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Chemical Components Analysis of Kencur (*Kaempreria galanga L*) Essential Oil Using GC-MS Method and Its Insecticide Tests on Fruit Fly (*Bactrocera* sp.)

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ABSTRACT

The hydrodistillation method isolated the essential oils of Kencur (Kaempreria galanga L) using the Stahl apparatus. It was distilled for ± 5-6 hours to produce as much as 0.89% (w/w) essential oil. The chemical components of Kencur essential oil were analyzed using GC-MS, consisting of 7 compounds which seven compounds could be identified, name: Limonene (2.39%), Cineol (2.22%), and terpenes (0.80%). Hexane (1.51%), Borneol (13.23%), Methyl cinnamate (1.50%), ethyl ester (78.35%) and its insecticide test from Kencur essential oil showed *Bactrocera* sp. mortality. The highest was 96.7% in the 3% ginger rhizome essential oil concentration.

Keywords: Kencur, Extraction, Essential Oil, Fruit Fly, Insecticide

ABSTRAK

Minyak atsiri rimpang jahe (*Kaempreria galanga* L) diisolasi dengan metode hidrodestilasi menggunakan Stahl. rimpang jahe didestilasi selama ± 5-6 jam untuk menghasilkan minyak atsiri sebanyak 0,89% (b/b). Komponen kimia minyak atsiri rimpang jahe yang dianalisa menggunakan GC-MS terdiri dari 7 senyawa dimana dapat diidentifikasi 7 senyawa yaitu Limonene (2,39%), Cineol (2,22%), terpinen (0,80%). Heksana (1,51%), Borneol (13,23%), Metil sinamat (1,50%), etil ester (78,35%) dan uji insektisida dari minyak atsiri Kencur menunjukkan *Bactrocera* sp. kematian. Nilai tertinggi adalah 96,7% pada konsentrasi minyak atsiri rimpang jahe 3%.

Kata Kunci: Ekstraksi, Insektisida, Kencur, Lalat Buat, Minyak Atsiri

1. Introduction

Research on potential plant families as botanical insecticides worldwide has been widely reported. Grainge and Achmed 1998 said that more than 1000 plant species are insecticidal, more than 380 species are food inhibitors, more than 270 are repellents, and more than 30 are growth retardants. Among the potential plant families as vegetable pesticides *are Meliaceae*, *Annonaceae*, *Verbenaceae*, *Rutaceae*, and *Piperaceae* [1}.

Increase agricultural yields, and this can be done by caring for plants, such as providing fertilizers to fertilize plants and pesticides as pest control [2]. Lately, many cases have shown that synthetic pesticides are increasingly ineffective and can even be said to have failed. This is evident from the increasing number of resistant pests to pesticides and resurgence, insect pests, diseases, and even weeds, due to the absence of natural enemies [3]. Insecticides are one of the materials that are widely used to control insect pests in agriculture [4]. Research that has been conducted in various countries shows that essential oils from multiple plants are not only able to repel insect pests but also show inhibition of consumption by these insects [5]. Results of previous research: Test the effect of instant Kencur powder (*Kaempferia galanga* L.) as a tonic on swiss webster strain male mice [6].

Based on the description above, the authors are interested in analyzing the chemical components of essential oil and testing vegetable insecticides from Kencur (*Kaempreria galanga* L) obtained from the Kampung Lalang market and testing vegetable pesticides against fruit flies (*Bactrocera* sp.). Essential oils were isolated using hydrodistillation and their application as a vegetable insecticide against fruit flies (*Bactrocera* sp.).

2. Materials and Methods

The tools used in this study include glassware, beaker glass, aquadest bottles, spray bottles, vials, separating funnel, Erlenmeyer glass, GC-MS, gauze, label paper, hotplate, volumetric flask, distillation flask, refrigerator, analytical balance, aluminium pot, dropper pipette, water pump, gloves, hoses, spatula, statives and clamps, teflon, plastic jars. The materials used in this study were: distilled water, fly feed fruit, diethyl ether, anhydrous Na_2S0_4, sodium chloride, sterile sand, Kencur rhizome, and Tween 80.

2.1. Sample Provision

The material used in this study was Kencur, which was cut into small pieces along with the skin obtained from the Kampung Lalang, Medan tax area.

2.2. Isolation of Essential Oil of Kencur with Stahl Distillation Equipment

As much as 300 g of Kencur were cut into small pieces and put into a round bottom flask with a volume of 1000 mL added 500 mL of distilled water, connected to a Stahl distiller equipped with an oil heater, heated to boil for ± 4-5 hours to produce water distillate with oil essential. Distillation is ended after the distillate that comes out is clear. The oil and water distillate obtained is collected in an Erlenmeyer glass. Then solid NaCl was added until a saturated solution occurred, put into a separatory funnel, diethyl ether was added, and allowed to stand until two layers were obtained. The top layer was added anhydrous Na_2SO_4, then decanted, put into vials, tightly closed and stored in a cool place. The essential oil obtained was analyzed for its chemical content using the GC-MS tool and continued testing as a pesticide [7].

2.3. Analysis of Essential Oil of Kencur with GC-MS

The sample is inserted into the injecting gate on a GC-MS device. Furthermore, the conditions were adjusted to the conditions of each piece of equipment as below. Then they observed the chromatogram produced by the recorder and mass recorder and the mass spectra of each compound.

2.4. Pesticide Testing

2.4.1. Preparation of Pesticide Solution from Kencur Essential Oil

Kencur essential oil pesticides were tested at 1%, 2%, and 3% (v/v) and dissolved using distilled water in 50 ml of the flask and tween 80 as an emollient.

2.4.2. Test Insect Propagation (Rearing)

The propagation of the test insects was carried out by collecting fruits indicated to be attacked by fruit flies, namely citrus fruits. The fruit obtained is placed in a plastic container filled with sterile sand and then covered with gauze. The amount of sand used is 1/3 of the volume of the container. The plastic container is placed in the rearing room with the temperature adjusted to the optimum temperature for the development of fruit flies, which ranges from 27-30 °C. The oranges are left for several days until they decompose, and the eggs turn into larvae, then pupae. Furthermore, the pupa is removed from the sand onto the surface of the sand to facilitate the exit of adult fruit flies. It takes for the larvae to become imago 10-12 days. The pupae that hatch into imago are given honey on gauze to feed the fruit flies. Then the fruit flies obtained from the propagation results are used as test insects [8].

2.4.3. Pesticide Application Against Fruit Flies (Bactrocera sp.)

Each vegetable pesticide was put into a spray bottle according to the concentration label. Four plastic jars were provided: jar-1 as a control, jar-2 with a concentration of 1%, jar-3 with a concentration of 2%, and jar-4 with a concentration of 3%. Include citrus fruit feed as a food source for fruit flies. Then the reproduced fruit flies (rearing) were put into each jar, as many as 10 per replicate, covered with gauze. Spray each pesticide on jar-2 (1%), jar-3 (2%) and jar-4 (3%). They observed and recorded the number of fruit flies that died in the jar for seven days [9]

3. Results and Discussion

3.1. Percentage of Essential Oil Content

The results of the isolation of essential oil from Kencur (*Kampreria galanga*) were obtained by hydrodistillation method using a Stahl apparatus. From the distillation of 900 grams of fresh Kencur rhizomes, an average of 2.67 g (w/w) was obtained, and the essential oil content was 0.89%.

Table 1. Hydrodistillation results of Kencur essential oil

No.	Sample (g)	Essential Oil (g)	Percentage (%)
1.	300	3.84	1.28
2.	300	1.64	0.54
3.	300	2.55	0.85
Average	300	2.67	0.89

3.2. GC-MS Analysis

Gas Chromatography-Mass Spectroscopy (GC-MS) was used to analyse the essential oil produced by hydrodistillation. The chromatogram of the GC analysis showed the presence of 7 compound peaks, indicating the presence of 7 compounds contained in the essential oil (Table 1) and the compounds from the interpretation results that could be identified as many as seven compounds based on Willey and NIST standard libraries (> 1%) In the terpenoid test which is based on the ability of the compound to.

3.3. Daily Mortality of Fruit Flies (Bactrocera sp.)

The results of observations on daily mortality (number of deaths) of fruit flies with different concentrations of isolated Kencur essential oil (*Kaempreria galangal.* L) showed that treatment with a concentration of 3% essential oil was toxic to fruit flies (*Bactrocera* sp.). Pictures of fruit fly daily mortality fluctuations can be seen in Figure 1.

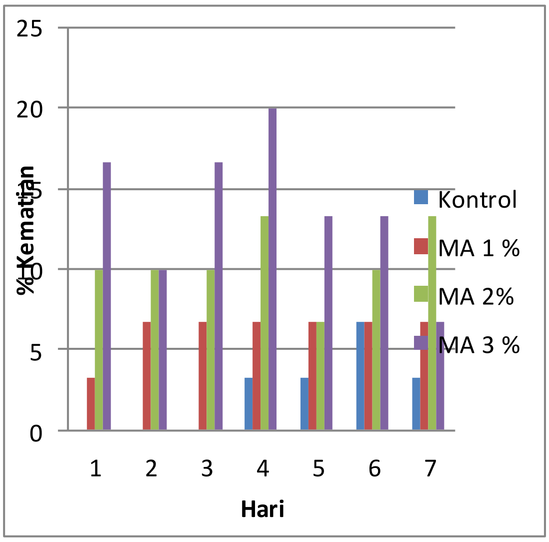

Figure 1. Graph of daily mortality of *Bactrocera* sp.

Figure 1 shows that Kencur essential oil gave different fluctuations for each treatment. On the first day, all treatments were able to kill fruit flies in the range of 3.3% - 16.7%, except for the control treatment. The daily mortality on the first day after the application was shown to be in the treatment of essential oil concentration of 3% has reached a peak with a percentage of 16.7%.

3.4. Total Mortality of Fruit Flies (Bactrocera sp.)

Observing the percentage of total mortality of fruit flies after being observed showed that treatment with essential oil concentrations of 1%, 2%, and 3% could kill flies, the fruit of 43.3%, 73.3%, and 96.7%, while in the control of 16.6%

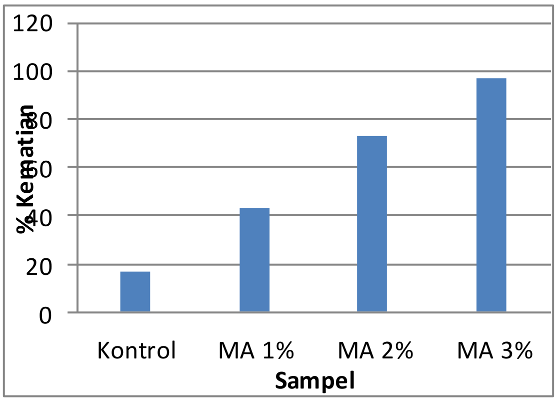

Figure 2. Graph of the relationship between concentration and % total mortality of *Bactrocera* sp.

Treatment of Kencur essential oil at a concentration of 1% and 2% was less effective because it only killed <90% of fruit flies. The small percentage of fruit fly mortality is due to the volatile oil, which is readily decomposed or degraded, so it does not have much effect on the test flies. It follows the opinion [10], who said that the chemical compounds contained in vegetable ingredients are fast

4. Conclusion

Based on the results of GC-MS analysis of Kencur (*Kaempreria galangal*. L) hydrodistilled with the Stahl apparatus, the main compound components contained in it were Limonene (2.39%), Sineol (2.22%), Terpinen (0.80%), Hexna (1.51%), Borneol (13.23%), Methyl cinnamic (1.50%), and ethyl ester (78.35%). The essential oil content of Kencur obtained by the hydrodistillation method is 0.86% in every 300 grams of Kencur. Essential oils with a concentration of 3% had a higher mortality rate than concentrations of 2% and 1%, with a mortality rate of 96.7%. So the essential oil of Rhizome Kencur has an effective vegetable pesticide activity to use. All topical creams from a combination extract of *Gymnanthemum amygdalinum* Del. and *Elaeis guineensis* Jacq. have anti-acne activity, and the F4 is the most effective concentration cream.

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6. Conflict of Interest

Authors declare no conflicts of interest

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