

Activities Test of Ethanol Extract to the three Varieties of *Zingiber officinale* Rosc Rhizomes to *Coptotermes curvignathus* Holmgren

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Abstract: *Zingiber officinale* Rosc rhizomes, is one of the plants from Zingiberaceae Familia which is contains terpenoids and have enough toxics to control *Coptotermes curvignathus* Holmgren. Besides from Zingiberaceae Familia it also known can control *Sitophilus zeamais* Motschulsky and *Tribolium castaneum* (Herbst) adult effectively. The activities test of ethanol extract to the 3 varieties of *Zingiber officinale* rhizomes to *Coptotermes curvignathus* Holmgren as a result IC_{50} from the smallest to the largest continually *Zingiber officinale* var *rubrum* IC_{50} 160 $\mu\text{g mL}^{-1}$, *Zingiber officinale* var *amarum* IC_{50} 1659 $\mu\text{g mL}^{-1}$ *Zingiber officinale* var *officinarum* IC_{50} 4210 $\mu\text{g mL}^{-1}$. Toxicity test of *Coptotermes curvignathus* Holmgren was using JIS K571 method which has already modified. Fractionation from selected ethanol extract *Zingiber officinale* var *rubrum* rhizome were used eluent n-hexane and ethyl acetate with ratio 10:0, 9:1, 8:2, 7:3, 6:4, 5:5, 4:6, 3:7, 2:8, 1:9, 0:10 continually. The results of fractions activity proved that the most effective fraction as *Coptotermes curvignathus* controller is n-hexane and ethyl acetate fraction (6:4) with IC_{50} 2.45 $\mu\text{g mL}^{-1}$.

Keyword: *Zingiber officinale*, *Coptotermes curvignathus*, activity

1. Introduction

Coptotermes curvignathus Holmgren termite are insect pests and wood destroyer for buildings that harmful for humans. Economic loss of termite attack in Indonesia is quite large such as in Bogor city reached more than 1 trillion rupiah [2].

Termite control recently is still based on the chemical control. A result of using of in discretion chemical control has a negative impact such as the occurrence of pest resistance, non-target killing of the body, and the residual effects on the unfavorable environment.

Another alternative control to do is by biologically control such as the use of extractive substances gained from plants. One of the plants that can be used as a termite control is from Zingiberaceae Familia which is *Zingiber officinale* rhizome. This research will be use 3 different varieties which each variety we expected to know how it can control *Coptotermes curvignathus*

This research is expected to give some contribution to the development of science, especially in the field of management of healthy and friendly environmental agriculture.

2. Methods and Materials

Materials which used in this research are *Z. officinale* var *rubrum*, *Z. officinale* var *officinarum* and *Z. officinale* var *amarum*. For the anti termite test was used *Coptotermes curvignathus*. For process of extraction and fractionation was used silica gel GF254, silicagel 60 G, silica gel 70-230 Mesh ASTM, ethanol, n-hexane and ethyl acetate materials.

Termite Activity Test

Z. officinale var *rubrum*, *Z. officinale* var *officinarum* and *Z. officinale* var *amarum* rhizome extract activities are being tested to *C. curvignathus* termite with JIS K 571 methods [1] which has already modified.

Wood which already weighed is tested with the size of $2 \times 2 \times 1 \text{ cm}^3$. Wood that has been given the extract is placed on the glass test, and then allowed to take an appropriate place with the relative humidity environments. Wood used for the control without the addition of feed extract. In the case of against termites, wood that had been treated inserted into a plastic container. Each sample was given as 50 worker termites and 5 healthy soldier termites which have been conditioned. Closed cup test black netting and stored in a dark place for 3 weeks.

The result of fraction gained are being tested to *C. Curvignathus* termite with JIS K 571 methods [1] which has already modified. Fractionation that has been done to *Zingiber officinale* var *rubrum* rhizome which has lowest IC_{50} were used eluent with ratio 10:0, 9:1, 8:2, 7:3, 6:4, 5:5, 4:6, 3:7, 2:8, 1:9, 0:10 continually.

3. Results and Discussion

Activity test of ethanol extract to the 3 varieties of *Z. officinale* against termite *C. curvignathus* showed that the lowest IC_{50} on *Z. Officinale* var *rubrum* in the amount of 160 mg mL^{-1} (Table 1), this means that *Z. officinale* var *rubrum* is the most effective termite control capability between the two other varieties. Profile extract the three varieties can be seen in Figure 1.

To learn more about the most effective substances performed in fractionation of the ethanol extract of selected rhizome *Z. officinale* with the smallest IC_{50} value. The result of fraction activity test gained as the most effective fraction

to control subterranean termites *C. curvignathus* which are n-hexane and ethylacetate(6:4) with 2:45 IC_{50} $\mu\text{g mL}^{-1}$, fraction profiles can be seen in Figure 2.

The ability of *Z. officinale* are effectively to control *C. curvignathus* because it contains sesquiterpene, it is like another member of the family Zingiberaceae rhizome of *Curcuma zedoaria* that contains 1,8-cineole (18.5%), o-and p-cymene (18.42%) and alpha-phellandrene (14.93%) its effective enough to kill termites *Odontotermes obesus* Rhamb with 24 hours incubation period [4].

Z. officinale Rosc, known as an Acetylcholinesterase inhibitor [3] so it have potential function as one of the alternative that can be used to control subterranean termites. Acetylcholinesterase test to the inhibitor fractions of ethanol extract of the rhizome *Z. officinale* selected will be done in further research.

Table 1: IC_{50} Three Varieties of *Zingiber Officinale*

Variety	IC_{50} ($\mu\text{g mL}^{-1}$)
<i>Z. officinale</i> var <i>rubrum</i>	160
<i>Z. officinale</i> var <i>officinarum</i>	4210
<i>Z. officinale</i> var <i>amarum</i>	1659

1. *Z. officinale* var *rubrum*
2. *Z. officinale* var *officinarum*
3. *Z. officinale* var *amarum*

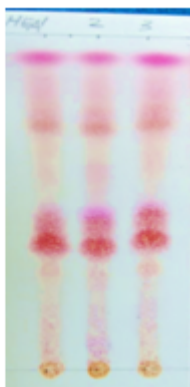


Figure 1: TLC ethanol extract Three Varieties of *Zingiber Officinale* Rhizomes

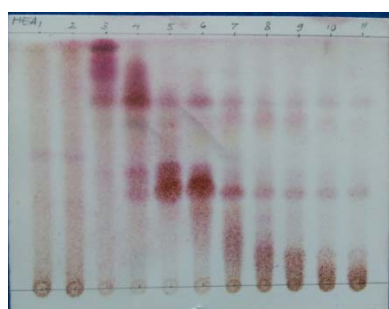


Figure 2: TLC *Zingiber officinale* var *rubrum* Fraction (n-hexane:ethyl acetate = 7:3)

4. Conclusion

Zingiber officinale var *rubrum* can control *C. Curvignathus* termites with IC_{50} 160 $\mu\text{g mL}^{-1}$ effectively. The results of fractions activity proved that the most effective fraction as *C. curvignathus* controller is n-hexane and ethyl acetate fraction (6:4) with IC_{50} 2.45 $\mu\text{g mL}^{-1}$.

References

- [1] Anonymous, 2004. Test Methods for Determining the Effectiveness of Wood Preservatives and Their Performance Requirement. JIS K 1571. Japanese Standart Association
- [2] Herdiansyah, R. 2007. An Analysis of Broken Building by Biological Factors from The Basic School in Bogor city. A Thesis from The Forest Product Department Faculty of Forestry, Bogor Agriculture Institute, Bogor
- [3] Rungsaeng, P., Polkit S., and Aphichart K. 2011. Protein with Acetylcholinesterase Inhibitory Activity from the Rhizomes of Zingiberaceae Plants. The 12th Khon Kaen University 2011 Graduate Research Conference
- [4] Singh G, Singh OP, Prasad YR, Lampasona MP, Catalan C. 2003. Chemical and Biocidal Investigations on Rhizome Volatile Oil of *Curcuma zedoaria* Rosc. Part 32. Indian Journal of Chemical Technology 10 (5): 462-465 SEP 2003