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Application of Integrated Pest Control Models Nilaparvata Lugens (Stal) (Homoptera: Delphacidae) In Rice Plants Outside of Sidoarjo Mud Impact Area

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ABSTRACT

This study aims to apply an integrated pest control model (IPC) of brown planthoppers (bph) on rice against the presence of natural enemies in maintaining rice productivity. The research was conducted in Sentul Village, Tanggulangin District, Sidoarjo, East Java Province from September 2020 to December 2020. The research was conducted using a survey method. The research location was selected using the purposive sampling method, namely the area with the highest percentage of attacks, having been attacked at least 3 times the planting season, planting Inpari-4 rice varieties, and reported as brown planthoppers endemic areas in Sentul Village, Tanggulangin District, Sidoarjo. The results showed population abundance, percentage level of attack, lowest brown planthoppers attack intensity with IPC treatment and the highest with conventional control pedals, while the composition and abundance of brown planthoppers natural enemies was dominated by the family, Tetragnathidae and Coccinellidae (Coccinela repanda).

Keywords : *natural enemies, brown planthoppers, IPC*

1. INTRODUCTION

Since May 28, 2006, there was a national ecological disaster of hot mud in Sidoarjo, East Java, when hot mud mixed with poison gas gushed near the Banjar Panji-1 drilling well during a seismic survey and exploitation of gas drilling by a national oil and gas company. This activity is part of a series of exploration activities because the nature of reserves and natural gas cannot be determined with certainty (Herawati, 2007). The hot mud covered around 250 hectares of land in November 2006, including seven villages, rice fields, sugarcane plantations and irrigation channels, and disrupted transportation routes. The mud flow volume forecast is between + 50,000 - 120,000 m3 / day. So that water separated from the sludge ranges from 35,000 - 84,000 m3 / day (White Paper LUSI, Ministry of Living Environment). It is estimated that there are two factors from the effect of the mudflow that affect the environment, namely microclimate factors and changes in land characteristics (Sari et al., 2020). The microclimate that has an effect is an increase in environmental temperature, a decrease in relative humidity and a reduction in the intensity of sunlight due to smoke. While changes in soil characteristics due to the presence of silt have an effect on increasing bulk density, changing pH, increasing nutrient content, and changing soil fertility levels.

Temperature fluctuations due to mudflow have an effect on changes in the microclimate around the eruption. The increase in temperature causes an increase in evapotranspiration and an increase in reaction speed in plant cells. Excessive reaction rates in cells for a long time can affect cell resistance so that cell function will decrease. Meanwhile, an increase in evapotranspiration rate will lead to a decrease in soil moisture, lack of irrigation water supply in the next growth phase and fluctuations in relative humidity. Reduced irrigation water supply can reduce plant growth rates and excessive relative humidity can decrease plant metabolism. These aspects trigger the emergence of various plant-disturbing organisms, especially the brown planthopper, in the rice planting area.

Aspects that affect the micro environment in rice plants outside the area affected by Sidoarjo mud are an increase in environmental temperature, a decrease in relative humidity and a reduction in the intensity of sunlight due to smoke so that some rice plantations often experience crop failure due to brown planthopper attacks during the growing season. This existence is a major problem for rice farmers in Sentul village, Tanggulangin sub-district, Sidoarjo, East Java. brown planthoppers (bph) attacks in Tanggulangin Subdistrict, Sidoarjo have been reported to cause crop failure, but since 2014 it has been found that brown planthoppers attacks have increased with an attack area of up to 6.7 ha in Tanggulangin District, namely in Sentul village, Tanggulangin sub-district, Sidoarjo. The attack continued for 4 growing seasons so that it is estimated to be an endemic area for brown planthoppers in Tanggulangin sub-district. The triggering factors for the increase in brown planthoppers attacks are the planting of the Inpari-4 variety in each growing season which is reported to be vulnerable, the planting is not simultaneous, the climate, the intensive use of synthetic fertilizers and excess pesticides that disturbs the ecological balance and suppresses the existence of natural enemies from predators and parasitoids (Sidoarjo Agriculture Office , 2016). However, no reports have been found regarding population abundance, attack intensity and the presence of natural enemies. Meanwhile, the percentage of brown planthoppers attack rate in Sentul village, Tanggulangin Subdistrict, Sidoarjo shows a value of 39% and is the highest attack rate (Humaidi,F., Didik Daryanto 2020).

The results of other research on brown planthoppers in Sepanjang Village, Glenmore District, Banyuwangi with direct exploration methods on paddy fields showed that the application of IPC and conventional had a significant effect on brown planthoppers populations and spiders as natural enemies of brown planthoppers. The average brown planthoppers population in IPC and conventional land was 0.30 and 0.57 individuals. Meanwhile, the average spider population in IPC and conventional land was 0.234 and 0.137. The spiders found were Pardosa sp. and Argiope sp. Rice production on IPM land is lower (4.56 tonnes) compared to conventional land (5.12 tonnes) (Claudya SEG, Gatot Mudjiono, Ludji Pantja Astuti, 2015). Integrated pest control is an integrated part of integrated pest management (Makarim & Las, 2005) because pest and disease control is an intermediate goal of plant cultivation. IPC increases the role of natural control and rational use of pesticides based on observations. The use of insecticides, plant pest traps (refugia) and the use of biological agents is an integrated control trend in suppressing the attacks of endemic populations of brown planthoppers in areas with the highest attack rates.

2. RESEARCH METHODS

The research was carried out in endemic areas in the rice planting area of Sentul village in the Tanggulangin sub-district, Sidoarjo, East Java Province, and the biology laboratory, Faculty of Agriculture, Wijaya Putra University, from September to December 2020. The temperature ranges from 22 - 33^{O}C. Humidity 78 - 82%. The research was conducted using a survey method. The selection of research locations used a purposive sampling method, namely the areas with the highest percentage of attacks, having been attacked at least 3 times the planting season, planting Inpari-4 rice varieties, and being reported as brown planthoppers endemic areas outside the affected area of the Sidoarjo mud in Tanggulangin district, Kota Sidoarjo. From the results of previous studies, Sentul Village was used in the study because the area was the highest brown planthoppers endemic compared to other villages in Tanggulangin sub-district, Sidoarjo (Humaidi, F., Didik Daryanto (2020).

The land used is divided into 2 areas, the first using the IPC application method with an area of about 1500 m2 while the second area with a distance of about 500 m using the conventional method with an area of 1500 m^2

The first land used Inpari-4 rice varieties, manure, urea fertilizer, sp-36 fertilizer, biological agents Beauveria bassiana, Corynebacterium, and Plant Growth Promoting Rhizobacterium (PGPR) and refugia plants (Axonopus compressus Beauv.) Refugia plants function as brown planthoppers natural enemy host. While the second land uses Inpari-4 rice varieties, urea, and SP-36 fertilizer.

Rice Plants with IPC Applications

The land to be planted with rice is given 200 kg of manure first, planting rice with a 3: 1 jajar legowo system (25 x 15 x 50 cm), the rice used is Inpari-4 variety. Rice was soaked with Plant Growth Promoting Rhizobacterium (PGPR) with a concentration of 10 ml / L for 9 hours then drained and then covered to germinate. When the nursery is 5 days and 8 days old, PGPR is sprayed with a concentration of 20 ml / L to spur the growth of the rice nursery. After the nursery is 12-14 days old, B. bassiana is applied, which aims to anticipate pest attacks during the nursery. After 16 days after planting, the rice seeds were dipped in a Corynebacterium solution with a concentration of 5 ml / L, then the seedbed was carried out in the fields. The application of fertilizer according to the recommendation of soil analysis results is 1.88 kg of urea fertilizer and 2.23 fertilizer for urea, for urea fertilization is carried out three times, namely during soil cultivation, when the plants are 2 and 4 weeks after planting.

Rice Plants with Conventional Applications

The principle of land to be planted is the same as the IPC method, planting rice using the jajar legowo system 3: 1 (25 x 15 x 50 cm), Inpari-4 variety, cruiser dropping rice seeds after soaking in water for 24 hours. Conventional application does not use manure, ferugia plants and local isolates such as the application of IPC. The fundamental difference between conventional use of pesticides such as the insecticide Plenum, Seltima® 100 CS.

Data Analysis

1. Abundance brown planthoppers population / clumps

Brown planthoppers population abundance / family was obtained by counting all nymphs and imago obtained. The data on the population per clump of the 20 samples are then averaged, and displayed in tabulated form.

2. Composition and abundance of natural enemies / clumps

The results of identification natural enemies in the insect bioecology laboratory were tabulated using an excel program and then analyzed to determine the composition and abundance of natural enemies. The composition of natural enemies is shown according to family.

3. Percentage of Brown planthoppers Attacks

The percentage of brown planthoppers attacks is calculated using the Abbot formula as follows:

P = a / b X 100%

Note:

P: Percentage of attack (%)

a: The number of rice clumps affected by brown planthoppers

b: The number of rice clumps observed.

4. Damage intensity

The intensity of damage due to brown planthoppers attack is determined using the formula:

$$I = \sum_{i=1}^{i} \frac{ni \times vi}{N \times Z} \times 100\%$$

Note:

I = intensity of attack

Ni = number of families attacked on the score i

Vi = score i

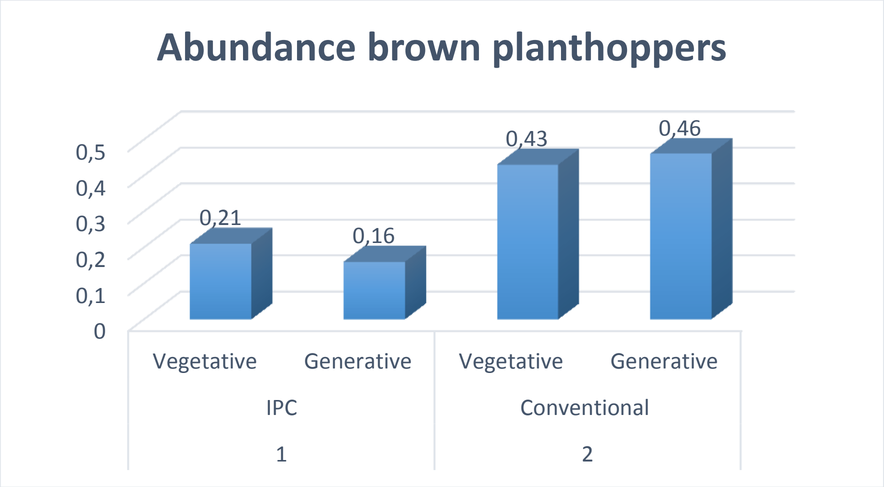
N = number of rice clumps observed

Z = highest score

3. RESULTS AND DISCUSSION

Abundance brown planthoppers population / clumps

The abundance of brown planthoppers population in the area of rice plants with Integrated Pest Management and Conventional systems shows that there are variations in the presence of brown planthoppers populations both from observations of the vegetative phase and the generative phase.



The brown planthoppers population with the IPC system showed a decrease in the abundance of brown planthoppers compared to the application of conventional control. The difference in population abundance in the IPC system is due to the application of biological agents on IPC land since the plants were 7 days after planting, which is thought to be the cause of the brown planthoppers population on IPC land being lower than conventional land using pesticides.

Composition and abundance of natural enemies / clumps

The composition and abundance of natural enemies from the 2 control methods showed the following results

Table 2: Composition and abundance of natural enemies / clumps from IPC and conventional control methods

No	Treatment	Phase	Family	Composition and abundance of natural enemies / clumps
1	IPC	Vegetative	Araneidae Salticidae	4 4

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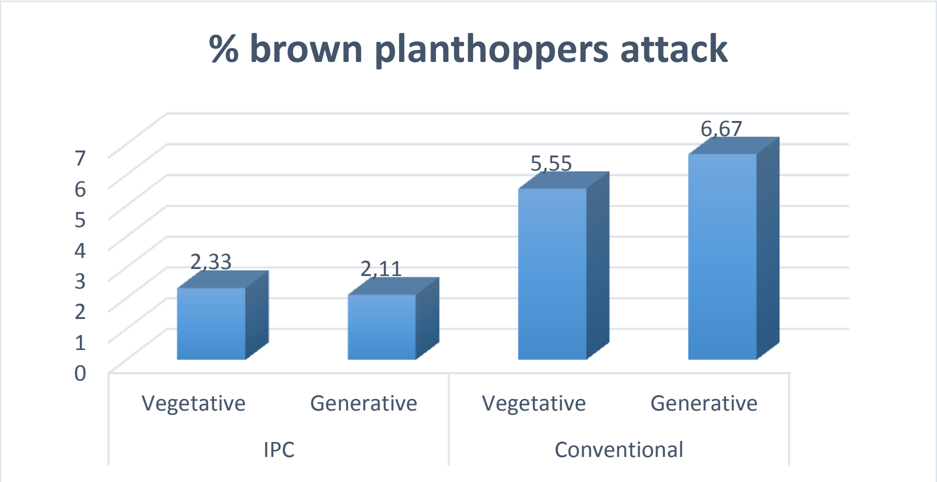
			Tetragnathidae Coccinellidae	6 5
		Generatif	Araneidae Salticidae Tetragnathidae Coccinellidae	5 6 8 8
2	Conventional	Vegetative	Araneidae Salticidae Tetragnathidae Coccinellidae	0 1 2 2
		Generative	Araneidae Salticidae Tetragnathidae Coccinellidae	0 2 1 1

The IPC control method shows that the level of diversity of natural enemies is very diverse, the Tetragnathidae group still dominates the rice fields and is followed by the Coccinellidae, Salticidae, and Araneidae families. In the generative phase there was an increase in the number of natural enemy populations with Tetragnathidae and Coccinellidae still dominating in the rice fields. With a high level of natural enemy population, the brown planthoppers attack rate is relatively small and can still be controlled. In addition, the growth ecosystem of natural enemies is still well preserved and the presence of natural enemies is also found in refugia plants. Whereas the conventional method of control shows that the diversity of natural enemies is very small, this is due to the high use of Plenum insecticides, which has an impact on population decline and diversity of natural enemies.

Percentage of Brown planthoppers Attacks

The percentage of brown planthoppers attack rates in Sentul village shows the results of different attack rates, the use of the IPC method shows a low attack compared to conventional methods.



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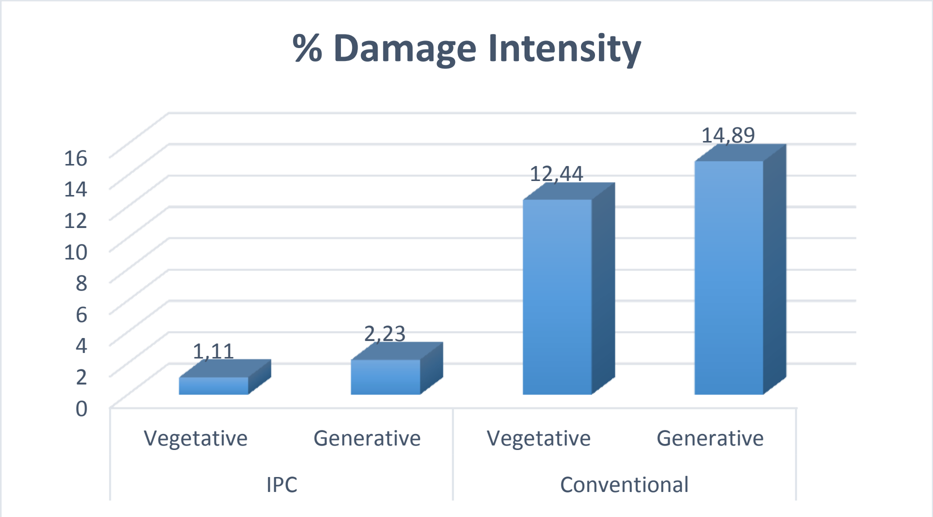
The high percentage of brown planthoppers attacks on rice plants with conventional control treatments both in the vegetative and generative phases is thought to be the presence of brown planthoppers resistance to insecticides also in line with the high daily average temperature ranging from 30°C to 33°C with the rice planting season besides that the Sentul village area is closer. with the area affected by the Sidoarjo mud.

Damage intensity

The intensity of damage to rice plants due to brown planthoppers attacks in Sentul village varied with the use of IPC and conventional control methods. The lowest damage was using the IPC method with a vegetative phase of 1.11% and a generative phase of 2.23%. While the highest percentage of damage intensity was in conventional control treatment with an attack intensity level of 12.44% in the vegetative phase and the generative phase of 14.89%.



The high intensity of damage to rice plants attacked by brown planthoppers in Sentul village is possible because the agroecosystem supports the occurrence of brown planthoppers explosions, such as the high average daily temperature of 30°C-33°C, the humidity level ranges from 60% -70% and adjacent to the area affected by the Sidoarjo mud.

4. CONCLUTION

Limited from the research results, it can be concluded as follows:

1. The abundance of endemic brown planthoppers in Sentul Village with conventional control treatment tends to be higher than that of IPC treatment.
2. The composition and abundance of brown planthoppers natural enemies with IPC were dominated by the family, Tetragnathidae and Coccinellidae (Coccinela repanda), while conventional treatments were dominated by the Tetragnathidae and Salticidae families.

3. the percentage of brown planthoppers attack rates with IPC treatment shows the lowest attack percentage compared to conventional control treatments
4. The lowest damage intensity occurred with IPC treatment, while the highest percentage of damage intensity occurred with conventional treatment

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