisting of six species of predators and one species of parasitoid. Most predators come from the order Coleoptera

in Jembayan as presented in Figure 2, 3 and 4 respectively, showed that the population of natural enemy insects is significantly different (F-count > F-table) and the pest population were significant difference also (F-count > F-table). So the use of these two weeds (*S. nodiflora*, and *A.* gangetica) may had an effect on the arrival of natural enemy insects and also pest insects in the rice field compared to the control treatment (p_0).

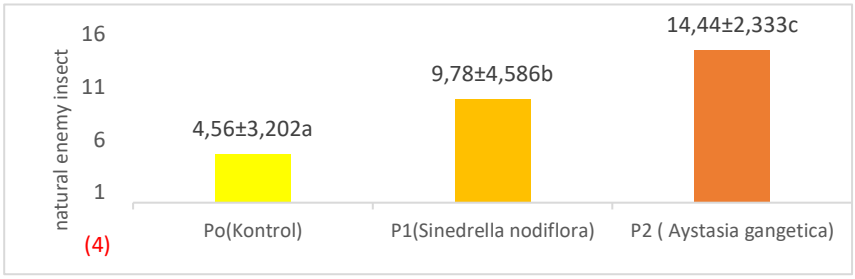

Figure 2. Natural enemy populations caught on Swing Net traps

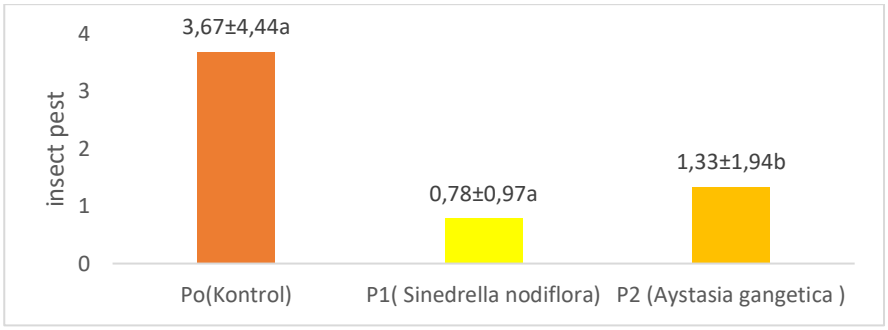

Figure 3. Pest populations caught on Swing Net traps

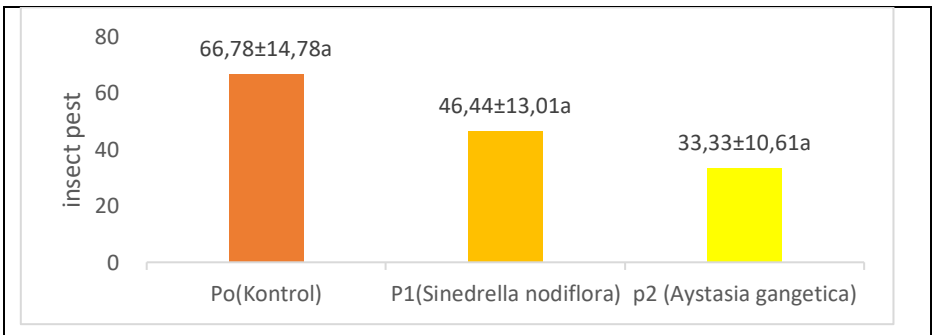

Figure 4. Population of pests caught on Pitfall traps

Table 2. Insect Diversity Index

Treatments	p_0	p_1	p_2
Diversity Index Natural enemies (Swing net trap)	0,808	1,370	1,346
Insect Pest Diversity Index (swing net trap)	1,113	1,550	1,144
Pest Diversity Index (Pitfall Traps)	1,361	1,217	1,398

d. Insect diversity in upland rice fields

The results of the calculation of the insect diversity index based on the results of observations in the field, for the number of populations of natural enemy insects and pest insects, are presented in the following Table 2. The results of the calculation of the Shanonn-Wiener diversity index were determined by the criteria of the diversity index value, namely H'<1.5 indicating low diversity, 1.5-3.5 indicating moderate diversity, and >3.5 indicating high diversity.

Table 2 shown that the diversity index of natural enemy insects in upland rice fields with *A. gangetica* (p_2) = 1.346 and *S. nodiflora* (p_1) = 1.370 treatment is classified as moderate diversity. Meanwhile, the control treatment (p_0) = 0.808 which is relatively low. For the insect pest diversity index in all traps, both swing net traps and pitfall is classified as medium and the highest insect pest diversity index is found in the treatment of *S. nodiflora* (p_1) responded to the swing net trap, which is 1,550. It appears that there are insect pests that dominate the environment with the highest number of pest population densities, namely *Teleogryllus emma* in pitfall trap results and *Leptysma marginicollis* marginicollis for swing net trap results

5. CONCLUSION

1. The results of this study show that *Asystasia gangecita* and *Sinedrella nodiflora* can be used as refugia in rice fields in Jembayan.
2. The placement of *Asystasia gangecita* and *Sinedrella nodiflora* around rice fields can bring and support the life of various types of natural enemy insects consisting of four orders, namely Araneae, Hymenoptera, Coleoptera, and Odonata.

REFERENCE

Amrullah, S.H., 2019. Pengendalian hayati (biocontrol): pemanfaatan serangga predator sebagai musuh alami untuk serangga hama (sebuah review). Prosiding Seminar Nasional Biodiversitas Indonesia 84 – 90. (Prosiding Seminar Nasional Biologi (uin-alauddin.ac.id)

Bulawan, J. A., L. Mpia, M. Sepe, E. Hardiana. 2023. The effectiveness of some types of refugia for supplying the population of the first lice (*Bemisia tabaci*) on soybean

Tim Pengajar DIHT FPN UGM, 2020. Pengelolaan Hama Terpadu (PHT) Dan Kebijakan Perlindungan Tanaman, 13p.

Yogi, IBPP. 2018. Padi gunung pada masyarakat dayak, sebuah budaya bercocok tanam penutur austronesia (melalui pendekatan etnoarkeologi). *Forum Arkeologi* 31(1): (45 - 56).

plant. *Jurnal Biologi Tropis,* 23 (3): 303 – 309

Kartohardjono, A. 2011. Penggunaan musuh alami sebagai komponen pengendalian hama padi berbasis ekologi. *Pengembangan Inovasi Pertanian* 4(1) : 29 – 46.

Nawir, W., N. Nelly, Yaherwandi. 2021. The potency of refugia plants in increasing insect diversity of ric e fields in Padang Pariaman, West Sumatra. *Jurnal Proteksi Tanaman.* 5(2): 60-68.

Septariani, D. N., Aktavia H, Mujiyo. 2019. Pemanfaatan berbagai tanaman refugia sebagai pengendali hama alami pada tanaman cabai (*Capsicum annum* L.), e: https://jurnal.uns.ac.id/prima/index. *J. Com. Empowering a Services* 3(1): 2 – 3

Supriyanti, A., Supriyanta, dan Kristamtini. 2015. Karakterisasi dua puluh padi (*Oryza sativa* L.) lokal Di Daerah Istimewa Yogyakarta. *J. Vegetalika* 4(3): 29-41

Sutriono, E. Purba, Marheni. 2019. Insect management with refugia plant in upland rice (*Oryza sativa* L.). *IOP Conf. Ser.: Earth Environ. Sci*. 260 012138