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THE EFFICACY OF *Toona sureni* (Bl.) *merr* LEAF EXTRACT ACROSS DIFFERENT CONCENTRATIONS IN MANAGING TOBACCO CUTWORM (*Spodoptera litura* F.) INFESTATIONS

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Abstract
Control of *S. litura* by farmers still depends on the use of synthetic pesticides which are believed to be practical. *Toona sureni* is a plant that has potential as a vegetable insecticide. This research was carried out at the Plant Protection Laboratory, Faculty of Agriculture, UPN "Veteran" Yogyakarta. The research was structured in a single factor Completely Randomized Design (CRD) with 6 treatments and repeated 3 times. The treatments tried were concentrations of *T. sureni* suren leaf extract, namely TP: Control without pesticide treatment, T0: control of the synthetic insecticide Deltamethrin, T1: 8% suren leaf extract, T2: 10% suren leaf extract, T3: 12% suren leaf extract, and T4: Suren Leaf Extract 14%. The method used for data collection is direct observation of pests. The parameters observed were larval mortality, larval feeding capacity, larval to pupal phase, percentage of larvae to pupae, larval to imago phase, percentage of larvae to imago, and efficacy. Data were analyzed using analysis of variance (ANOVA). If there is a real difference between each treatment. If it shows a real effect, then proceed with the 5% DMRT test. Application of *T. sureni* concentrations of 8%, 10%, 12%, and 14% had the same effective effect in increasing *S. litura* mortality and efficacy.

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INTRODUCTION

Heavy infestation of pest organisms in plants causes leaves to be damaged or consumed, which can reduce production and even kill the plants. The caterpillar pest tobacco cutworm (*S. litura*) from the order Lepidoptera and family Noctuidae is one of the important pests in crops including soybean, cabbage and mustard. Yield losses due to pest attacks can reach 85%, and can even cause crop failure (puso). This pest has a polypagous nature so that it can eat various types of plants for its survival (Azwana & Adikorelsi, 2009). Control of leaf-eating caterpillars by farmers still depends on the use of synthetic pesticides which are believed to be practical in application and control results are clearly visible, but farmers tend to use excessive doses of pesticides, so the use of pesticides needs to be managed and controlled effectively and safely for the environment (Julaily *et al*., 2013).

In overcoming this problem, there needs to be an alternative control method including the use of vegetable pesticides. Vegetable pesticides are pesticides that have active ingredients produced from plants and have a function as a controller of pests and diseases that attack plants. Vegetable pesticides are pesticides that can be an alternative to reduce the use of synthetic pesticides. Vegetable pesticides are environmentally friendly and the plants that produce them are easy to cultivate (Adnyana, 2012). As an example of the use of plants that can be used as vegetable pesticides is Suren.

Suren (*Toona sureni* (Bl.) *merr*) is a plant that has potential as a vegetable insecticide because it contains triterpenoid compounds suren, surenin, and surenolactone which have toxic properties for pests and have antifeedant properties against insects (Hidayati *et al*., 2013). In previous research conducted by (Widyastuti *et al*., 2020) regarding the effectiveness of

vegetable insecticides from surian leaves with a concentration of 5 ml with water solvent applied to purple leaf caterpillar pests (*Doleschallia bisaltidae*) showed significant results on larval mortality which reached a larval mortality rate of 91, 67%.

The phenol content in suren leaf extract is proven to be able to kill crabs (*Cimex lectularius*), a type of mattress flea and fleas that live in board cracks (Antira *et al*., 2013). Based on the results of the study, the ethyl acetate extract of suren leaves is active as an anti-termite with an LC50 value of 8.97%, a pure compound from the phenol group called coumarin was found (Setiawan, 2017). Coumarin compounds are proven to kill termites at concentrations of 4 & 6% with a mortality rate of 92%, coumarin compounds in Toona sureni extract are also proven to be antimicrobial because they can inhibit the growth of *E. coli* and *S. aureus* bacteria and the growth of *C. albicans* fungi, at a concentration of 5.7 mg/ml has the highest inhibition against microbes (Firdaus, 2018).

RESEARCH MENTHODS

The research was conducted at the Plant Protection Laboratory, Faculty of Agriculture, UPN "Veteran" Yogyakarta, Condongcatur, Depok District, Sleman Regency, Yogyakarta Special Region, from March to May 2024 using a single-factor completely randomized design (CRD) with three replications. The treatment tested was the concentration of *T. sureni* leaf extract, namely TP: Control Without Pesticide Treatment, T0: Deltamethrin Synthetic Insecticide Control, T1: 8% Suren Leaf Extract, T2: 10% Suren Leaf Extract, T3: 12% Suren Leaf Extract, and T4: 14% Suren Leaf Extract.

The tools used included gauze/tissue, binocular microscope, rotary evaporator, oven, handsprayer, tweezers, brushes, beakers, petri dishes, measuring cups, filter cloth, scissors, erlenmeyer, measuring tubes, stirrers, and 1000 mL jars.

Materials used included suren leaf extract, *S. litura* F. larvae, pakcoy, distilled water, deltamethrin active ingredient synthetic insecticide, and 96% ethanol.

RESEARCH IMPLEMENTATION

1. Larvae Provision

The multiplication of tobacco cutworm pests was carried out before the research was carried out by collecting *S. litura* larvae from the field. *S. litura* propagation was carried out using a plastic box, the bottom of which was lined with paper towels. The plastic box was used for rearing S. litura larvae, the larvae were fed 250 grams of pakcoy leaves. Prepare a pupation box with a size of 50 cm x 50 cm x 50 cm. Larvae that have formed pupae are moved into the pupation box, to further develop into imago. Imago are fed with a 10% honey solution impregnated on 21 cotton rolls. After the eggs hatched, they were nurtured to 3rd instar larvae and then infested into the experimental plots as required.

2. Preparation of Suren Leaf Extract

The manufacture of suren leaf extract is as much as 1 kg weighed then washed and dried. Leaves in the oven at 48 ^{o}C for 4 days until dry. The dried leaves were ground using a blender until they became powder. Suren leaf symplisia was put into a large jar to be macerated using 96% ethanol for 3 replicates. The first maceration was macerated with a ratio of 1: 3 between 100 g suren leaf powder and 300 mL 96% ethanol for 24 hours. The results of the first maceration were filtered using filter paper and then stored in an erlenmeyer and covered using aluminum foil. The second repeat maceration was macerated with a ratio of 1: 2 between the remaining pulp of suren leaf powder in the first replication of 80 g with 96% ethanol 160 mL for 24 hours. The results of maceration were filtered using filter paper and then stored in an erlenmeyer and covered using aluminum foil. The third replicate maceration was macerated

with a ratio of 1: 2 between the remaining pulp of suren leaf powder in the second replication of 60 g with 96% ethanol 120 mL for 24 hours. The results of maceration were filtered using filter paper and then stored in an erlenmeyer and closed using aluminum foil. The results of maceration for each replication were mixed, then the filtrate of suren leaf extract and 96% ethanol were vacuum evaporated using a rotary vacuum evaporator. The result of the evaporation is a thick black extract with a concentration of 100%.

3. Application

The application stage is first making a solution according to the treatment concentration. Suren leaf extract solution was diluted according to the treatment, namely 8%, 10%, 12%, and 14%. The deltamethrin solution was diluted according to the recommended usage of 2 mL/L. *S. litura* larvae were put into 1000 mL jars of 10 each in each treatment. Pakcoy leaf feed was weighed using analytical scales as much as 10 grams, after which it was dipped in a solution of each extract for 10 seconds and then dried and given to each experiment. Pakcoy leaf feed is replaced every day and observations are made. Laboratory tests were conducted to determine the toxic effects of suren leaf extract on *S. litura*. This test uses the leaf deep bio essay method (Prijono, 1999).

RESULT AND DISCUSSION

A. Mortality Of *S. litura* Larvae

Based on the observation of 1 DAA (Table 1), mortality in some treatments but based on analysis of variance there is no significant difference between treatments. Based on research conducted by Darwiati (2013), suren plants are effective in controlling leaf pests *Eurema spp*. and *S. litura*. In the observation of 2 - 4 DAA (Table 1) showed a significant difference, it was known that the highest mortality was in the treatment of 8% Suren Leaf Extract at 26.67%, which was significantly higher than the other treatments. This shows that in this observation the results obtained increased in the treatment of suren leaf extract with low concentrations. Suren leaf extract at low concentrations (6.25 - 8.25%) is more effective in suppressing damage up to 51% on soybean plants (Noviana et al., 2012). Observations at 5-6 DAA (Table 1), based on the analysis of variance there were no significant differences between treatments. This is because all treatments show mortality results that are not too significant.

Table 1 Average Mortality of *S. litura* 6 - 10 Days After Application (DAA) (%)

Treatment (%)	Average Mortality of S. litura on ... Days After Application				
	1	2	3	4	5
Control Without Pesticide Treatment	0.0±0.0a	3.3±3.3bc	3.3±3.3cd	3.3±3.3c	6.7±3.3a
Deltamethrin Synthetic Insecticide Control	0.0±0.0a	0.0±0.0c	0.0±0.0d	3.3±3.3c	10.0±5.8a
Suren Leaf Extract 8%	3.3±3.3a	26.7±6.7a	26.7±6.7a	26.7±6.7a	26.7±6.7a
Suren Leaf Extract 10%	3.3±3.3a	10.0±0.0b	10.0±0.0bc	13.3±3.3b	13.3±3.3a
Suren Leaf Extract 12%	6.7±6.7a	10.0±10b	13.3±8.8bc	13.3±8.8b	13.3±8.8a
Suren Leaf Extract 14%	0.0±0.0a	0.00±0.0c	0.0±0.0d	0.0±0.0c	13.3±3.3a

Note: Numbers followed by the same letter in the same column indicate differences that are not significant based on the DMRT follow-up test at the 5% level. Data after analysis is transformed to Arcsin$\sqrt{X + 0.5}$

Observation of 7 DAA (Table 2) shows the results of real differences, it is known that the highest percentage of mortality is still in the treatment of 8% Suren Leaf Extract at 93.33%,

not significantly different from the treatment of 12% Suren Leaf Extract and 14% Suren Leaf Extract, respectively 70% and 80%. This is because the treatment given suren leaf extract began to be infected with compounds in suren leaves. Surian plants contain secondary metabolites (Cavoski *et al*., 2011) in the form of flavonoids, tannins, quinones, steroids and alkaloids (Sari *et al*., 2011). Flavonoids in plants can function as vegetable insecticides that work by inhibiting the activity of protease and amylase enzymes so that they can inhibit the larval digestive system (Shahabuddin & Pasaru, 2009).

Based on the analysis of variance and further DMRT, Observation 8 - 10 DAA (Table 2) shows significantly different results, it is known that the percentage of mortality in the treatment of 8% Suren Leaf Extract, 10% Suren Leaf Extract, 12% Suren Leaf Extract, and 14% Suren Leaf Extract respectively 100%, 100%, 100%, 90% are not significantly different, but significantly higher than the other treatments. This shows that the concentration of Suren Leaf Extract 8%, 10%, 12% or 14% did not show significantly different results. This happens the higher the concentration used for treatment, the more metabolite compounds in the extract so that the toxic power is higher, thus the death of larvae is more.

This is in accordance with the opinion of Priyono (1994) in Marhaeni (2001), that the higher the concentration used, the more active ingredients in the solution so that the toxic power of vegetable pesticides is higher. The higher the toxicity causes more larval mortality. The increase in the percentage of larval mortality with the higher concentration of extracts is not only due to the high levels of active ingredients that are toxic, but also presumably due to the lack of nutrients consumed by the larvae due to the presence of anti-feeding compounds in the extracts. The mortality percentage in the suren extract treatment is higher than the control treatment, this is thought to be because suren leaves contain triterpenoid compounds including surenon, surenin and surenolactone (Junar, 2000).

In the observation, it was found that the 14% Suren Leaf Extract treatment had larvae that were still alive compared to the other suren leaf extract treatments. This is because there are allegations of errors during application, these errors include dipping the entire feed which is not submerged, causing the pesticide to stick to the pakcoy leaves a little. In the positive control treatment, namely deltamethrin insecticide which is a contact and stomach poison in this study, resistance occurred. Insect resistance to insecticides occurs due to the unwise use of insecticides that cause insects to adapt and/or evolve. These changes occur in the insect's body, both in terms of physiological, biochemical, and genetic.

Table 2 Average Mortality of *S. litura* 6 - 10 Days After Application (DAA) (%)

Treatment (%)	Average Mortality of S. litura on ... Days After Application				
	6	7	8	9	10
Control Without Pesticide Treatment	6.7±3.3a	16.7±3.3d	20.0±0.0c	26.7±3.3c	30.0±0.0c
Deltamethrin Synthetic Insecticide Control	23.3±12.a	50.0±11.5c	50.0±11.5b	66.7±14.5b	66.7±14.5b
Suren Leaf Extract 8%	26.7±6.7a	93.3±6.7a	93.3±6.7a	100.0±0.0a	100.0±0.0a
Suren Leaf Extract 10%	23.3±8.8a	63.3±23.3bc	76.7±14.5a	96.7±3.3a	100.0±0.0a
Suren Leaf Extract 12%	26.7±8.8a	70.0±10bc	73.3±12a	90.0±5.8a	100.0±0.0a
Suren Leaf Extract 14%	23.3±6.7a	80.0±11.5ab	80.0±11.5a	86.7±8.8a	90.0±10a

Note: Numbers followed by the same letter in the same column indicate differences that are not significant based on the DMRT follow-up test at the 5% level. Data after analysis is transformed to Arcsin$\sqrt{X + 0.5}$

B. Larval Feeding Powder

The results showed that the application of suren leaf extract affected larval feeding ability. Based on the analysis of variance of observation 1 DAA (Table 3), it is known that the highest feeding ability of the No Pesticide Treatment Control treatment is 51.23%, but based on the analysis of variance there is no significant difference between treatments. Observation 2 DAA (Table 3) shows the results are not significantly different between treatments. Observation 3 - 4 DAA (Table 3) treatment with the highest larval feeding power, namely Control Without Pesticide Treatment, was significantly different from the other treatments. The small larvae damaged the leaves by leaving the remains of the upper epidermis (transparent) and only the bones of the leaves, while the large caterpillars ate the leaf bones and fruit parts. The observation at 5 DAA (Table 3) showed no significant difference between treatments. This is because at 5 DAA observations in all treatments did not show significant differences.

Table 3 Average Feeding Power of Larvae 1 – 5 Days After Application (DAA) (%)

Treatment (%)	Average Eating Power of S. litura on ... Days After Application				
	1	2	3	4	5
Control Without Pesticide Treatment	51.2±7.6a	46.0±7a	42.4±3.7a	74.8±16.6a	100.0±0.0a
Deltamethrin Synthetic Insecticide Control	7.0±2.7bc	15.5±0.4a	22.2±5.2c	17.0±8.3c	67.5±27a
Suren Leaf Extract 8%	2.5±2.5c	37.4±9a	17.2±5.8c	24.9±6.8bc	48.8±26.5a
Suren Leaf Extract 10%	12.2±0.5b	31.2±5.3a	21.3±1.4c	24.2±2.2bc	29.5±12.3a
Suren Leaf Extract 12%	8.8±3.2bc	41.8±11.7a	17.8±4.2c	39.1±6.8b	54.4±24.2a
Suren Leaf Extract 14%	12.4±3.8b	23.3±3.3a	30.2±1.3b	59.3±4.7a	74.1±4.8a

Note: Numbers followed by the same letter in the same column indicate differences that are not significant based on the DMRT follow-up test at the 5% level. Data after analysis is transformed to Arcsin$\sqrt{X + 0.5}$

Observation of 6 DAA (Table 4) shows the results are very significantly different between treatments, it is known that the highest larval feeding power value in the control treatment without pesticide treatment of 95.97% is significantly higher than the other treatments. Observations at 7 DAA showed that the average value of feeding power of treatments treated with suren leaf extract began to decline along with the decline in larval mortality. Suren leaf extract has also been applied to bagworms in a study by Suhaendah *et al*. (2008). The results showed that the suren leaf solution did not kill directly but had the property of inhibiting the feeding power of the caterpillars. Phytochemical screening of suren leaf simplisia showed the presence of flavonoid, tannin, and steroid/tripenoid compounds (Sesilia *et al*. 2006). Suren contains surenon and surenin (Kraus *et al*. 1979). These compounds have a bitter taste (Robinson, 1991). The mechanism of suren leaf extract in controlling pests is thought to be related to the repellen mechanism, namely by rejecting the presence of insects due to the pungent odor of suren leaves. In addition, if consumed by *S. litura* larvae, it will cause the feeding activity of *S. litura* larvae to be disrupted or inhibited.

Observations 8 - 10 DAA (Table 4) showed the same results significantly different, it is known that the highest feeding power in the treatment of Control Without Pesticide Treatment was significantly higher than other treatments. Deltametrin Synthetic Insecticide Control treatment of 15.80% was significantly different from the other treatments, while the

treatment of 8% Suren Leaf Extract, 10% Suren Leaf Extract, 12% Suren Leaf Extract, and 14% Suren Leaf Extract was not significantly different. This is because the treatment began to give a weakening reaction as evidenced by the value of feeding power <35%, besides that it is also because the suren leaf extract also contains triterpenoid compounds, these compounds can function as repellence which has a pungent odor and astringent taste which causes larvae to not want to eat (Junar, 2000). According to Syah & Purwani (2016), some of the content in suren leaves in the form of flavonoids that act as insecticides such as surenon, surenin, surenolactone, sedrelon, carotenoids, zeasantin and lactusantin which are antifeedant (inhibiting insect appetite) and repellent (repelling or repelling insects) on army caterpillar test insects (*Spodoptera litura*).

Table 4 Average Feeding Power of Larvae 6 – 10 Days After Application (DAA) (%)

Treatment (%)	Average Eating Power of S. litura on ... Days After Application				
	6	7	8	9	10
Control Without Pesticide Treatment	95.9±4a	96.3±3.7a	68.1±4.8a	33.4±10.6a	28.6±4.5a
Deltamethrin Synthetic Insecticide Control	15.1±4c	32.6±6b	21.2±4.1b	12.7±2.5b	12.9±2.4b
Suren Leaf Extract 8%	25.0±12.6bc	22.0±20bc	1.5±1.1d	0.0±0.0c	0.0±0.0c
Suren Leaf Extract 10%	38.3±24.4b	17.4±11.5c	1.7±1.1d	1.9±2c	0.0±0.0c
Suren Leaf Extract 12%	31.3±5.8bc	6.2±2c	12.1±5.6c	1.2±0.7c	0.0±0.0c
Suren Leaf Extract 14%	43.0±1.5b	5.2±2.7c	5.1±3.8cd	4.0±3bc	5.4±5.4c

Note: Numbers followed by the same letter in the same column indicate differences that are not significant based on the DMRT follow-up test at the 5% level. Data after analysis is transformed to Arcsin$\sqrt{X + 0.5}$

C. How long it takes for the larval phase to become pupa & the larval phase to become imago

The results of the study (Table 5), showed the average length of the larval phase into pupae in the treatment of Suren Leaf Extract, 10% Suren Leaf Extract and 12% Suren Leaf Extract the average length of the larval phase into imago 0, days. This shows that the larval phase into pupae in the treatment given suren leaf extract does not change into pupae because the mortality value is very high. If the larvae enter the pre-pupal period faster, there is a possibility of an explosion of *S. litura* because the offspring produced will be greater in number. A female imago can lay hundreds of eggs. Conversely, if the larvae are slower to enter the prepupal period, the *S. litura* explosion can occur more slowly, making it more beneficial in control efforts (Noviana *et al*., 2012).

The application of *T. sureni* also causes the average duration of the larval phase to become imago longer. It is known that the average length of the larval phase into imago (Table 5) in the treatment of 8% Suren Leaf Extract, 10% Suren Leaf Extract, 12% Suren Leaf Extract and 14% Suren Leaf Extract on the average day 0, were not significantly different from each other. This occurred because in these treatments there was no change in imago because there were no pests that succeeded in becoming pupae - imago. The control treatment showed that some larvae were still able to develop to imago. In the fastest treatment, namely the Untreated Control, the average larval phase to imago was longer on day 19.93, significantly different from the other treatments. The Deltamethrin Synthetic Insecticide Control treatment averaged the larval phase to imago on day 18.83, significantly different from the other treatments.

Table 5. Average of larval phase to pupa & larval phase to imago (days)

Treatment	1st Instar Larva Phase to Pupa (days)	Pupa Phase to Imago (days)
Control Without Pesticide Treatment	15.13±7.23b	19.93±39.73a
Deltamethrin Synthetic Insecticide Control	14.45±77.67b	18.83±44.10a
Suren Leaf Extract 8%	0.00±0.0c	0.00±0.0b
Suren Leaf Extract 10%	0.00±0.0c	0.00±0.0b
Suren Leaf Extract 12%	0.00±0.02c	0.00±0.0b
Suren Leaf Extract 14%	19.67±176.3a	0.00±0.0b

Note: Numbers followed by the same letter in the same column indicate differences that are not significant based on the DMRT follow-up test at the 5% level.

D. Percentage of Larvae becoming Pupae & Percentage of Larvae becoming Imago

The results of the observation of the average percentage of larvae becoming pupae (Table 6), showed that the average value of the percentage of larvae becoming pupae was not significantly different between the treatments of 8% Suren Leaf Extract, 10% Suren Leaf Extract, 12% Suren Leaf Extract with an average value of the percentage of larvae becoming pupae 0%. This occurs because in these treatments the mortality rate produced is high, preventing the larvae from developing into pupae. The 14% Suren Leaf Extract treatment with an average percentage of 10% was significantly different from the other treatments. The Deltamethrin Synthetic Insecticide Control treatment of 33.33% was significantly different from the other treatments, as well as the No Pesticide Treatment Control treatment which had the highest percentage of 73.33% larvae that became pupae. This is because the suren leaf extract also contains triterpenoid compounds, these compounds can function as repellence which has a pungent odor and astringent taste that causes larvae to not want to eat (Junar, 2000). Endah & Heri (2000) stated that these compounds have another function, namely affecting nerve function by inhibiting the cholinesterase enzyme, there will be impaired transmission of stimuli which causes decreased coordination of muscle work, convulsions, and death for larvae that will develop into adults.

In the parameter of the percentage of larvae becoming imago (Table 6), the highest mean percentage of larvae becoming imago was obtained in the No Pesticide Treatment Control treatment of 50%, significantly higher than the other treatments. The Deltamethrin Synthetic Insecticide Control treatment with an average of 20% larvae to imago was significantly different from the other treatments. In the treatment of 8% Suren Leaf Extract, 10% Suren Leaf Extract, 12% Suren Leaf Extract and 14% Suren Leaf Extract with an average value of the percentage of larvae becoming imago 0%. This is because there is no change of larvae into pupae or imago due to the high mortality value that reduces the chance of pupa and imago formation. The treatment of 14% Suren Leaf Extract that succeeded in becoming pupae did not succeed in becoming imago because there were defects in the pupae. This is due to the presence of surnolactone compounds in suren leaves that inhibit reproduction so that the pupae fail to become imago.

Table 6. Average percentage of larvae becoming pupae & percentage of larvae becoming imago (%)

Treatment	Percentage of Larvae becoming Pupae (%)	Percentage of Pupae to Imago (%)
Control Without Pesticide Treatment	73.33±3.33a	50.00±15.28a
Deltamethrin Synthetic Insecticide Control	33.33±14.53b	20.00±10.0b
Suren Leaf Extract 8%	0.00±0.0c	0.00±0.0c
Suren Leaf Extract 10%	0.00±0.0c	0.00±0.0c
Suren Leaf Extract 12%	0.00±0.0c	0.00±0.0c
Suren Leaf Extract 14%	10.00±10.0c	0.00±0.0c

Note: Numbers followed by the same letter in the same column indicate differences that are not significant based on the DMRT follow-up test at the 5% level. Data after analysis is transformed to Arcsin$\sqrt{X + 0.5}$

E. Efficacy

Efficacy is influenced by the percentage of pest mortality. Based on Table 6, the average efficacy of *T. sureni* in the treatment of 8% Suren Leaf Extract, 10% Suren Leaf Extract, 12% Suren Leaf Extract and 14% Suren Leaf Extract each at 90 - 100% did not show significantly different results. This shows that the efficacy of each treatment given suren leaf extract has an insignificant effect on controlling *S. litura* pests. The higher the death rate of pests indicates that the efficacy is also higher (Herlinda, et al., 2008).

Table 7. Mean Efficacy (%)

Treatment	Efficacy (%)
Control Without Pesticide Treatment	26.67±3.33c
Deltamethrin Synthetic Insecticide Control	66.67±14.53b
Suren Leaf Extract 8%	100.00±0.0a
Suren Leaf Extract 10%	100.00±0.0a
Suren Leaf Extract 12%	100.00±0.0a
Suren Leaf Extract 14%	90.00±10.0a

Note: Numbers followed by the same letter in the same column indicate differences that are not significant based on the DMRT follow-up test at the 5% level. Data after analysis is transformed to Arcsin$\sqrt{X + 0.5}$

CONCLUSION

1. The application of *T. sureni* at various concentrations has an effect on mortality and biological components of *S. litura* which include feeding power, length of larval phase to pupae, percentage of larvae to pupae, length of larval phase to imago, and percentage of larvae to imago.
2. The application of *T. sureni* in all treatment concentrations of Suren Leaf Extract 8%, 10%, 12%, and 14% gave the same effective effect in increasing *S. litura* mortality on days 8 - 10 HSA and efficacy

SUGGESTION

Based on the research that has been done, the researcher gives advice to conduct research on the effect of the *Toona sureni* application method if it is carried out in the field so

that it can be seen the effectiveness when applied directly to plants attacked by *Spodoptera litura* pests.

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