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Effects of oleander leaves (*Nerium oleander*) against metabolism, activity pattern, and the leaves potency as rice-field rat repellent (*Rattus argentiventer*)

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Abstract

Nerium oleander is a plant that has historically been known as one of the poisonous plants in the world that can be used to control pests. However, studies on the effects of oleander leave against *Rattus argentiventer* as a major agricultural rodent pest are limited. This research aimed to probe the potency of oleander leaves extracted in methanol as rice-field rat repellent. The experiments involve a choice test (T-maze arena) and a no-choice test (metabolic cage) that being analyzed by the T-test using three replications for six days. The result showed that the rats on the T-maze avoided consuming food and beverage near the oleander treatment. The same result occurs in the metabolic cage, which was indicated by the decrease in the average of food and feces, and also the increase in the average of beverage and urine. Besides, the treatment also caused daily activity patterns disorder, which was significantly indicated by the increase of the average percentage of time for resting activities by 22.84% and the decrease of time for locomotion and nesting activities (by 9.71% and 13.13% respectively). Overall, oleander leaves have the potential to provide a repellent effect on rice-field rats, especially in the choice test.

Keywords: extract; plant-based; repellence; Nerium oleander; Rattus argentiventer.

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Methodology

Choice Test in T-Maze Arena

- **Rice-field Rats**

12 mature males and 12 not pregnant females (weight range between 90-130 g).

- **Plant Materials and Extraction**

Young oleander leaves collected and washed

↓

Air-dried 2 weeks and blended into powder

↓

Soaked with methanol (75%) ratio 100 grams: 1 litre

↓

Filtered and steam distilled (± 80°C for 1.5-2 h)

↓

500 ml extract sample ready for the treatment.

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Methodology

Choice Test in T-Maze Arena

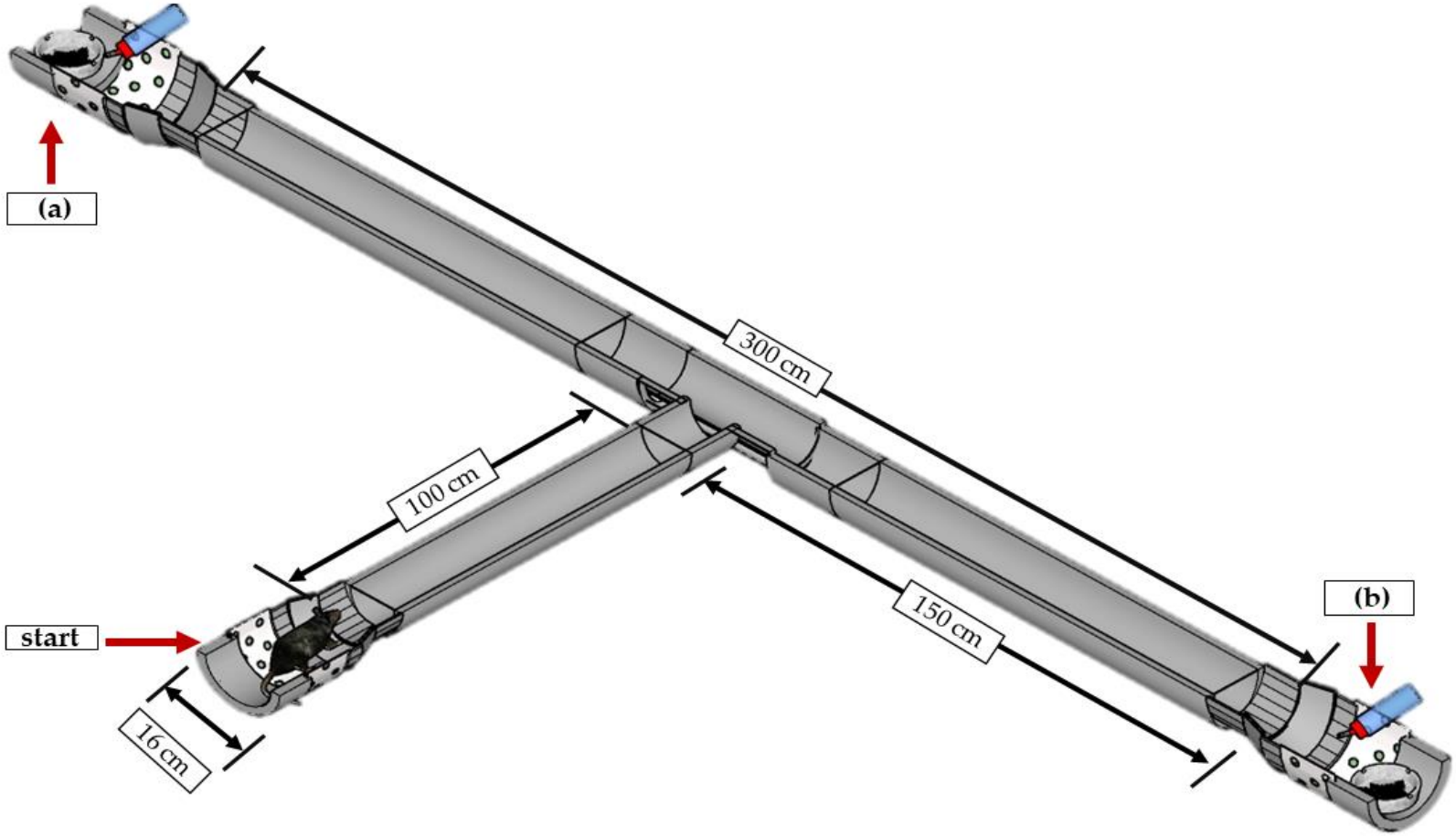

Figure 1. T-Maze arena prototype and pipe size. (a) extract of oleander leaves treatment and (b) control room without extract of oleander leaves.

The extract was sprayed onto two cloth sheets (10x10 cm) with a hand sprayer (5 ml/sheet). Provided with food (brown rice 10 % of body weight) and beverage (100 ml of water).

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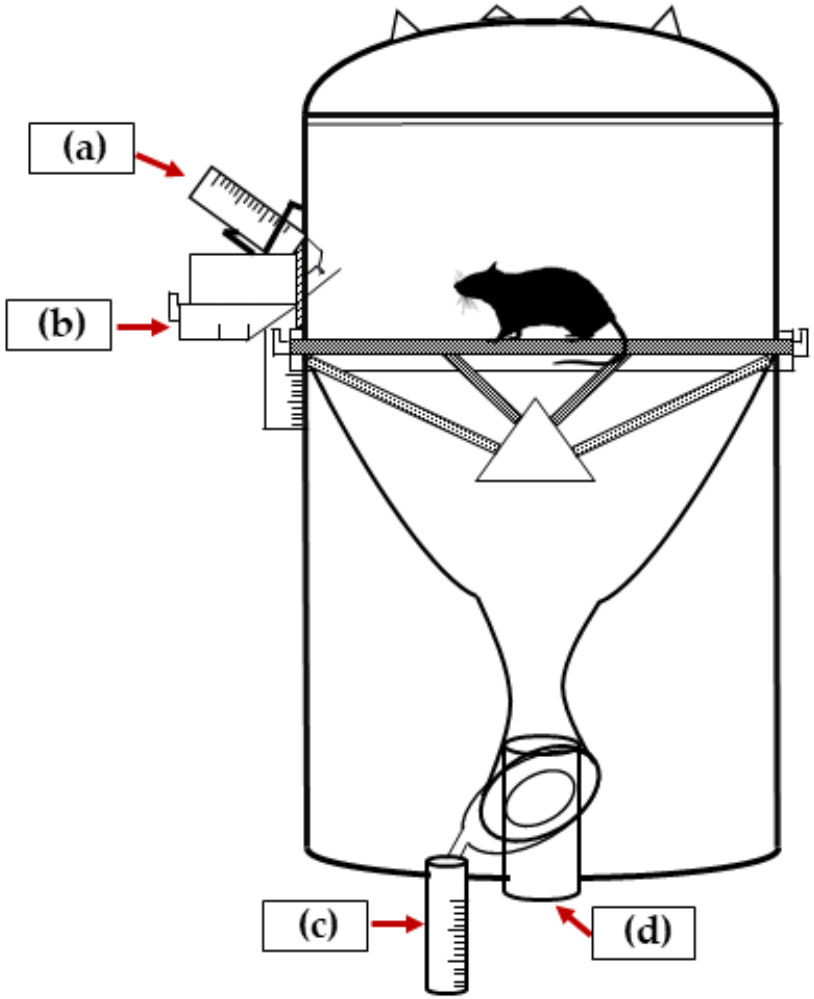
Methodology

No-Choice Test in Metabolic Cage



The extract was sprayed onto two cloth sheets (10x10 cm) with a hand sprayer (5 ml/sheet).

Provided with food (brown rice 10 % of body weight) and beverage (100 ml of water).

The observation include:

1. **Metabolism**
2. **Daily activities** using CCTV in 18.00-06.00 every day (the parameters are locomotion, foraging, and resting)

Figure 2. Metabolic cage prototype. Container of (a) beverage; (b) food; (c) urine; (d) feces.

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Methodology

Data Processing and Analysis

- The treatment was done with **3 replications** (both female and male rats).
- **The experimental data compared** using the **average difference test method** with **two independent data (Independent Sample T-test)** between extract and control treatment.
- **Statistical results and the significance** assessed at **95% confidence level** to compare the differences between treatment means that analyzed using Statistical Package for the Social Sciences **(SPSS)** software version 25.0 in Windows.

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Results

Choice Test in T-Maze Arena

Table 1. The average amount of food and drink consumption between female and male rice-field rats each day after six days of the choice test in the T-maze arena.

Sex	Treatment	Average per day	
		Food consumed (g)	Drink consumed (ml)
Female	Extract	2.44*	4.56*
	Control	5.86	9.11
Male	Extract	3.29*	4.56**
	Control	6.17	10.11

(*) indicates a significant difference between the treatments. *P < 0.05; **P < 0.001 highly significant.

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Results

No-Choice Test in Metabolic Cage

Table 2. The average amount of food, drink consumption, feces, and urine between female and male rice-field rats each day after six days of the choice test in the metabolic cage.

Sex	Treatment	Average per day			
		Food consumed (g)	Drink consumed (ml)	Feces (g)	Urine (ml)
Female	Extract	6.13*	4.44**	0.52**	1.78*
	Control	9.72	10.78	1.56	3.5
Male	Extract	7.08*	8.00*	1.05	3.33
	Control	10.02	11.72	1.75	4.11

(*) indicates a significant difference between the treatments. *P < 0.05; **P < 0.001 highly significant.

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Results

No-Choice Test in Metabolic Cage
(Daily Activity Patterns)

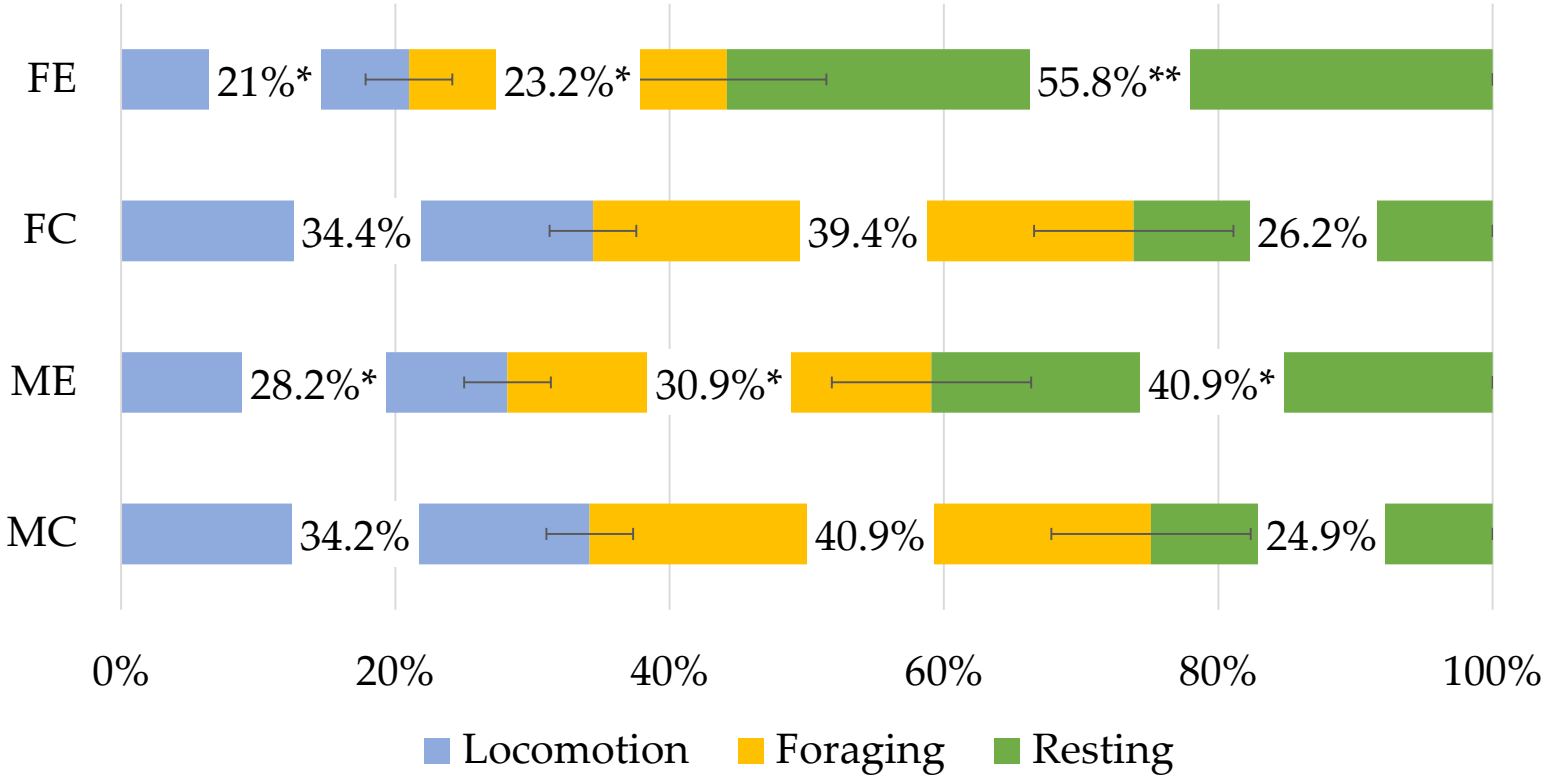

Figure 3. Comparison of the percentage averages daily activity pattern in 12 hours (18.00-06.00) using CCTV every day until six days of observation in the metabolic cage.

Female Extract (FE); Female Control (FC); Male Extract (ME); Male Control (MC). The standard error (SE) of the mean is showed by a vertical bar. The symbol asterisk (*) indicates a significant difference between the treatments. *P < 0.05; **P < 0.001 highly significant.

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Discussion

- The circumstances of both test experiment (choice and no-choice test) are thought to be due to neophobic behavior that caused stress actions that makes rice-field rats reduce their will to consume food and drink in due to the influence 5 ml of oleander leaves.
- The smaller food and drink rats consumed, then the smaller amount of feces and urine they will produce.
- The aroma arising from oleander leaves is thought to provide uncomfortable conditions for rice-field in metabolic cages so that the activity of rats is disrupted which supposed to be active at night but became passive.
- Gender differentiation can also make a difference in the measured patterns of rice-field rat activities.

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Conclusions

This study concludes that extract oleander leaves gives a repellent, metabolic, and daily activity pattern disorder to both female and male rice-field rats. The rats tend to reduce their will to consume food or water that affects the amount of urine and feces they produce.

Moreover, oleander leaves also affect the rice-field rats' daily activity patterns which showed by a change in their habitual on the observation time (18.00-06.00) from actively foraging or locomotion to become passively (resting). It is also found that male rice-field rats tend to take more risk to consume more food and drink rather than female rats.

Owing to the experiment that has been done, it is worth investigating more further regarding the isolation of bioactive compounds of oleander leaves as a repellent against rice-field rats or makes other experiments on other species.

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