Performance of Resistance of Rice Varieties Recommendation of Jember Regency to Brown Planthopper Pest (*Nilaparvata lugens* Stal.)

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Abstract. This study aims to determine the susceptibility and resistance response of Jember Regency suggested rice varieties from brown planthopper pest (*Nilaparvata lugens* Stal). The research used randomized block design (RAK). Differences between treatments were tested by DMRT at 5% level. The treatments in this study are using seven varieties of rice such as: treatment A (Sintanur), B (Cibogo), C (Ciherang), D (Inpari 13), E (Cigeulis), F (IR-66) and G (IR-64), each with three replicates. The results showed that the highest planthopper pest populations was on Sintanur variety with an average of 7.10 insects and intensity of attacks in the last observation by 34.07%. This parameter affects the number of productive tillers, grain weight and percentage of dry milled grain hollow. During the study, brown planthoppers preferred a young aged rice, whereas in the older age of the plant population, brown planthoppers were rarely found. The most resistant varieties of this research was the variety IR66 which has a low intensity of the attack on the last observation by 1.11% with a population of brown planthopper pest average of 6.36 insects. Thus, to inhibit the development of brown planthoppers population, Sintanur varieties are not recommended while other varieties can be planted in Jember regency.

1. Introduction

Rice is an agricultural commodity that is needed in Indonesia, because almost 90% are used as a main food source. The main obstacle in rice cultivation in Indonesia is the problem of brown planthopper pests which causes low rice production to cause crop failure [1]. Brown planthopper (*Nilaparvata lugens*) is a type of insect that has the potential as the most dominant pest attacking rice plants in Indonesia and Asia [2]. Planting resistant varieties can reduce the development of brown planthopper pests [3]. The causes of brown planthopper population explosion include the use of nitrogen fertilizer exceeding the dose, and the non-alternating planting period and insecticides [4].

Until now, farmers still rely on synthetic insecticides to overcome the problems caused by brown planthopper pests. According to [5], the use of synthetic insecticides can harm both the environment and human health. Therefore, other integrated control techniques are needed, both using natural methods such as the use or planting of resistant varieties [6].

Rice varieties that are often cultivated by farmers in Jember are Sintanur, Cibogo, Ciherang, Inpari 13, Cigeulis, IR-64, and IR-66. Among these varieties, resistance brown planthopper biotypes has not been
identified that attacked the research site or in the field. Therefore, this research needs to be done to
determine the resistance of rice varieties tested against brown planthoppers that attack at the study site.

2. Method
This research was conducted in Lembengan Village, Ledokombo District, Jember Regency. The research
took place from October 2016 to February 2017. The materials used were rice varieties: Sintanur, Cibogo,
Ciherang, Inpari 13, Cigelius, IR-64, and IR-66. The tools used are: insect nets, petri dishes, tweezers,
brushes, loops, keys to insect determination, microscope, glass beaker, raffia rope, meter, electric scales.

The study used a randomized block design (RBD) method consisting of seven rice varieties, namely: A
= Sintanur, B = Cibogo, C = Ciherang, D = Inpari 13, E = Cigelius, F = IR-66 and = IR-64 (control ).
Each treatment was repeated three times. Planting is carried out on paddy fields with a length of 21 m and
a width of 9 m. This rice field is divided into 21 plots, each plot measuring 2x2 meters. Planting distance
of 20x20 cm, distance between plots measuring 75 cm. Seed removal is done at the age of 25 days, each
planting hole is filled with one plant. Observation data will be analyzed and to distinguish differences
between treatments data were analyzed by variance (ANOVA) while to distinguish the mean between
treatments DMRT test was conducted at the level of 5%.

The parameters observed are:
1. The population of brown plant hopper (Nimpha population and Imago brown planthopper.) Observed at
the age of the plant after moving from the nursery (0 days), observation interval once a week.
2. Percentage of damage to plant leaves (%) by systematic random sampling on rice sample units.
   Determination of attack intensity (IS) is indirectly done by calculating the score of damage to plant parts
   by using a formula (Digilib, 2003):
\[ P = \frac{\sum (nv)}{ZxN} \times 100\% \]

Information:
P = Attack / Damage intensity
n = Number of examples observed for each damage category
v = Score score for each damage category
Z = The highest damage category score
N = Number of sample units observed

Observation of score scores for the intensity of attacks caused by brown plant hopper pests on each clump
of rice plants.
(a) Score of 0: No damage to the leaves of the plants observed
(b) Score 1: Very little damage
(c) Score 3: Most of the first and second leaves of the plant turn yellow in part
(d) Score 5: Yellow and dwarf plants or about 10-25% wilted plants
(e) Score of 7: More than half of the plants wither or die and the remaining plants are very stunted or dry
(f) Score of 9: All plants die (IRRI, 1985).
3. Rice Crop Performance by looking at the morphology of the leaves and stems of the tested rice plants
under a microscope.

3. Result and Discussion
3.1 Population of Brown Planthopper Pests Nilaparvata lugens. Stal on some rice varieties
The highest pest population at the age of 52 days was found in Sintanur variety rice plants, namely 13.00
head and the lowest was in Inpari 13 variety, which was 2.67. Furthermore, the highest population of
planthopper pests at the age of 66 days was found in Sintanur 6.0 insects and Ciherang 6.67 insects while the lowest population was in Cibogo variety which was 0.67 per clump. At the age of 73 hst equal to 66 hst, the highest population of planthopper pests was found in Sintanur 3.0 insects and Ciherang 3.33 insects while the lowest population was in Cibogo variety which was 0.33 per clump.

Population increase from 10 days to 24 days is very rapid, because brown plant hopper prefers rice plants in the vegetative phase or young age [7], brown planthopper is abundant in young plants because the tissue is still soft. In old age plants, the brown planthopper population is rarely found. This was presumed because the availability of food for brown plant hopper in rice plantations at generative age was less, so brown plant hopper moved or migrated to other fields looking for rice crops that were still young. In line with age, the population of brown planthopper pests which initially increased, gradually decreased in six varieties of rice plants.

The peak of population development in rice varieties observed, occurred at various ages, between 24 - 31 days. Based on [8], the economic threshold for brown plant hopper that has been determined is an average of 2 head per clump for rice plants aged less than 40 days and 5 per clump for rice plants more than 40 days after planting [9]. Thus, the leafhopper population in this study has exceeded the economic threshold at the age of 17-52 days, because the average population at the age of 17 days was 4.71 and up to 52 years old the population ranged above 7.38 heads. Cibogo variety (6.67 head) and Inpari 13 (5.67 head), had a population below the economic threshold at the age of 45 days, then IR64 (6.67 head) and Ciherang (5.33 insect) decreased at age 52 hst, IR 66 variety (4.33 insects ) and Cigeulis (4.33 insects) at the age of 59 hst, while the Sintanur variety (6.67 insects) the new population fell at the age of 66 hst.

Thus, in this study, varieties that have brown planthopper populations below the shortest economic threshold are Cibogo and Inpari 13, namely 28 days, then IR 64 and Ciherang 35 days, then IR 66 and Cigeulis 42 days, the longest are Sintanur varieties namely 49 days. Thus, to inhibit the development of brown planthopper populations, Sintanur varieties are not recommended for planting.

3.2 The intensity of the attack of the Brown Planthopper Pest Nilaparvata lugens. Stal
The treatment of IR64 variety has a low attack intensity of 3.70% on the last day of observation. The highest intensity of brown planthopper pest attack was on sintanur varieties with an attack intensity of 34.07%, and the lowest intensity of brown planthopper pest was IR66 with 1.11%. It is clear that sintanur varieties are varieties that are susceptible to brown planthopper pests. In addition to sintanur varieties, the Cigeulis variety has a criterion susceptible to brown planthopper pests, namely 31.48%. [10], the response of plants to pests and diseases caused by the most destructive brown planthopper pest damage to rice plants, according to the resistance assessment more than half of the plants wither and the plants become stunted or die, according to the symptoms caused in the field. research land. According to [11], damage to the rice plant network is caused by most of the reovirus in the planthopper is pathogenic and causes various symptoms in the host plant.

IR64 is more resistant than sintanur varieties, but more susceptible when compared to IR66 varieties. It was seen in the observation of 101 hst plant age, the intensity of the attack on IR66 varieties was the lowest with symptoms of leaves per clump of yellowing rice plants at the time of observation. This is also the tolerance of rice plants on brown plant hopper with its ability to recover or process the healing of rice plants after being damaged due to the attack of brown planthopper pests [12]. In this case, pests are present in rice plants, but the damage and losses can be minimized because of the ability of these varieties to repair (repair) and replace (damage) damage caused by brown planthopper pests, so that the plant can continue to grow again.
### Table 1. The Effect of Several Rice Varieties on the Population of Brown Planthopper Pests Nilaparvata lugens. Stal

| Treatment | Brown planthopper pest population | Average |
|-----------|----------------------------------|---------|
|           | 10 hst  | 17 hst  | 24 hst  | 31 hst  | 38 hst  | 45 hst  | 52 hst  | 59 hst  | 66 hst  | 73 hst  | 80 hst  | 87 hst  | 94 hst  | 101 hst |
| Ciherang  | 1.33 a  | 5.00 a  | 14.33 a | 15.00 a | 9.67 a  | 5.33 bcd| 3.33 a  | 6.00 a  | 3.33 a  | 2.33 a  | 1.33 a  | 0.33 a  | 0.00 a  |         |
| Cigeulis  | 1.00 a  | 4.00 a  | 16.67 a | 16.33 a | 11.33 a | 7.00 a  | 9.00 ab  | 4.33 a  | 4.00 ab  | 2.67 ab  | 2.33 a  | 2.33 a  | 1.00 a  | 0.00 a  | 5.86    |
| Sintanur | 0.33 a  | 6.67 a  | 21.33 a | 11.00 a | 10.67 a | 15.33 a | 13.00 a | 7.67 a  | 6.67 a  | 3.00 a  | 1.67 a  | 1.67 a  | 0.33 a  | 0.00 a  | 7.10    |
| IR66     | 1.67 a  | 4.00 a  | 18.33 a | 20.00 a | 12.33 a | 11.33 a | 10.67 ab | 4.33 a  | 3.33 abc | 1.33 abc | 0.33 a  | 0.67 a  | 0.67 a  | 0.00 a  | 6.36    |
| Cibogo   | 0.33 a  | 2.00 a  | 17.67 a | 11.00 a | 6.00 a  | 6.67 a  | 4.33 ed  | 1.67 a  | 0.67 c  | 0.33 c  | 1.00 a  | 0.33 a  | 0.00 a  | 0.00 a  | 3.71    |
| IR64     | 1.67 a  | 6.67 a  | 15.33 a | 12.67 a | 13.67 a | 8.67 a  | 6.67 abcd| 2.67 a  | 1.00 bc | 1.00 bc | 1.00 a  | 0.00 a  | 0.00 a  | 0.00 a  | 5.14    |
| Inpari 13| 0.67 a  | 4.67 a  | 14.00 a | 16.33 a | 9.00 a  | 5.67 a  | 2.67 d   | 4.67 a  | 1.00 bc | 1.00 bc | 1.00 a  | 0.00 a  | 0.00 a  | 0.00 a  | 4.48    |
| Rata-rata| 1.00    | 4.71    | 16.81   | 14.71   | 11.14   | 9.19    | 7.38     | 4.10    | 3.24    | 1.90    | 1.43    | 1.19    | 0.33    | 0.00    |

Remarks: Numbers followed by the same letter in the same column are not significantly different at the 5% level on the Duncan Multiple Range Test (DMRT).

### Table 2. Effect of Several Rice Varieties on the Intensity of Brown Planthopper Pests Nilaparvata lugens. Stal

| Treatment | Intensity of brown planthopper attacks | Average |
|-----------|--------------------------------------|---------|
|           | 10 hst  | 17 hst  | 24 hst  | 31 hst  | 38 hst  | 45 hst  | 52 hst  | 59 hst  | 66 hst  | 73 hst  | 80 hst  | 87 hst  | 94 hst  | 101 hst |
| Ciherang  | 0.00 a  | 1.85 a  | 7.40 a  | 9.99 a  | 14.81 a | 12.22 a | 11.18 a | 7.11 abc | 8.52 ab | 11.11 abc | 12.59 ab | 13.33 ab | 19.26 ab | 20.74 ab | 10.72 |
| Cigeulis  | 0.00 a  | 0.37 a  | 5.56 a  | 10.73 a | 11.85 a | 8.14 a  | 5.92 a  | 11.48 ab | 14.81 a | 15.92 ab  | 22.22 a  | 22.59 a  | 30.00 a  | 31.48 a  | 13.65 |
| Sintanur | 0.00 a  | 1.11 a  | 6.66 a  | 8.14 a  | 10.73 a | 13.70 a | 12.96 a | 15.18 a | 14.07 a | 19.62 a  | 22.22 a  | 23.70 a  | 28.87 a  | 34.07 a  | 15.08 |
| IR66     | 0.00 a  | 0.74 a  | 3.70 a  | 6.85 a  | 7.77 a  | 8.88 a  | 7.03 a  | 2.59 c  | 0.74 b  | 1.11 c  | 1.11 b  | 1.11 b  | 1.11 b  | 3.13    |
| Cibogo   | 0.00 a  | 0.00 a  | 2.22 a  | 5.55 a  | 4.07 a  | 6.66 a  | 4.44 a  | 2.96 bc | 2.96 ab | 3.70 b  | 5.18 b  | 3.70 b  | 3.70 b  | 3.52    |
| IR64     | 0.00 a  | 1.85 a  | 8.51 a  | 10.00 a | 12.22 a | 7.77 a  | 5.92 a  | 2.59 bc | 0.37 b  | 0.37 c  | 1.85 b  | 2.96 b  | 3.70 b  | 3.70 b  | 4.42    |
| Inpari 13| 0.00 a  | 1.11 a  | 8.51 a  | 8.88 a  | 7.40 a  | 7.40 a  | 5.92 a  | 9.25 abc | 1.48 b  | 7.03 abc | 8.51 ab  | 3.33 b  | 4.81 b  | 4.81 b  | 5.60    |

Remarks: Numbers followed by the same letter in the same column are not significantly different at the 5% level on the Duncan Multiple Range Test (DMRT).
Cibogo and IR64 varieties have the same low intensity of attack that is 3.703%, and the Inpari 13 variety is 4.813%. According to the initial description, the variety is a variety of rice plants with a rather resistant criteria with the characteristics of the first yellow and first few leaves when observed on the ground. So this level of resistance becomes resistant [13]. Because IR64 is more resistant compared to Sintanur varieties, it is more susceptible when compared IR66.

Commonly, varieties that are sensitive to brown plant hopper are which hair or hair on the torso are rare or few but rather long and between long hairs there are also small, relatively dense small feathers. In resistant rice cultivars have a variety of feathers or hair but are generally longer and more abundant in the leaves and stems of rice plants [14]. Coarse fiber on the leaf and stem surface of rice varieties tested in accordance with the description of varieties according to [15] is that each variety has a rough leaf and stem surface on resistant varieties while in varieties susceptible to leaf surfaces and rather rough rod. In IR66 varieties tend to have coarse stem walls and this is also the same in IR64 varieties, whereas in Sintanur varieties have rather coarse stems and large stems and the presence of cavities in the stem.

3.3 Performance of Resistance to Seven Test

Table 3. Performance of Tested Resistance of Rice Varieties

| Varietis Padi | The average population of brown planthopper pests (ekor) | Average Intensity of Brown Planthopper Attack (%) | Heavy Grain Dry Grain (g) | Morphological Performance | Conclusion of Resilience |
|---------------|--------------------------------------------------------|---------------------------------------------------|---------------------------|--------------------------|-------------------------|
| Ciherang      | 5.93                                                   | 10.72                                             | 425.00 c                  | The surface of the stem and leaves is rough | rather vulnerable       |
| Cigeulis      | 5.86                                                   | 13.65                                             | 483.33 c                  | The surface of the stem and leaves is rough | susceptible             |
| Sintanur      | 7.10                                                   | 15.08                                             | 375.00 c                  | There is no stem hair or rarely seen with a microscope 10x magnification | vulnerable or sensitive |
| IR66          | 6.36                                                   | 3.13                                              | 1475.0 a                  | Stem hairs do not exist or are rarely seen with a microscope 10x magnification | Tolerant                |
| Cibogo        | 3.71                                                   | 3.52                                              | 1216. 7 a                 | The surface of the stem and leaves is rough | Antixenoksis            |
| IR64          | 5.14                                                   | 4.42                                              | 1266.7 a                  | There are rod hairs seen with a microscope 10x magnification and rough surface of the stem and leaves | Antixenoksis            |
| Inpari 13     | 4.48                                                   | 5.60                                              | 833.33 b                  | The surface of the stem and leaves is rough | Antixenoksis            |

Remarks: Numbers followed by the same letter in the same column are not significantly different at the 5% level on the Duncan Multiple Range Test (DMRT)
In rice varieties that are resistant to brown planthopper biotypes, three have the highest silica content and in varieties that are resistant to planthopper biotypes, one and two has little silica content meaning that the most silica content in rice plants has hard and stocky stems causing activity, especially feeding brown planthopper is disturbed and resistant to brown plant hopper [16].

In accordance with the description of varieties about pest resistance, it can be inferred that Sintanur varieties are sensitive to brown planthopper biotype 3, so that the population and intensity of brown planthopper pest attack is the largest in Sintanur variety, Cigeulis variety which is pest resistant ie brown plant hopper biotype 3 and ciherang variety which is somewhat resistant against biotype 3 planthopper, while in IR66 and inpari 13 varieties, pest resistance was resistant to brown planthopper biotypes 1, 2 and 3 so that the population and intensity of brown planthopper pest was the lowest. The population and intensity of brown planthopper pests in all rice varieties tested affected rice growth and production.

Plant varieties that are resistant to pests and diseases have a group of factors contained in plants and obtained naturally, while their nature is to reject, prevent or tolerate attacks by pests and diseases. Factors that control the nature of resistance include physical, chemical, anatomical, physiological and genetic factors [16]. Antixenosis is the insect's preference for mechanical factors derived from the physical structure and surface properties of plants. The structure and physical properties of the surface of the plant include, thickness of the skin, length and dense hairs on the surface of the leaf, the size of the stomata and the thickness of the cuticle layer. The insect's preference for mechanical factors is closely related to the structure of the tools and the way to take food and lay eggs held by insects.

The mechanism of resistance in the seven varieties of rice plants tested showed that the Inpari 13 variety, Cibogo and IR 64 showed antixinoxic resistance which means that the three varieties contained morphological resistance which did not benefit the brown planthopper pests in the test plants, namely the presence of long and hard fur and the surface of the stem and coarse leaves that inhibit the way of eating, the feathers are found on the leaves and stems that are seen using a 10x magnification microscope on the IR 64 variety, and can be seen in the population, the intensity of the brown planthopper pest attack is low.

In Sintanur, Cigeulis and Ciherang varieties showed the population and intensity of large brown planthopper pest attacks and also the yield of milled dry grain weight per low experimental plot, this was due to the morphological resistance of the three varieties, Sintanur, Cigeulis and Ciherang, which were very low. Sintanur varieties which have no or rarely found hair on the stem seen with a 10x magnification microscope as well as on the rather rough surface of the stem and leaves.

In IR 66 varieties which showed a high population of brown planthopper pests, the lowest intensity of brown planthopper pests and the yield of milled dry grains per experimental plot were the highest compared to the production of other varieties. This is because the resistance of IR 66 varieties shows tolerant resistance which means tolerant is one of the properties possessed by plants that can heal themselves from damage to pest attacks, although the number of pests that attack amounts to the same as those that attack IR 66 varieties, the presence of feathers on the stems and leaves and the rough surface of the stem and leaves (table 3).

4. Conclusion
Treatment of IR66 and IR64 (control) varieties had low attack intensity and Sintanur varieties had high attack intensity, so it was known that sintanur varieties were susceptible varieties when compared to controls. 2. High in the number of productive tillers, the weight of dry milled grain and the percentage of empty grain on Sintanur varieties is lower when compared to other varieties and also control.

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