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Rice Leaf Folder (*Cnaphalocrosis medinalis)* Infestation at Different Planting System and Varieties

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ABSTRACT

The proliferation of pests is mostly influenced by the host plants and other environments including planting distance and humidity. Agriculture research and development departments have released many varieties of rice but their resistance to pests and diseases in various developmental areas are different. The study aims to determine the population and damage intensity of the rice leaf folder (RLF) (*Cnaphalocrosis medinalis*) on farming rice jajar legowo ganda and regular systems (tegel). The study used a Split plot research design with four replications. The results showed that the RFL damage all varieties in both systems. However, the RLF damage on the farming rice jajar legowo ganda was at average of 7.96 %, lower than that on regular system with damage average of 9.35 % per week. The intensity of the RLF attacks on Inpari 31 was at average of 5.56 %, lower than Situbagendit with damage average of 13.43 %. The result showed that the highest populations *Cnaphalocrosis medinalis* was found in the regular system with an average of 9.35 h / c, while the lowest in the rice farming '*jajar legowo ganda'* with an average of 7.96 h/c. The highest populations of *Cnaphalocrosis medinalis* were found in Situbagendit variety, while the lowest in Inpari 30. The intensity of *Cnaphalocrosis medinalis* incidence increased with rice age, while the population density decreased because of the chemical control. Jajar legowo system combined with suitable varieties such as Inpari 30 was effective in reducing damage intensity rates and population of *Cnaphalocrosis medinalis.*

INTRODUCTION

Increasing rice productivity can use new superior variety (NSV) seeds with high yield potential (Husnain et al. 2016). This rice variety was developed with the aim of producing new varieties having characteristics suitable for lowland rice typology, high productivity, pest resistance, and good taste. The new superior varieties have contributed significantly to increasing rice production. The contribution of these new improved varieties to national rice production reaches 56%, while the interaction between irrigation water, improved varieties, and fertilization to increase rice production contributes up to 75% (Syahri and Somantri 2016). The research and development agencies have released many superior rice varieties, but their productivity and pest resistance in each region are different (Saleh and Hipi, 2019).

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One of the obstacles in rice cultivation is a pest damage, especially the rice leaf folder (RLF) (*Cnaphalocrosis medinalis*). The RLF was previously considered a minor pest. The significant increase in population occurred in the 1980s, making *Cnaphalocrosis medinalis* one of the main pests of rice plants in Indonesia and in other South Asian countries. Loss of yield due to this pest reaches 30 to 80% (Nanda et al., 1990; Gangwar, 2015).

The leaf folder damages the crop in its larval stage. The young larvae feed on open leaves but later feed inside the rolled leaf formed by folding the leaf longitudinally with a sticky substance. The larvae chew inside the fold by scraping the green matter. The scraped leaves become membranous, turn whitish and finally wither. A single larva can damage a number of leaves. This activity disturbs the photosynthesis and plant growth and ultimately yield is reduced (Sulagitti et al., 2017). The relative abundance of rice leaf folder varied with the rice seasons, especially depending on the relative humidity of the environment (Rahayu, 2012). The development of a pest's life span depends on environmental conditions. Low temperature can prolong egg stage; on the other hand, high temperature shortens egg stage. Another factor that affects the RLF population is the use of nitrogen at high doses (Pracaya, 1991).

The jajar legowo ganda planting system is one of the components of integrated rice management (IRM) (Figure 1). It is a row of plants interspersed with 1 empty row at the edge of the half-row plant spacing in the middle row with the benefit of increasing production, increasing plant population, facilitating maintenance including fertilization and pest control (BPTP, 2013). It is an effective and efficient method for rice cultivation (Saeroji, 2013). Generally, pest infestation will increase when rice varieties cultivated in tight space conditions due to high humidity and lack of sunlight intensity. Planting with wide spacing results in better rice performance than those with narrow spacing (Abdulrachman et al. 2013).

The application of the jajar legowo ganda system with selected new superior varieties can provide the best solution in reducing the population and intensity of *Cnaphalocrosis medinalis* infestation. This study aims to determine the most suitable planting system and varieties to reduce the intensity of *Cnaphalocrosis medinalis* infestation.

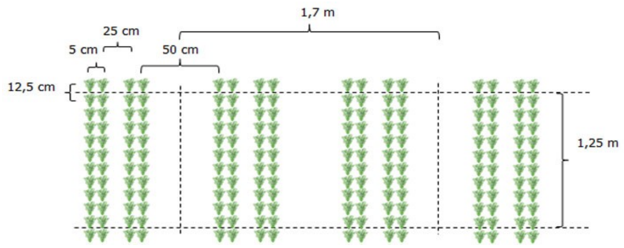

Figure 1. Layout of Jajar Legowo Ganda System

MATERIALS AND METHODS

The research was conducted in Buntulia Village, Duhiadaa District, Pohuwato Regency from July to October 2019. The land was harrowed and the seeds were sown for 21 days, transferred to rice field on 21 days. spacing 5 cm x 12.5 x cm, plant rows 25 cm apart and every two rows of plants interspersed with rows of 50 cm. The dose of fertilizer in the treatment was 250 kg / ha of urea, 150 kg applied at the beginning of planting, 50 kg ha^{-1} at 21 days after sowing (DAS), and 50 kg at 45 DAS. Super Phosphate 36 at 150 kg ha^{-1} and KCl at 100 kg ha^{-1} were applied at the beginning of planting. Crop management included controlling weeds, controlling pests and diseases using the concept of integrated pest control (IPM).

The research design used a plot with four replications. The main plot consisted of jajar legowo ganda and regular systems, while the subplots were varieties consisting of Inpari 30, Inpari 31, Inpari 42, and 4 Situbagendit. The observation was made on intensity of *Cnaphalocrosis medinalis* carried out at 30 clumps per plot at plant ages of 5, 7, 9, and 11 WAS. Data analysis was performed with ANOVA for all major data. When treatment differences were observed, the test continued with the Duncan Multiple Range Test (DMRT) at the 5% significance level for mean separation (Gomez and Gomez, 2007). The intensity of *Cnaphalocrosis Medinal* infestation was

Table 1. Effect of planting systems on C*naphalocrosis medinalis* infestation intensity

Planting Systems	Observations								Average
	5 WAS		7 WAS		9 WAS		11 WAS		
Jajar Legowo	4.81	b	7.04	b	8.15	b	11.82	a	7.96
Regular	6.02	a	8.33	a	10.18	a	12.87	a	9.35
CV (%)	5.77		6.70		9.07		10.28		

Note: Numbers followed by the same letter in the same column are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level

calculated by following the formula (Direktorat Perlindungan Tanaman, 2018):

Damage scale of *Cnaphalocrosis medinalis* (Direktorat Perlindungan Tanaman 2018):

$$I = \frac{\Sigma(nixvi)}{(NxV)} \times 100\%$$

Note:
I = attacks intensity
ni = sample with damage on scale vi
vi = scale of damage
N = Plants Observed
Z = Highest Damage Scale

1 = infestation intensity / damage less more than 25%
2 = infestation intensity/damage between 25 - 50%
3 = infestation intensity/damagebetween 50 - 75%
4 = infestation intensity/damage > 75%

Populations observation of *Cnaphalocrosis medinalis* by taking larva on leaf rolls sample. larva populations calculated by formula (Direktorat Perlindungan Tanaman, 2018):

$$P = \frac{a}{b}$$

where:
P = populations
a = larvae's founded on sample
b = number of observations

RESULTS AND DISCUSION

The intensity of *Cnaphalocrosis medinalis* infestation increased with increasing plant age (Table 1). Young plants have relatively small leaves, so this was likely to cause high sunlight intensity around the plant. The high intensity of sunlight caused the temperature to increase, causing the population of *Cnaphalocrosis medinalis* in plants at 5 and 7 WAS to be low.

The results showed that the regular system had a higher *Cnaphalocrosis medinal* infestation rate than the '*jajar legowo ganda'* system. The intensity of *Cnaphalocrosis medinal* infestation in each phase of observation tended to increase in each week of observation. The highest infestation intensity (12.87%) occurred in the regular system at 11 WAS. The jajar legowo ganda system had a significantly lower effect on the intensity of *Cnaphalocrosis medinal* infestation compared to the regular system. Abdulrachman et al. (2013) stated that the jajar legowo ganda system has a wider space between the two groups of lines so that humidity reduced, the air temperature between plants remained optimal, thereby reducing the intensity of infestation.

Observations on larvae of *Cnaphalocrosis medinalis* showed that the highest population was observed in the regular system with an average of 11.32 hours / c and the lowest in the jajar legowo row ganda system with an average of 7.28 hours/c. The mean population of *Cnaphalocrosis medinal* larvae in each week was presented in Table 2. It showed that the *Cnaphalocrosis medinal* larvae population tended to be lower in the jajar legowo ganda system. In this system, more sunlight occurred, causing a decrease in air humidity and an increase in air temperature. This caused the life cycle of the *Cnaphalocrosis medinal* larvae to be disrupted. Rahayu (2012) stated that a dense planting system caused the development of *Cnaphalocrosis medinalis* to be faster. This high plant density served as a good place for the larvae to avoid sunlight or hide from predators. In addition, *Cnaphalocrosis medinalis* multiplied rapidly in the moist and low air temperature ecosystems (Baehaki, 2011) .

Table 3 showed that the intensity of *Cnaphalocrosis medinalis* infestation fluctuated. The egg-laying behavior of *Cnaphalocrosis medinalis* imago was different for each rice variety. Imago *Cnaphalocrosis medinalis* only

Table 2. Effect of planting systems on *Cnaphalocrosis medinalis* larvae population.

Planting Systems	Observations								Average
	5 WAS		7 WAS		9 WAS		11 WAS		
Jajar Legowo	8.00	b	9.70	b	6.17	b	5.23	a	7.28
Regular	10.03	a	13.60	a	14.74	a	6.89	a	11.32
CV (%)	9.25		15.85		17.24		38.53		

Note: Numbers followed by the same letter in the same column are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

laid eggs on selected variety (Baehaki, 2013). The results showed that the infestation intensity in Situbagendit was higher than the other varieties, especially at the age of 11 WAS. The intensity of infestation in Inpari 30 was lower than the other varieties at the age of 5 to 11 WAS and was significantly different from all varieties. The Inpari 30 variety was resistance to *Cnaphalocrosis medinalis* infestation because it is well adapted in moist ecosystems and irrigated rice fields with abundant water.

Table 4 showed that the highest population of larvae of *Cnaphalocrosis medinalis* (11.67 hours / c) was found in the Situbagendit variety and the lowest (7.26 hours/c) in the Inpari 30 variety. The Situbagendit variety had relatively more leaves than other varieties. The Situbagendit variety was thought to have the nutrients needed for the growth of Cnaphalocrosis medinalis. According to Slansky and Rodriguez (1987), normal growth of larvae occured if their nutritional needs were met from the host or food source. Meanwhile, the Inpari 30 variety, although the availability of food was abundant, the nutritional content required for *Cnaphalocrosis medinal* was insufficient.

The data in Table 5 showed that the intensity of *Cnaphalocrosis medinalis* infestation in the Inpari 30 variety planted on 'jajar legowo ganda' was an average of 4.72% and the regular system was 6.39% lower than other varieties. The highest infestation was found in the Situbgendit variety planted with the regular system (15.09% on average) and in the jajar legowo ganda system (11.76%), but the jajar legowo ganda system was still superior to the regular system in terms of resistance to *Cnaphalocrosis medinal* damage. This indicates that the intensity of *Cnaphalocrosis medinalis* infestation on all

Table 3. Effect of varieties on infestation intensity of *Cnaphalocrosis medinalis*

Varieties	Observations								Average
	5 WAS		7 WAS		9 WAS		11 WAS		
Inpari 30	2.97	d	5.00	c	6.48	c	7.78	c	5.56
Inpari 31	4.81	c	7.22	b	9.07	b	11.11	cb	8.05
Inpari 42	5.56	b	6.48	b	5.93	c	12.35	b	7.58
Situbagendit	8.36	a	12.04	a	15.18	a	18.15	a	13.43
KK (%)	11.58		11.42		13.80		27.11		

Note: Numbers followed by the same letter in the same column are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

Table 4. Effect of varieties on of *Cnaphalocrosis Medinalis* larvae population.

Varieties	Observations								Average
	5 WAS		7 WAS		9 WAS		11 WAS		
Inpari 30	6.67	c	10.87	b	7.53	c	3.96	b	7.26
Inpari 31	10.27	a	12.07	ab	9.74	b	5.05	b	9.28
Inpari 42	8.47	b	10.47	b	9.73	b	7.25	a	8.98
Situbagendit	10.67	a	13.20	a	14.80	a	7.99	a	11.67
KK (%)	11.20		15.39		12.24		33.19		

Note: Numbers followed by the same letter in the same column are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

varieties grown on ‘jajar legowo ganda was lower than all varieties grown in the ordinary system. The infestation rate of *Cnaphalocrosis medinal* was influenced by various factors such as the environment, cultivated rice varieties, planting systems, and maintenance (Saleh and Hipi 2018). The jajar legowo ganda system made controlling pests and diseases in rice fields easier and provided economic benefits when applied with standard operating procedures.

The population of *Cnaphalocrosis medinalis* larvae in all varieties and cropping systems fluctuated. It increased at the age of 5 WAS because the number of plant leaves increased with the age of the plant. The highest infestation occurred in Inpari 31 variety which was planted regularly (11.43 hours/c). The flag leaves in the Inpari 31 variety were wide and this created high humidity. This condition made the larvae relatively easier to roll the leaves and favorable to thrive in this condition.

The population of *Cnaphalocrosis medinalis* larvae at the age of 11 WAS tended to decrease in all varieties, except for Inpari 42, which population continued to increase. This might occur because the population of *Cnaphalocrosis medinalis* imago from other varieties spread and infested the Inpari 42 variety. Table 6 showed that the jajar legowo ganda system had a significant effect on the its larvae population. The jajar legowo ganda system allowed high sunlight intensity which could change the body of adult insects morphology including body development, wing development and decrease in reproductive ability (Tangkilisan *et al*., 2013).

CONCLUSIONS

The jajar legowo ganda system was effective in reducing the infestation intensity and population of *Cnaphalocrosis medinal*. It increased sunlight intensity and temperature, lowered air humidity, and made plant maintenance easier. Suitable varieties could be used to reduce the infestation intensity and the population of *Cnaphalocrosis medinalis*. Generally, *Cnaphalocrosis medinalis* selected the most preferred variety as a host and a food source. Inpari 30 variety had a resistant characteristic to the infestation intensity of *Cnaphalocrosis medinalis* in both cropping systems. Inpari 30 had a suitable agronomic appearance such as an upright flag leaf and was suitable for moist ecosystems.

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