Effect of *Dioscorea hispida* dennst. against *Rattus sp*

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Abstract. *Rattus sp* is one of the main pests of food crops that attack plants from plantation to storage and can decrease production up to 50%, it is necessary to control the pest by means of the use of *D. hispida* are more environmentally friendly. The study aims to investigate the effect *D. hispida* against *Rattus sp*. The dose use for *D. hispida* were 300 gr, 450 gr, 700 gr, 950 gr and control. The experiment indicated that treatment significantly different from control. The treatment with *D. hispida* has an effect on male and female *Rattus sp*. that are characterized by damage to the internal organs of *Rattus sp*. In the treatment of 450 doses can kill *Rattus sp*. with an average day of death of 5.65 days where male 3 days and female 9 days, while doses of 300 gr, 700 gr and 950 gr can also kill the *Rattus sp*. The present study clarified that the *D. hispida* can killed *Rattus sp*. and could be used for control of *Rattus sp.* in the field.

1. Introduction

*Rattus sp.* is one of the important pests in plants. Rats can cause damage to crops ranging from cropping to storage. Rats are pests have some excess compared to insects, rats are capable of damaging the cultivation in a short time and inflict a large amount of loss resulting in the need for control measures. Rat control measures at this time only depend on chemical control. Information from some farmers who have been found in the field says controlling rats using rodenticides in the form of bait and powder. The use of synthetic pesticides among farmers tends to be exaggerated and not precisely targeted. Pesticide use negatively affects the environment and organisms such as environmental pollution, pest resistance, the increasing of secondary pest populations even impact human health. Therefore, it is necessary to take alternative countermeasures to control rats by utilizing plants as a more environmentally friendly pest control.

The use of plants that have the potential to control pests is very effective because they contain chemical compounds that will cause toxic effects such as feeding deterrent, repellent, ovicidal, growth inhibitors and sterile/infertile pests. Plant extracts have specific ways of working such as damaging growth, reducing appetite, and inhibiting reproduction [1]. Plant material liked or disliked by rats, both those that affect the sense of smell or those that are toxic to the body of rats. The use of materials that are not preferred by rats can reduce the survival of rats due to eating, drinking, finding a partner, and impaired reproduction [2]. Types of plants that can be used as plant-based pesticides and the potential to control rats are yam tuber (*Dioscorea hispida*).

*D. hispida* is a plant of tubers that contain nutrients and harmful toxic compounds that can be used as alternative pest control because it contains secondary metabolites. Compound of *D. hispida* can be cause infertility [3]. The used *D. hispida* as much as 30% was the best treatment and was able to kill 5 rats [4]. *D. hispida* with 25% was able to cause mortality by 70% [5]. The higher dose is given then the...
better in killing rats, the dose used is 900 gr [6]. Based on the above explanation then the research purpose of this research is to obtain information about the effect of *D. hispida* against *Rattus* sp.

2. Materials and Methods

2.1. Preparation Experimental Rats

Rats collected in cages measuring 50 x 20 x 20 cm³. A total of 15 male rats and 15 female rats aged 3 months and body weight between 20 - 35 grams. Rats were adapted for 2 weeks. During the adaptation process takes place, the rats were given a drink and feed in the form of blocks of size 2 x 1 cm² consisting of 20 grams of dried shrimp + 20 grams of bran + 20 grams of coconut.

2.2. Preparation Bait Block

Manufacture of feed blocks used *D. hispida* with attractan. Attractan materials used are dried shrimp, bran, coconut. The *D. hispida* tuber are cleaned and ground using a blender. Puller is made in the form of flour. All ingredients are mixed in the appropriate dosage. The bait to be printed is weighed first with a weight of 5 grams and then shaped like a block with a size of 2 x 1 cm². As for treatment that is P0 : Control (20 gr dried shrimp + 20 gr bran + 20 gr coconut), P1 : 300 gram of *D.hispida* + attractan, P2 : 450 gr of *D.hispida* + attractan, P3 : 700 gr of *D.hispida* + attractan and P4 : 950 gr of *D.hispida* + attractan.

2.3. Preparation and Test

Test container measuring 30 x 20 x 15 cm³, the base of the box is made of boards. All walls are made of aluminum wire, each box is given a place to eat and drink. The adapted rats were then put into the experimental container and then fed according to the treatment, before giving the test animal feed for 48 hours.

2.4. Statistical analysis

Statistical analysis was carried out of effect *D. hispida* against *Rattus* sp using Microsoft excel. Oneway analysis of variance (ANOVA) was applied to the data to determine differences. To check significant differences between the levels of the mean factor with BNT were α = 0.05.

3. Results and Discussion

The results showed that *D. hispida* had an effect on *Rattus* sp which was characterized by reduced body weight of rats, reduced the ability to eat, damaged organs in rats and led to death.

| Treatment       | The average weight of rats (gr) | Average remaining feed (gr) | Average age (days) |
|-----------------|---------------------------------|-----------------------------|-------------------|
|                 | Early                          | End                         |                   |
| Control         | 25.12                          | 26.67 b                     | 0.00 a            | 0.00 a            |
| *D. hispida* 300 gr | 25.07                          | 19.80 a                     | 1.31 b           | 6.67 b            |
| *D. hispida* 450 gr | 25.12                          | 20.85 a                     | 2.06 c           | 5.67 b            |
| *D. hispida* 700 gr | 24.05                          | 19.72 a                     | 1.69 c           | 6.67 b            |
| *D. hispida* 950 gr | 25.12                          | 20.03 a                     | 3.27 d           | 7.67 b            |

Note : A number that is followed by the same letter (a, a) means that it is not significantly different and a number that is followed by a different letter (a, b, c, d) means it is significantly different at the BNT test level α = 0.05.

The table above shows that all treatments are significantly different from controls. The observation of the final body weight of rats after being treated showed that the treatment with *D. hispida* 300 gr and 700 gr on the observation that the highest average residual feed was found in the *D. hispida* 950 gr
treatment. The treatment that gave the fastest reaction and caused the rats to die was found in the *D. hispida* 450 gr treatment.

![Death of days comparison](image1.png)

**Figure 1.** Comparison of death days of male and female *Rattus* sp. all treatments.

In the table above shows that the treatment of *D. hispida* effects on gender of *Rattus* sp. *Rattus* sp male die faster than female. In addition, *D. hispida* can also damage internal organs of rats (Figure 2) thus affecting the activity of *Rattus* sp.

![Internal organs comparison](image2.png)

**Figure 2.** Comparison of internal organs of rats. (A) Male, (B) Control, and (C) Female.

*D. hispida* affects body weight of *Rattus* sp., damages internal organs and shortens the life of *Rattus* sp. *D. hispida* affects the body weight of rats caused by secondary metabolite compounds contained in *D. hispida* which are antifeedant. Effect antifeedant caused by *D. hispida* was seen in the remaining feed given in each treatment at the time of research. *D. hispida* contains anti-eating compounds obtained from the alkaloid group [7]. *D. hispida* contains antifeedant compounds and
poisons that can metabolism disorder in the body there by reducing body weight and growth inhibition [8].

The rate of death of rats is marked by death days of rats. Doses that can kill rats quickly are at a dose of 450 gr, whereas at the highest dose they also kill rats but require a long time. At a dose of 450 gr is the ideal dose where carbohydrates, proteins and pullers are balanced so that the rat cannot distinguish the taste while at a high dose the poison content can be detected by the rat. The rat senses are able to distinguish bitter taste, poison and good taste [9].

The death of male and female Rattus sp is very different where males are shorter than females. This is caused by the dioschorine compound contained in D. hispida affecting the immune system of male and female Rattus sp. Females have reproductive hormones so that the working process of toxic compounds is slow and can cause infertility in female rats. Male of Rattus sp. has an immune system that is not influenced by reproductive hormones [10]. The use of D. hispida with a low dose or dose that is not favoured by rats can cause infertility in rats. Dioscorine compound in D. hispida cause birth control [11] and can cause infertility [3].

Damage that occurs in the organs of rats is caused by toxic compounds present in D. hispida including dioscin, diosgenin and cyanide acid. Dioscorin can damage internal organs and even destroy and increase blood pressure in rats [12]. These compounds can cause hemolysis, paralysis of the nervous system and poison the body. Rattus sp who consumes D.hispida tubers will experience organ damage including dark coloured liver, swelling of the bladder, black intestine and disintegration. The rats treated with D. hispida caused internal organ damage including darker liver and spleen colour [13]. The effect of D. hispida against organs in Rattus sp. can cause damage to the liver, kidney, spleen and in the ovary, no development of follicles has been observed [14].

4. Conclusions
D. hispida can have several effects on Rattus sp. as antifeedant, damaged organs in rats and led to death. All treatment with D. hispida affect Rattus sp. and has the potential to be an environmentally friendly control. Field studies need to be carried out to determine its effectiveness in the field so that D. hispida can be recommended by the army as an environmentally friendly control.

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