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# Population Density of Brown Planthoppers (*Nilaparvata Lugens* Stall) and Green Planthoppers (Nephotettix Virescens) in Rice Varieties in Merauke, South Papua Province

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**ABSTRACT:** The aim of the study was to analyze the density of brown planthopper (*Nilaparvata lugens* Stall) and green leafhopper (*Nephotettix virescens*) populations on rice plants in Merauke Regency. The research was carried out from June to October 2022 in the Merauke District using a Randomized Block Design (RBD) consisting of 6 varieties with 3 replications. The varieties used were Nutrizinc, Mamberamo, Inpari 42, Inpara 2, Inpari 32 and Inpari Sidenuk. Each treatment was repeated 3 times so that 18 experimental plots were obtained. Plot area 3x3 m2, using a spacing of 20 x 20 cm. The green leafhoppers were collected in the afternoon using the double sweeping method for each sub-plot, while the brown planthoppers were collected using direct observation to count the BPH population in the plants. Based on the results of research on brown planthopper pest populations on rice plants at the age of 2 weeks and 4 weeks the highest was in the Inpari 32 variety (3.21 individuals) and the lowest was in Inpara 2 (0.9 individuals) then increased again in the generative phase (3.5 individuals). individual). The highest population density of green leafhopper pests at 2 weeks of age was found in Nutrizinc and Inpari Sindenuk varieties (4 individuals), while the lowest at 4 weeks of age were Inpari 32 and Mambramo varieties (3.5 individuals). Meanwhile, in the generative phase, green leafhoppers decreased in all varieties. The highest number of grains per panicle was Inpara 2 (1,650 grains), while the other varieties were almost evenly distributed and the fewest number of grains was Inpari 32 (887 grains). While the highest number of empty grains was in the Inpara 2 variety (47.5 grains) and the least empty was in the Mambramo variety (28.9 grains).

**KEYWORDS**: Papua, Paddy, brown planthopper, green planthopper.

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## INTRODUCTION

Rice is an important food crop for the people of Indonesia, because it is a staple food in the form of rice. The demand for rice in Indonesia is getting higher day by day, this makes farmers try to continue to increase production by minimizing crop failures. Crop failure can be caused by many factors, one of which is the attack of plant-disturbing organisms (OPT). Many types of OPT attack rice plants, causing losses in quality and quantity. This can affect food security at the national level, especially in Merauke Regency. Merauke has a sizeable planting area for rice commodities of 49,322.75 ha with a harvested area of 47,444.25 ha, and a productivity of 4.39 tonnes/ha in 2019 (Merauke dalam angka, 2020). The potential for rice development in this region is supported by natural resources (*particularly climate, soil and water*) which are very suitable in most areas. One of the problems with increasing rice production is the influence of the climate, where normal rainfall only occurs in early February. In addition, pests and diseases of rice plants can also reduce production. Wereng are rice pests that cause the most anxiety for farmers during the rice planting season (Intan, et al 2016). The types of leafhoppers that are most often encountered and cause high damage are the brown planthopper (*Nilaparvata lugens* Stall) and the green leafhopper (*Nephotettix virescens*). Green leafhopper (*N. virescens*) is one of the important pests in rice plants. This is due to its ability as a vector for the tungro virus. Meanwhile, the brown planthopper (*N. lugens* Stall) is capable of causing rapid and severe damage to rice plantations (Harahap and Tjahjono, 2003).

Tungro epidemics often occur in Indonesia and are one of the main diseases with the characteristic symptom of a change in color from green to yellow or orange. Heavy attacks cause plants to become stunted so that crop production will be disrupted.

The causes of tungro disease are two different viruses, namely rice *tungro bacilliform virus* (RTBV) and *rice tungro spherical virus* (RTSV). Factors supporting the development of tungro are the availability of inoculum, susceptible varieties and populations of green leafhoppers (*N. virescens*). The brown planthopper (*N. lugens*) is one of the main pests of rice in Indonesia because the damage it causes is quite extensive in almost every growing season. Typical symptoms of the attack are the plants wither, and dry up like a fire. Besides being able to reduce rice productivity, this pest can also be a vector for viruses that cause stunted and empty grain rice plants. This pest is able to survive throughout the season and produce a large number of offspring in a short time (Baehaki, 2013).

In general, the control of brown leafhoppers (*N.lugens* Stall) and green leafhoppers (*N.virescens*) is carried out by farmers using synthetic insecticides and using more than one type of active ingredient. Excessive use of insecticides can have negative impacts, one of which is pest resistance (Fajrullah *et al*, 2015). The spread of leafhoppers is greatly influenced by the rainy season and high humidity (Nurbaeti *et al*., 2010). Planthoppers play a role in the development of the disease, this is related to the initial infection of the disease which is positively correlated with the planthopper population. The higher the planthopper population supported by the availability of inoculum will affect the percentage of infection. Reducing the planthopper population will be very effective in limiting transmission of the virus. Conventional rice cultivation by farmers, such as excessive use of nitrogen fertilizers, little organic fertilizer application and asynchronous planting, as well as control using synthetic insecticides, are thought to cause planthopper populations to be found all the time. The purpose of this study was to analyze the density of brown planthopper (*N.lugens* Stall) and green leafhopper (*N.virescens*) populations on rice plants in Merauke Regency.

## MATERIALS AND METHODS

The research was carried out from June to October 2022 in the Merauke District. Tools and materials used include insect nets, plastic rope, plastic bottles, aspirators, gauze, scissors, pipettes, sprayers, rice seeds and alcohol. This study used a randomized block design (RBD) consisting of 6 varieties with 3 replications. The varieties used were Nutrizinc, Mamberamo, Inpari 42, Inpara 2, Inpari 32 and Inpari Sidenuk. Each treatment was repeated 3 times so that 18 experimental plots were obtained. Plot area 3x3 m2, using a spacing of 20 x 20 cm. The green leafhoppers were collected in the afternoon using the double sweeping method for each sub-plot, while the brown planthoppers were collected using direct observation to count the BPH population in the plants.

## RESULTS

Population density Population density of brown planthopper pests on rice plants at 2 weeks and 4 weeks of age was highest in Inpari 32 (3.21 individuals) and lowest in Inpara 2 (0.9 individuals). At the age of 8 weeks after planting, the highest was in the Inpari 32 variety (3.5 individuals) and the lowest was in the Nutrizinc variety (0.8 individuals). Whereas at the age of 12 weeks the brown planthopper spread evenly in all varieties.

**Table 1. Population density of BPH at 2 weeks, 4 weeks, 8 weeks, 12 weeks with various rice varieties**

| Varieties | observation time | | | |
|---|---|---|---|---|
| | 2 weeks | 4 weeks | 8 weeks | 12 weeks |
| Nutrizinc | 1,2a | 2a | 0,8 a | 3,2 a |
| Inpari 42 | 1,3 a | 2,5 a | 0,9 a | 3,1 a |
| Mambramo | 1,05 a | 1,9 a | 1,05 a | 2,95 |
| Inpari 32 | 3,21 b | 3,5a | 1,3a | 3,21 a |
| Inpari sidenuk | 1,05 a | 2, 1 a | 1,05 a | 3,25a |
| Inpara 2 | 0,9 a | 1,9a | 1,05 a | 3,25a |

Note. Numbers followed by the same letters are not significantly different from Duncan's test at the 5% test level

The population density of green planthopper pests on rice plants in all plant varieties is spread evenly. At 2 weeks of age, green leafhoppers were found most in Nutrizinc and Inpari Sindenuk varieties (4 individuals), while at 4 weeks the lowest were in Inpari 32 and Mambramo varieties (3.5 individuals). At the age of 8 weeks, green leafhoppers were most commonly found in the Inpari 32 variety (1.2 individuals) and the lowest was the Nutrizinc variety (0.5 individuals). Meanwhile, at the age of 12 weeks, the highest number of green leafhoppers was in the Inpari sidenuk variety (0.7 individuals) and still below 1 individual per variety.

**Table 2. Density of green leafhopper populations at 2 weeks, 4 weeks, 8 weeks, 12 weeks of various rice varieties**

| Varieties | Observation Time | | | |
|---|---|---|---|---|
| | 2 weeks | 4 weeks | 8 weeks | 12 weeks |
| Nutrizinc | 4,0a | 3,9a | 0,5a | 0a |
| Inpari 42 | 3,9a | 3,9a | 0,9a | 0,4a |
| Mambramo | 3,8 a | 3,5a | 1a | 0a |
| Inpari 32 | 3,8a | 3,9a | 1,2a | 0,5a |
| Inpari sidenuk | 4,0a | 3,5a | 0,9 | 0,7a |
| Inpara 2 | 3,9 a | 3,9a | 1,1a | 0,5a |

Note. Numbers followed by the same letters are not significantly different from Duncan's test at the 5% test level

In the variety with the highest number of tillers, namely the Inpara 2 variety (6.73 tillers) with a plant height of 53.80 cm, an average of 1.56 individuals were found for brown planthoppers and 2.33 for green planthoppers. In the Inpari 42 variety with the number of tillers (5.16 tillers) with a height of 49.40 cm, 1.80 individuals of brown planthoppers were found and 2.23 individuals of green leafhoppers (Table 3).

**Table 3. Number of tillers, plant height and leafhopper population**

| Varieties | Rice tillers | Plant height (cm) | Brown planthopper (individual) | Green leafhopper (individual) |
|---|---|---|---|---|
| Nutrizinc | 5.87a | 51.47b | 1.80a | 1.99a |
| Inpari 42 | 5.16a | 49.40b | 1.95a | 2.23a |
| Mambramo | 5.78a | 50.67b | 1.51a | 2.08a |
| Inpari 32 | 5.69a | 43.87a | 2.80b | 2.24a |
| Inpari sidenuk | 5.36a | 57.13b | 1.84a | 2.35a |
| Inpara 2 | 6.73b | 53.80b | 1.56a | 2.33a |

Note. Numbers followed by the same letters are not significantly different from Duncan's test at the 5% test level

In Table 4 it can be seen that the highest number of grains per panicle is the Inpara 2 variety (1,650 grains), while the other varieties are almost evenly distributed and the fewest number of grains is the Inpari 32 variety (887 grains). While the highest number of empty grains was in the Inpara 2 variety (47.5 grains) and the least empty was in the Mambramo variety (28.9 grains).

**Table 4. Panicles and Empty Grains**

| Varieties | Panicles | Brown planthopper (individual) | Green leafhopper (individual) | Empty rice grains |
|---|---|---|---|---|
| Nutrizin | 1,232b | 1.80a | 1.99a | 37.5b |
| Inpari 42 | 1,324b | 1.95a | 2.23a | 41.2b |
| Mambramo | 1,418b | 1.51a | 2.08a | 28.9a |
| Inpari 32 | 887a | 2.80b | 2.24a | 39.3b |
| Inpari sidenuk | 1,542b | 1.84a | 2.35a | 38.9b |
| Inpara 2 | 1,650b | 1.56a | 2.33a | 47.5c |

Note. Numbers followed by the same letters are not significantly different from Duncan's test at the 5% test level

## DISCUSSION

Green leafhopper pests (*N. virescens*) usually attack plants in the vegetative stage, while in the generative phase the intensity of attacks begins to decrease (Sianipar *et al*, 2017). This is different from the brown planthopper (*N. lugens*) which can attack during the vegetative and generative phases. The increase in planthopper populations is strongly influenced by the biological characteristics of the pest itself, including personality, male/female ratio, migration and mortality. In addition, several factors include temperature, humidity, rainfall and wind. Plant varieties and cultivation techniques greatly influence the development of leafhoppers, including the use of insecticides. Excessive use of insecticides can result in a decrease in natural enemy populations (Trisnaningsih, 2015). Attacks by brown planthoppers and green planthoppers can hinder increased rice production, especially in endemic areas where frequent explosions occur (Baehaki and Mejaya, 2014).

Factors that affect the development and intensity of pest attacks are temperature, humidity and rainfall. In addition, the use of resistant varieties and the use of insecticides greatly affect planthopper populations in rice cultivation (Usyati *et al*, 2018). The spread of this disease can be minimized by vector control and land sanitation to reduce inoculum sources. Another control alternative that is environmentally friendly is the use of resistant varieties (Suprianto *et al*, 2016). Environmental factors, especially rainfall, greatly influence the dynamics of planthopper populations. Sari (2013) stated that when rainfall is above 600 mm, green leafhopper populations tend to decrease. Widiarta (2005), the peak population density of green leafhoppers is higher in the rainy season than the dry season. The environmental and physiological conditions of green leafhoppers during the rainy season are more favorable for the reproduction of these planthoppers. At the time the research was conducted during the rainy season so that the population of green leafhoppers in paddy rice plants was quite high. According to Sembel, (2011) the use of pest-resistant varieties is an important factor in pest control.

The use of superior plant varieties is now one of the government's programs to increase crop production, especially food crops and at the same time to prevent it plants from pests and diseases. Growth indicator is plant height, this is one of the factors that determine production. The difference in plant height is thought to be due to environmental influences and the genetic nature of the plants. High plant growth also does not guarantee high plant productivity, although plant height is a factor in plant selection. All varieties planted had plant heights above 50 cm, this indicated that the plants could make optimal use of sunlight falling on the leaf surface. This will have an impact on the rate of photosynthesis which can encourage better plant development (Saidah et al., 2015. The number of tillers of rice plants in the vegetative phase also determines the yield of rice plants. The number of tillers in planted varieties is generally relatively the same. Each variety has a number of maximum productive tillers because it is a genetic trait, although the number of tillers will always be influenced by environmental interaction factors Each variety has different characteristics thus showing different morphological diversity. The difference in the number of tillers of each rice variety in new cleared land depends on genetic traits and its ability to adapt in a new environment.The number of productive tillers has a direct effect on the number of panicles produced.The more productive tillers the higher the grain that will be obtained so that it will increase production (Endrizal and J. Bobihoe, 2010).

The number of tillers and plant height are thought to be closely related to insect populations and plant resistance factors. In general, the number of tillers and plant height affect the humidity of the environment around the plant. Many brown planthoppers and green leafhoppers are found on plants that have a high number of tillers and plants. In addition, the environmental factors of the surrounding plants, where there are still many swamps and forests, greatly affect the planthopper population. High levels of attack accompanied by plant death indicate the absence of mechanisms of antibiosis and tolerance (Sodig, 2009). In general, varieties that have large stem sizes are preferred by pests (Mustikawati, 2017). One of the factors that affect plant resistance is having trichomes and certain chemicals that insects don't like (Pasaru, 2011), thereby affecting the growth or laying of pest eggs (Hasibuan, 2009).

Environmental factors such as high rainfall and low temperatures are unfavorable for rice plants during anthesis (fully opened flowers) which will affect the full grain (Sutanto *et al*, 2013). The lower the empty grain presentation, the higher the filled grain presentation. The yield of rice production is a complex character that is influenced by genetic traits and is strongly influenced by environmental factors when the variety is planted. The ability to grow plants that lack nutrients and the presence of pests affects the amount of grain. Varieties that are able to adapt to the environment will produce a good amount of grain. Weather conditions at the time of flowering or filling greatly affect the grain weight of 1000 grains. This is because the amount of carbohydrates produced from photosynthesis will affect the shape, size and content of grain (Suharto, 2007).

The lowest total weight was found in the Inpari 42 variety. It is suspected that this variety lacks absorption of nutrients in the soil and adaptability to the environment and the influence of plant-disturbing organisms so that the results obtained are not optimal. This is in line with the statement by Dunggulo *et al* (2017) that the weight of grain is influenced by nutrients, temperature, humidity and genetic factors of the plant. Environmental factors are supporting factors to support the genetic properties of plant varieties. Grain weight is strongly influenced by the dry matter contained therein. The dry matter is the result of photosynthesis which is used for seed filling (Zainal et al, 2014). The weight of 1000 grains is a reflection of the dry weight accumulated on the grain (Bilman, 2008), and the size of the rice grain depends on the size of the husk (lemma and pallea). Zainal, et al (2014) also said that the height or weight of the seeds depends on how much dry matter is contained in the seeds. The dry matter in the seeds is obtained from the results of photosynthesis which can then be used for filling the seeds, the weight of 1000 grain seeds depends on the size of the lemma and pallea. Bilman (2008) emphasized that the weight of 1000 seeds is a reflection of the dry weight accumulated on the grain. In addition, the weight of 1000 seeds also reflects the size of the rice grain which depends on the size of the skin (*lemma and pallea*).

Rice production is strongly influenced by the genetic characteristics of these varieties and the environment that supports their growth, such as nutrients and climate. Growth differences and varieties are influenced by the ability of a variety to adapt to the environment in which the plant grows. To support the production and productivity of rice plants, it is necessary to use superior and quality varieties. Handoko *et al*., (2017) that rice production is determined by many important components including the number of panicles, number of tillers and filled grain. In general, the higher the number of filled grain per panicle, the lower the empty grain, the higher the productivity of rice plants. This is one of the factors that determine the success of a rice variety on a particular land. But this is also influenced by other factors such as plant resistance to pests and diseases. Aryana *et al*., (2015) stated that the number of filled grain per panicle was significantly related to plant yield but was strongly influenced by the number of empty grain. The results of the analysis showed significant differences in each of the filled grain varieties. It is presumed that the variety that has the highest number of filled grains is the variety that is able to absorb balanced nutrients and adapt to the environment in which it grows and is free from plant-disturbing organisms, so that it is capable of producing pithy panicles.

## CONCLUSION

Population density of brown planthopper pests on rice plants at 2 weeks 32 (3.21 individuals) and 8 weeks after planting (3.5 individuals). This is because the brown planthopper can attack in the vegetative and generative phases. The population density of green leafhopper pests on rice plants in all plant varieties was spread evenly and was most abundant in Nutrizinc and Inpari Sindenuk varieties (4 individuals) in the vegetative phase. Plant production was closely related to the number of seeds per panicle, the most being Inpara 2 (1,650 seeds) but having the most empty seeds among the five varieties tested (47.5 seeds).

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