

Efficacy of *Annona Squamosa* Leaf Extract as An Insecticide against Cockroach (*Periplaneta americana*)

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Abstract

Cockroach role as vectors of many diseases, as well as allergens. Eradication using chemical insecticide with risky accumulate on foodstuffs and through inhalation and damage the environment. Annona squamosa is potentially leaves as botanical insecticide as it is more environmentally friendly. This research aims to unravel the efficacy of Annona squamosa leaves extract to kill cockroach (Periplaneta americana). This research is experimentally with post-test only control group design. The research consists of seven groups treatment based on the concentration of the leaf extract (100%, 75%, 50%, 25%, 10%, 5%, and 0.1%), a positive control (deltamethrin 0.6%) and negative control (aquadest). Each group consists of five cockroaches with two replication for each treatment. Mortality number (%) after treatment were calculate and analyzed by one way anova. There are significant differences between the research groups (F calculated 41,25 > F table 3.32). Leaves extract 25%, 50%, 75% and 100% proved effective kill Periplaneta americana, but less effective when compared to the positive control (deltamethrin). Leaves extract 0.1%, 5% and 10% proved ineffective kill Periplaneta americana. The lethal concentration of leaves extract Annona squamosa (LD_{50}) were 61,302% against cockroach.

Key words: *Periplaneta americana, insecticide, Annona squamosa.*

INTRODUCTION

Cockroaches including of the important insects in health. There's some kind of cockroaches in the world, among them are *Periplaneta americana*. The insect is nocturnally, and the food is organic materials, just like paper, shoes, hair, bread, fruits, books, fish, beans, rice, part of animals nest, clothing and a dead insect (Bell and Adiyodi, 1981). The insect is as various agents vector, like a poliomyielitis virus, enteropathogenic bacteria, amœbas cyst, eggs of worm, and the fungus *Aspergillus* (Soedarto, 1995). More or less 22 species of bacteria, virus, fungi and protozoans and 5 species of worms have been isolated from the body of the cockroach in the field.

Eradication cockroaches recently conducted using chemical, an insecticide e.g. powder chlordane 5%, solution chlordane 2% or malathion 3% (Soedarto, 1995). Permethrin use either in the agriculture or for eradication

household pest, like a spider, bug, ants, bee, cockroaches and bedbugs.

Though an insecticide synthetic is effective kill insects, but frequently use of it will induce environmental damage and health problems, because of inhaled, ingested insecticides and also because of its residue in food. Besides, In addition, the use of insecticides to kill cockroaches population might finally may can also kill insects that parasitic against cockroaches (Miller and Koehler, 2008).

An insecticide plants now developed because of the potential they have potential to have an effect as an insecticide, among others, a member of the family Meliaceae, Rutaceae, Asteraceae, Labiatae, Canellaceae and Annonaceae (Miller and Koehler, 2008). Sugar-Apple (*Annona squamosa*) is widespread throughout the tropical regions of the world. *Annona squamosa* The leaf contain borneol allegedly had the effect of insecticides

or repelen (Duke, 1992). Borneol is a bicyclic organic compound, and is easily oxidized to camphor yielding ketones. Borneol can be synthesized by the reduction of camphor with Meerwein-Ponndorf-Verley Reduction method. Its chemical structure is the molecule C₁₀H₁₈O. Borneol is an essential oil component, often used in traditional Chinese medicine as moxa (Dharmananda,--).

Ethanol extract both the leaves and seeds of the Family family of Annonaceae have many researched its had efficacy against some insects, especially of vector diseases mosquito (Chorge, 2000). Leatemia and Isman (2004) said that ethanol extract *Annona squamosa* have a better insecticide effect most good against caterpillar and larvæ of mosquito. However, until now there is no efficacy is the research on extract *Annona squamosa* against cockroaches (*Periplaneta americana*). This research aims to unravel the efficacy of leaf leaves extract of *Annona squamosa* against *Periplaneta americana*. The results of this research are expected to be able to contribute provide information on biological insecticide development. in the field of health. Furthermore, it Next could be developed as a bioinsecticide to prevent infectious diseases through contaminated food, insect bite and reduce the allergies due to insects.

MATERIAL AND METHODS

Design of the research is post test only control group. Subjects are adult cockroaches (*Periplaneta americana*), derived from the houses. Homogenization subjects cannot could not be done obtained by rearing in the laboratory because the life cycle of cockroaches very long time, so that only be conducted by taking cockroaches randomly with a kind of male sex and almost the same size (35-40 cm). Sampling was done randomly.

Adult cockroaches of *Periplaneta americana* were reddish brown with images of colored bands of a pale brown or yellow pronotum just around the corner.

Variables in research is a series of concentrations of *Annona squamosa* leaf extract as a freeindependent variable and mortality cockroach test (%) as a depends variable. Concentrations of the extract would be tested is are 100%, 75%, 50%,

25%, 10%, 5%, the 0.1% (b/v or v/v?), respectively. The dilution calculated by the formula weight per volume, with the solvent aquadest. While mMortality is defined as dead /number of subjects x 100%. As a comparison is We used positive control group that is which is exposed with the insecticide deltamethrin 0.6%^{*}) and a negative control group which is exposed by aquadest.

Instruments used are tube A 20 cm tube in length 20 cm and diameter 2,5 cm, with a gauze to cover the tubes, so that cockroaches can still respiration, tweezers, filter paper and timer were used in this research. While, The material used is are the ethanol extract of leaf of *Annona squamosa* *squamosa* leaves, Deltamethrin 0.6%^{*}) and aquadest. Research done in the laboratory of Parasitology FKIK UMY.

Preparation of the research include: 1). collection of the cockroach *Periplaneta americana* adult males; 2. creation of a test material: the leaves are taken from trees in the region of Bantul, Yogyakarta then dried by means of hang out in the air, and then processed the extraction with ethanol solvent in the laboratory of Pharmacy Gadjah Mada University. The most high viscosity is 100%, and the dilution performed immediately before the test is done on a cockroach. Dilution is carried out by the formula b/v with aquadest as diluent, to get the desired concentration. Insect properties: *Periplaneta americana* adult males were collected from household. Determination of species and size were conducted in Laboratorium of Parasitology FKIK UMY. Insecticidal properties: Leaves of *Annona squamosa* were collected from plants and air-dried and powdered. 12.5 g of the powdered material was soaked for 24 h in a glass jar in a solution of 12.5 ml water and 50 ml solvent (methanol). Subsequently, the solutions were filtered through a filter and then the extracts were stored in the refrigerator (4°C) prior to use.

Treatment on all research groups are were done by entering a cockroach into the

tube that insidewith the filter paper inside. The filter paper was smeared with is smeared material test as much as 2 ml2 ml extract. Each research groups consisting of 5 cockroaches and was done in duplicate with 2 replication. The observation is done by counting the number of died subjects who died after 24 hours of exposure (death rate in %) was observed. (It is based on the prior research by Dharmasena *et al.* (2001).

Analysis of variance was done to evaluate for knowing the significance of the difference between the mortality research groups. In addition, and Probit probit analysis was done for knowing to investigate lethal concentration (LD₅₀). If the negative control mortality were 5-10%, then the treatment group mortality corrected with Abbott's formula (1925) *cit.* Sundari and Kesetyaningsih (2002). The Abbott's formula is as follows:

$$\% \text{ corrected mortality} = \frac{\% \text{ test group mortality} - \% \text{ neg control mortality}}{100 - \% \text{ neg control mortality}}$$

*) deltamethrin 0,6% produced by PT. Panca Talentamas, Jakarta, Indonesia

RESULT AND DISCUSSION

The results of study shown on table 1. The table 1 shows that the mortality rate is 100% in positive control group. On the treatment groups, it seem the higher the concentration of the extract of *Annona squamosa* leaves, the higher death rate cockroach that the death rate of cockroach related to the dose of the extract. Groups extract 0.1% seem ineffective kill cockroaches after 24 hours of exposure. This appears to be from This shown by 0% mortality in the group, together with same as in the negative control group.

Figure 3 shows that the lower the concentration of the test substance, the lower the death cockroach, even at concentrations of 0.1% there are 100% cockroach still alive.

Results of statistical tests with *one way Anova* shows that there are significant

differences between the research groups (F calculate 41,25 > F table 3.32). The continued test of *Post Hoc Duncan multiple range test* showed that in research groups on *Annona squamosa* leaf leaves extract concentration 0.1%, 5%, and 10% was not effectively kill *Periplaneta americana* .(p= This is demonstrated by the results of insignificance of that groups with the negative control. Treatment group on extract 25% (p=0,037), 50% (p=0,00), 75% (p=0,00) and 100% (p=0,00) proven effective killing *Periplaneta americana*, but less effective when compared to the positive control. chemical insecticide use.

Annona squamosa leaves have not been much researched in relation to as insecticides. There are still in discussion about the active compound of *Annona squamosa* as insecticide. According to Duke (2008), one of the *Annona squamosa* leaf content in leaves that possibility effective as insecticides or repellent is borneol that possibility effective as insecticides or repellent. Borneol is a essential oil with bicyclic organic compound that belong to essential oil, and has a natural insect repellent effect. It is nothas not been yet known how the about the mechanism of mechanisms work borneol as insect repellent. According to Belaqziz *et al.* (2010), borneol contained within their *Thymus broussonetti* has antibacterial effect and ability to kill of *Culex pipiens* larvae insecticide.

In terms of solvent, it is also still widelyput in discusseddiscussion. Khalekuzzaman and Sultana (2006) reported that methanol is the most proven lowlowest toxic solvent compared to acetate and acetone against *Tribolium castaneum* beetle, but have not been compared with water solvent. According to Wardhana *et al.* (2005), methanol is more effective as an insecticide against *Boophilus microplus*, but its toxicity has not been not examined its toxicity. In the form of wWater as a solvent for eextraction extracts provenprove more effective use in the community because as it is cheap and easily easy to obtained.

LD₅₀ of ethanolic extract of *Annona squamosa* ethanol leaf extractleaves in this research against cockroaches on the research was quite high (61,30%). This is likely due to size of insect insect subjects are large, so it required a large dose to the dose required to

Table 1. The number of deaths of cockroach (*Periplaneta americana*) after exposure to the test substance *Annona squamosa* leaf leaves extract in various concentrations (100%, 75%, 50%, 25%, 10%, 1%, the 0.1%), (positive control) and aquadest (negative control)

STUDY GROUPS	R	Number of coackroach death			
		N total	N death	Average of death	% of death
POSITIVE CONTROL	1	5	5		
	2	5	5	5,00 ± 0,00	100%
EXTRACT 100%	1	5	4		
	2	5	4	4,00 ± 0,00	80%
EXTRACT 75%	1	5	3		
	2	5	3	3,00 ± 0,00	60%
EXTRACT 50%	1	5	2		
	2	5	3	2,5 ± 0,71	50%
EXTRACT 25%	1	5	1		
	2	5	1	1,00 ± 0,00	20%
EXTRACT 10%	1	5	1		
	2	5	0	0,5 ± 0,701	10%
EXTRACT 5%	1	5	1		
	2	5	0	0,5 ± 0,701	10%
EXTRACT 0,1%	1	5	0		
	2	5	0	0,00 ± 0,00	0%
NEGATIVE CONTROL	1	5	0		
	2	5	0	0,00 ± 0,00	0%

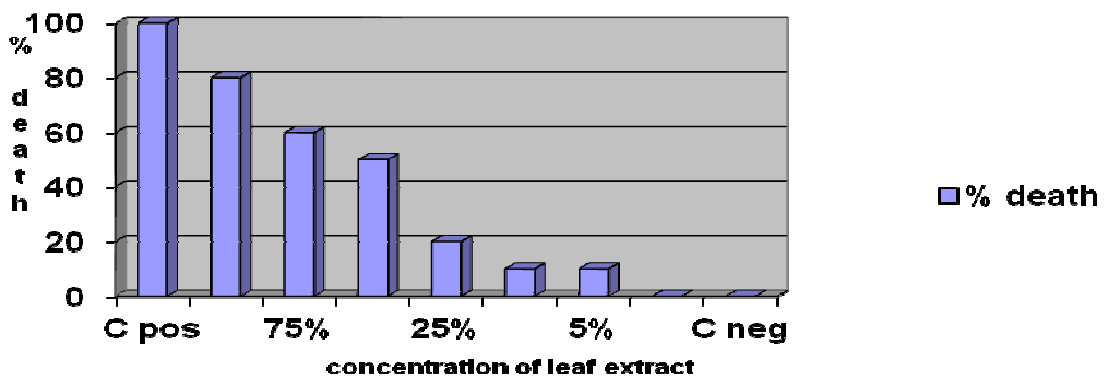


Figure 3. Graph tThe death of *Periplaneta americana* after 24 hours exposure to the test materialwith the extract.

kill the insect.is also quite large. There has been no research report concerning the LD₅₀ of Annonaceae leaves extract against large-sized insects.

According to Trindade *et al.* (2011), there is the influence of the period to collect collection time leaf *Annona muricata* leaf is affected toward the effectiveness of insecticides against *Plutella xylostella* (Lepidoptera). , with tThe best results for collection if the collection was carried out during the dry season. In this research, a collection of leaves made in October (the wet

season), so it is likely to be one of the causes of the low toxicity of extract of *Annona squamosa* leaves against the cockroach. Extract The storage of extract also affect the effectiveness as an insecticide. According to Dharmasena *et al.* (2001), storage for six months can decrease the activity of *Annona squamosa* insecticide leaf extract against *Callosobruchus maculatus* significantly. In this research, the fresh leaves has been used. This research using fresh leaves, it means thatObviously, there is no reason to lack effectiveness due to storage.

CONCLUSION

The leaves extract from *Annona squamosa* with Extract leaves 25%, 50%, 75% and 100% (w/v) concentration *Annona squamosa* showed effectively kill *Periplaneta americana*, but less effective if compared to the positive control (Deltamethrine 6%), while extract leaves 0.1%, 5%, and 10% ineffective. While, LD₅₀ of the extract were was very high (61,30%).

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