

Effectiveness of *Ageratum conyzoides* (Babandotan) Leaf Extract and *Sapindus rarak* (Lerak) Fruit Extract in Control of *Myzus persicae* in Chili Plants

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ABSTRACT: Chili is one of the important agricultural commodity in Indonesia. *Myzus persicae* Sulz. is one of the important pests in Chili cultivation because it can cause damage up to 80%. Nabati insecticide utilization is one of the safer alternatives to control and more environmentally friendly than synthetic insecticides. One Nabati insecticide utilization that can be used in controlling pests are *Ageratum conyzoides* L extract and *Sapindus rarak* D.C extract. The purpose of this study was to determine the effectiveness of *A. conyzoides* extract, *S. rarak* extracts and extract *S. rarak* mixture of both in the control of *M. persicae*. This research was factorial, treatment consisted of 2 factors: 1 Nabati insecticide consists of *A. conyzoides* and *S. rarak* and factor of 2 each given concentration is 0 %, 1%, 2 %, 3 %. Using a completely randomized design (CRD) with 16 treatments 3 replications. The results variance showed that the treatment performed with extracts from *A. conyzoides* effect on mortality, damage to crops, *M. persicae* population, and leaf greenness level after treatment. Extract treatment *S. rarak* affects on mortality, *M. persicae* population and leaf greenness level after treatment. While treatment mix *A. conyzoides* leaf extracts and fruit extracts *S. rarak* effect on mortality, *M. persicae* population. The results showed that the treatment is effective in controlling pests aphids *M. persicae* are *A. conyzoides* leaf extract mixture of 3 % and 3 % *S. rarak* fruit extract with the highest mortality value of 96.14%, which gives a real influence in the control of aphids *M. persicae* and different real control. LC50 and LC90 showed the best application in the control extract are 18.46 ml and 51.86 ml.

Key words: Nabati (plant extract) insecticide Utilization, *Myzus persicae*, Chili

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INTRODUCTION

Red chili (*Capsicum annum* L.) is an essential vegetable which is highly economical and is favored by Indonesian people. Chili contains many nutrients and vitamins, such as calories, protein, fat, carbohydrates, calcium, vitamin A, vitamin B1, and vitamin C (Setiadi, 2002). The high demand for this commodity necessitates an increase in production not only in terms

of quantity but also in terms of quality. The problems that exist in red chili plants are not only limited to cultivation problems, but how to deal with pests and diseases of red chili plants (Setiadi, 2002).

One of the important pests in red chili plants is *M. persicae* (Kalshoven, 1981). Aphids (*M. persicae*) can reduce the quality and quantity of chili production. These pests eat all types of plants (polyphages).

M. persicae attack can cause curly leaves, wrinkled shoots that stunted plant growth. In severe attacks it can cause the leaves to fall off and eventually die (Dafrinal *et al.*, 2012).

According to Herlinda *et al.* (2009) *M. persicae* pests cause damage by puncturing the tissue and sucking the leaf cell fluid which results in abnormal leaf growth and the affected leaves become brittle. Another damage caused by *M. persicae* is the formation of sooty moisture due to the presence of a sweet liquid produced by *M. persicae*, which affects the photosynthesis process. The losses caused by *M. persicae* as a pest ranged from 6-25% and as a vector can reach losses of more than 90%.

The population density of *M. persicae* and the level of leaf damage by *M. persicae* has a close relationship with the loss of yield of red chilies (Sudarjat, 2008). So it is necessary to do effective control, one of which is using vegetable insecticides that can be obtained from plants, including weeds. The use of vegetable insecticides as pest control has received a lot of attention to be developed because it is relatively easy to obtain, safe for non-target animals and easily decomposes in nature leaving no environmental pollution, the residue is relatively short, and pests don't develop to become resistant to vegetable insecticides (Oka, 1993).

Several types of vegetable insecticides are able to control *M. persicae*, including soursop leaves (*Annona muricata* L.), neem leaves (*Azadirachta indica* J.), papaya leaves (*Carica papaya* L.), and babandotan (*Ageratum conyzoides* L.) (Astriani, 2010).

The leaves of *A. conyzoides* contain pyrolizidin alkaloida compounds with chemical structures in the form of Lycopsamin and Echinatin, which have been developed as vegetable pesticides

although they are still on a limited scale (Kinasih *et al.*, 2013). In the classification, this plant includes flowering plants, members of the Asteraceae family. In Indonesia *A. conyzoides* is one of the most disturbing plants, it can live in fields, yards, gardens, and roadsides (Gainge dan Ahmed, 1988).

A. conyzoides extract has been used in Widiastuti and Shinta's (2008) research on house flies (*Musca domestica*). The results of *A. conyzoides* extract are effective in killing house flies. In addition, research by Purnama *et al.* (2016) reported that *A. conyzoides* leaf extract was able to inhibit the growth of the stink bug (*Leptocorisa acuta*), with various concentrations indicating that the higher the concentration given, the higher the mortality of the pest.

Another plant that has the potential to be used as a source of vegetable insecticides is lerak fruit (*Sapindus rarak* D.C.) (Heyne 1987). The content of compounds found in *S. rarak* pulp includes triterpene, alkaloids, steroids, anthraquinones, tannins, flavonoids and saponins. *S. rarak* fruit extract contains saponins around 48.9% (Sunaryadi, 1999). Saponins have distinctive characteristics, taste bitter, form stable foam in water, are toxic to cold-blooded animals, such as fish, snails and insects (Tekeli *et al.*, 2007). Saponins are found in all parts of the *S. rarak* plant with the highest content found in the fruit (Widowati, 2003). According to Yanuar and Prijono (2013) in their research, *S. rarak* extract prepared with water, either singly or in mixture with forest betel fruit extract, is quite effective against larvae of *Crocidolomia pavonana*.

Research purposes

To determine the effectiveness of *A. conyzoides* leaf extract, *S. rarak* fruit and a mixture of both in controlling *M. persicae* in chili plants.

RESEARCH METHOD

Research Implementation

The research was conducted at the Laboratory of Plant Protection and Screen Houses, Faculty of Agriculture, University of Bengkulu. This research was arranged factorial using a completely randomized design (CRD) with 16 treatments 3 times repetition. There were 48 plants for the experimental unit, consisting of:

Factor 1 = type of vegetable insecticide
Ageratum conyzoides (B)

Sapindus rarak (L)

Factor 2 = Concentration of plant extract insecticides: 0 %, 1 %, 2 %, 3 %

Research stages

Thousand gram of *A. Conyzoides* leaf extraction were used. *A. Conyzoides* leaf extract was prepared by using the crude extract method by blending it directly. Previously, *A. Conyzoides* leaves were washed and dried to dry, after which 1000 g of *A. Conyzoides* leaves were sufficiently dry, added with 1000 ml of water, blended until smooth. Furthermore, the solution is transferred to the beaker and then allowed to stand for 24 hours. After 24 hours the solution was stirred and filtered using a filter cloth, and obtained as much as ± 1000 ml as the main solution. The preparation of *S. rarak* fruit extract was carried out by separating the pulp and seeds. 1000 g of *S. rarak* pulp is blended by adding 1000 ml of water. Furthermore, the solution was transferred to a beaker and let stand for 24 hours. After 24 hours, the solution was

stirred and filtered using a filter cloth, and obtained as much as ± 1000 ml as the main solution. The concentrations used in the test were 1 %, 2 %, and 3 %.

M. persica is infused into each plant as many as 30 individuals / plant. Pest infestation is carried out when the plants are 4 weeks after planting in the polybags.

The application of botanical insecticides was carried out 24 hours after *M. persicae* was infused on the plant. The application of vegetable insecticide spraying was carried out in the afternoon using a hand sprayer containing a solution of *A. conyzoides* extract, *S. rarak* extract and extracts from the mixture of the two, with a concentration according to the treatment to be carried out. Spraying is done once, with a spray volume of 12 ml / plant. Observations were made after 24 hours of application, daily for one week.

Observation Variable

a. Mortality of *M. persicae*. Mortality observations of *M. persicae* were carried out every day for one week after application of the extract.

Mortality is calculated using the formula (Natawigena, 1993):

$$\text{Mortality} = \frac{a}{a+b} \times 100 \%$$

Note: a = number of dead *M. persicae*, b = number of living *M. persicae*

a. Scoring damage to crops, observations carried out one time during the week to count the leaves were affected, with criteria yellow, curl, and wrinkle.

Table 1. Value and category of infestation by aphids (Natawigena, 1993)

| Score | Category | Percentage | Attack category |
|-------|----------------------------------|------------|-----------------|
| 0 | There is no attack on the leaves | 0 | Normal |
| 1 | 1-5 parts of the leaf roll | >0-25 | Light |
| 2 | 6-10 leaf sections curled | >25-50 | Moderate |
| 3 | 11-15 curled leaf sections | >50-75 | Weight |
| 4 | > 16 sections rolled | >75 | Very heavy |

- b. Changes in behavior and morphology of *M. persicae* , by observing the movement and color of *M. persicae* due to treatment. Observations were made once a day for 1 week after the extract was applied.
- c. The number of *M. persicae* that is still alive, observations were made after spraying / application of the extract, done once a day for 1 week.
- d. The level of greenness of the leaves, observations were made 2 times using a chlorophyll meter (SPAD) before the extract application and at the end of the study. The observations were repeated 2 times on the 4th and 5th leaves.

Data analysis

The data were analyzed with ANOVA variance level of 5%, if a significant effect was tested further by using (DMRT) and probit analysis using Minitab.16 program to determine the value of LC₅₀ and LC₉₀

RESULTS AND DISCUSSION

Observation variables for treatment of *A. conyzoides* leaf extract and *S. rarak* fruit extract on chili plants

Results of analysis of variance observation variable treatment of extracts of leaves of *A. conyzoides* and extract fruit *S. rarak* on planting an chili served on table 2.

Table 2. Analysis of variance of observed for chilli plants and *Myzus persicae* Sulz

| No. | Items | <i>A. conyzoides</i> leaf extract | <i>S. rarak</i> fruit extract | Interaction |
|-----|-------------------------------|--------------------------------------|----------------------------------|--------------------|
| 1 | Mortality | 34,84** | 46,63** | 8,32** |
| 2 | Damage scoring | 26,66** | 4,44* | 2,66* |
| 3 | <i>M. persicae</i> population | 192,43** | 127,95** | 3,90** |
| 4 | Green Leaf I | 0,83 ^{ns} | 0,56 ^{ns} | 1,09 ^{ns} |
| 5 | Green Leaf II | 17,01** | 9,03** | 12,79** |

Note: * = Significantly different at the 5 % level test , ** = very significantly different at the 1% level , ns = Not significantly different

The results of the analysis of variance showed that babadotan leaf extract, *S. rarak* fruit extract and mixed extract significantly affected the mortality of *M. persicae*, *M. persicae* population and leaf greenness levels after treatment. The single treatment of babadotan leaf extract influenced mortality, plant damage, *M. persicae* population, and leaf greenness after treatment. In single treatment, *S. rarak* fruit extract affected mortality, *M. persicae* population and leaf greenness after treatment. While the treatment of a mixture of babadotan leaf extract and *S. rarak* fruit extract has an effect on mortality,

M. persicae population. To evaluation the effect of the extract on the observed variables can be seen in the Duncan's Multiple Range Test (DMRT). The DMRT test results showed that single and mixed extract treatments had a significant effect on mortality and *M. persicae* population.

The average percentage of *M. persicae* mortality in tests using *A. conyzoides* leaf extract and *S. rarak* fruit extract is presented in Table 3. The results showed that in general the mortality of *M. persicae* was higher along with the increase of concentrations of *A. conyzoides* leaves extract and *S. rarak* fruit extract .

Table 3. Average interactions of *A. conyzoides* leaf extract and *S. rarak* fruit extract on mortality of *M. persicae*

| Treatment | Mortality (%) | | | |
|------------------------|-------------------|--------------------|-------------------|-------------------|
| | <i>S.rarak</i> 0% | <i>S.rarak</i> 1 % | <i>S.rarak</i> 2% | <i>S.rarak</i> 3% |
| <i>A.conyzoides</i> 0% | 0,20 Aa | 59,05 Ab | 72,26 AC | 78,00 AD |
| <i>A.conyzoides</i> 1% | 64,00 Ba | 70,74 Bb | 80,38 BC | 83,01 BC |
| <i>A.conyzoides</i> 2% | 77,26 Ca | 79,15 Cb | 82,51 BB | 84,98 BB |
| <i>A.conyzoides</i> 3% | 79,09 Ca | 86,63 Db | 90,20 CB | 96,14 CC |

Note: The numbers followed by the same letter in the same column / row show no significant difference in the DMRT follow-up test at the 5 % level. (Letters large on the column are equally readable for comparing the extract of the fruit of *S. rarak* and letters little on the line that equally readable for comparing extracts of leaves of *A. conyzoides*).

The results of the statistical test using *S. rarak* fruit extract only can increase the mortality of *M. persicae* from a concentration of 1 % to a concentration of 3 %. Meanwhile, *A. conyzoides* leaf extract only at a dose of 2 % was able to increase the mortality of *M. persicae*. Thus, *A. conyzoides* leaf extract is more effective than *S. rarak* fruit extract. In the 1 % *A. conyzoides* treatment, the effectiveness increased when mixed with 2 % of *S. rarak*, while the use of 2 % *A. conyzoides* mixed with 1 % of *S. rarak* had shown good effectiveness. But the *A. conyzoides* extract with a concentration of 3 % was the most effective at killing *M. persicae* when mixed with 3 % of *S. rarak*. Thus the highest mortality was achieved when 3 % of *A. conyzoides* leaf extract was mixed with 3 % of *S. rarak* fruit extract.

Referring to table 3, The statistical test of plant extract pesticides had a significant effect on the mortality of *M. persicae*. In general, it can be seen that the treatment given *A. conyzoides* leaf extract, *S. rarak* fruit extract and mixed extract at various concentrations resulted in the mortality of *M. persicae* increasing with the high concentration given. In the extract treatment given caused *M. persicae* mortality of more than 50 %. The highest mortality was found in the treatment of a mixture of 3 % *A. conyzoides* leaf extract

and 3 % of *S. rarak* fruit extract (B4L4), which caused a mortality of 96.14 % *M. persicae*.

In table 3, treatment of *A. conyzoides* extract containing saponins, flavonoids and polyphenols, and fruit extracts of *S. rarak* containing alkaloids, triterpenes, steroids, and saponins, which are effective in protecting plants from pests have toxic power against *M. persicae*, and are compatible (suitable) so that it is synergistic, that is, when the two extracts are mixed it will produce better results. The results showed that the testing of *A. conyzoides* leaf extract, *S. rarak* fruit extract and a mixture of both had a very significant effect on the mortality of *M. persicae*. *M. persicae* which died from poisoning caused by the contents of the two extracts which is characterized by the body being stiff and blackish-brown in color. Saponins have a characteristic bitter taste and are toxic to insects (Tekeli *et al*, 2007). Purba (2007) states that an increase in dosage is directly proportional to the increase in toxic substances, so that the killing power is higher.

After the application of plant extract insecticides, aphids *M. persicae* become swirling, and rarely moving, grows progressively weaker and then die. Its body become stiff and blackish brown in colour

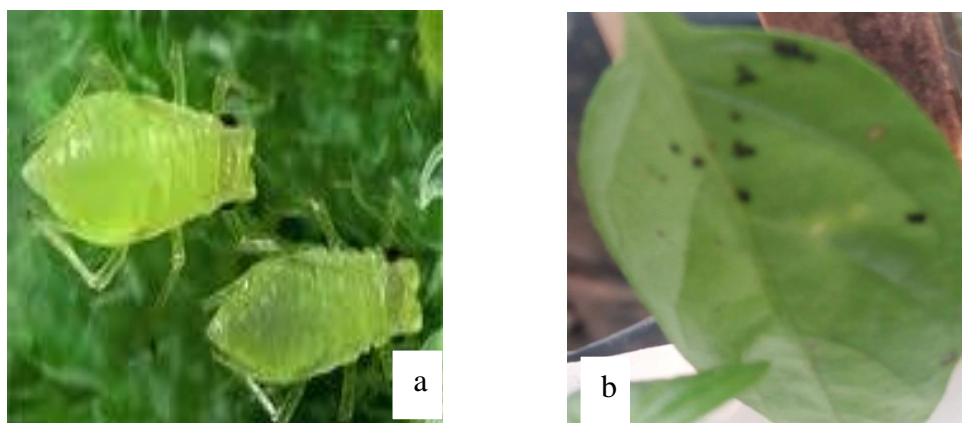


Figure 1. *M. persicae*
a. *M. persicae* healthy, b. *M. persicae* death

The surviving *M. persicae* after the extract application is presented in table 4. The use of *S. rarak* fruit extract showed effectiveness at a concentration of 2 %, leaving 30 surviving *M. persicae*. Meanwhile, the use of *A. conyzoides* leaf extract fruit extract effectiveness at a concentration of 3 % left *M. persicae* still alive. The mixed use of the two kinds of extracts showed that the dose of 1 % *A.*

conyzoides leaf extract mixed with 2 % of *S. rarak* fruit extract was more effective than 1 % of *S. rarak* fruit extract. But the dosages of 2 % and 3 % *A. conyzoides* leaf extract were more effective by leaving the lowest *M. persicae* without a mixture of *S. rarak* fruit extract. Thus, *A. conyzoides* leaf extract was more effective at reducing the number of live *M. persicae* at a dose of 2 %.

Tabel 4. The average interaction of *A. conyzoides* leaf extract and *S. rarak* fruit extract on the live population of *M. persicae* on chili plants.

| Treatment | Population <i>M. persicae</i> (tail) | | | |
|------------------------|----------------------------------------|-------------------|-------------------|-------------------|
| | <i>S.rarak</i> 0% | <i>S.rarak</i> 1% | <i>S.rarak</i> 2% | <i>S.rarak</i> 3% |
| <i>A.conyzoides</i> 0% | 159,38 Aa | 39,67 AB | 30,14 Ac | 28,05 Ac |
| <i>A.conyzoides</i> 1% | 41,57 Ba | 35,67 AA | 23,28 Ab | 20,04 Ab |
| <i>A.conyzoides</i> 2% | 22,14 Ca | 21,05 BA | 20,24 Aa | 18,90 Aa |
| <i>A.conyzoides</i> 3% | 14,25 Da | 13,04 BA | 10,76 Aa | 6,15 Ba |

Note : The numbers followed by the same letter in the same column / row show no significant difference in the DMRT follow-up test at the 5% level. (uppercase letters in the same column are read to compare *S. rarak* fruit extracts and lowercase letters in the same row are read to compare *A. conyzoides* leaf extracts).

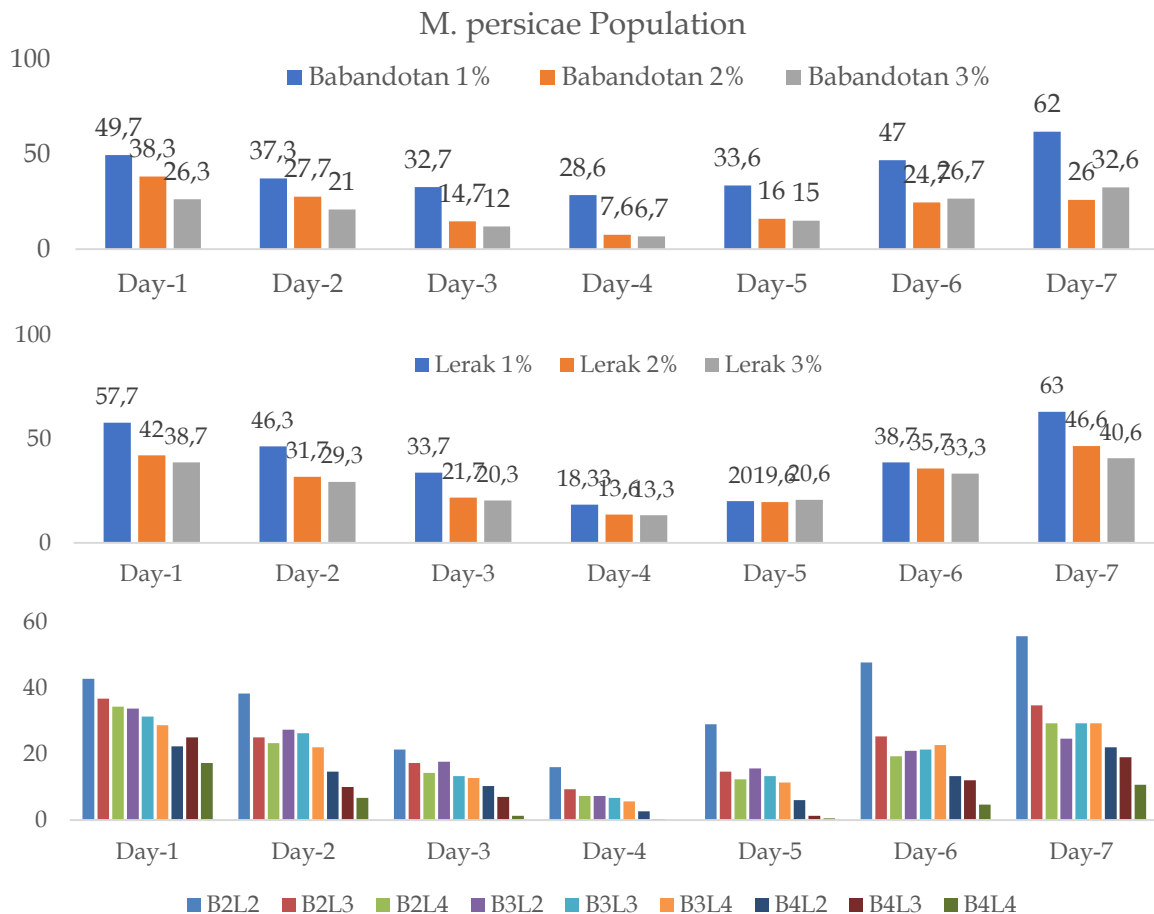
Based on Table 4. Treatment of application of *A. conyzoides* extract and *S. rarak* fruit extract tended to reduce the number of living population of *M. persicae* until the fourth day of observation. On the 5th, 6th, and 7th days there was an increase in the number of *M. persicae* population in chili plants, due to the effect of decreasing / missing chemical content in plants (Figure 2).

The increase in the number of *M. persicae* can be caused by the residue in the pesticide which is easily broken down due to hot weather. According to Syakir (2011), Biopesticides can kill or disturb plant pests (OPT) through a combination of two different insecticides and singly, besides these advantages, plant extract insecticides also have disadvantages such as being easily damaged and not resistant to

exposure to sunlight. cause the vegetable insecticide to degenerate easily.

Referring to Figure 2, it shows that the mixture of *A. conyzoides* leaf extract and *S. rarak* fruit is very good compared to the single extract of *A. conyzoides* leaves and *S. rarak* fruit. The effectiveness of the extracts of *A. conyzoides* leaves and *S. rarak* fruit in

reducing *M. persicae* populations until day 4. On the fifth day, there was an increase in the population of *M. persicae* due to the reproduction of the remaining nymphs in the plant. *M. persicae* is very fast breeding. According to Srivivasan (2009) a female *M. persicae* will produce 20 nymphs every day and will mature in one week.



Note: B=*A. conyzoides*; L=*S. rarak*; 2=1 %; 3=2 %; 4=3 %

Figure 2. *M. persicae* Population

The population of *M. persicae* was seen to increase from day 5 to day 8. This is because the residues of *A. conyzoides* leaf extract and *S. rarak* fruit extract have been lost from the plant, so that it is no longer an inhibiting factor for the growth of *M. persicae*. Yolanda (2013) states that

vegetable pesticides have properties that are easily biodegradable, are not resistant to the sun and must be applied repeatedly. So it is necessary to spray repeatedly to suppress the growth / reproduction of *M. persicae*.

Tabel 5. The mean score of plant damage after the application of *A. conyzoides* leaf extract and *S. rarak* fruit extract

| Treatment | Population <i>M. persicae</i> (tail) | | | |
|------------------------|----------------------------------------|-------------------|-------------------|-------------------|
| | <i>S.rarak</i> 0% | <i>S.rarak</i> 1% | <i>S.rarak</i> 2% | <i>S.rarak</i> 3% |
| <i>A.conyzoides</i> 0% | 3, 67 Aa | 3,67 AA | 2,67 Ab | 2,67 Ab |
| <i>A.conyzoides</i> 1% | 3,00 Ba | 3,00 AA | 3,00 Aa | 3,00 Aa |
| <i>A.conyzoides</i> 2% | 2,33 Ba | 2,33 AA | 2,67 Aa | 2,00 Aa |
| <i>A.conyzoides</i> 3% | 2,00 Ba | 2,00 BA | 2,00 Aa | 2,00 Aa |

Note: The numbers followed by the same letter in the same column / row show no significant difference in the DMRT follow-up test at the 5% level. (uppercase letters in the same column are read to compare *S. rarak* fruit extracts and lowercase letters in the same row are read to compare *A. conyzoides* leaf extracts).

The results of statistical tests show that the use of *S. rarak* fruit extract without *A. conyzoides* leaf extract can suppress plant damage at a concentration of 2 % with moderate damage category (2.67), which is more effective than *S. rarak* 1 % with severe damage category (3.67). In the treatment of *A. conyzoides* leaf extract without *S. rarak* mixture, the effectiveness range was seen in the 1% *A. conyzoides* leaf extract with severe damage category (3.00) which was no different from 2 and 3 % with moderate damage category, respectively 2.33 and 2, 00. This makes babandotan leaf extract more effective in suppressing plant damage. A mixture of 1 % of *S. rarak* extract and 3 % of *A. conyzoides* extract with moderate damage category (2.00) was more effective than 2 % *A. conyzoides*

extract with severe damage category (3.00).

Referring to Table 5. the effectiveness of the extract given is able to suppress plant damage, because it can interfere with the stages of the insect development process so that it does not develop and even dies. Prijono (1999) states that the anti-juvenill hormone contained in *A. conyzoides* interferes with the stages of the development process in insects. Plant damage is closely related to mortality, the higher the concentration given, it shows that the mortality of *M. persicae* is higher and the damage to plants is lower. Other research states that the use of *A. conyzoides* extract and siam weed extract can reduce the intensity of the stink bug attack on rice plants (Purnama, 2016).

Table 6. Average levels of leaf 1 and 2 leaf greenness in the application of *A. conyzoides* leaf extract and *S. rarak* fruit extract on chili plants.

| Treatment | Green level 1 | | | | Green level 2 | | | |
|-----------|---------------|-------|-------|-------|---------------|----------|----------|----------|
| | L1 | L2 | L3 | L4 | L1 | L2 | L3 | L4 |
| B1 | 44,30 | 42,1 | 37,36 | 43,56 | 38,63 AA | 37,26 BA | 31,83 BA | 37,93 BA |
| B2 | 40,80 | 45,13 | 44,13 | 41,60 | 36,00 BA | 39,93 BA | 39,56 BA | 37,00 BA |
| B3 | 47,10 | 41,26 | 45,1 | 41,40 | 42,26 BA | 36,73 BA | 39,73 BA | 35,76 BA |
| B4 | 43,06 | 38,67 | 41,90 | 40,50 | 36,20 BA | 33,66 BA | 35,76 BA | 35,13 BA |

Note : B = *A. conyzoides*; L = *S. rarak*; 1 = 0 %; 2 = 1 %; 3 = 2 %; 4 = 3 %, the numbers followed by the same letter in the same column / row show no significant difference in the DMRT follow-up test at the 5% level. (uppercase letters in the same column are read to compare *S. rarak* fruit extracts and lowercase letters in the same row are read to compare *A. conyzoides* leaf extracts).

Referring to table 6, the level of greenness of the leaves before treatment showed no significant effect, this was due to the absence of plant pests (OPT). differ in the level of greenness of the leaves after treatment. The treatment of *A. conyzoides* leaf extract with various concentrations showed no significant difference. The same thing happened in the treatment of *S. rarak* fruit extract with various concentrations, showing results that were not significantly different, but different from the control.

High leaf greenness is one of the factors that indicates that a plant is healthy. Leaf greenness can be affected by the presence of pests that can cause damage to plants. *M. persicae* is one of the pests that are very detrimental to plants, *M. persicae* can cause plant leaves to turn yellow,

wrinkled and curl, so that plant growth is inhibited. *A. conyzoides* leaf extract, *S. rarak* fruit extract and a mixture of *A. conyzoides* leaf extract and *S. rarak* fruit extract given were able to control *M. persicae*, but the effectiveness of the *A. conyzoides* leaf extract and *S. rarak* fruit extract only lasted until the 4th day. The increase in the live population of *M. persicae* occurred on the 5th day continuously. El-khawas (2008) stated that aphids attack can cause a significant reduction in metabolic content, including chlorophyll.

Determination of LC50 and LC90

The effectiveness of *A. conyzoides* leaf extract, *S. rarak* fruit extract and a mixture of both in controlling *M. persicae* with the extract given is known from the LC50 and LC90 values, to determine the optimal concentration needed to control 50% and 90% of the tested insects.

Table 7. Effective concentrations of LC50 and LC90 in the application of *A. conyzoides* leaf extract, *S. rarak* fruit extract and a mixture of both

| Extract Solution | LC50 | LC90 |
|----------------------------------------------------------------|----------|----------|
| <i>A. conyzoides</i> leaf | 5,19 ml | 49,10 ml |
| <i>S. rarak</i> fruit | 13,30 ml | 73,50 ml |
| A mixture of <i>A. conyzoides</i> leaf + <i>S. rarak</i> fruit | 18,46 ml | 51,86 ml |

Referring to Table 7, the results showed that to kill 50% and 90% of the tested pests, the *A. conyzoides* leaf extract required 5.19 ml and 49.10 ml, the *S. rarak* fruit extract was given 13.3 ml and 73.5 ml. The LC50 and LC90 values of the *S. rarak* fruit extract were greater than the LC50 and LC90 values of *A. conyzoides* leaf extract, this indicates that *A. conyzoides* leaf extract is more efficient in controlling *M. persicae*. Determination of LC50 and LC90 values aims to see / determine the best extract concentration in killing / controlling *M. persicae*. In this study, *A. conyzoides* leaf extract and *S. rarak* fruit were very effective in controlling *M. persicae*. *A. conyzoides* leaf extract, *S. rarak* fruit extract and a mixture of *A. conyzoides*

leaf extract and *S. rarak* fruit extract have high killing power, because the chemical content of each plant can affect the nervous system, hormonal balance, reproduction, behavior in the form of rejection, food withdrawal, and the respiratory system. According to Soesanthy (2013), terpenoids, steroids, flavonoids, alkaloids, and saponins are repellent, affecting insect behavior, and can even cause death. These compounds are believed to influence the behavior and physiology of insects (Dadang and Prijono, 2008). Yanuar and Prijono (2013) reported that the saponin content in *S. rarak* fruit can kill pests up to 100% mixed with piper fruit..

CONCLUSIONS

The results showed that the most effective application in controlling the pest of *M. persicae* was a combination of a mixture of 3 % *A. conyzoides* leaf extract and 3 % *S. rarak* fruit extract with the highest mortality value of 96.14% until the 4th day, so it was necessary to re-spray it. From the research description, it is necessary to spray again with the *A. conyzoides* leaf extract and the *S. rarak* fruit extract three times with details on the 1st, 5th and 10th days with the same concentration.

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