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Article[3]

Concentration Test of Binahong *(Anredera cordifolia)* Leaf Extracts on Growth, Years and Severity Leaf Blight Disease of Red Onion *(Allium ascalonicum L.)* Plant

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Abstract. This study presents an investigation into the optimal concentration of binahong *(Anredera cordifolia)* extract for enhancing the growth, yield, and mitigating leaf blight in shallots. Conducted within a controlled environment at a well-established laboratory, the experiment employed a completely randomized design (CRD) to evaluate the effects of five different concentrations of binahong leaf extract. Data analysis included variance tests, and when significant effects were identified, Duncan's multiple range test (DMRT) was employed to further examine the results. The findings demonstrate that a 30% concentration of binahong *(Anredera cordifolia)* extract significantly improves growth, yield, and effectively suppresses the development of Red onion(*Allium ascalonicum L.*) leaf blight. Moreover, this concentration resulted in a wet tuber weight per hill of 76.30 g. These insights contribute to the development of sustainable agricultural practices and offer a promising alternative to chemical-based treatments for managing crop diseases, thereby advancing our understanding of the potential applications of binahong *(Anredera cordifolia)* extract in agricultural settings.

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1. Introduction

Shallots (*Allium ascalonicum L.*) represent a vital horticultural crop in Indonesia, cultivated intensively as a primary ingredient in spices and traditional medicine [1-2]. As a nationally superior commodity, the demand for Red onion(*Allium ascalonicum L.*) has been increasing alongside the population growth. Data from the Central Bureau of Statistics (2020) highlights a sequential increase in Red onion(*Allium ascalonicum L.*) productivity from 2018 to 2020. To maintain production levels and meet future demand, there is a need to explore alternative, sustainable agricultural practices, particularly as chemical materials currently utilized by farmers can pose long-term health risks. Plant extracts offer a promising organic solution for addressing plant needs [3-5].

Binahong (*Anredera cordifolia*) extract, derived from a medicinal plant, has potential as a growth regulator and biopesticide [6-7]. The plant's efficacy is attributed to secondary metabolites, including saponins, alkaloids, polyphenols, flavonoids, and mono-polysaccharides [8-9]. These compounds contribute to the plant's ability to treat various diseases and protect itself. Despite the prevalent use of chemical pesticides in Red onion(*Allium ascalonicum L.*) farming, results remain suboptimal, and their routine application poses negative impacts on human health and the environment. Botanical pesticides, made from natural ingredients such as plants, offer a more integrated, eco-friendly approach to pest and disease control [10-12].

The binahong (*Anredera cordifolia*) plant, a species from the Basellaceae family, is a suitable candidate for botanical pesticide production due to its antimicrobial properties [13-15]. Research has shown that a 6.25% concentration of binahong (*Anredera cordifolia*) leaf water extract inhibited the growth of the *Colletotrichum capsici* fungus by 66.88% and suppressed conidia germination by 5.63%. Additionally, a 2% concentration of binahong (*Anredera cordifolia*) leaf extract effectively reduced seed blight incidence by 100% in rice plants [16-17]. This study contributes to the development of sustainable agricultural practices and provides insights into the potential applications of binahong (*Anredera cordifolia*) extract as an alternative to chemical-based treatments for crop disease management.

2. Methods

2.1. Material and Methods

In this experiment, the growth of Yellow Red onion(*Allium ascalonicum L.*) variety seeds was monitored using materials such as binahong (*Anredera cordifolia*) leaf extract, Urea, SP-36, and KCl. The equipment employed included rotary evaporators, 20 x 30 cm polybags, raffia rope, tape measures, plastic mulch, gembor, scissors, sample boards, markers, weighing scales, calculators, writing instruments, petri dishes, cotton, tissues, test tubes, matches, spirit lamps, analytical balances, vernier calipers, microscopes, sterile cotton, Erlenmeyer flasks, beaker glasses, parchment paper, tweezers, ovens, incubators, label paper, measuring cups, water baths, paper discs, and micropipettes.

2.2 Experimental Design

The experiment was conducted using a completely randomized design (CRD) with six treatment levels of binahong (*Anredera cordifolia*) leaf extract: 0% (B0), 10% (B1), 15% (B2), 20% (B3), 25% (B4), and 30% (B5) [18]. Each treatment was repeated three times, resulting in a total of 18 experimental units. The collected data were analyzed for variance, and if significant effects were observed at the 5% or 1% significance level, Duncan's multiple range test (DMRT) was performed for further evaluation [19-22].

2.3 Implementation of Land Preparation Experiments

The selected plot of land was cleared of weeds and existing plants using manual tools such as machetes and hoes [23-24]. After clearing, the land was leveled to ensure neat arrangement of the polybags. For the preparation of the planting medium, a 20 x 30 cm polybag was filled with a mixture of topsoil and cow manure in a 2:1 ratio, amounting to 500 grams per polybag. The planting medium was then

incubated for one week [25-26]. Alluvial soil was the chosen soil type for this experiment.

2.4 Seed Preparation

The Red onion(*Allium ascalonicum L.*) seeds used in this experiment were of the Yellow Variety, sourced from farmers in the Lubuk Alung area. Seeds were selected from tubers with a uniform size, having a diameter between 1.5 and 2.5 cm. These seeds were then dried and stored in a non-damp area for one week before planting.

For planting, the top 1/3 of each tuber was cut off. Treatments were administered by spraying binahong *(Anredera cordifolia)* leaf extract at varying concentrations: 0% (B0), 10% (B1), 15% (B2), 20% (B3), 25% (B4), and 30% (B5). This was done using a spray method that targeted all parts of the plant leaves, applied once a week from 1 WAP (Week After Planting) to 10 MST (Maturity Stage). Transplanting, or stitching, was performed one week after planting when any abnormal growth in the plants could be observed. The seeds used for replanting were intentionally grown separately in other polybags as reserve seeds.

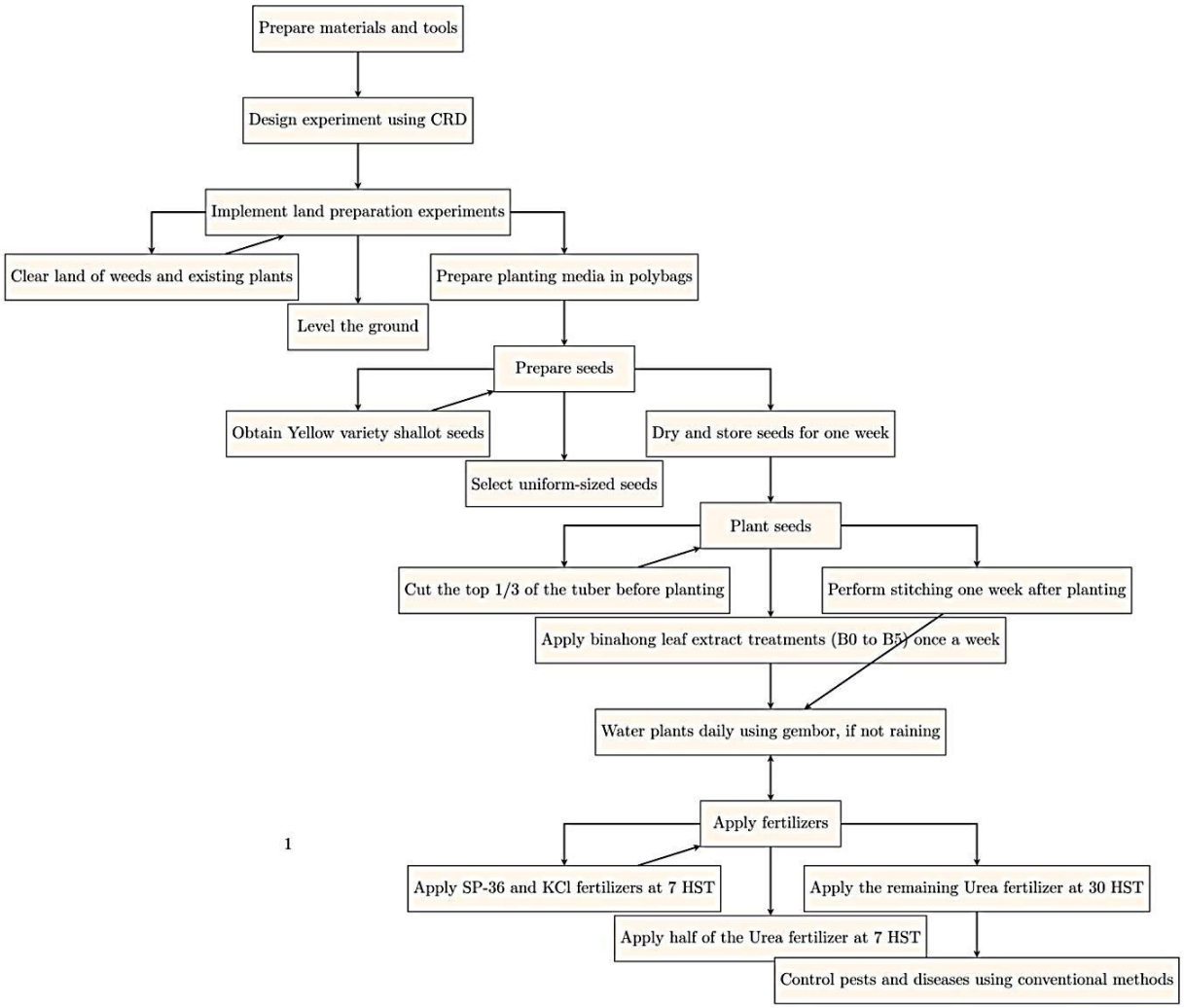

Figure 1. Schematic process of research

2.5 Sprinkling

Watering is performed daily, barring rain, using a gembor. Young plants are watered with care to prevent damage. Fertilization follows the recommended guidelines for Red onion(*Allium ascalonicum L.*) plants, which include 100 kg/ha of Urea, 100 kg/ha of SP-36, and 100 kg/ha of KCl. In this experiment, the SP-36 and KCl fertilizers were initially applied at 7 days after transplanting (DAT), with each polybag receiving 0.06 g of SP-36 and 0.06 g of KCl. Urea fertilizer was administered in two parts, with 50 kg/ha (equivalent to 0.03 g/polybag) applied at 7 DAT, and the remaining half provided at 30 DAT by sowing it in plant rows within the plot.

For pest and disease control, conventional methods can be employed to address pests attacking the plants without causing disturbances [27-29]. Harvesting Red onion(*Allium ascalonicum L.*) plants is deemed appropriate when the following criteria are met: leaves have begun to wilt; 70-80% of leaves have turned yellow; the stem base has hardened; tubers exhibit a bright red hue; tubers have increased in size; and many leaves have fallen.

3. Result and Discussions

3.1. Plant Hight

The impact of binahong (Anredera cordifolia) leaf extract on the growth of various Red onion(Allium ascalonicum L.) plant heights was evaluated and found to be significant. The data for red onion(Allium ascalonicum L.) plant heights are presented in Table 1.

Table 1. Red onion(*Allium ascalonicum L.*) plant height with extract administration leaf binahong (*Anredera cordifolia*)

Concentration of Binahong (*Anredera cordifolia*) Leaf Extract (%)	Plant Height (cm)
0	38.67C
10	40.00 B
15	42.00 B
20	43.33 B
25	44.67 B
30	47.00 A
KK = 2.71%	

Columns with the same uppercase letters indicate no significant differences according to Duncan's Multiple Range Test (DMRT) at the 5% significance level.

Table 1 demonstrates that the application of binahong (*Anredera cordifolia*) leaf extract significantly influences the height growth of red onion(*Allium ascalonicum L.*) plants (Allium cepa var. aggregatum). A 30% concentration of the extract results in the tallest plants at 47.00 cm, while other concentrations yield shorter plants: 10% at 40.00 cm, 15% at 42.00 cm, 20% at 44.67 cm, and 25% at 44.67 cm. This effect can be attributed to the secondary metabolites present in binahong (*Anredera cordifolia*) leaves, which are known to contain growth regulators [30-33].

Furthermore, binahong (*Anredera cordifolia*) leaves can inhibit pathogen growth and exhibit antimicrobial properties [34-35]. As a result, the plants develop optimally. Binahong (*Anredera cordifolia*) plants are widely used as medicinal ingredients in the healthcare field and as antimicrobial agents for plant pathogens [36-37]. The ability of plant extracts to suppress pathogen growth is generally due to the metabolites they contain [38-39].

Additionally, compounds in binahong (*Anredera cordifolia*) leaves can modulate auxin (IAA) activity. When absorbed by plant tissues, auxin activates food reserve energy and promotes cell division and elongation, ultimately resulting in stem elongation. This highlights the potential of binahong (*Anredera cordifolia*) leaf extract for promoting the growth and health of red onion(*Allium ascalonicum L.*) plants, providing valuable insights for sustainable agriculture [40].

3.2 Number of Leaves

Application of binahong (*Anredera cordifolia*) leaf extract has been found to significantly influence the number of leaves in red onion(*Allium ascalonicum L.*) plants (Allium cepa var. aggregatum). Table 2 presents the varying effects of the extract on the leaf count in the tested red onion(*Allium ascalonicum L.*) plants.

Table 2. Influence of binahong (*Anredera cordifolia*) leaf extract administration on the leaf count of red onion(*Allium ascalonicum L.*) plants (*Allium cepa var. aggregatum*)

Binahong (*Anredera cordifolia*) Leaf Extract Concentration (%)	Number of Leaves (strands)
0	27.48 B
10	27.97 B
15	33.00 AB
20	33.67 AB
25	35.00 A
30	36.30 A
KK 3.21%	

Table 2 demonstrates that the administration of binahong (*Anredera cordifolia*) extract has a notable impact on the number of leaves in red onion(*Allium ascalonicum L.*) plants. At a concentration of 30%, there is a higher leaf count (36.30 strands/clump) compared to 0% concentration. The 30% concentration is statistically similar to the 15%, 20%, and 25% concentrations according to Duncan's Multiple Range Test (DMRT) at a 5% significance level. However, it significantly differs from the 0% and 10% concentrations.

Binahong (*Anredera cordifolia*) plants are known to contain an abundance of bioactive compounds such as alkaloids, polyphenols, flavonoids, saponins, terpenoids, steroids, glycosides, and anthraquinones. The flavonoid compounds present in binahong (*Anredera cordifolia*) plants can modulate auxin activity (IAA), leading to the strengthening of plant tissue structures by forming callus and sealing the vascular system. This helps prevent pathogen infection and promotes healthy growth [41-42].

3.3 Number of Tubers

The application of binahong (*Anredera cordifolia*) leaf extract had a significant effect on the number of bulbs produced by the red onion(*Allium ascalonicum L.*) plant, as demonstrated by the range of bulb quantities presented in Table 3.

The results of the study, presented in Table 3, indicate that the application of binahong (*Anredera cordifolia*) leaf extract affects the number of red onion (*Allium ascalonicum L.*) bulbs produced. The administration of 25% and 30% extract concentrations did not produce significant differences in bulb quantity, while administering 0%, 10%, 15%, and 20% extract concentrations yielded varying quantities of red onion (*Allium ascalonicum L.*) bulbs. Specifically, administering 20% extract concentration did not result in significant differences when compared to 15%. However, there were significant differences observed when comparing 20% extract concentration to 0%, 15%, 25%, and 30% extract concentrations.

Table 3. The number of red onion(*Allium ascalonicum L.*) bulbs produced was determined by the administration of binahong (*Anredera cordifolia*) leaf extract

Leaf Extract Concentration Binahong (*Anredera cordifolia*) (%)	Number of tubers
0	3.33 C
10	4.00 B
15	3.67 C
20	4.67 B
25	5.33 A
30	6.00 A
KK 10.48%	

At a significance level of 5%, the numbers in the column labeled with capital letters were not significantly different based on DMRT analysis.

Notably, administering 30% extract concentration resulted in the highest mean number of bulbs (6.00 bulbs), which could be attributed to the presence of saponins in binahong (*Anredera cordifolia*) leaves. Saponins play a role in enhancing plant resistance to fungal infections by combining with sterol membranes in fungi, which leads to stunted fungal growth. As a result, red onion(*Allium ascalonicum L.*) plant pathogens are unable to develop properly, promoting optimal red onion (*Allium ascalonicum L.*) bulb development. Additionally, the number of red onion (*Allium ascalonicum L.*) bulbs produced was influenced by growth regulators produced by binahong (*Anredera cordifolia*) leaf extract, specifically auxin [43-44].

3.4 Weight of Tubers Produced by a Single Hill of Plants

The effect of binahong (*Anredera cordifolia*) leaf extract on the fresh weight of bulbs per clump of red onion(*Allium ascalonicum L.*) plants was examined, and it was found to be significant. The fresh weight of bulbs per hill of red onion(*Allium ascalonicum L.*) plants is presented in Table 4.

Table 4. Fresh weight of bulbs per hill of red onion(*Allium ascalonicum L.*) plants with administration of leaf extract binahong (*Anredera cordifolia*)

Concentration of Binahong (*Anredera cordifolia*) Leaf Extract (%)	Gross weight tubers per hill (g)
0	62.33 B
10	63.67 B
15	65.67 B
20	68.00 B
25	82.33 AB
30	92.70 A
KK 2.68%	

Based on DMRT (Duncan's Multiple Range Test) at a significance level of 5%, the number column which followed the letter 'big' was not found to be significantly different.

Table 4 indicates that the use of binahong (*Anredera cordifolia*) leaf extract has a significant impact on the fresh weight of tubers per clump of red onion(*Allium ascalonicum L.*) plants. A concentration of 30% did not produce any statistically significant difference compared to a concentration of 25%. However, administering a concentration of 0% to 20% resulted in a significant difference. A concentration of 25% with a gift concentration of 0% to 20% did not produce a significant difference. The fresh weight of the tubers increased with the increasing concentration of the extract, with the highest fresh weight being achieved with a 30% concentration.

This outcome can be attributed to the optimal growth of soybean tubers, which was made possible by the suppressive effect of binahong (*Anredera cordifolia*) leaves on disease incidence in red onion(*Allium ascalonicum L.*) plants. This subsequently affected the growth characteristics of the red plants. Furthermore, the effect can also be attributed to the presence of plant growth regulators (ZPT) such as IAA, which are produced by the binahong (*Anredera cordifolia*) extract. These regulators can help to enhance the composition of organic matter in the soil, resulting in better nutrient absorption by plants. Additionally, K nutrients can promote the translocation of nutrients from leaves to other parts of the plant, which in turn can increase the size, number, and yield of the tubers [45-47].

3.5 Root Dry Weight Per Hill

The analysis of variance (ANOVA) for the dry weight of tubers per clump of red onion(*Allium ascalonicum L.*) plants, following the administration of Binahong (Anredera cordifolia) leaf extract, revealed a significant effect. The dry weight of bulbs per hill of red onion(*Allium ascalonicum L.*) plants is presented in Table 5.

Table 5. Dry weight of bulbs per clump of red onion(*Allium ascalonicum L.*) plants treated with binahong (*Anredera cordifolia*) leaf extract

Concentration of Binahong (*Anredera cordifolia*) Leaf Extract (%)	Root dry weight per clump (g)
0	49.33 B
10	49.67 B
15	51.67 B
20	55.33 AB
25	63.00 A
30	76.30 A
KK 2.09%	

Columns with corresponding uppercase letters did not exhibit significant differences based on the Duncan's Multiple Range Test (DMRT) at a 5% significance level.

Table 5 demonstrates that the application of Binahong (Anredera cordifolia) leaf extract affects the dry weight of tubers per clump of red onion(*Allium ascalonicum L.*) plants. Concentrations of 30%, 25%, and 20% did not differ significantly, while concentrations ranging from 0% to 15% were different, except for the 20% concentration, which did not differ from 0% to 15%. A 0% concentration yielded 49.33 g, a 10% concentration produced 49.67 g, a 15% concentration resulted in 51.67 g, a 20% concentration generated 55.33 g, a 25% concentration created 63.00 g, and a 30% concentration achieved 76.30 g. Binahong (Anredera cordifolia) leaves possess antibacterial and antimicrobial properties, owing to the presence of active compounds such as flavonoids, alkaloids, terpenoids, and saponins. Flavonoid compounds serve as antioxidants and antimicrobials [48-50].

3.6 Tuber Diameter

The analysis of variance (ANOVA) for the diameter of red onion(*Allium ascalonicum L.*) bulbs, following the administration of Binahong (Anredera cordifolia) leaf extract, revealed a significant effect. The diameter of red onion(*Allium ascalonicum L.*) bulbs is presented in Table 6.

Table 6. Diameter of red onion(*Allium ascalonicum L.*) bulbs treated with binahong (*Anredera cordifolia*) leaf extract.

Concentration of Binahong (*Anredera cordifolia*) Leaf Extract (%)	Tuber diameter (cm)
0	1.78 B
10	1.89 B
15	1.96 AB
20	2.17 A
25	2.17 A
30	2.30 A
KK 2.40%	

Columns with corresponding uppercase letters did not exhibit significant differences based on the Duncan's Multiple Range Test (DMRT) at a 5% significance level.

Table 6 indicates that the application of Binahong (Anredera cordifolia) leaf extract affects the diameter of onion bulbs. Concentrations of 30%, 25%, 20%, and 15% were not significantly different from each other, but they were distinct from the 0% and 10% concentrations, with the exception of the 15% concentration, which did not differ from 0% and 10%. A 0% concentration yielded a diameter of 1.78 cm, a 10% concentration produced 1.89 cm, a 15% concentration resulted in 1.96 cm, a 20% concentration generated 2.17 cm, a 25% concentration created 2.17 cm, and a 30% concentration achieved 2.30 cm.

This is presumably due to the compounds present in the Binahong (Anredera cordifolia) extract, which can influence the diameter of the bulbs. Flavonoid compounds in the extract can modulate indole-3-acetic acid (IAA) activity, a plant hormone found in stem tips, roots, and flower formation. IAA functions as a regulator of cell enlargement and triggers cell elongation in the area behind the apical meristem. Root growth in cuttings requires a growth regulator that stimulates root formation [51-52].

3.7 The First Day the Symptoms of the Disease Appear

The variance analysis (ANOVA) of the first day of disease symptoms in red onion(*Allium ascalonicum L.*) plants, following the administration of Binahong (Anredera cordifolia) leaf extract, revealed a significant effect. The initial day of disease symptom manifestation in red onion(*Allium ascalonicum L.*) plants is presented in Table 7.

Table 7. The symptoms of red onion(*Allium ascalonicum L.*) plant disease appeared with extract administration leaf binahong (*Anredera cordifolia*)

Concentration of Binahong (*Anredera cordifolia*) Leaf Extract (%)	The First Day Appeared Disease Symptoms
0	10.36 B
10	11.05 B
15	11.68 B
20	13.64 AB
25	14.07 A
30	14.90 A
KK 8.66%	

Columns with corresponding uppercase letters did not exhibit significant differences based on the Duncan's Multiple Range Test (DMRT) at a 5% significance level.

Table 7 indicates that the application of Binahong (*Anredera cordifolia*) leaf extract affects red onion plants. Concentrations of 30%, 25%, and 20% were not significantly different from each other, but they were distinct from concentrations ranging from 0% to 15%, with the exception of the 20% concentration, which did not differ from 0% to 15%. A 0% concentration resulted in 10.36 days, a 10% concentration yielded 11.05 days, a 15% concentration led to 11.68 days, a 20% concentration produced 13.64 days, a 25% concentration generated 14.07 days, and a 30% concentration achieved 14.90 days. The delayed appearance of symptoms at a 30% concentration is presumably due to the ability of Binahong (*Anredera cordifolia*) extract to inhibit pathogen development. The plant's resistance is activated by compounds present in the Binahong (*Anredera cordifolia*) leaf extract, including alkaloids, flavonoids, and saponins [53-55].

3.8 Incidence of Bacterial Blight

The occurrence of bacterial leaf blight in Red onion(*Allium ascalonicum L.*) was not subjected to statistical analysis. The compiled data can be found in Table 8.

Table 8. Incidence of bacterial leaf blight of red onion(*Allium ascalonicum L.*) plants with extract administration leaf binahong (*Anredera cordifolia*)

Concentration of Binahong (*Anredera cordifolia*) Leaf Extract (%)	Incidence (%)
0	100
10	100
15	100
20	100
25	100
30	100

Table 8 presents the average occurrence of late blight symptoms in red onion(*Allium ascalonicum L.*) plants, with varying percentages for each concentration. However, the application of 25% and 30% concentrations effectively suppressed the growth of pathogens that could hinder the growth and development of red onion plants. Moreover, these concentrations can also induce plant resistance to diseases through various mechanisms, such as antibiotic production, lysis, competition, parasitism, and resistance induction [56-57].

3.9 Severity of Leaf Blight Symptoms

The application of Binahong (Anredera cordifolia) leaf extract had a significant impact on the varying intensity of leaf blight symptoms in red onion(*Allium ascalonicum L.*) plants. The intensity of leaf blight symptoms in red onion plants can be observed in Table 9.

Table 9. Severity symptom blight leaf onion plants with giftleaf extract binahong (*Anredera cordifolia*)

Extract Concentration Binahong (*Anredera cordifolia*) leaves (%)	Severitas (%)	Effectiveness Emphasis (%)
0	18.63 C	0.00
10	15.19 CB	18.46
15	14.26 B	23.46
20	12.33 A	33.81
25	12.00 A	35.59
30	12.00 A	35.59
KK 14.36%		

Columns with corresponding uppercase letters did not exhibit significant differences based on the Duncan's Multiple Range Test (DMRT) at a 5% significance level.

Table 9 demonstrates that the leaf extract concentration effectively mitigated the progression of leaf blight in red onion(*Allium ascalonicum L.*) plants. A 30% concentration of Binahong (*Anredera cordifolia*) leaf extract resulted in a reduced attack rate of 12.00 and a disease suppression efficacy of 35.59%, which was not significantly distinct from the 20% and 25% concentrations of the same extract. In comparison to the application of Binahong (*Anredera cordifolia*) leaf extract, the absence of the extract led to a higher attack rate of 18.62%. The inhibition of disease development in red onion(*Allium ascalonicum L.*) plants can be attributed to the antimicrobial properties of the flavonoid compounds found in Binahong (*Anredera cordifolia*) leaves [57-58]. Furthermore, these leaves can modulate indole-3-acetic acid (IAA) activity, thereby fortifying the plant tissue structure through callus formation and closing the vascular system to prevent pathogen infiltration [59-62].

4. Conclusion

Based on the research that has been done, the binahong (*Anredera cordifolia*) extract is able to increase growth and yield with a tuber weight of 76.30 g per hill with suppression of leaf blight severity 35.59% at a dose of 30%. From the experimental results it is suggested to test the concentration of binahong (*Anredera cordifolia*) leaf extract which is higher than 30% in red onion(*Allium ascalonicum L.*) plants.

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