Study of the effect of ultrasonic device against the dengue mosquito, *Aedes aegypti* (Diptera: Culicidae)

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ABSTRACT - The study of the effect of ultrasonic device against the dengue mosquito, *Aedes aegypti* adults was done in Peet Grady chamber. Three replications of tests were performed based on 24 hours expositions. 50 female mosquitoes on each replication were introduced by ultrasonic device (type ICE) in Peet Grady Chamber, and the other 50 females were put in other Peet Grady Chamber without the device. Observation and counts on knock down mosquitos (mortality rate) were done every one hour to six hours, then 24 hour after exposure. The result showed that during the first hour observation, 2.67% of mosquitoes were knockdown (died) by ultrasonic device (ICE type). In the long run (one to six hours) observation, 3.33 to 10% of the mosquitoes were died, however, after 24 hours exposure 74% of the mosquitoes died. On the control groups, all of the mosquitoes (100%) were still alive on the six hour observations, and after 24 hour observations only 7.33% mosquitoes died. Based on the observation, the ultrasonic device (ICE type) affected the mosquitoes after 24 hours observations by giving them knock down efect and finally died (74%).

KEY WORD: *Aedes aegypti*, knockdown effect, mosquito, ultrasonic.

INTRODUCTION

The recent increase in dengue epidemics all around the world and the real risk of resurgence of urban yellow fever has directed public concern on how to avoid *Aedes aegypti* (L.) and *Aedes albopictus* (Skuse) bites. The avoidance of mosquito bites consequently turns to the obvious- personal protection and how to obtain the perfect repellent or other devices without insecticides. Sonic, electronic and ultrasonic devices have all been advertised as repelling mosquitoes. Some devices are available in a bracelet, watch or necklace form for personal protection while others plug into room outlets and claim to eliminate mosquitoes from a larger area (Barrido *et al.* 1993). Ultrasound is a form of cyclic sound pressure with a frequency greater than the upper limit of human hearing, this limit being approximately 20 kilohertz (20,000 hertz).

The upper frequency limit in humans (approximately 20 kHz) is caused by the middle ear, which acts as a low-pass filter. If ultrasound is fed directly into the skull bone and reaches the cochlea without passing through the middle ear, much higher frequencies can be heard. This effect (sometimes called ultrasonic hearing) was first discovered by divers exposed to high frequencies (ca. 50 kHz) sonar signal. Carefully-designed scientific studies have been performed and confirmed what they call the hypersonic effect - that even without consciously hearing it, high-frequency sound can have a measurable effect on the mind. It is a standard fact in psychoacoustics that children can hear some high-pitched sounds that older adults cannot hear, because in humans the upper limit pitch of hearing tends to become lower with age (Takeda *et al.* 1992).

However, in Indonesia there is no information about the effect of the ultrasonic devices against the mosquitoes. Here, the research was aimed to study the effect of ultrasonic devices against the dengue mosquito, *Aedes aegypti.*

MATERIAL AND METHODS

Product tested was ultrasonic device (ICE type), 20kHz ~ 100kHz, 12 volt, 12 minutes interval produce by LG. The test was carried out in Entomology Laboratory, Division of Parasitology and Medical Entomology, Department of Animal Diseases and Veterinary Public Health, Faculty of Veterinary Medicine, Bogor Agricultural Unicersity, Bogor Indonesia. The test was done from February to April 2009. The mosquito used in this study was *Aedes aegypti*, strain Liverpool, female, 4-5 days old, colonized in Entomology laboratory.

The test were done in 190x190x190 cm3 Peet Grady (PG) chambers. Four to five days old *Aedes agypti* were use for the test. Ultrasonic device (ICE type) was put inside right at the center of the PG and used, waited for one minute. Fivety sucrose-fed females were released into PG chamber, observed for several minutes to make sure that no mosquito fell down to the floor. Observation and counts on knock down mosquitos were done every hour up to six hours, then 24 hours after exposure.

RESULTS AND DISCUSSION

The result of the research was performed in Table 1. The result showed that during the first hour observation, 2.67% of mosquitoes were knockdown (died) by ultrasonic device (ICE type). In the long run (one to six hours) observation, 3.33 to 10% of the mosquitoes were died, however, after 24 hours exposure 74% of the mosquitoes died. On the control groups, all of the mosquitoes (100%) were still alive on the six hour observations, and after 24 hour observations only 7.33% mosquioes died.

Based on the observation, the ultrasonic device (ICE type) affected the mosquitoes after 24 hours observations by giving them knock down effect and finally died (74%). According to the theory is that rodents and insects can hear sounds that are above the range of human senses (upper than 20 kHz). By emitting a loud *ultrasound*, it's assumed that the mosquitoes will received the effect of ultrasonic wave through their antennae as receptors, and their will be repelled, driven insane or discomfort and finally dead.

Table 1. Mortality rate of mosquioes after exposured by ultrasonic device (ICE type, 20~100 kHz, 12 volt, 12 minutes interval) in Peet Grady Chamber

Time observed (hour)	Treatment (%)				Control (%)			
	Replication 1	Replication 2	Replication 3	Average	Replication 1	Replication 2	Replication 3	Average
1	4.00	0.00	4.00	2.67	0.00	0.00	0.00	0.00
2	6.00	0.00	4.00	3.33	0.00	0.00	0.00	0.00
3	12.00	0.00	4.00	5.33	0.00	0.00	0.00	0.00
4	12.00	0.00	4.00	5.33	0.00	0.00	0.00	0.00
5	14.00	0.00	6.00	6.67	0.00	0.00	0.00	0.00
6	20.00	2.00	8.00	10.00	0.00	0.00	0.00	0.00
24	82.00	56.00	84.00	74.00	6.00	8.00	8.00	7.33

CONCLUTION

Ultrasonic device (ICE type, 20 kHz ~ 100 kHz, 12 volt, 12 minute interval) affected the mosquitoes (*Aedes aegypti*) after 24 hours observations by giving them (74%) knock down effect and finally died.

References

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