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The Effect Of Frequency Tuba Root Extract Applications (*Derris elliptica* Benth.) On The Pest Of Brown Planthopper (*Nilaparvata lugens* Stal.) in Rice Plants (*Oryza sativa* L.)

Nurjayanti[1], Rusli Rustam[1], Hafiz Fauzana[1]
Universitas Riau, Kampus Bina Widya KM 12,5, Simpang Baru, Kecamatan Tampan,Kota Pekanbaru, Riau
email: nurjayanti77@gmail.com

ABSTRACT

Rice plants are plagued by the brown planthopper (Nilaparvata lugens Stal.). Synthetic pesticides are commonly used in pest control, which have negative consequences such as secondary pest explosions, resistance, natural enemy death, revival, and contamination. As a result, a pest-control alternative is required, namely the use of vegetable pesticides derived from tuba roots (Derris elliptica Benth.). The study's goal was to see how effective tuba root extract combined with organic solvents was at controlling brown planthoppers on rice plants in greenhouses at various spraying intervals. Plant Pest Laboratory and Technical Implementation Unit for Experimental Gardens, Postgraduate Agricultural Sciences, Faculty of Agriculture, Riau University, conducted the study. To acquire 20 experimental units, the investigation was conducted experimentally utilizing a Completely Randomized Design (CRD) with four treatments and five replications. Without spraying tuba root extract, spraying tuba root extract 1x1 week, 1x2 weeks, and 1x3 weeks were the treatments used. Spraying tuba root extract once a week was the most effective interval, as it reduced the brown planthopper nymph population to 38.20 imagos per clump, the imago population to 31.80 individuals per clump, and the attack intensity to 24 percent.
Keywords: *Brown Planthoppers, Rice Plants, Tuba Roots*

1. INTRODUCTION

Indonesians eat rice as their primary source of nutrition. Every year, as the world's population grows, the need for rice grows as well. As a result, rice plant output must be maintained to fulfill the needs of Indonesians in diverse places. Riau is one of Indonesia's rice-producing provinces. According to the Riau Province Central Statistics Agency (2019), the rice harvested area in 2018 was 93,755 ha, with a productivity of 3.90 tons/ha and a GKG production of 365.293 tons.

The challenges farmers confront in producing high grain yields are becoming more diverse, with pest infestations being one of them. The brown planthopper is a pest that attacks rice (*Nilaparvata lugens* Stal.).

Rice plants are plagued by brown planthoppers, which are a severe pest. Rice plants are attacked by brown planthoppers during all stages of

development, from seedling to harvest. These pests cause direct harm by piercing and draining plant fluids from the phloem tissue (Saxena and Barrion, 1983), lowering chlorophyll and leaf protein content, and slowing photosynthesis (Iswanto et al., 2015). (Watanabe and Kitagawa, 2000). Plants that are affected turn yellow, wilt, and eventually die from hopperburn or dry death (Baehaki and Mejaya, 2014). The brown planthopper also serves as a vector for the transmission of grass dwarf and hollow dwarf diseases, which can do even more damage than the brown planthopper itself (Wagiman et al., 2011; Baehaki, 2012).

The attack of four imago brown planthoppers per clump of rice during the tillering period for 30 days can reduce yields by 77 percent, 37 percent during pregnancy, and 28 percent during fruit ripening (West Java Agricultural Technology Research Center, 2010). In 2015, the area affected by brown planthopper attacks, particularly in Riau Province, reached 77.2 ha (Rustam, 2016).

Chemical pesticides are a common method of control. Continuous and indiscriminate use of chemical pesticides has undesirable consequences such as pollution, secondary pest explosions, natural enemy death, resistance, and resurgence (Untung, 2000). Given its negative consequences, it is vital to have alternate options for more environmentally friendly pest control, such as the use of plant-based insecticides (Dadang and Prijono, 2008). Tuba root (Derris elliptica Benth.) is one of the plant species that has the potential to be used as a vegetable pesticide (Hien et al., 2003).

The tuba root plant is a member of the Fabaceae (Leguminosae) family, and its leaves, roots, and twigs contain insecticidal properties (Rahmawasiah, 2017). Tuba roots contain active chemicals such as dehydrotenone, dequelin, elliptone, and rotenone (Yoon, 2006). The rotenone component in tubal roots ranges from 0.3 to 12 percent (Kardinan, 2004). Because it is a contact poison and stomach poison against insect pests, this rotenone compound is commonly reported in agriculture as an insecticide (Isman, 2006). (Kardinan, 2004).

Crude extracts of plant materials obtained with organic matter are tested at quantities of no more than 1% (1 g/100 ml). Meanwhile, no more than 100 g of plants per liter of water should be used in water extracts (Dadang and Prijono, 2008). Several research findings have been made public. The application of tuba root extract at a concentration of 75 g/l of water was able to suppress Oryctes rhinoceros larvae with a total mortality of 82.5 percent, according to Akbar and Rustam's research (2019). Tuba root extract in ethanol solvent killed 50% of Periplaneta americana in 6.505 hours at a concentration of 3 g/100 ml, according to Kinansi et al. (2018).

The maceration method is used to make vegetable pesticides, which attempts to obtain plant extracts using several solvents, one of which is methanol, which intends to speed up the process of extracting extractive chemicals from these plants. Methanol has the advantage of having a lower boiling point, which allows it to be easily evaporated at lower temperatures, according to Atun (2014). According to Sihombing et al. (2013), the highest amount of extractive

chemicals in tuba roots was obtained from methanol solvent at 206.4 g (13.76 percent), while the lowest content was obtained from chloroform solvent at 163.2 g. (10.88 percent).

As a result, research and investigations on "The effect of the frequency of application of tuba root vegetable insecticides (Derris elliptica Benth.) with organic solvents against brown planthoppers (Nilaparvata lugens Stal.) on rice plants" have been carried out (Oryza sativa L.). The study's goal was to see how effective tuba root extract combined with organic solvents was at controlling brown planthopper pests on rice plants in greenhouses at various intervals and spraying frequency.

2. MATERIALS AND METHODS

From July to December 2019, the research was conducted at Riau University's Plant Pest Science Laboratory and the Technical Implementation Unit for Experimental Gardens, Bina Widya Campus JL. Bina Widya Simpang Baru Village, Tampan District, Pekanbaru City, Riau Province.

Rice seeds of the IR42 type, brown planthopper imago, manure, tuba root extract, methanol, water, sterile distilled water, and 1000 ml plastic cups were utilized as the materials.

Analytical balance, rotary evaporator, thermohygrometer, stir bar, Walt Men filter paper, 26 x 20 cm container, 500 ml hand sprayer and 1000 ml erlemeyer, label paper, aspirator, knife, filter, scissors, gauze, tissue rolls, camera, and stationery were among the items used in this investigation.

To acquire 20 experimental units, the investigation was conducted experimentally utilizing a Completely Randomized Design (CRD) with four treatments and five replications. The treatments were as follows: no spraying tuba root extract, 1x1 week, 1x2 weeks, and 1x3 weeks of spraying tuba root extract. There are various steps to the research implementation, including:

a. Preparation of rice seeds

Rice seeds that have been planted are kept for 30 days before being placed in a 150x100 centimeter lid. Fertilization and weeding are two things that need to be done on a regular basis. Rice plants were fertilized with 200 kg urea per hectare, 100 kg TSP per hectare, and 75 kg KCl per hectare.

b. Brown planthopper preparation

Propagation continued until an imago of one day old was obtained. Propagation continues until the F2 generation is reached (within 2 months).

c. Production of extracts

A magnetic stirrer was used to stir the tuba root flour extract and methanol in a 1:4 ratio for 6 hours, then macerated (soaked) for 24 hours. To produce 100 percent tuba root extract, it was also filtered using a Buchner funnel with filter paper and the filtrate was evaporated using a rotary evaporator at 78°C. For treatment, the extraction findings were diluted again with distilled water.

d. Use of insecticides on vegetables

Each 30-day-old rice plant in a greenhouse was infested with up to 10 brown planthopper imago using an aspirator and left for 12 hours before treatment. The tuba root extract was applied at a concentration of 1%.

The following are the parameters that were observed:

a. Population of nymphs

Following the application of tuba root extract with organic solvents, the population of brown planthopper nymphs

was monitored every 24 hours. Visual in situ on each rice plant is the method employed.

b.Imago population

c.Attack intensity

Observation of attack intensity was carried out once a week. The formula used according to Natawigena (1993) is:

$$I = \frac{\sum(ni \times vi)}{Z \times N} \times 100\%$$

Description:

I = Attack intensity (%)

Ni = number of plants from each attack category (i = 0-9)

vi = Scale value of each attack category (i = 0-9)

Z = The scale value of each category of the highest attack

N = Number of plants observed

Table 1. Attack Intensity Grouping Scale

Scale	Damage symptom
0	No symptoms of attack
1	Plant slightly yellowed
3	Some of the first and second leaves turn yellow
5	Yellowing leaves, stunted or wilted growth, 20-25% stunted
7	More than half of the plants are wilted or the plants are very stunted
9	Complete wilting, dead plant

Source: International Rice Research Institute (2002)

Table 2. Categories of Pest Attacks on Plants.

Attack intensity	Category
0%	Not affected
<25%	Very light intensity
>26-50%	Light intensity
>51-75%	Moderate intensity
76%	Weight intensity

Source: Directorate of Food Crop Protection (2008).

3. RESULTS AND DISCUSSION

Nymph population

The results of observations on the population of brown planthopper nymphs with the application of tuba root vegetable insecticides with different spraying intervals caused different averages for each treatment. The population of brown planthopper nymphs can be seen in Figure 1.

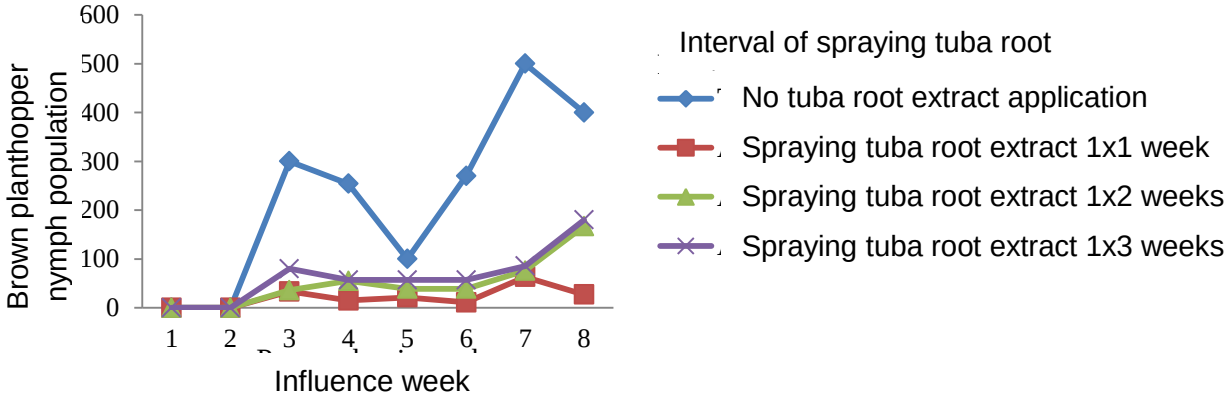


Figure 1. Population of brown planthopper nymphs after application of tuba root extract spraying

Figure 1 demonstrates that there were no brown planthopper nymphs in the first and second weeks of observations. In the third week, new brown leafhopper nymphs emerge. Because the brown planthopper was still in the imago and egg stages in the first and second weeks, the nymphs only arrived in the third week. This is due to the brown planthopper's developmental stages, which range from egg to nymph to imago, each with its own age. Brown

planthopper imago lays eggs in groups of 3-21 eggs and hatches in 7-11 days, according to Baehaki and Widiarta (2010). The eggs hatch into nymphs, who have a lifespan of 12 to 15 days (Sogawa, 1971). Nymphs become imago, while white brown nymphs become blackish brown imago (Wirajaswadi, 2010). Meanwhile, imago's average age is 12.82 days (Sianipar et al., 2015).

Spraying tuba root extract at different intervals caused the population of brown planthopper nymphs to fluctuate over eight weeks. The variation was supposed to be caused by the imago of the brown planthopper laying eggs at different times, causing the eggs to hatch at different times. As a result, the eggs do not hatch at the same time, leading the nymph population to fluctuate week to week. Untung (2000) agrees, stating that fluctuations in the number of insect populations in lowland rice can occur from time to time, but that there is a population growth and reduction.

According to these findings, spraying tuba root extract 1 time per week resulted in a lower mean population of nymphs than spraying 1 once every two weeks or 1 time every three weeks. This is due to a discrepancy in tuba root extract treatment frequency till the eighth week. Spraying tuba root extract once a week increased the frequency of spraying to eight times, four times once every two weeks, and three times once every three weeks. The more tuba root extract is sprayed, the more secondary metabolites are exposed, and the more insects die. This is corroborated by Nurmansyah's (2014) findings, which show that the application interval has a significant impact on the effectiveness of vegetable pesticides. The active components in vegetable pesticides degrade quickly, according to Dadang and Prijono (2008), and a rapid fall in efficacy of vegetable insecticides necessitates more frequent or repeated treatments to reduce the population of the test insects.

The analysis of variance revealed that the spraying interval of tuba root extract had a significant effect on the nymph population in rice plants aged 12 weeks after treatment or in the generative phase. Table 3 displays the findings of the BNT follow-up test analysis at the 5% level of the nymph population.

Table 3. Population of Brown Leafhopper Nymphs on Rice Plants (12 msa) with Different Spraying Intervals of Tuba Root Extract.

Interval of spraying tuba root extract	Nymph population (imagos)
No tuba root extract application	120,2 d
Spraying tuba root extract 1x1 week	31,8 a
Spraying tuba root extract 1x2 weeks	44,8 b
Spraying tuba root extract 1x3 weeks	88,6 c

The numbers in the rows followed by lowercase letters that are not the same are significantly different according to the BNT test at the 5% level, after being transformed by √y.

The population of brown planthopper nymphs in each treatment revealed significantly different outcomes, as shown in Table 3. The effectiveness of tuba root extract to control brown planthopper nymphs with varying spraying intervals can be seen in the population of these pests. The brown

planthopper nymph population could not be suppressed without spraying tuba root extract. This is shown by the fact that the population average of brown planthopper nymphs in rice plants remains high, at 120.2 imagos/clump, which is much higher than in other treatments. Meanwhile, spraying tuba root extract at intervals of 31.8-88.6 imagos/clump was effective to suppress the brown planthopper nymph population. Tuba root extract was found to be effective in controlling the population of brown planthopper nymphs. Based on information from.

In comparison to the population of brown planthopper nymphs without tuba root extract, Table 3 reveals that tuba root extract was effective to suppress the population of brown planthopper nymphs. The toxic chemical rotenone, which is classed as a contact and stomach poison, is thought to be present in the tuba root extract, causing the brown planthopper's death. Tarumingkeng (1992) claims that rotenone chemicals penetrate through natural perforations in the cuticle layer, causing respiratory paralysis in insects and resulting in defective insect body cells. Toxic compounds can enter the body through insect food, interfering with the digestive organs, causing an imbalance of substances in body fluids, resulting in inert symptoms, paralysis, and death.

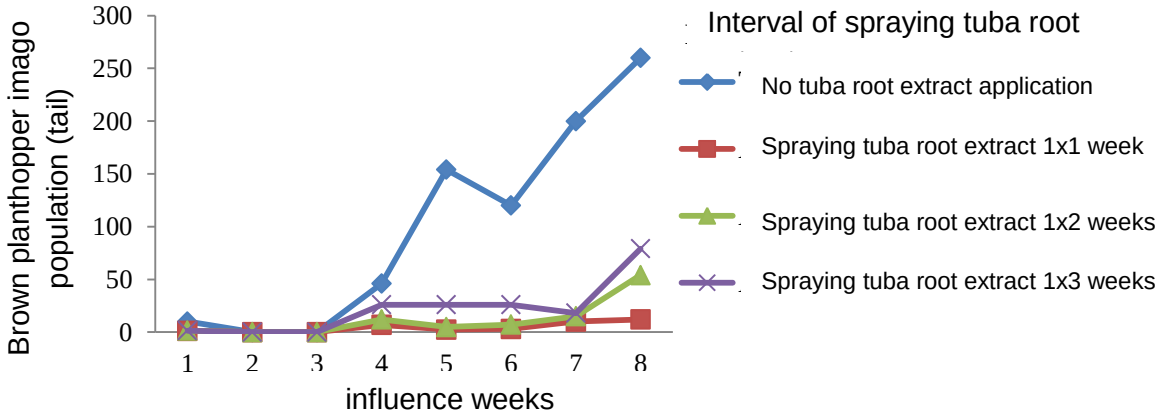
With 1 time in two weeks, tuba root extract treatment resulted in significantly different nymph populations than with 1 time in two weeks. While applying once every two weeks is drastically different than applying once every three weeks, The brown planthopper nymph population was reduced to 31.80 imagos/clump with a weekly tuba root extract spraying treatment. When compared to spraying tuba root extract once every two weeks and once every three weeks, the population of brown planthopper nymphs was the lowest, with 44.8 imagos per clump and 88.6 imagos per clump, respectively.

The results revealed that spraying once a week was the best interval for suppressing the lowest nymph population, which was 31.8 imagos per clump. This is due to the frequent spraying frequency, which exposes the active components in the tuba root extract to the brown planthopper's body. Astuti and Widyastuti (2016) argue that spraying botanical pesticides requires more time and frequency in order to be successful. Plant-disturbing organisms may only be managed or killed if they are exposed to the active ingredients of pesticides in adequate quantities, according to Djojosumarto (2008). In his study, Gohan (2015) stated that if 10 imagos per clump were observed in rice 40 days after planting and 20 imagos per clump in rice more than 40 days after planting, the quantity of brown planthoppers had achieved the economic threshold. The treatment of tuba root extract once a week resulted in the lowest nymph population of 31.8 imagos/clump in rice plants aged 12 weeks after application, according to the findings. Meanwhile, the population of brown planthopper nymphs was higher than the set economic threshold for brown planthoppers. However, the population of brown planthopper nymphs did not affect the growth of rice plants, because the rice plants were already in the generative phase.

Imago population

The use of tuba root vegetable insecticides with varying spraying intervals generated changes in the imago population of brown planthoppers until the eighth week, according to the results of observations on the imago population of brown planthoppers. Figure 2 depicts the population of brown planthopper imago.

Figure 2: Brown Planthopper Imago Population



According to Figure 2, the brown planthopper imago population fluctuated. The imago population of brown planthoppers was 10 imagos/clump in the first week of treatment without spraying tuba root extract. This is in contrast to the tuba root extract spraying treatment, which has a lower imago/clump range of 1.2-1.4 brown planthopper imago/clump. This is most likely because there was no rotenone in the applied distilled water in the treatment without spraying tuba root extract, hence the spraying was unable to kill the brown planthopper. The brown planthopper imago population was suppressed by using tuba root extract. This is due to the poisonous effects of the tuba root's active compounds, which are toxic to brown planthoppers. Rotenone, deguelin, ellipton, and toxikarbol are insecticidal chemicals found in tuba roots (Wu et al., 2012). Rotenone, according to Suganya and Thangaraj (2014), is a cellular respiration inhibitor that affects nerve tissue and muscle cells, causing insects to cease eating.

Rotenone is an active chemical that inhibits the electron transport chain in the mitochondria, acting as a contact toxin and insect stomach (Khater, 2012 in Arsyad et al., 2019). When the electron transport chain to the mitochondria is inhibited, the synthesis of ATP and the activity of insect cells both diminish, resulting in paralysis and death of the insects. Rotenone also inhibits respiratory enzymes that operate between NAD+ and coenzyme Q, resulting in a loss of respiratory function (Gupta and Milatovic, 2014).

In all treatments, the imago population of brown planthoppers was 0 individuals/clump in the second and third weeks before reappearing in the fourth week. This is due to the brown planthopper's imago stage being depleted. Brown planthoppers are also still in their egg and nymph phases. The brown planthopper has three stages of development: egg, nymph, and imago. As a result, each live stage has a time limit for transitioning to the next level.

According to Baehaki and Widiarta (2010), eggs hatch in 7-11 days, with an average of 9 days. According to Sianipar et al. (2015), the egg period lasts an

average of 9.26 days. After that, the eggs hatch into nymphs. Nymphs go through multiple molts or instars, each of which lasts a varied amount of time. There are five instars in the brown planthopper nymph. Because each instar lasts between 2-4 days, the typical nymphal stage lasts 15.58 days. After then, the nymph transforms into an imago. Imago had an average age of 12.82 days.

According to these findings, spraying tuba root extract 1 time per week resulted in a lower average population of brown planthopper imago than spraying 1 once every two weeks or 1 time every three weeks. This is due to a discrepancy in tuba root extract treatment frequency till the eighth week. The more tuba root extract is sprayed, the more active chemicals or secondary metabolites are exposed, resulting in more brown planthopper imagos dying. According to Nurmansyah's research (2014), spraying citronella 1x1 week was more successful than spraying it 2x2 weeks or 3x3 weeks against the nymph and imago population of Helopeltis antonii. Figure 3 shows the brown planthopper imago population during the fourth, eighth, and twelfth weeks.

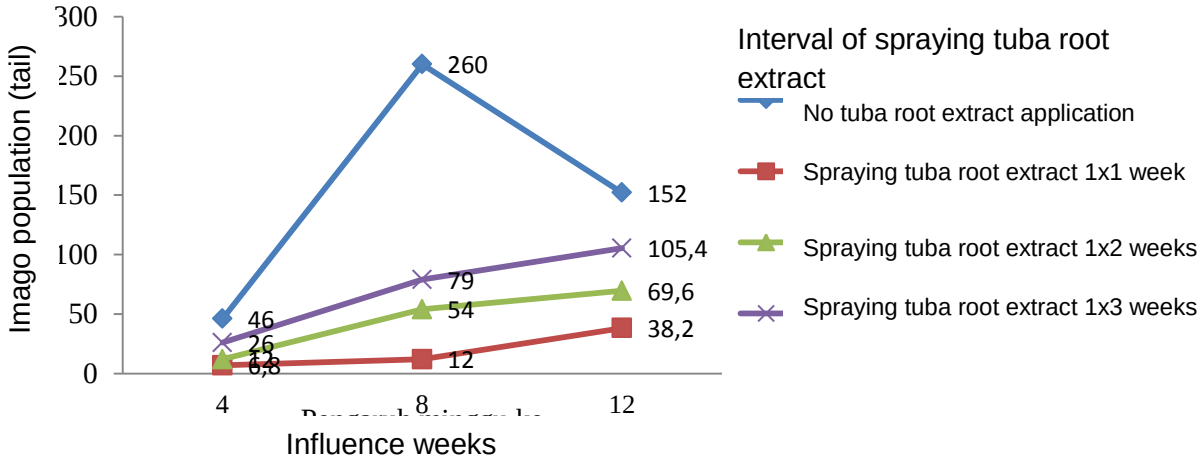


Figure 3. Population of Brown Planthopper Imago on Weeks Four, Eight and Twelve.

The brown planthopper imago population changed after application of tuba root extract at various spraying intervals, as shown in Figure 3. In the fourth week, the imago population of brown planthoppers was in the range of 6.8-46 imagos/clump, which was thought to be the first generation of brown planthoppers. The brown planthopper nymphs were thought to have entered the second generation in the eighth week, with an increase in the range of 12-260 imagos/clump. This is due to a plentiful supply of food and favorable environmental conditions. According to Ratna et al. (2010) in Sianipar et al. (2015), the ability to devour insects, in addition to laying eggs, is a factor that influences the population growth of brown planthoppers. Furthermore, rice plants are expected to take more nitrogen nutrients during the vegetative phase (Campbell, 2008). Brown planthoppers get their sustenance from nitrogen uptake in rice plants (Rashid et al., 2016). Furthermore, the brown planthopper population will rapidly increase in lush plants with high humidity of 70-80 percent and an ideal daytime temperature of 28-30oC. (Nurbaeti et al., 2010).

The third generation was assumed to have begun after the twelfth week of treatment without tuba root extract, when the number of imagos/clump reduced by

152. Brown planthoppers are thought to be suffering from a lack of food supply due to the large population. In the twelfth week, the number of imagos treated with tuba root extract 1 time per week, 1 time every two weeks, and 1 time every three weeks increased to 38.2 imagos/clump, 69.6 imagos/clump, and 105.4 imagos/clump, respectively. This is assumed to be because the rice plant has entered the pre-harvest/generative phase of its life cycle. Plants in the generative phase are assumed to require and absorb additional P and K nutrients in order to make rice grains (Santoso, 2011). Plants absorb less nitrogen during the generative phase, which is a food supply for brown planthoppers. In order for the brown planthopper to convert its wings into macroptera during the generative phase and find a more suited host (Baehaki and Widiarta, 2010). In pursuit of nourishment, brown planthoppers will travel to younger, healthier plants (Nurbaeti et al., 2010). The findings show that a large population of brown planthoppers has run out of food sources. As a result of the effort to migrate in search of food, the brown planthopper imago population increased in the twelfth week.

The analysis of variance revealed that the interval between spraying tuba root extract had a significant effect on the imago population in rice plants aged 12 weeks after treatment, or in the generative period. Table 4 displays the findings of the BNT follow-up test analysis at the 5% level of the imago population.

Table 4. Population of Brown Planthopper Imago on Rice Plants (12 msa) with Different Spraying Intervals of Tuba Root Extract.

Interval of spraying tuba root extract	Imago population
No tuba root extract application	152,0 d
Spraying tuba root extract 1x1 week	38,2 a
Spraying tuba root extract 1x2 weeks	69,6 b
Spraying tuba root extract 1x3 weeks	105,4 c

The numbers in the rows followed by lowercase letters that are not the same are significantly different according to the BNT test at the 5% level, after being transformed by √y.

The ability of tuba root extract to suppress brown planthopper imago with different spraying intervals can be seen in Table 4 from the population of these pests. The tuba root insecticide-free treatment was considerably different from the other treatments. With 1 time in two weeks, tuba root extract treatment resulted in significantly different nymph populations than with 1 time in two weeks. While applying once every two weeks is drastically different than applying once every three weeks,

The imago population of brown planthoppers could not be suppressed without spraying tuba root extract. The high average imago population in rice plants (152 imagos/clump) demonstrates this. Meanwhile, spraying tuba root extract at intervals of 38.2-105.4 imagos/clump was effective to inhibit the imago population of brown planthoppers. This showed that spraying tuba root extract suppressed the appearance of brown planthopper imago as compared to spraying tuba root extract alone.

Spraying tuba root extract once a week was able to inhibit the emergence of a lower imago population of 38.2 imagos/clump, with the average imago population being lower than the treatments done once every two weeks

and once every three weeks. Brown leafhoppers had 69.6 imagos per clump while brown leafhoppers had 105.4 imagos per clump. The economic threshold for brown planthoppers, according to Prakash et al. (2014) in Minarni et al. (2018), is 10-15 nymphs and imagos/clumps 30 days after sowing. In his study, Gohan (2015) noted that if 10 imagos per clump were observed in rice 40 days after planting, and 20 imagos per clump in rice more than 40 days after planting, the quantity of brown planthoppers had reached the economic threshold. The results showed that the imago population of brown planthoppers in the treatment of spraying once a week was already above the economic threshold, but that it was able to suppress the imago population the least, with 38.2 imagos/clump, when compared to the other treatments. This was due to the fact that tuba root extract was applied more frequently under the weekly spraying treatment, causing the imago of the brown planthopper to die more frequently.

Vegetable insecticides, according to Dadang and Prijono (2008), have several disadvantages, including low persistence, which means that the active ingredients decompose quickly, and a rapid decrease in efficacy, which means that they must be applied more frequently or repeatedly to ensure that the insects are tested. The population is on the decline.

Attack intensity

Varied treatment intervals of spraying tuba root vegetable pesticides induced different percentages of attacks, according to the results of observations on the intensity of brown planthopper attack. Figure 5 depicts the severity of the brown planthopper attack.

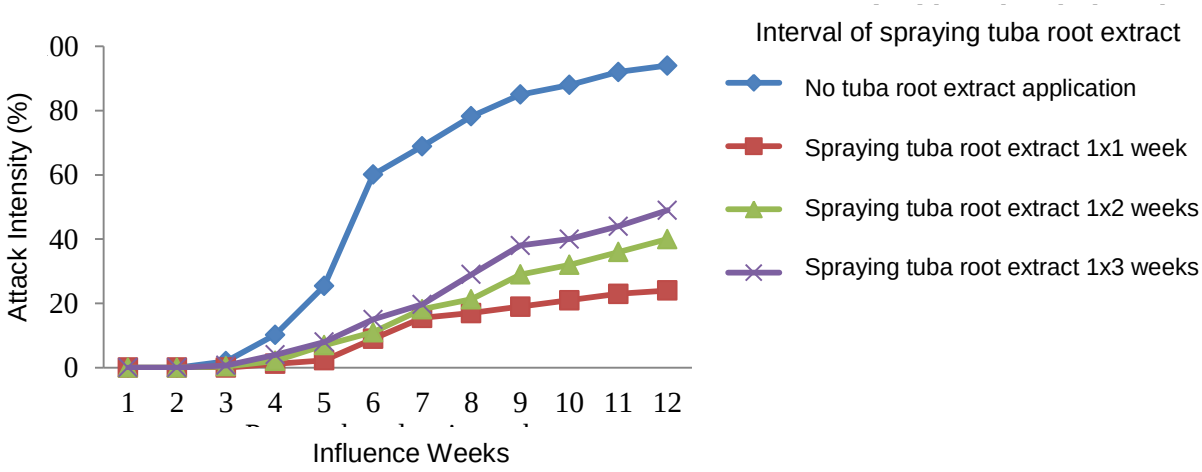


Figure 3. Intensity of brown planthopper attack on rice plants with different spraying intervals of tuba root extract.

Figure 3 demonstrates that the intensity of brown planthopper attack on rice plants varies week to week depending on whether the treatment includes spraying tuba root extract 1 time a week, 1 time every two weeks, or 1 time every three weeks. There were no signs of brown planthopper attack in the first and second weeks of all treatments.

In comparison to tuba root extract treatment, treatments without tuba root extract revealed a higher proportion of brown planthopper attack intensity. The severity of brown planthopper assaults

without spraying tuba root extract increases by 2% in the third week and continues to rise dramatically until the 12th week, when it reaches 94%. Meanwhile, tuba root extract was effective to reduce the severity of brown planthopper attack on rice plants throughout the interval treatment.

The severity of brown planthopper attack increased by 0.7 percent after a three-week treatment interval of spraying tuba root extract, and continued to climb to 49 percent at week 12. Spraying tuba root extract once every two weeks resulted in a 0.4 percent rise in attack intensity, which escalated by 40% by week 12. However, increasing the frequency of tuba root extract spraying to once a week was effective to lessen the intensity of assaults by 1.2 percent until the fourth week, when it tended to increase by 24 percent at week 12. This indicated that increasing the tuba root extract application to once a week suppressed the intensity of brown planthopper attacks when compared to once every two weeks and once every three weeks. This has something to do with the difference in spraying frequency; the more frequent the spraying, the more repressed the imago and nymph populations of brown planthoppers will be, making harm to rice plants take longer. The intensity of assault is mostly influenced by population density and insect food requirements, according to Olsen et al. (2011).

The last observation was the strength of the brown planthopper attack in week 12. The interval of spraying tuba root extract had a significant effect on the intensity of attack on rice plants at the age of 12 weeks following application, according to the results of analysis of variance. Table 5 displays the findings of the BNT further test analysis at the 5% level of attack intensity.

Table 5. Intensity of attack on rice plants (12 msa) with different spraying intervals of tuba root extract.

Interval of spraying tuba root extract	Intensity of attack (%)
No tuba root extract application	94,0 d
Spraying tuba root extract 1x1 week	24,0 a
Spraying tuba root extract 1x2 weeks	40,0 b
Spraying tuba root extract 1x3 weeks	49,0 c

The numbers in the rows followed by unequal lowercase letters were significantly different according to the BNT test at the 5% level, after being transformed with Arc Sin√ y.

Table 5 demonstrates that the level of attack on rice plants was considerably different at 12 weeks after each treatment was applied. The degree of brown planthopper attack on rice plants was not suppressed by spraying without tuba root extract. The high average assault intensity of 94 percent demonstrates this. Meanwhile, spraying tuba root extract at various intervals reduced the intensity of brown planthopper attack by 24.00-49 percent.

The lowest severity of brown planthopper attack was 24.00 percent when tuba root extract was sprayed once a week. Tuba root extract was applied once every two weeks and once every three weeks, with results of 40.00 percent and 49.00 percent, respectively. The effect of tuba root extract on brown planthopper assault on rice plant growth is shown below.

The treatment without spraying tuba root extract had the highest assault

intensity of 94.00 percent, which was significantly different from all other treatments. The use of a therapy without tuba root extract reduced the severity of brown planthopper attacks on rice plants. This is due to tubal roots lacking toxin content, resulting in a large population of nymphs and imagos. The intensity of attacks on rice plants will rise as the population of nymphs and imago grows. This is supported by Dianawati and Sujitno (2015), who claim that the higher the brown planthopper population density, the more severe the plant damage.

The absence of active components from the tuba roots that were administered resulted in a high degree of attack in the treatment without spraying tuba root extract. Meanwhile, in the treatment of spraying tuba root extract 1 time per week, the intensity of attack was reduced because the spraying was more frequent (13 applications) compared to the intervals of 1 time every two weeks and 1 time every three weeks, which were 7 and 5 applications, respectively. This demonstrates that the closer tuba root vegetable pesticides are sprayed, the more brown planthoppers die, and the intensity of brown planthopper assaults on rice plants is reduced.

When compared to the initial observation before application, the average attack intensity towards the end of the observation looked to rise in all treatments. However, without spraying tuba root extract, the rise was still significant. As a result, pesticide treatment of tuba roots is particularly effective at reducing brown planthopper damage to rice plants. It's thought that the tuba root extract includes a hazardous active element called rotenone, which serves as a cell respiration inhibitor and has an effect on nerve cell tissue and muscle cells, causing insects to cease eating and die (Tarumingkeng, 1992).

Brown planthoppers cause an initial attack that is defined by a yellow color shift on the oldest leaf blades and a lot of honey dew secretion. The color change spreads to all areas of the plant until it is completely brown and hopperburned (Darmadi and Alawiyah, 2018). The brown planthopper caused the harm by sucking fluid from the rice plants' transport tissue (stem). Plants wilt and dry quickly in the generative stage of rice plants due to a high population density of brown planthoppers, starting with older leaves and advancing to younger leaves, giving the appearance of burnt or hopperburned plants (Sogawa, 1982). The degree of assault on tuba root pesticide spraying treatment with a weekly spraying interval was remained in the very light category, at 24.00 percent (Figure 3.2). While spraying every two weeks and every three weeks, respectively, falls into the mild group (40 percent and 49 percent). Furthermore, it fell into the category of severe assault intensity of 94 percent in the treatment without spraying tuba root extract. Figure 4 depicts the degree of brown planthopper attack on rice plants in the twelfth week.

Figure 4: Brown planthopper attack intensity on rice plants in the twelfth week: (a) No tuba root extract spraying; (b) 1x1 week spraying interval; (c) 1x2 week spraying interval; (d) 1x3 week spraying interval.

4. CONCLUSIONS

Spraying tuba root extract 1x1 week was the most effective interval, as it reduced the mean nymph population to 38.20 imagos/clump, imago population to 31.80 individuals/clump, and attack intensity to 24 percent.

The spraying of tuba root extract in the field should be done once a week.

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