Identification Secondary Metabolite of Weed as Organic Pesticide on Tomato

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Abstract. One of horticulture commodity is tomato. The tomato production every years is fluctuating. Because of many problem on tomato cultivation. One of problem is pest controlling which use synthetic pesticide to pest control. One of effort to minimize synthetic pesticide is application organic pesticide from nature compose (in around us). This research to know secondary metabolite of weed as organic pesticide on tomato. This research randomized block design with fourth threatmen are Ageratum conyzoides, Cyperus rotundus, Cyperus kyllinga, Chromolaena odorata. The fourth weed was cyperaceae group and broadleaves. The result showed that potential secondary metabolite whose not saponin to fourth organic pesticide

1. Introduction

Tomatoes are the main commodity of horticulture with fluctuating productivity, in 2010 it reached 14.58 tons / ha and in 2011 it increased 16.65 tons / ha, but in 2012 it decreased by 15.75 tons / ha and in 2013 it increased to 16.61 tons / ha then in 2014 it decreased to 15.52 tons / ha [1]. The damage of pest has an influence on this productivity. The malfunction of chemical control methods will lead to high production costs and not be environmentally. One methods to minimize the risk of control is the use organic pesticide from material around us. This cultivated-based organic pesticide also supports the concept of organic farming cultivation, utilizing organic matter around to produce organic products. The material around us that can be used as organic material is weeds.

Weed is a group of plants whose existence is undesirable, this is because its growth interferes with the growth and development of the main commodities of agricultural land. The growth of unwanted weeds, due to increased competition in nutrients, water and light with the main crop commodities on a land, besides that weeds can produce allelopathic which inhibits root growth and seed germination of agricultural land commodities. This allelopathic content will be used as an active ingredient in plant pesticides.

The use of weeds as the main ingredient of organic pesticides is due to the presence of secondary metabolites (allelopathic) of the plant. Secondary metabolites such as alkaloids, tannins, saponins, phenolics, terpenoids, steroids and essential oils. [2] States that chirinyu weed (Chromolaena odorata) has Pyrrolizidine alkaloids which are secondary compounds produced by plants and function as plant defense compounds against herbivores [3]. According to [4], babandotan extract with a concentration of 9% can suppress the ability to eat Aulocaphora sp. In cucumbers by about 20%.
Based on previous research, the application of antiviral weed extracts before inoculation was able to extend the incubation period of the virus in chilli plants. This can be seen with the intensity of the disease around 40-55% [5]. This study examines the concentration of the solution and types of weeds as the main ingredient of organic pesticides to increase the effectiveness of organic pesticides in tomato cultivation.

2. Method.

2.1 Extract Weed as Organic Pesticide and Bioassay on Tomato Germination

Weeds that become the main ingredients as organic pesticides are babandotan (Ageratum conyzoides), chirinyuh (Chromolaena odorata L or Eupatorium odoratum L), Cyperus rotundus and Cyperus kyllinga. Weeds are cleaned and dried for 3-5 days, then blended weed and maceration using 70% methanol (w/v = 1: 3). Maceration product collected and thickened by decrease ±70-90% water. Then to bioassay, weed extract was tested for effectiveness at the beginning of tomato growth with concentrations of 0, 500, 750, 1000ppm. The parameters observed include the percentage of life.

2.2 Application Organic Pesticide on Tomato Plants

Tillage field of 500m² tomato cultivation and 100m² of area for each weed treatment. Land is formed row with a size of 1x6m, spacing of plant 0.7x0.5m and spacing between row 0.5m. In the beginning of land processing, it provides cow manure 750kg / 500m², KCl fertilizer 6kg /500m², ZA 6kg /500m², SP36 10kg /500m², Trichoderma sp. 30g /plant. F1 servo tomato seeds are deep on water for two days, then seedling on sausage media. The row is covered with black silver mulch. Application of chemical pesticides in control land is a normal dosage (one dose) while the treatment field is applied chemical pesticides with half dose once a week and accompanied by application of organic pesticides (Cyperus rotundus, Cyperus kyllinga, Chromolaena odorata and Ageratum conyzoides) once every 3 days. Observation parameters included plant height, damage intensity and pest population.

2.3 Identification metabolite secondary of weed

Weed extracts carried out qualitative tests including: alkaloids, saponins, tannins, and phenolics. According to [6] the testing procedure includes fresh weed stems and leaves using a blender at room temperature. Take 5g of each weed that is homogenized with 10mL 70% ethanol (v / v), then centrifug 2000rpm for 10 minutes at room temperature. The supernatant is adjusted to the final volume for 10mL.

2.3.1 Alkaloids, take 1% hydrochloric acid by boiling at 95°C for 10 minutes, then add two drops of reagent Wagners (1.27g of iodine and 2g of potassium ions in 100mL of distilled water). Reddish brown deposits show positive results.

2.3.2 Saponin, boil 1mL of weed extract for 10 minutes, then add 5% sodium carbonate solution. The solution is homogenized and the formation of foam shows positive results.

2.3.3 Tanin, 0.5mL weed extract mixed with 0.1mL of 1% iron chloride solution and yellow precipitate showed positive results.

2.3.4 Fenolik, pectropometric method by diluting 200µL of weed extract by mixing 1mL of 0.1mol / L Folin-Ciocalteu reagent. The solution was darkened for 30 minutes and then added 200 µL7% sodium carbonate. The blue absorbance produced is measured at 750nm using gallic acid (standard solution). Furthermore content of analysis each weed extract use technology gas chromatography.
3. Result and Discussion

Secondary metabolites are plant products that are produced under stress and for plant defense against pests. Allelopathy is a chemical produced by plants as a secondary metabolite product. It has several roles such as attractant of other organisms, defense from pathogens, protection and adaptation to environmental stress, plant regulating substances and compete with other plants [7]. The content of organic pesticides can influence seed germination and growth of plant tomatoes. Bioassay organic pesticides on tomato to know optimization concentration to tomato growth in field. The result of bioassay shows that optimization of concentrations of organic pesticides on concentration 500ppm to all sample organic pesticides (Fig. 1). It is able to grow more 50% seed germination.

The main classification system includes three major groups: terpenoids, alkaloids, and phenolics [8]. None of the organic pesticides (Table 1) in this research contained saponins. However, all organic pesticides have phenolic content and the highest in *Ageratum conyzoides* 3,057 mgGAE / g (Table 1).

![Figure 1. Percentage seed germination of tomato](image)

The dominant content in secondary metabolites of organic pesticide is phenolic. The use of phenolic content to resistant plant from feeding insect and inhibit of growth plant. Based on research according to [9] shows that phenolic substances affect plant growth, biological processes in the soil and nitrogen requirements of a plant. This relates to soil biological processes that are able to produce substances needed by plants, but the role of phenolic substances can reduce microorganism in the soil so that the availability nutrients to plants is low.

| Organic Pesticide | Fenolic Total | Analysis |
|-------------------|--------------|----------|
|                   |              | Alkaloid | Tanin | Saponin |
| C. kyllinga       | 1,339mgGAE/g | +        | -     | -       |
| C. rotundus       | 0,954mgGAE/g | -        | +     | -       |
| Chrodorat         | 1,878mgGAE/g | -        | -     | -       |
| A conyzoides      | 3,057mgGAE/g | -        | +     | -       |
| Nature of Chemical Compound | Chr.odorata | A.conyzoidez | C.rotundus | C.kyllinga |
|-----------------------------|-------------|--------------|-------------|------------|
| Silane, trichlorooctadecyl-  | 0.11        | -            | -           | -          |
| delta.-Guaiene              | 0.5         | 0.71         | -           | -          |
| Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-C | 10.47   | 8.79         | 4.92        | 3.57       |
| Tetradecanal (CAS) Myristaldehyde | 3.68   | -            | -           | 3.2        |
| Patchouli alcohol           | 1.72        | 4.55         | 1.18        | -          |
| Pentadecanoic acid (CAS) Pentadecylic acid | 26.08  | -            | -           | 28.18      |
| 1,2-Benzenedicarboxylic acid, bis(2-methoxy) | 3.39   | -            | -           | 0.88       |
| 9-Octadecenoic acid (Z)     | 28.07       | 12.98        | 30.28       | 39.17      |
| Eicosanoic acid             | 4.49        | -            | -           | -          |
| Oxirane, 2,2-Dimethyl-3-(3,7,12,16,20-| 0.39       | -            | -           | -          |
| 1,2-Benzenedicarboxylic acid, 3-nitro- (CAS) | 0.72   | -            | -           | -          |
| Squalene                    | 2.54        | -            | -           | -          |
| 8-Isopropenyl-1,3,3,7-Tetramethyl | 6.67   | -            | -           | -          |
| Dibenzo[a,h]cyclotetradecene, 2,3,11,12-tetrae | 4.96   | -            | -           | -          |
| 03027205002 flavone 4-OH,5-OH,7-DI-O | 2.37    | -            | -           | -          |
| Ergost-25-ene-3,5,6,12-tetrol, (3.bet.,5.alpha) | 2      | -            | -           | -          |
| 1H-Naphtho[2,1-b]pyran-8(4A)-one, 3-etheny | 1.84    | -            | -           | -          |
| Tetradecanal                | -           | -            | -           | 5.07       |
| oxirane, tetrade cyl        | -           | -            | -           | 0.19       |
| 1,5,9,13-Tetracatetraene    | -           | -            | -           | 2.36       |
| Dibutyl phthalate            | -           | -            | -           | 1.85       |
| 10-12-Pentacosadiynoic acid | -           | -            | -           | 0.54       |
| Eicosanoic acid             | -           | -            | -           | 5.23       |
| Dibenzo[a,h]cyclotetradecene, 2,3,11,12-tetrae | -      | -            | -           | 1.76       |
| 1H-Indene, 2,3-dihydro-4,7-dimethyl- (CAS) 4 | -     | -            | -           | 2.41       |
| alpha.-Guaiene              | -           | -            | -           | 5.6        |
| alpha.-Patchouline           | -           | 0.2          | -           | -          |
| 4(3H)-Pyrimidinone, 5-ethoxy-2,3-dimethyl-| -         | 0.08         | -           | -          |
| Hexadecanoic acid           | -           | 12.27        | 19.41       | -          |
| Cholest-5-ene, 3-bromo-, (3.beta.-) | -        | 1.49         | -           | -          |
| Androstan-17-one, 3-ethyl-3-hydroxy-, (5.alph | -         | 1.99         | -           | -          |
| Eicosane (CAS) n-Eicosane   | -           | 2.01         | -           | -          |
| 1,2-Benzenedicarboxylic acid, bis(2-ethylhexy | -        | 3.17         | -           | -          |
| 2,4,6-Tris-(1-phenylethyl)-phenol | -      | 35.77        | -           | -          |
| 1,6,10,14,18,22-Tetracosahexaen-3-ol, 2,6,10, | -         | 9.7          | -           | -          |
| Stigmast-5-en-3-ol, (3.beta.,24S)- (CAS) Clion | -     | 6.57         | -           | -          |
| Cyclopropanemethanol, 2-isopropylidene-.al ph | -        | -            | 2.38        | -          |
| 1,2-Cycloheptanediol, trans-(-,+/-)- | -        | -            | 2.39        | -          |
| 2,5-Hexanedione             | -           | -            | 2.54        | -          |
| Docosane (CAS) n-Docosane   | -           | -            | 0.62        | -          |
| Dodecanal (CAS) n-Dodecanal | -           | -            | 0.59        | -          |
| 1-(1'-Methoxycyclopropyl)-6,6-dimethyl-2,4-c | -        | -            | 8.04        | -          |
| 4,7,10,13,16,19-Docosahexaenoic acid, methyl | -       | -            | 5.45        | -          |
| Stigmastan-3-ol, 5-chloro-, acetate, (3.beta.,5.al | -       | -            | 5.64        | -          |
| Ethyl Iso-allocholate       | -           | -            | 10.13       | -          |
| Cyclotridecanone            | -           | -            | 3           | -          |
| 1-Naphthalenepropanol, .alpha.-ethenylecahy | -        | -            | 1.78        | -          |
| (+)-Isopulegol              | -           | -            | 1.66        | -          |
Based on the results of the GC-MS analysis (table 2) shows some substances contained in all organic pesticides namely phenol, 2,6-bis (1,1-dimethylethyl) -4-methyl-. This chemical is classified as phenolic. Another form of phenol is 2,4,6-Tris- (1-phenylethyl) -phenol. In addition to phenolic content, there are sesquiterpene in some organic pesticides used. Sesquiterpenes between each other has a different form. delta.-Guaiene is a sesquiterpenen in A.conyzoides and Chr.odorata, but in C. kyllinga in the form of alpha-guaiene. Patchouli alcohol is found in Chr.odorata, A.conyzoides and C. rotundus, this component is classified as sesquiterpene. Sesquiterpene when applied to plants acts as a barrier to the growth of Lepidoptera larvae [10]. Another form of terpene is Isopulegol in C. rotundus.

The results of identification of weed content used as organic pesticides have a tendency of dominant substances. Chr.odorata has high values on Pentadecanoic acid (CAS) Pentadecylic acid and 9-octadecanoic acid. C.kyllinga and C. rotundus are dominant in 9-octadecanoic acid. 9-octadecanoic acid is classified as a fatty acid. Some fatty acids when applied to plants will induce resistance gene expression [11]. Based on the results of GC-MS analysis (table 2), it shows that 2,4,6-Tris- (1-phenylethyl) -phenol in A. conyzoides counts for the highest value in ingredients phenolic chemistry. This is the main suspicion, at the beginning of the growth of tomato plants in A. conyzoides application has growth retardation (table 3). Allelopathic A.conyzoides can play a role in inhibiting the growth of tomatoes [12].

### Table 3. Average plant height on tomato

| Treatment       | 1 wp | 2 wp | 3 wp | 4 wp | 5 wp | 6 wp | 7 wp |
|-----------------|------|------|------|------|------|------|------|
| A.conyzoides    | 5.9  | a    | 25.7 | a    | 55.1 | a    | 80.5 | c    | 103.0 | d    | 110.7 | d    | 117.8 | d    |
| C. rotundus     | 21.3 | bc   | 40.1 | c    | 54.6 | a    | 75.5 | b    | 84.4  | a    | 104.6 | bc   | 105.5 | a    |
| C. kyllinga     | 20.5 | b    | 35.0 | b    | 56.7 | a    | 72.2 | a    | 91.0  | c    | 101.0 | b    | 109.8 | b    |
| Chr.odorata     | 22.4 | c    | 40.5 | c    | 54.1 | a    | 75.4 | b    | 88.6  | b    | 106.7 | c    | 118.1 | c    |
| Control         | 18.8 | b    | 39.7 | c    | 53.9 | a    | 73.1 | a    | 84.2  | a    | 95.6  | a    | 117.6 | c    |

The numbers followed by the same letters (a,b,c,d,e) and the same column shows the real no different at LSD test level α = 5%.

Analysis of the data in table 3 shows that the treatment of pesticides with A. conyzoides weeds at ages 1 Wp to 2 Wp has the lowest plant height. However, at the age of 4 Wp up to 7 Wp this treatment has the highest plant height. Whereas in the treatment of pesticides made from weed C. rotundus, C. kyllinga and Chr. odorata plant growth tends to be stable. Plant height is influenced by many factors, one of which is nutrient. It has been mentioned earlier by [9] that the phenolic content in a cultivated soil will affect fertilizer requirements. This is because this phenolic which has a high concentration will reduce the soil microbiology population which plays a role in increasing the availability of nutrients for plants.

### Table 4. Average weight on tomato

| Treatment       | Weight per sample (gram) | Weight per plot (gram) |
|-----------------|--------------------------|------------------------|
| A. conyzoides   | 1792.6                   | d                      | 33975.7                | b                      |
| C. rotundus     | 1399.1                   | b                      | 29010.8                | a                      |
| C. kyllinga     | 1467.3                   | b                      | 29698.5                | a                      |
| Chr. odorata    | 1604.0                   | c                      | 35579.0                | b                      |
| Control         | 1230.0                   | a                      | 29509.5                | a                      |

a,b,c,d: The numbers followed by the same letters and the same column shows the real no different at LSD test level $\alpha = 5\%$.
Figure 2. Intensity Damage of *Thrip tabacci* on Tomato plant

In table 4 it can be seen that the treatment of pesticides made from *A. conyzoides* weeds produced the highest sample weights and plots compared to other treatments. Whereas the treatment of pesticides made from weed *C. rotundus, C. kyllinga* and *Chr. odorata* produce higher yields than controls (chemical pesticides). This is because the use of organic pesticide has a positive effect on the quality of tomatoes. Organic Pesticide from *A. conyzoides* have intensity damage (Fig. 2) lowest than other, but have higher population of pest (Fig. 3). Because this organic pesticide have highest phenolic content is 3,057mgGAE/g. *A. conyzoides* have a role as antifungal and insecticidal properties [12].

4. Conclusion
The result of identification secondary metabolite on weed as organic pesticide were contain alkaloid, tannin and phenolic. All organic pesticide have not content saponin. *Ageratum conyzoides* have highest production and lowest intensity damage of pest but higher population pest. Because this organic pesticide have highest phenolic content is 3,057mgGAE/g.
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