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Population Dynamics Brown Plant Hopper (*Nilaparvata LUGENS* (Stal) On Rice Plants In The Outside Area Impact of Sidoarjo MUD

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ABSTRACT

This study aimed abundance for brown plant hopper (bph) in rice plants against the presence in natural enemies to maintain productivity in rice plants. The study was conducted in the villages in Gempolsari, Penatar sewu and Sentul, Tanggulangin district, Sidoarjo, East Java in May 2019 to October 2019. The research was conducted using survey methods. The research location was selected using by purposive sampling method, which is the area with the highest percentage of attacks, has been attacked at least 3 times the growing season, Ciherang rice varieties, and was reported as brown plant hopper endemic area in 3 villages of Tanggulangin District, Sidoarjo. The results showed population abundance, percentage of attack rates, lowest intensity of brown plant hopper attacks occurred in Gempolsari village and the highest in Sentul village while the composition and abundance of natural enemies of brown plant hopper were dominated by odonata family then followed by families Salticidae, Tetragnathidae and Coccinellidae (*Coccinela repanda*).

Keywords : natural enemies, *Purposive Sampling, bph*

1. INTRODUCTION

The national ecological disaster of the hot mud that occurred in Sidoarjo, East Java began on May 28, 2006, when poisonous gas and hot mud gushed near the Banjar Panji-1 drilling well owned by PT Lapindo Brantas, Inc. drilling activities. which until now still cannot be stopped. Oil and gas exploration activities as carried out by PT Lapindo Brantas, Inc. is a seismic survey and exploration activities. These activities are a series of activities carried out because the nature of oil and gas reserves in the bowels of the earth cannot be determined with certain location (herawati, 2007).

The hot mud in November 2006 covered about 250 hectares of land, including seven villages, rice fields, sugar cane plantations, and irrigation channels, and disrupted transportation routes. Estimated volume of mudflow between + 50,000 - 120,000 m3 / day. So that the water separated from the mud deposit ranges from 35,000 - 84,000 m3 / day (LUSI White Book, KLH). It is estimated that there are two factors of the effect of the mudflow that affect the environment, namely microclimate and changes in land characteristics. The influential microclimate is an increase in ambient temperature, a decrease in relative humidity and a reduction in the intensity of sunlight caused by smoke. While the change in soil characteristics due to the presence of mud affects the increase in Bulk density, changes in pH, increase in soil content, and changes in the level of soil fertility.

Changes in air temperature due to mudflow which affect microclimate changes in the area around the center of the blast. An increased in temperature causes an increase in evapotranspiration and an increase in reaction speed in plant cells (Ali, Purwanti, & Hidayati, 2019). The speed of reaction in cells that occur excessive in a long time can affect cell resistance so that cell function will decrease. While the increase in the speed for evapotranspiration will trigger a decrease in soil moisture, lack of irrigation water supply in the next growth phase and increase the relative humidity in the air. Reduced irrigation water supply can reduce plant growth rates and excessive relative air humidity can reduce plant metabolism. These aspects as a trigger for the emergence of various plant-disturbing organisms, especially brown plant hopper in the rice crop area.

One aspect that affects the microenvironment of rice plants outside the map affected by environmental temperature fluctuations, reduction in relative humidity and reduction in sunlight intensity due to smoke so that some rice crops often experience crop failure due to brown plant hopper attacks in the planting season MK 1 and MH 1 and MH 2. This presence is a major problem for rice farmers in the villages of Gempolsari, Penatar sewu and Sentul in Tanggulangin district, Sidoarjo, East Java Province. There is not data on the dynamics of WBC pest poulasi, so farmers have difficulty in controlling the WBC population.

Nilaparvata lugens (Hemiptera: Delphacidae) are rice pest species whose population and extent of attacks continue to grow rapidly along with the choice of farmers to continue applying conventional rice cultivation. WBC slopes attack rice plants by sucking phloem fluid, reducing chlorophyll and leaf protein content, and reducing the rate of photosynthesis (Watanabe & Kitagawa 2000). Rice plants become miserable and grow stunted, leaves turn yellow and wither, which eventually die dry or called hopperburn. Oka (1982) reported that the WBC attack that caused hopperburn in Indonesia occurred around the 1980s. These events continue from year to year until now.

Population explosion can occur due to WBC proliferating at an exponential (r-strategic) growth rate and causing severe damage to rice plants after generation 2-3. In one plant about 400-1000 nympha can be found, filling the lower part of the rice grove and continuing towards the leaf tips. Towards puso, the macroptera population can reach 200-500 pairs per family (Baehaki & Mejaya 2014). Nurbaeti et al. (2010) states, attacks of 1-4 leafhoppers / clumps in the period of tillers reduce yields by 35% -77%, attacks during pregnancy decrease yields by 20% -37%, while attacks during decrease yields by 28%.

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WBC attacks in the Tanggulangin District of Sidoarjo have been reported to have caused crop failure, but since 2014 there was an increase in WBC attacks with an area of 6.7 ha in the Tanggulangin District, namely in the villages of Gempolsari, Penatar Sewu and Sentul in the Tanggulangin District of Sidoarjo. The attack continued during the 4 growing seasons so it was estimated to be a WBC endemic area in Tanggulangin sub-district. The triggering factors for increasing WBC attacks are planting Ciherang varieties in each planting season which is reportedly vulnerable, non-simultaneous planting, climate, intensive use of synthetic fertilizers and synthetic pesticides so that it disrupts the ecological balance and suppresses the presence of natural enemies from predators and parasitoids (Sidoarjo Agriculture Office, 2016). However, no reports have been found regarding population abundance, intensity of attacks and the presence of natural enemies.

Recent research on WBC in Sepanjang Village, Glenmore Subdistrict, Banyuwangi District with the method of exploration or direct observation on rice fields, to determine the WBC population and spiders on IPM and conventional land. The results showed that the application of IPM and conventional influence significantly on WBC population and spiders as natural enemies of WBC. The average WBC population on IPM and conventional land is 0.30 and 0.57. While the average spider population on IPM and conventional land is 0.234 and 0.137. The spider found was Pardosa sp. and Argiope sp. Rice production on IPM land is lower (4.56 tons) compared to conventional land (5.12 tons) (Claudya SEG, Gatot Mudjiono, Ludji Pantja Astuti, 2015).

2. RESEARCH METHODS

The study was conducted using survey methods. The research location was selected using the purposive sampling method, which is the area with the highest percentage of attacks, has been attacked at least 3 times the planting season, planted rice varieties of Ciherang rice, and reported as WBC endemic areas outside the Sidoarjo mud affected map, namely Gempolsari village, Penatar sewu and Sentul, Tanggulangin sub-district, Sidoarjo City. Collection of brown rice plant hopper (WBC) and natural enemies carried out 6 times, simultaneously, which began when the rice plants were 3 weeks after planting at intervals once every two weeks. Collection was carried out on 20 groups of sample plants in each treatment plot using modified D-vac vacuum. Zig zag samples were selected following a diagonal line in the survey area. WBC Wereng and natural enemies collected successfully are then stored in plastic containers that have been given camphor, and then transferred to a collection bottle that already contains 70% alcohol and taken to the biology laboratory at the Faculty of Agriculture, Wijaya Putra University.

Calculation of WBC population abundance is carried out in an insect biology laboratory. The process of identifying, counting, and classifying natural enemies according to the trophy (predators and parasitoids) is done by using several references and keys of determination, namely: Barrion & Litsinger (1995), Heinrichs (1994), Goulet & Huber (1993), Wilson & Claridgege (1991), Kalshoven (1981).

Observation of the symptoms WBC attack was carried out after the collection of samples per family was carried out, but on the same day. The first step is to pay attention to each rice seedling in one sample family to determine whether the sample family shows symptoms of WBC or not. If it shows symptoms of an attack, then the clump is determined as a clump. The next step is to determine the scoring symptoms of attacks / clumps based on Baehaki (1985).

The Data Analysis as followed :

1. Population abundance of WBC / clumps

   The abundance of WBC population / clumps is obtained by counting all nymphas and imago obtained. Data on population per cluster from 20 samples are then averaged, and displayed in tabulated form.

2. Composition and abundance of natural enemies / clumps

   The results of identification of natural enemies in the insect bioecology laboratory are tabulated using the Excel program and then analyzed to determine the composition and abundance of natural enemies. The composition of natural enemies is displayed according to the family.

3. Percentage of WBC Attacks

   The percentage of WBC attacks is calculated using the Abbot formula as follows: P = a / b X 100%

4. Damage intensity

   The intensity of damage due to WBC attacks is determined using the formula:

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

3. RESULTS AND DISCUSSION

Population abundance of WBC / clumps

The abundance of brown plant hopper / WBC populations in rice plants in 3 villages of Tanggulangin Subdistrict, Sidoarjo revealed the existence of variations in the presence of WBC populations both from vegetative and generative phases.

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The WBC distribution ranges from 3.9 to 6.6 / clumps. The average abundance of WBC in the 3 villages above shows the generative phase is higher than the vegetative phase, it occurs in all study locations. The highest WBC population was found in PenatarSewu village, especially in the Generative phase (Figure 1).

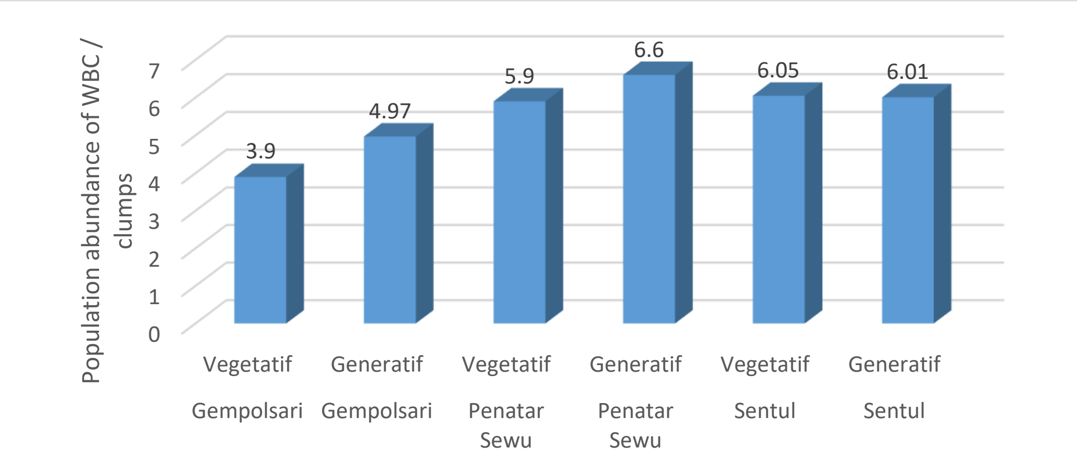

Figure 1. Abundance of WBC in 3 Endemic Villages, Tanggulangin District, Sidoarjo

The smallest WBC abundance occurred in Gempolsari village with WBC abundance in the vegetative phase of 3.9 and generative phase of 4.97. While the abundance WBC in rice plants in Sentul village tends to be stable and slightly decreased during the generative phase. The characteristics of rice plants in the village Gempolsari showed that there are farmers organized with integrated pest control / SLPHT field schools. The use of insecticides is greatly reduced and the use of biopesticides has been done a lot.

Composition and abundance of natural enemies / clumps

The composition and abundance of WBC natural enemies from the 3 observation villages showed the following results :

Table 1. Composition and abundance of natural enemies / clumps in 3 villages of Tanggulangin District, Sidoarjo

No	Village	Phase	Family	Composition and abundance of natural enemies / clumps
1	Gempolsari	Vegetatif	Araneidae Salticidae Tetragnathidae	7 8 6

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			Coccinellidae Odonata	8 9
		Generatif	Araneidae Salticidae Tetragnathidae Coccinellidae Odonata	13 15 17 16 9
2	Penatar Sewu	Vegetatif	Araneidae Salticidae Tetragnathidae Coccinellidae	2 3 2 4
		Generatif	Araneidae Salticidae Tetragnathidae Coccinellidae	5 2 2 4
3	Sentul	Vegetatif	Araneidae Salticidae Tetragnathidae Coccinellidae	2 1 3 2
		Generatif	Araneidae Salticidae Tetragnathidae Coccinellidae	0 2 1 4

For Gempolsari village, the level of diversity of natural enemies is very diverse, the odonata group still dominates the rice field diareal and is followed by the families of Salticidae, Tetragnathidae and Coccinellidae (Coccinela repanda). In the generative phase, the relative population of natural enemies with Tetragnathidae and Coccinellidae still dominates in the area of rice fields. With a relatively high natural enemy population level in Gempolsari village, the WBC attack rate is relatively small and can still be controlled. Besides that the natural enemy growth ecosystem is still awake. While the natural enemy population in 2 villages of Penatar Sewu and Sentul, the abundance of natural enemies has decreased and the WBC attack rate is relatively high. The reduced level of abundance of natural enemies / clumps is due to the high use of insecticides in controlling WBC pests both in the vegetative and generative phases. In the way of rice cultivation by multiplication of absolute organic fertilizer without using chemicals including chemical fertilizers, the population density of brown plant hopper, green leaf hopper and white back hopper are low due to the poor development for arthropods in these habitats (Kajimura et al., 1993).

Percentage of WBC Attacks

The percentage of WBC attack rates in 3 observation villages shows the results of different attack rates, Gempolsari village shows the lowest percentage of WBC attacks while the highest in Sentul village. The high percentage of WBC attacks on rice plantations in Sentul village was 11.67% at the vegetative level and 16.67% in the Generative phase along with the high daily average temperatures ranging from 30oC to 33oC with MK 1 planting season besides the territory Sentul village is closer to the Sidoarjo mud affected map area.

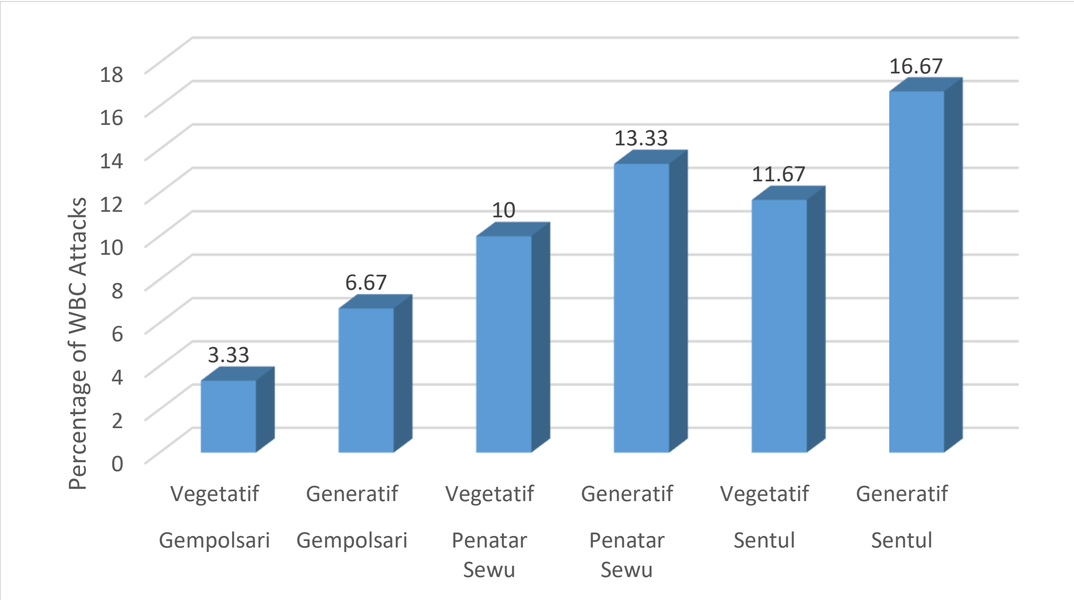

Figure 2. WBC Attack Rates in 3 Villages in Tanggulangin District, Sidoarjo

Damage intensity

The intensity of rice crop damage due to WBC attacks in the villages of Gempolsari, Penatar Sewu and Sentul varied, the lowest damage occurred in the village of Gempolsari with a vegetative phase of: 1.11% and a generative phase of 6.67%. While the highest percentage of damage intensity occurred in Sentul village with 19.44% attack intensity level and 38.89% generative phase.

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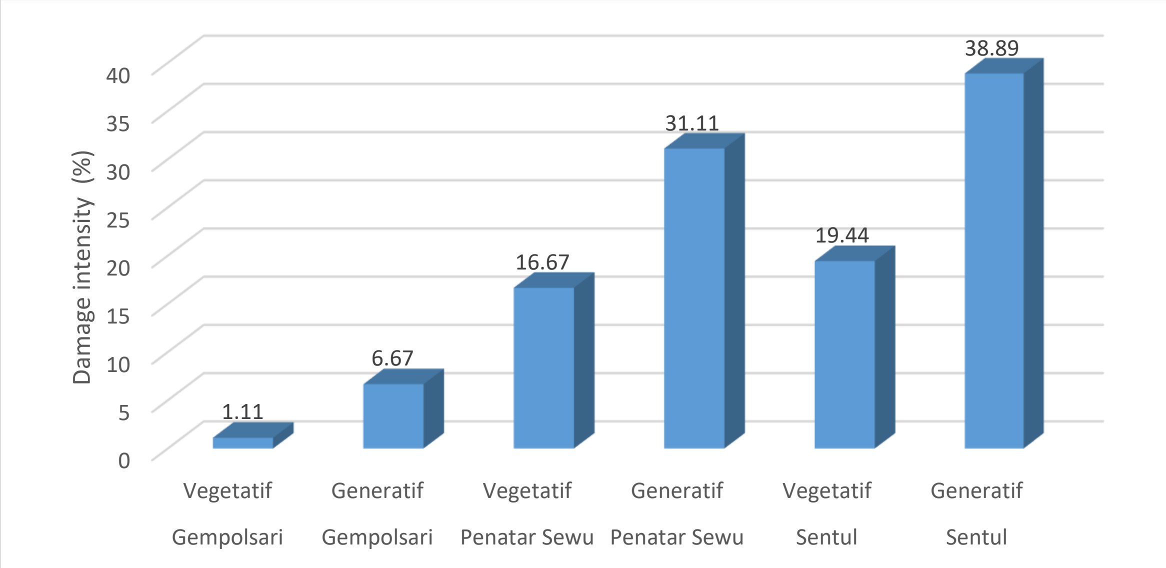

Figure 3. WBC Damage Level in 3 Villages in Tanggulangin District, Sidoarjo

The high intensity of damage to rice plants affected by WBC in Sentul village is possible because the agroecosystem supports WBC explosion such as the high average daily temperature of 30oC-33oC the humidity level ranges from 60% -70%. Besides because because in the Sentul area, farmers do not plant rice simultaneously so that the brown plant hopper pest cycle is not interrupted. Around the trap plant, the age of the rice plant is not uniform and the presence of predators is still unable to suppress the brown planthopper population in the field.

4. CONCLUSION

Limited from the results of the study it can be concluded as followed:

1. WBC Abundance Population in 3 Endemic Villages Kec. Tanggulangin Sidoarjo lowest in the vegetative and generative phases occurred in Gempolsari village and the highest in Sentul village.
2. The composition and abundance of WBC natural enemies is dominated by the family of odonata then followed by the families of Salticidae, Tetragnathidae and Coccinellidae (Coccinela repanda)
3. The percentage of WBC attack rates in Gempolsari village shows the lowest percentage of WBC attacks while the highest WBC attack is in Sentul village.
4. The lowest damage intensity occurred in Gempolsari village while the highest damage intensity percentage occurred in Sentul village.

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