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THE EFFECT OF CONCENTRATION AND FREQUENCY OF NEEM LEAF EXTRACT ON APHID ATTACKS ON CHILI PLANTS

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Oktavianus Lumban Tobing[1], Yanyan Mulyaningsih[1], Amida Dwi Safitri[1]

[1] *Agrotechnology Departement, Faculty of Agriculture, Universitas Djuanda, Indonesia*

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Corresponding Author:
Oktavianus Lumban Tobing
oktavianus@unida.ac.id

ABSTRACT

Aphids that attack red pepper plants cause yield loss. Applying neem leaf extract in the form of concentration and frequency of yield losses can be avoided. Neem leaf extract contains secondary metabolite compounds that can function as vegetable insecticides to suppress the level of aphid attacks on chili plants. Saponins, meliantriol, and azadirachtin have been known as active ingredients that act as insecticides with different mechanisms of action against aphids, such as saponins as stomach poisons and contact poisons, meliantriol as a repellent (repellent/repellent), and azadirachtin as an inhibitor of ecdysone hormones (hormones that play a role in the process of metamorphosis or molting or exoskeleton of aphids). The study aimed to determine the effect of concentration and frequency of neem leaf extract on the incidence and severity of chili aphid attacks as well as plant development. The proposed solution to overcome aphid attacks is administering neem leaf extract to red chili plants. The method uses a randomized trial design of factorial groups with two factors. The first factor is the concentration of neem leaf extract which consists of four levels, namely: S0 = 0% (100 ml of water or without neem leaf extract), S1 = 10% (10 ml of neem leaf extract + 90 ml of water), S2 = 30% (30 ml of neem leaf extract + 70 ml of water), and S3 = 50% (50 ml of neem leaf extract + 50 ml of water). The second factor is the frequency of giving neem leaf extract, which consists of four levels: M1 = age 8 HSPT, M2 = age 16 HSPT, M3 = age 24 HSPT, and M4 = age 32 HSPT. The findings of this study are that the frequency of giving neem leaf extract three times showed a real effect on the severity of aphid attacks at the age of 44 days after transplanting, and giving a 10% extract had a real effect on height, leaf area, number of flowers, header dry bobobt, and dry weight of chili plant roots. The results of this study conclude that the administration of neem leaf extract can suppress the severity of the attack of red chili plant aphids.

1. INTRODUCTION

The study was conducted to determine the effect of giving neem leaf vegetable pesticides on chili aphid attacks. The extract and frequency of providing neem leaves in this study turned out to suppress the attack of red chili aphids because it has active ingredients saponins, meliantriol, and azadirachtin, which functions as a vegetable insecticide. This argument is supported by research data where the concentration of neem leaf extract and the frequency of administration make a real contribution to the severity of chili aphid attacks, growth, duplication, and oviposition. Vegetable pesticides can overcome pest attacks (Hasibuan et al., 2021). Aphid attacks on chili plants can cause problems, especially in yield and growth, which is why this study was conducted. The novelty value of this study is that there has yet to be any previous research on the treatment of neem leaf extract concentration and frequency on red chili plants for site-specific suppressing of red chili aphid attacks.

Research treatment testing is: A= Control, B= Garlic extract 100 ml/plant, C= Neem extract 100 ml/plant, D= Soursop extracts 100 ml/plant. The test results of giving neem leaf extract 100 ml/plant is the best treatment compared to garlic extract 100 ml /plant and soursop extract 100 ml /plant (Haerul et al., 2016). Giving neem leaf extract concentration of 200 g / 1 liter of water is the best treatment in suppressing aphid attacks compared to treating 150 g / l water, 100 g / l water, and without treatment (control). From the results of this study, it can be concluded that the higher the concentration of neem leaf extract given, the better the ability to suppress eggplant aphid attacks because it has higher toxicity (Syakur et al., 2022). Giving neem leaves to aphids of string bean plants had a significant effect on mortality and the level of plant damage with control treatment or 0 g neem leaves (A0), 15 g neem leaves (A1), 20 g neem leaves (A2), 25 g neem leaves (A3), 30 g neem leaves (A4), and 35 g neem leaves (A5) (Javandira et al., 2022).

The difference between this study and other studies cited is the treatment, concentration, and frequency of administration of neem leaf extract. The difference between this study and the others cited lies in its treatment. The research on the treatment was the concentration and frequency of giving neem leaf extract, while other studies treated it differently.

2. METHODS

This study used a factorial group randomized trial design method, as the first factor was the concentration of neem leaf extract consisting of four levels, namely: S0 = 0% (100 ml of water or without neem leaf extract), S1 = 10% (10 ml of neem leaf extract + 90 ml of water), S2 = 30% (30 ml of neem leaf extract + 70 ml of water), and S3 = 50% (50 ml of neem leaf extract + 50 ml of water). The second factor is the frequency of giving neem leaf extract, which consists of four levels: M1 = age 8 days after transplanting (dat), M2 = age 16 dat, M3 = age 24 dat, and M4 = age 32 dat. Each treatment is repeated three times. If the concentration treatment and frequency of neem leaf extract differ markedly, proceed using the Duncan Multiple Range Test likewise, if there is an interaction for each factor. The neem leaf extract is made by taking 300 grams of neem leaf powder dissolved with 1 liter of 100% methanol in a closed container for 3 x 24 hours and stirring occasionally. Neem leaf solution stored for 3 x 24 hours is then filtered using a batiste to separate neem leaves from the pulp. The filtered solution is stored in containers as a starter liquor that can be diluted with a solvent to the required concentration.

3. RESULTS AND DISCUSSION

3.1. Results

The results of the influence of neem leaf extract concentration and frequency factors on the following modifiers did not find interactions with seven variables. The variables are the incidence and severity of aphids, height, leaf area, number of flowers, dry weight of the header, and dry weight of the roots of red pepper plants. The variables are the incidence and severity of aphids, height, leaf area, number of flowers, dry weight of headers, and dry weight of red pepper plant roots presented in Tables 1 and 2, Figures 1, 2, and 3, and Table 3.

Table 1 The incidence of aphid attacks at the age of 34-74 HSPT

Treatment	Intensity of pest infestation				
	34 HSPT	44 HSPT	54 HSPT	64 HSPT	74 HSPT
Control	11,83	13,37	17,56	24,18	13,82
Neem Leaf Concentration					
S1 (10% Extract)	25,58	12,59	19,32	12,41	13,59
S2 (30% Extract)	17,58	13,93	17,91	17,63	15,47
S3 (50% Extract)	20,42	10,76	13,71	17,55	11,48
Frequency of administration of neem leaf solution					
M1 (8 HSPT)	13,19	7,63	10,93	9,87	9,06
M2 (8,16 HSPT)	12,77	8,47	11,57	11,21	8,63
M3 (8,16,24 HSPT)	18,24	10,62	14,81	10,35	8,92
M4 (8,16,24,32 HSPT)	13,35	8,63	12,31	8,63	12,13

Table 2 The severity of aphid infestation at the age of 34-74 HSPT

	Severity of aphid infestation				
Treatment	34 HSPT	44 HSPT	54HSPT	64 HSPT	74 HSPT
Treatment	54,61	52,47[a]	51,75	51,96	47,88
Control	60,87	63,08[b]	55,25	63,56	45,83
Neem Leaf Concentration					
S1 (10% Extract)	48,72	54,95	55,18	52,86	51,49
S2 (30% Extract)	48,08	50,31	49,61	51,85	45,6
S3 (50% Extract)	67,07	52,16	50,46	51,16	46,54
Frequency of administration of neem leaf solution					
M1 (8 HSPT)	31,63	35,38[a]	36,29	36,5	35,26
M2 (8,16 HSPT)	29,40	31,98[a]	32,15	30,14	28,43
M3 (8,16,24 HSPT)	35,99	40,31[b]	36,99	37,14	33,46
M4 (8,16,24,32 HSPT)	32,00	32,68[a]	34,29	35,84	32,31

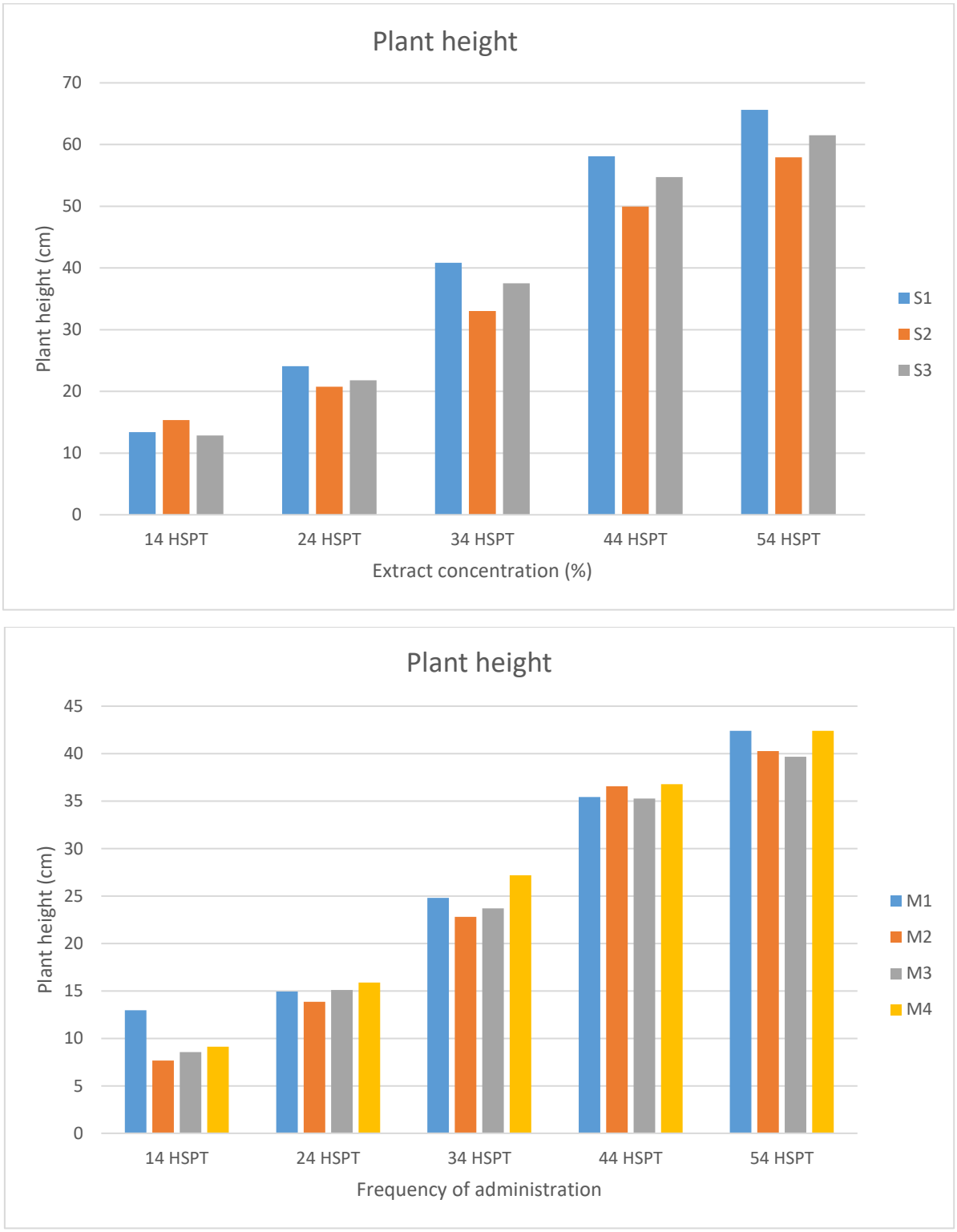

Figure 1 Concentration and Frequency of Neem Leaf Extract on Chili Plant Height

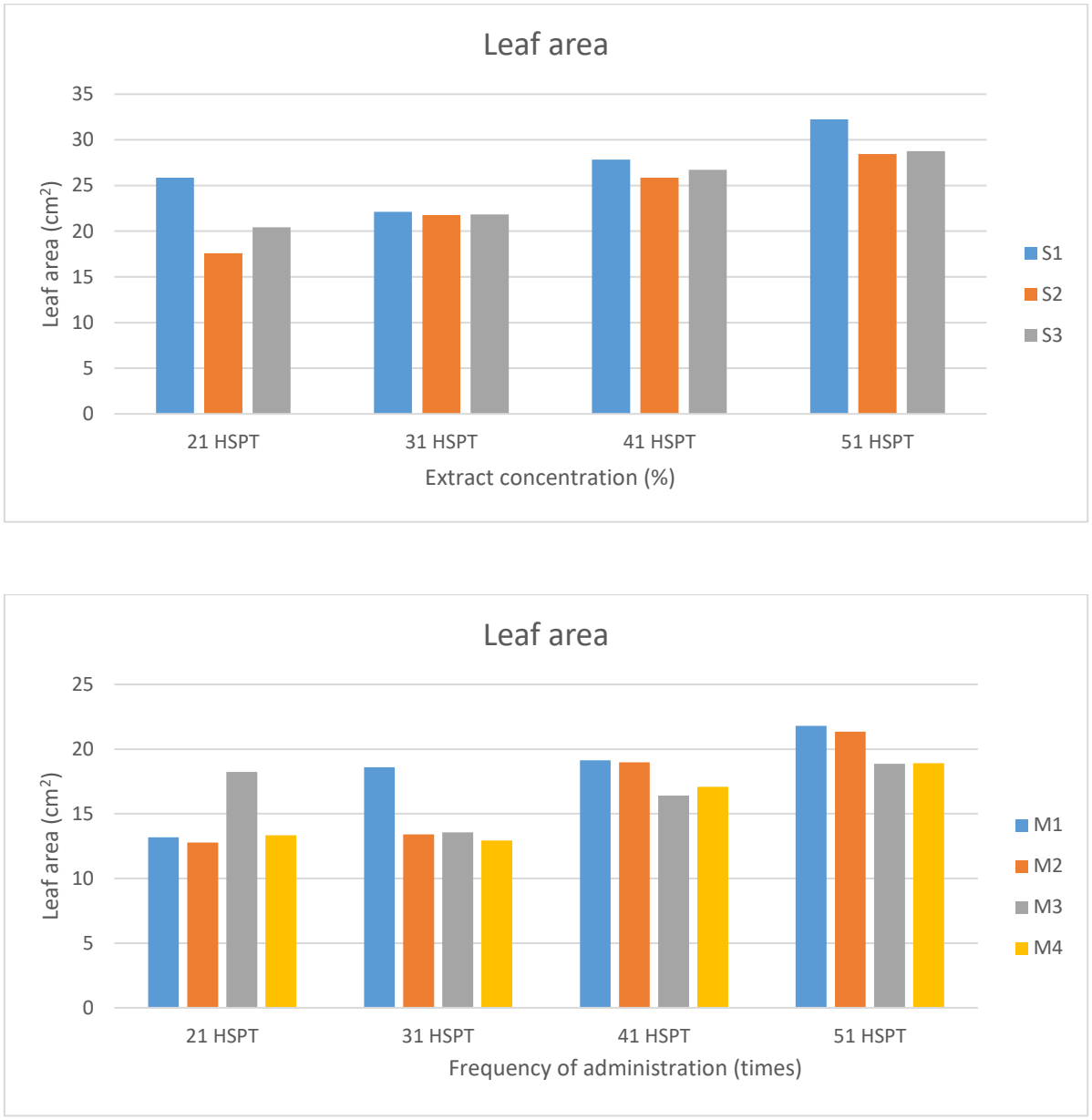

Figure 2 Concentration and Frequency of Neem Leaf Extract on The Leaf Area of Chili Plants

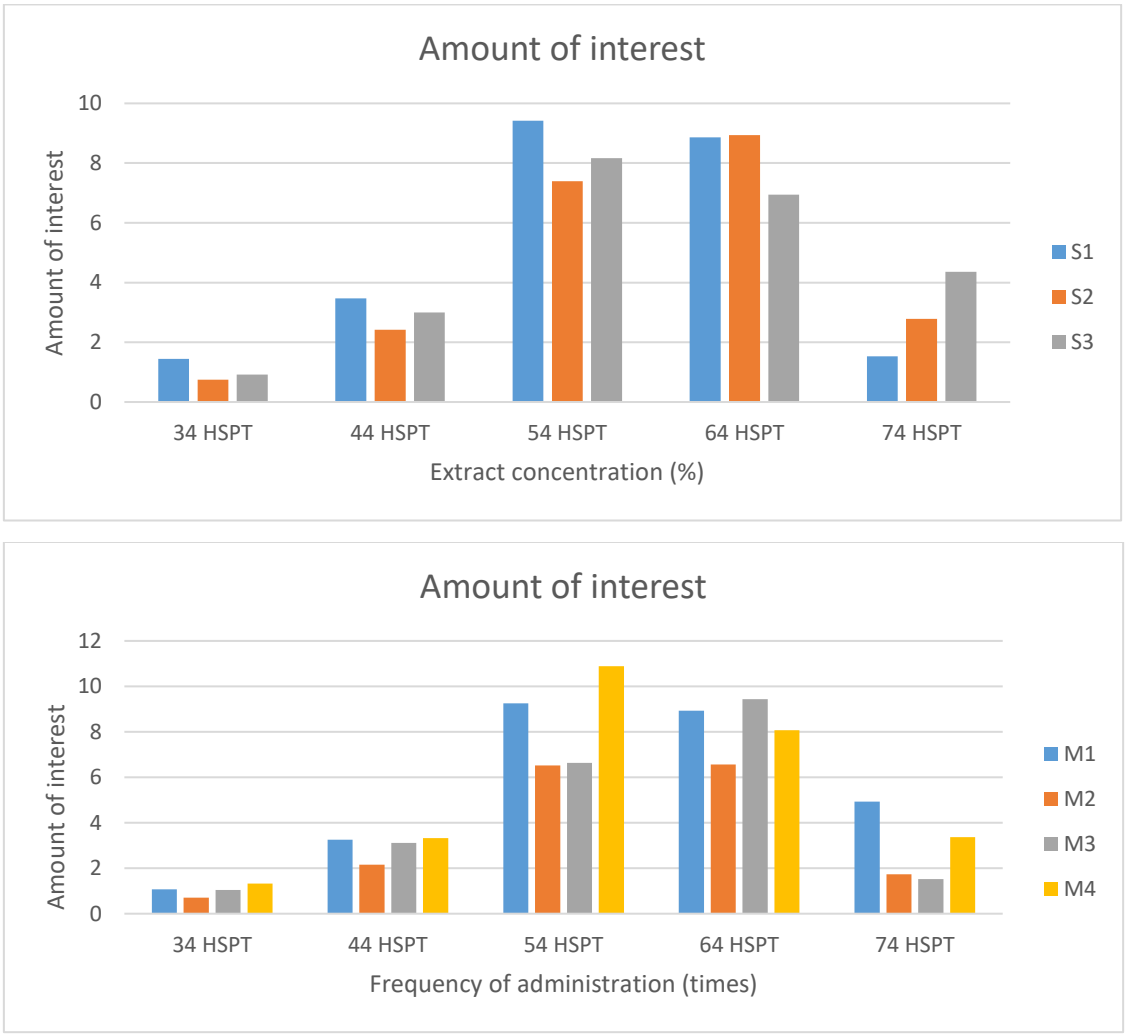

Figure 3 Concentration and Frequency of Neem Leaf Extract on the Number of Flowers

Table 3 Dry weight of the crown and roots of red pepper plants

Treatment	a dry weight of the header	the dry weight of roots
Treatment	35,1	3,97
Control	29,44	4
Neem Leaf Concentration		
S1 (10% Extract)	46,31[b]	4,24[b]
S2 (30% Extract)	30,05[a]	3,62[a]
S3 (50% Extract)	28,94[a]	4,06[b]
Frequency of administration of neem leaf solution		
M1 (8 HSPT)	38,3	4,28[a]
M2 (8,16 HSPT)	32,13	3,43[a]
M3 (8,16,24 HSPT)	32,16	3,9[ab]
M4 (8,16,24,32 HSPT)	37,8	4,28[b]

3.2. Discussion

Neem leaf extract concentration and frequency of administration had a significant effect on the severity of aphids seen in Table 2. In contrast, disease incidence did not have the real effect seen in Table 1. The results of this study have something to do with some arguments from previous researchers listed in the following descriptions. Giving banana weevil extract and neem leaf extract can increase leaf area growth, resulting in increased photosynthesis, which has an impact on increasing the volume of chili plants and is also a vegetable insecticide (Tobing & Mulyaningsih, 2020). Applying as much as 50 ml and 75 ml of neem leaf extract has a significant effect and is the best treatment against whitefly mortality. The treatment consists of 0 ml of neem leaf extract as a control (P0), 50 ml of neem leaf extract / 1 L of clean water (P1), and 75 ml of neem leaf extract / 1 L of clean The combination of concentration treatment between neem leaves. The rest of the cayenne pepper fruit has a real difference between treatments, namely 0%, 5%, 10%, 15%, and 20% on aphid mortality (Rajab et al., 2018). The research aims to gain influence on the dosage of neem leaf extract (Azadirachta indica juice), which has the potential to control whitefly pests (Bemisia tabaci). Testing on dosage, 0 ml of leaf extract neem as a control (P0), 50 ml Neem leaf extract dissolved with clean water 1 liter (P1), 75 ml Neem leaf extract dissolved with clean water 1 liter (P2), 100 ml Neem leaf extract dissolved with clean water 1 liter (P3). Multiple doses of neem leaf extract administered to The whitefly (Bemisia tabaci) may decrease mortality gradually. The best dose is 50 ml, and 75 ml leads to the death of the whitefly 100% (Maharani et al., 2020).

Application of formulations with active neem ingredients is 100% Neem oil, 70% Neem oil, and 1.2% azadirachtin A and B (Azatrol). The study results obtained the application of neem-guided formulations that were tested to be very effective in reducing the population of aphids (Myzus persicae). 14-40% The excretory rate of eating aphids-fed foliar foods containing neem active ingredients decreased markedly compared to controls(Shannag et al., 2014). Reproduction of aphid imago (Myzocallis coryli/Aphididae) decreased by 50% after eating neem leaves at a dose of 2.5 ppm. It increased by 80% at 62.5 ppm, but there was total mortality of nymphs at 25 ppm or larger doses. This test was carried out in the laboratory, while field testing showed a noticeable decrease in aphid populations after eating neem leaves according to treatment.

Testing four insecticides on differences in concentration were Neemix (2 ml/L), Jholmol (125 ml/L), Cannabis extract (100 g/L), Chlorpyrifos 50% EC, and Cypermethrin 5% EC (2 ml/L) as well as control against Craccivora KOCH ticks. All insecticides tested showed a marked difference in tick population decline. The best emphasis on lice is Neemix, then Jholmol and cannabis extract. The highest significant Neemix application yield was 11.10 t/ha, and the lowest was 7.58 t/ha control treatment on cowpea plants (Dhakal et al., 2019). In India, neem plants are plants that have many uses, primarily functioning as insecticides, namely antifungal, antifeedant, larvicide, antidermatic, hormonal, antiallergic, antiscab, anti-inflammatory, and works as spermaticidal, and others. It functions as a plant-based insecticide, increases food production, is environmentally friendly, and is safe for living things. Nowadays, neem pesticides are part of sustainable agriculture and modern cultivation techniques so that synthetic pesticides and fertilizers can be eliminated (Acharya et al., 2017).

In laboratory studies, the concomitant effect of various Azal-T/S neem and Azal-T/S neem is a vegetable insecticide on the mortality percentage of imago from Aphis craccivora Koch. Azal-T Neem and Azal-T/S Neem extracts have a significant affisidial effect on imago by decreasing fecundity and longevity of lice (Aphis craccivora Koch). The cooperative

combination of ethyl oleate, sesame oil, and dimethyl sulfoxide (DMSO) increases the afficidal influence on both plant-based insecticides (Dimetry & El-hawary, 1997). Adding gum cordia to neem oil leaves will increase the effectiveness in suppressing aphid attacks (Homoptera: Aphididae). Cordia gum is derived from the fruit of Cordia myxa as an anionic polysaccharide with strong adhesion and emulsification properties. The more effective pesticide is determined by its ability to adhere more firmly to the surface of the leaves. Neem oil, as a vegetable pesticide, has been known to be very sensitive to UV rays. LC50, or mortality concentration of a formulation, was given to Myzus persicae and Schizaphis graminum tick species. Neem oil formulation adding 0.5% gum cordia will increase adhesion 6 times more to mustard leaves than control. An increase in the concentration of gum cordia will decrease LC50. The results obtained the LC50 value of neem oil applied to spinach, mustard, and wheat leaves with 0.5% gum cordia concentrations of 0.205, 0.715, and 2.074%, while for neem oil control applications (not given gum cordia) LC50 values were 1.833, 2.112, and 4.992% respectively against the leaves tested above. Applying 0.125% gum cordia to neem formulations shows a barrier to UV irradiation (Ali et al., 2022).

Neem is already known as a new biocide in controlling pests and plant diseases; this is evidenced by the collection of available scientific data on neem and its formulation for controlling pests and plant diseases. The PRISMA framework (Preferred reporting items for systematic review and meta-analysis) was used to retrieve data in this study. Neem is a biocontrol agent with few poisonings and is greatly useful in pest and plant disease management systems. Neem biocide opportunities with the active ingredient azadirachtin affect insect metabolic processes such as sexual communication disorders, protein synthesis, changes in biological health, and chitin synthesis (Adusei & Azupio, 2022). Using neem oil and kaolin, prevents cabbage plant lice (Brevicoryne brassicae (L.)) on kale plants. Neem oil, protesyl (kaolin), Rocksil rock dust, orange oil, pyroligneous extract (alone or mixed with pepper + citronella), and neem oil + pyroligneous were sprayed against kale plants. Spraying 1% neem oil and 5% protesyl on kale plants showed lower cabbage aphid communities than controls, but a decrease occurred in the third spraying. Citrus oil causes toxicity to plants and does not decrease aphid communities. The results obtained by applying neem oil and kaolin are suitable for suppressing cabbage aphid communities on kale plants (Pissinati & Venture, 2015).

Neem (Azadirachta indica A. Juss) is known as a native plant of India that functions as a vegetable pesticide made from tetranortriterpenoid and other chemical compounds. The influence of neem on the behavior and physiology of insects is noticeable in insect pests of 15 orders. Azadirachtin has a major limonoid antifeedant influence. The effect varies depending on the dose and species of insects. Neem toxicity is low, so it is safe against mammals, predators, and parasitoids for pest biological control. Neem can be a broad-spectrum pesticide by combining with plants, synergists, antagonists, microbial biopesticides, and adjuvants to increase its effectiveness (Roychoudhury, 2016). Research on the comparative effectiveness of neem extract and synthetic organic insecticides against mustard lice was studied at the Bangladesh Institute of Agriculture, Joydebpur, Gazipur, for two consecutive years, 2010-011 and 2011-2012 on mustard aphid countermeasures. Malataf insecticides (malathion 57EC) @ 2ml/L showed a marked decrease in the highest aphid community by 93.75%, with the highest mustard seed yield of 1440 kg/ha. 63.16-72.55% of mustard aphid communities decreased in neem leaf extract, while 73-81% decreased in neem seed extract. The highest decline in aphid population communities during the preliminary trial of 81% at 50 g neem seeds per liter plot

through high MBCR processing (3.88), followed by 75 neem seeds/plot to be tested 1 had a decrease of 80%, and MBCR 3.78 (Biswas, 2013).

All organs of neem, especially extracts of leaves, bark, and roots, can serve as biopesticides. Azadirachtin, the active neem compound, can be used to control various agricultural pests. The method of action on pests is to repel and inhibit feeding and disrupt metamorphosis and reproduction (Bhandari et al., 2020). In the bio-efficacy study, applying Polygonum hydropiper leaf extract concentration of 5% best suppressed the aphid population by 77.48%. Successively by neem oil concentration of 1% by 74.11%, leaf extract of Ocimum sanctum concentration of 5% by 74.00%, Murraya koenigii leaf extract concentration of 5% was 70.96%, ash at a dose of 10 kg/ha was 68.04%, river sand + neem leaf powder at a dose of 10 kg/ha (ratio 3:1) was 44.48% and ash + sand river dose of 10 kg/ha (5:1 ratio) of 42.53% after 7 days of spraying (Mohapatra et al., 2021).

Green peach aphid is the most critical pest on Solanaceae, Fabaceae, and Brassicaceae plants. This tick is very difficult to control if the population is abundant in greenhouses and fields. The purpose of this study mainly centered on neem, which influences the control of various pests, and began to develop new biological pesticides against green peach aphids. Look for neem ingredients that have a repellent effect against green peach aphids and determine the effective concentration of neem. Extracts of volatile neem material were subjected to insect-repellent tests against green peach aphids. Neem cake has a strong repellent effect against green peach aphids. Raw neem leaves have less repellent, while neem oil has no effect. Volatile extract of 10 g of neem cake showed a repellent effect comparable to that of neem cake. These results suggest that volatile components in neem cake have a repellent effect on green peach aphids (Ikeura et al., 2013).

The plant-based growth regulators gibberellins and cytokinins are found in banana weevil extract, while plant-based pesticides are found in neem leaf extract. These two active ingredients play a role in chili plants' growth, yield, and vegetable pesticides. The first factor is banana weevil extract which consists of four percentage levels, namely 0%, 15%, 30%, and 45%, and the second factor uses neem leaf extract, which consists of four percentage levels, namely 0%, 15%, 30%, and 45%. Provide 600 grams of banana weevil and neem leaves; each is given 1 liter of methanol. Each concentration is made into a volume of 250 ml and applied in this study. Neem leaf extract application significantly affected crown width at 44 and 54 days after planting. In comparison, the leaf area had a significant interaction between 44 and 64 days after planting, the main branch had a significant interaction between 54 days after planting, and disease incidence had a significant interaction between 44 days after planting (Tobing & Mulyaningsih, 2020).

The dose of the admixture of the extract that effectively controlled aphids was determined through experimental methods that involved harvesting and crashing $0.1 \times 10\text{-}4$ of Neem tree parts. Extract fermentation time during 18-48 hours. The concentrations tested varied by 20 mL, 30 mL, and 40 mL of extracts, respectively, in 10 liters of water and applied to cabbage in the field at intervals of once a week, twice a week, and once in 2 weeks in Random Block Design complete triple. Aphid counts at the concentration of 30mL in 10L of water was significantly lower for live aphids and higher for dead aphids ($P < 0.05$);. However, all controls are visible Significant differences from controls in terms of tick mortality, the overall average number of ticks showed a decrease in number (implies high mortality) with an increase in the concentration of Neem extract applied, and The strength of cabbage increases with increasing frequency of application of the mixture, with biweekly application, yielded significant results ($P < 0.05$). The highest concentration (40 mL) more effectively controls aphids but causes light leaf scorch (Stella et al., 2018).

The neem containing irrigation water was tested on soils with different concentrations of life modifiers of aphids (Myzus persicae Sulzer) (Hemiptera: Aphididae). After the

pepper seedlings were transferred to 1.5 L pots, pepper plants were divided into five groups to be watered only with irrigation water (as a control) and irrigation water containing 250, 500, 750, and 1000 mg L-1 neem. The results obtained were the intrinsic rate of increase (rm), net production rate (R0), and average generation time (T0) ranging from 0.039 to 0.352 females/females/day, 1,700 to 57,295 females/females and 11,503 to 15,086 days, respectively. The doubling time (T2) and limited rate of increase (λ) ranged from 1.970 to 17.915 days and 1.039 to 1.422 individuals/females/day, respectively. The influence of neem on the biological character of pests increases due to the increase in neem concentration applied systemically through plant roots (Birgücü et al., 2018).

This research investigates the effectiveness of botanical extracts and synthetic insecticides in tackling wheat aphids by recording aphid population data at 24, 48, 72, and 168 hours after plant application of botanical extracts and synthetic insecticides. The maximum number of deaths recorded after 168 hours were 85.06% and 79.29% by neem and eucalyptus leaf extract, followed by 72 hours 72.29% and 71.69%, 48 hours 63.35% and 62.45% and 24 hours 48.91% and 48.68% respectively. Neem leaf extract is more effective than Eucalyptus leaf extract among botanical extracts. Carbosulfan and imidacloprid showed mortality of 76.80% and 75.62%, followed by 84.40% and 84.08%, 91.35% and 90.53%, and 95.39% and 93.85% after 48, 72, and 168 hours respectively, (Saleem et al., 2023). Three commercial neem-based formulations tested, namely Azatrol (1.2% Azadiractin A and B), Triple Action Neem Oil (70% neem oil), Pure Neem Oil (100% neem oil), assessment of green peach aphid, Myzus persicae, with the location of laboratories and greenhouses. A twofold increase in the concentration of Azatrol and Triple Action Neem Oil caused a 50% decrease in the number of aphids on treated leaf tissue compared to untreated leaf tissue. Aphids are fed leaves containing insecticides made from neem; the grade excretion of melons is significantly reduced, up to 14-40% of the control, thus indicating the prevention of feeding. Azatrol also works well systemically when applied through the root, resulting in a 50% reduction in treated aphids' feeding activity compared with controls. Results obtained Neem-based formulations tested are highly effective in suppressing tick populations but do not act as an efficient repellent in Standard application rate. When suppressing feeding, they cannot wholly inhibit food intake (Shannag et al., 2014).

The testing of seven different biopesticides was NSKE 5%, neem oil 0.3%, azadirachtin (0.15 EC) 0.0006%, garlic bulbs extract 3%, Beauveria bassiana 2 x 108 CFU / G, Lecanicillium lecanii 2 x 108cfu/g and A decoction of 2% tobacco is evaluated in comparison with control (water spray) for their bio-efficacy relative to A. Craccivora on fenugreek plants. Of the seven bio-pesticides evaluated against A. craccivora on fenugreek, 0.0006% Azadirachtin, 0.3% neem oil, and 3% garlic bulb extract, It was found to be most effective in suppressing tick populations. The crop is listed on the plot as treated with azadirachtin followed by neem oil and garlic bulb extract. The maximum net realization is obtained at azadirachtin, and the ICBR treatment maximum listed in neem oil is 0.3% (Sarvaiya et al., 2018). Peanuts (Arachis hypogaea L.) include legume plants grown for their edible seeds. Various insect pests among them damage the plant Aphis craccivora Koch. It causes heavy damage to the tender leaves of the plant and decreases yield. The best imidacloprid insecticide against aphids decreased the population by 85.47%, followed by a mixed formulation of azadirachtin + tobacco which decreased the population by 79.94%, and imidacloprid + Polygonum (decreased by 79.18%). Peanuts provide better aphid control when plant extracts are mixed with plant-based insecticides such as azadiractin or small amounts of chemical insecticides. Plant extracts (bio-pesticides) with less or no harmful environmental effects can be included in pest management (Ghosh, 2020).

The results reported the success of neem oil and cinnamic oil on cowpea aphid Aphis craccivora Koch (Hemiptera: Aphididae), which attacked various host plants, causing severe damage. Neem oil is more effective in overcoming A. craccivora, where LC50 is 125.26 ppm, compared to cinnamic oil, where LC50 is recorded at 378.68 ppm. GC/MS analysis of Neem oil showed the presence of saturated and unsaturated fatty acids by 99.34%, of which eight different fatty acids were obtained. Linoleic acid represents a significant proportion, with 34.69% (Aziz et al., 2018). Pests and diseases are one of the main factors limiting plant growth and yield. Pests are known as vectors of pathogens, including viruses. Proper plant pest management is an indirect way to control viral diseases of plants. Potency testing of neem extract and synthetic insecticide (lambda-cyhalothrin) for the management of aphids and Cowpea aphid-borne mosaic virus (CABMV) on five different cowpeas (Vigna unguiculata) genotypes and to determine the effect of insecticide residues on cowpea grains—test results for cowpea yield and nature of viral diseases. The applied treatment affects the occurrence of pests and viral diseases. Neem extract reduces aphid infestations and viral diseases as much as insecticides (Kareem et al., 2022).

The effectiveness of botanical extracts and synthetic insecticides in tackling wheat aphids tested. Time recording of tick populations 24, 48, 72, and 168 hours after plant extracts and synthetic insecticides administration. The maximum mortality recorded after 168 hours was 85.06% and 79.29% by Neem and Eucalyptus leaf extracts followed by 72 hours 72.29% and 71.69%, 48 hours 63.35% and 62.45% and 24 hours 48.91% and 48.68% respectively. Botanical extracts are effective and environmentally friendly compared to synthetic insecticides. Among synthetic insecticides, carbosulfan is more effective than imidacloprid but has a toxic effect on natural enemies. The results showed that botanical extracts were part of integrated pest management, providing an alternative to synthetic insecticide control (Saleem et al., 2023).

4. CONCLUSION

Based on the results of the study, it can be concluded that the effect of giving concentration and frequency of neem leaf extract can suppress the severity of aphid attacks, but there is no suppression on the incidence of disease. The effect of giving concentration and frequency to increase plant development, which occurs in plant height gradually starting from the age (14, 24, 34, 44, 54) days after planting, leaf area (41, and 51) days after planting, the number of flowers (54, and 64) days after planting, and the dry weight of the crown and roots of chili plants

REFERENCES

Acharya, P., Mir, S. A., & Nayak, B. (2017). Competence of Biopesticide and Neem in Agriculture. *International Journal of Environment, Agriculture and Biotechnology (IJEAB)*, *2*(6), 2958–2965. https://doi.org/http://dx.doi.org/10.22161/ijeab/2.6.23 Vol-2,

Adusei, S., & Azupio, S. (2022). Neem : A Novel Biocide for Pest and Disease Control of Plants. *Journal of Chemistry*, *2022*. https://doi.org/10.1155/2022/6778554

Ali, S., Haq, M. A., Naz, S., & Faheem Akbar, M. (2022). Gum cordia effectively enhances foliage adhesion of neem oil and increases its efficacy against aphids (Homoptera: Aphididae). *Journal of Asia-Pacific Entomology*, *25*(2), 101904. https://doi.org/10.1016/j.aspen.2022.101904

Aziz, W., Shalaby, M., & Tawfik, W. (2018). Efficacy of some Essential Oils on Cowpea Aphid, Aphis craccivora Koch (Hemiptera: Aphididae). *Journal of Plant Protection and*

Pathology, *9*(12), 827–830. https://doi.org/10.21608/jppp.2018.44074

Birgücü, A. K., Özger, Ş., Pohl, D., & Karaca, İ. (2018). Effects of soil application of neem on some biological characteristics of myzus persicae (Sulzer) (hemiptera: Aphididae). *Tarim Bilimleri Dergisi*, *24*(2), 256–268. https://doi.org/10.15832/ankutbd.446452

Biswas, G. C. (2013). *COMPARATIVE EFFECTIVENESS OF NEEM EXTRACTS AND SYNTHETIC ORGANIC INSECTICIDE AGAINST MUSTARD APHID*. *38*(June), 181–187. https://doi.org/10.3329/bjar.v38i2.15881

Dhakal, R., Ghimire, R., Sapkota, M., Thapa, S., Bhatta, A. K., & Regmi, R. (2019). BIOEFFICACY OF DIFFERENT INSECTICIDES ON COWPEA APHID (APHIS CRACCIVORA KOCH) Roshan. *International Journal of Entomological Research*, *07*(01), 1–9. https://doi.org/10.33687/entomol.007.01.2629

Dimetry, N. Z., & El-hawary, F. M. A. (1997). SYNERGISTIC EFFECT OF SOME ADDITIVES ON THE BIOLOGICAL ACTIVITY AND TOXICITY OF NEEM-BASED FORMULATIONS AGAINST THE COWPEA APHID, APHIS CRACCIVORA KOCH. *Insect Sci. Applic*, *17*(3), 395–399. https://doi.org/10.1017/s174275840001924x

Ghosh, S. K. (2020). Aphid (Aphis craccivora Koch.) Management on Groundnut Crop (Arachis hypogaea) by using Bio-pesticides. *International Journal of Current Microbiology and Applied Sciences*, *9*(10), 24–34. https://doi.org/10.20546/ijcmas.2020.910.004

Haerul, Idrus, M. I., & Risnawati. (2016). Efektifitas Pestisida Nabati Dalam Mengendalikan Hama Pada Tanaman Cabai. *Agrominansia*, *3*(2), 129–136. https://doi.org/10.34003/271888

Hasibuan, M., Delina, E., & Zulhaida, L. (2021). *Pemanfaatan Daun Mimba (Azadirachta indica) sebagai Pestisida Nabati : Review*. *5*(1), 1153–1158.

Ikeura, H., Murata, N., Sakura, A., Hayata, Y., & Kobayashi, F. (2013). Search for neem materials having repellent effect against green peach aphid (Myzus persicae Sulzer). *International Society for Horticultural Science*, *989*, 97–102. https://doi.org/10.17660/ActaHortic.2013.989.10

Javandira, C., Yuniti, I. G. A. D., & Widana, I. G. (2022). Pengaruh Pestisida Daun Mimba terhadap Mortalitas Kutu Daun (Aphis craccivora Koch) pada Tanaman Kacang Panjang. *Agro Bali : Agricultural Journal*, *5*(3), 485–491. https://doi.org/https://doi.org/10.37637/ab.v5i3.998

Kareem, K. T., Olayinka, R. B., Ugwu, J. A., & Oduwaye, O. F. (2022). Effects of Neem Aqueous Extract (Azadirachta indica) against Aphids and Aphid-borne Virus in Cowpea (Vigna unguiculata L. Walp). *Tanzania Journal of Science*, *48*(1), 47–56. https://doi.org/10.4314/tjs.v48i1.5

Maharani, S., Sepriani, Y., & Walida, H. (2020). Pengaruh Ekstrak Daun Mimba (Azadirachta indica Juss) Terhadap Mortalitas Hama Kutu Kebul (Bemisia tabaci). *Agustus*, *1*(2), 55–60.

Mohapatra, S., Gogoi, I., Bhattacharyya, B., Nath, P. D., & Neog, B. (2021). Efficacy of some indigenous products against cowpea aphid, Aphis craccivora Koch. *Indian Journal of Traditional Knowledge*, *20*(3), 822–826. https://doi.org/10.56042/IJTK.V20I3.28261

Pissinati, A., & Venture, M. U. (2015). Control of cabbage aphid, Brevicoryne brassicae (L.) using kaolin and neem oil. *Journal of Entomology*, *12*(1), 48–54. https://doi.org/10.3923/je.2015.48.54

Rajab, A. M., Hayati, A., & Zayadi, H. (2018). Pengaruh Larutan Kombinasi Daun Mimba (Azadirachta indica) dengan Buah Cabai Rawit (Capsicum frutescens) terhadap Mortalitas Kutu Daun Hijau (Aphis gossypii) Secara In Vitro. *Jurnal SAINS ALAMI (Known Nature)*, *1*(1), 1–6. https://doi.org/10.33474/j.sa.v1i1.1390

Roychoudhury, R. (2016). Neem Products. *Ecofriendly Pest Management for Food Security*, 545–562. https://doi.org/10.1016/B978-0-12-803265-7.00018-X

Saleem, U., Asrar, M., Hussain, D., Hussain, S., Ghaffar, A., & Usman, H. (2023). *Efficacy of Plant Extracts and Selective Insecticides Against Wheat Aphid in Faisalabad, Pakistan*. *9*(1), 65–71.

Sarvaiya, R. M., Rathod, N. P., & Patel, R. M. (2018). Bio-Efficacy of Bio-Pesticides against Aphid, Aphis craccivora Koch Infesting Fenugreek. *International Journal of Current Microbiology and Applied Sciences*, *7*(10), 2634–2640. https://doi.org/10.20546/ijcmas.2018.710.306

Shannag, H. S., Capinera, J. L., & Freihat, N. M. (2014). Efficacy of different neem-based biopesticides against green peach aphid, Myzus persicae (Hemiptera : Aphididae). *International Journal of Agricultural Policy and Research*, *2*(2), 61–68.

Stella, A. E., Flarian, M. M., & Tedson, M. J. (2018). Efficacy of Neem Tree (Azadirachta indica A. Jusieu) Extract on White Cabbage Aphid (Brevicoryne brassicae L. (Hem: Aphididae) Control in the field. *Journal of Agricultural Science*, *10*(3), 370. https://doi.org/10.5539/jas.v10n3p370

Syakur, A., Hasrianty, Alam, M. N., & Asrun, B. (2022). Pengaruh Pemberian Ekstrak Daun Mimba(Azadirachta india A. Juss) Terhadap Hama Kutu Daun(Aphis craccivora) Pada Tanaman Terong (Solanum melongena L). *Jurnal Pendidikan Biologi*, *7*(2), 258–265.

Tobing, O. L., & Mulyaningsih, Y. (2020). THE RECONDITIONING GROWTH OF PRODUCTION OF CHILI THROUGH THE BANANA HUMP AND MIMBA LEAF EXTRACT. *Indonesian Journal of Applied Research*, *1*(3), 136–149. https://doi.org/10.30997/ijar.v1i3.71