

## Toxicity test of jatropha leaf filtrate (*Jatropha curcas* L.) on mortality of golden snail (*Pomacea canaliculata*)

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**Abstract:** This study was an experimental study to determine the effect of the toxicity of *Jatropha curcas* L. leaf filtrate on the mortality of the *Pomacea canaliculata* (golden snail). *Pomacea canaliculata* as many as 240 tails aged 7 days after hatching is the object of research. A completely randomized design of 6 (treatment) and 4 (replication) was used in this study. Data was collected by observing the golden snail every hour for 24 hours. ANAVA and BNT analysis to calculate research data. Calculation of 50% mortality of research objects using LC50. The ANAVA results are  $F_{count} 434.160 > F_{table} 2.64$ . The findings indicated that the filtrate from *Jatropha curcas* leaves had toxicity on golden snail mortality. The concentration of jatropha leaf filtrate that can kill the golden snail is 7% based on calculations with LC50. This concentration was able to kill half of the golden snails tested.

**Keywords:** *Jatropha curcas* L., godel snail mortality, *Pomacea canaliculata*, toxicity

**Abstrak:** Penelitian ini merupakan penelitian eksperimen untuk mengetahui pengaruh daya toksisitas filtrat daun *Jatropha curcas* L. terhadap mortalitas *Pomacea canaliculata* (keong mas). *Pomacea canaliculata* sebanyak 240 ekor yang berumur 7 hari setelah menetas adalah objek penelitian. Desain rancangan acak lengkap 6 (perlakuan) dan 4 (ulangan) digunakan dalam riset ini. Data dikumpulkan dengan mengamati keong mas setiap jam selama 24 jam. Analisis ANAVA dan BNT untuk mengkalkulasi data penelitian. Kalkulasi kematian 50% dari objek penelitian menggunakan LC<sub>50</sub>. Hasil ANAVA adalah  $F_{hitung} 434,160 > F_{tabel} 2,64$ . Temuan mengindikasikan bahwa filtrat dari daun jarak pagar mempunyai daya toksisitas pada mortalitas keong mas. Konsentrasi filtrat daun jarak pagar yang dapat mematikan keong mas adalah 7 % berdasarkan kalkulasi dengan LC50. Konsentrasi tersebut sudah dapat mematikan keong mas setengah dari jumlah keong mas yang di uji.

**Kata kunci:** *Jatropha curcas* L., mortalitas keong mas, *Pomacea canaliculata*, toksisitas

### INTRODUCTION

*Jatropha* (*Jatropha curcas* L.) is one of the plants that can be used as poison for golden snails. It contains saponins, steroids, alkaloids, phenol, flavonoid, tannins, (Ruma & Sanchez, 2016). *Jatropha* contain secondary metabolites such salicylic acid, thymol,  $\gamma$ -terpinene, potent cytotoxic, molluscicidal (Devappa et al., 2012; Ibrahim et al., 2022; Mahalakshmi et al., 2013; Muniz et al., 2020). These compounds can affect the metabolism of cold-blooded animals such as mollusks.

The content of saponin compounds is reported to have a molluscicidal effect (Abdul Aziz et al., 2021; Dawidar et al., 2012; El Aziz et al., 2019; Murthy et al., 2020). The toxicity

of this substance is high enough for gold snails to be able to kill them (Chengjun et al., 2021). Several studies have reported that saponin compounds have been tested for their biological activities including molluscicidal effects (Chen et al., 2020; Ramli et al., 2019; Rosli et al., 2021). Saponins kill snails by interfering with their nutrition and development and by impeding their respiration (Noorshilawati et al., 2020). The researcher advised future studies to perform field experiments in quest of natural and ecologically friendly molluscicides.

Jatropha leaf toxic substances are reported to be effective as pesticide agents, both larvicides and molluscicides, among others, the toxic activity of *Jatropha curcas* effectively kills *Schistosoma mansoni* and *S. haematobium* larvae contained in the snail *Biomphalaria glabrata* as vectors (Pereira Filho et al., 2014; Rug & Ruppel, 2000). *Jatropha* leaf saponins were also reported to be effective in killing *Anopheles arabiensis* larvae (Tomass et al., 2011), and *Pomacea canaliculata* (Quijano et al., 2014)

The golden snail (*Pomacea canaliculata*) is one of the rice pests that is difficult to control because it has mobility, adaptability, and high reproductive power. The golden snail is called a pest because it eats 10-day-old rice plants in rice fields and the eggs that stick to the rice stalks cause the rice plants to die. The Golden Snail is a significant pest of rice in a number of Indonesian locations. This pest attacks from the seedling stage forward. The most severe outbreaks often start between 1 and 7 days after transplanting and last until the plants are around 30 days old (Manueke, 2016).

The life cycle of the golden snail depends on the availability of food and the aquatic environment that allows the golden snail to reproduce. According to (Budiyono, 2006), golden snails during their lifetime are able to produce 15-20 groups of eggs, each group totaling approximately 500 eggs, with a hatching percentage of more than 85%. The time needed in the egg phase is 1 - 2 weeks, at the initial growth it takes 2 - 4 weeks and then becomes ready to mate at the age of 2 months.

*Jatropha curcas* is a wild plant that is not difficult to find, but it has not been used by farmers in controlling golden snails because farmers do not yet know the potential of *Jatropha* plant which has a molluscicidal effect in controlling gold snail pests. Utilization of the potential of *Jatropha* as a botanical molluscicide is an effort to control gold snail pests as an effective and efficient way to control gold snail pests.

## METHOD

The research was conducted at the Green House and Zoology Laboratory, Department of Biology, Mathematics and Natural Sciences, State University of Gorontalo. The research starting from preparation to the preparation of the report. The object of the research was 240 gold snails (*Pomacea canaliculata*) aged 7 days after hatching. The research method used is an experimental method with a completely randomized design (CRD). The treatment in this study consisted of 6 treatments and 4 replications. Treatment A: control or without *jatropha* leaf filtrate. Treatment B: *Jatropha* leaf filtrate with a concentration of 10%. Treatment C: *Jatropha* leaf filtrate with a concentration of 20%. Treatment D: *Jatropha* leaf

filtrate with a concentration of 30%. Treatment E: Jatropha leaf filtrate with a concentration of 40%. Treatment F: Jatropha leaf filtrate with a concentration of 50%

Data obtained through direct observation of the object under study. Observation of gold snail mortality was carried out every hour for 24 hours. The tools used in this research are filtration devices in the form of measuring cups, Erlenmeyer tubes, funnels, pipettes, analytical balances, stirring rods, filter devices such as cheesecloth and filter paper, sieves and blenders. The treatment test equipment was petridish, small brush, and label paper. Observation tools include microscopes, digital cameras, and writing instruments. The material used is the filtrate of Jatropha leaves (*Jatropha curcas* L.). Golden snails aged 7 days after hatching, distilled water for control treatment, aquades solution as a solvent at the time of making Jatropha leaf filtrate.

The experimental animal used was the golden snail (*Pomacea canaliculata*). First, start with the manufacture of an artificial pond measuring 100 x 50 x 30 cm and at the edge of the pool a plastic barrier is made. Snail eggs collected from rice fields are placed in polybags contained in artificial ponds filled with water. After the eggs hatch and young snails are formed. Every 24 hours in the morning, feed is given from papaya leaves and kale leaves. The test animals used were all golden snails aged 7 days after hatching and placed in 24 petridishes. Each petridish contains 10 gold snails. The golden snail used in this study was 7 days old, because according to Gassa (2011), young snails can be observed and have a thin shell structure so that toxic compounds are easily penetrated into the snail's body.

Preparation of jatropha leaf filtrate using mature leaves that are not too young. For the manufacture of jatropha leaf filtrate, the following steps are carried out: cleaning and drying by drying, making powder: the dry material is blended until smooth and sieved to obtain powder, filtering the powder solution using distilled water as a solvent.

The data obtained were analyzed by analysis of variance (ANOVA) using the F test with a significant level of  $\alpha = 0.05$ , to see whether there was an effect of Jatropha (*Jatropha curcas* L.) leaf filtrate on the mortality of the golden snail (*Pomacea canaliculata*). If the results of the analysis of variance (ANOVA) show an effect, then proceed with the least significant difference (LSD) test. The test was continued by calculating the lethal concentration 50 (LC50) value calculated using probit analysis.

## RESULTS AND DISCUSSION

Based on the results of the observation of the toxicity test of Jatropha leaf filtrate on the mortality of golden snails which was carried out every hour for 24 hours, it showed the toxicity of the compounds contained in the Jatropha leaf filtrate. This can be seen from the mortality of golden snails at each concentration of the filtrate. The mortality of golden snails can be seen in the table below.

Table 1. Mortality of Golden Snails to Jatropha Leaf Filtrate

<b>Concentration</b>	<b>Mean Mortality</b>	<b>Percentage Mean Mortality</b>	<b>Time Mortality (Hours After Application/HAA)</b>
Control	0	0 %	24 HAA
10 %	6.75	67.5 %	22 HAA
20 %	8.5	85 %	20 HAA
30 %	9.75	97.5 %	15 HAA
40 %	10	100 %	13 HAA
50 %	10	100 %	14 HAA

Table 1 shows the level of concentration is directly proportional to the level of mortality seen based on the average percentage of mortality, and shows the mortality time of golden snails at each different concentration. Mortality at filtrate concentrations of 50% and 40% effectively killed golden snails with an average mortality of up to 100%, 30% concentrations killed golden snails up to 97.5%, 20% concentrations killed gold snails with an average mortality of 85%, and at a concentration of 10 % turn off the golden snail by 67.5 % of all test animals. Meanwhile, at the control concentration, there was no mortality even up to 24 hours after application (HAA). This shows that the higher the concentration of jatropha leaf filtrate, the higher the percentage of gold snail mortality.

The results of the Anova test with a confidence level ( $\alpha$ ) of 0.05 obtained the calculated F value = 434.160. While the F table is 2.64 which means the calculated F value > the F table value. This shows that there is an effect of Jatropha leaf filtrate on the mortality of the golden snail.

Table 2. LSD Test Results

<b>Concentration</b>	<b>Mean Mortality</b>	<b>Notation</b>
Control	0.00	A
10 %	6.75	B
20 %	8.50	C
30 %	9.75	D
40 %	10.00	D
50 %	10.00	D

Note: different letters indicate that there is a significant difference in the LSD test = 0.05.

Table 2 above shows the results of the LSD test at each concentration of jatropha leaf filtrate. These results can be seen that there are differences between treatments at each concentration. Based on the LSD test that the control concentration, 10%, and 20 %, showed a significant difference to each treatment concentration which was calculated based on the average mortality of golden snails, namely 0, 6.75, and 8.5. Between each concentration 30%, 40%, and 50% did not show a significant difference in mortality of golden snails, namely

9.75, 10, and 10 average mortality. The results of the LC50 test using probit analysis, obtained an estimated concentration of jatropha leaf filtrate that can kill golden snails of 50 % or half of the number of test snails is a concentration of 7%.

Based on the results of the study, it was found that the toxicity test of jatropha leaf filtrate had a positive effect on the mortality of golden snails. This is indicated by the presence of mortality symptoms shown by golden snails when given *Jatropha* leaf filtrate with different concentrations. The concentration is proportional to the increase in the number of gold snail mortality. The higher the concentration, the higher the number of gold snail mortality.

The real effect of jatropha leaf toxicity test, has a difference in each concentration of jatropha leaf filtrate. This is based on the LSD test, that the control concentrations, 10%, and 20%, showed significant differences, which means that at these concentrations the average number of gold snail mortality was significantly different. Between each concentration of 30%, 40%, and 50% did not show a significant difference in mortality of golden snails. This means that at that concentration, the average number of mortality is almost the same. The results of the LSD test showed that at each treatment concentration there was an increase in the average number of mortality, while at a concentration of 30 %, 40 %, and 50 % did not experience a significant increase in the average number of mortality because between these concentrations already indicated the total number of deaths of golden snails tested.

*Jatropha* leaf filtrate toxicity showed a very high effect on gold snail mortality. It can be seen from each concentration that the average percentage of mortality is more than 50% or more than half the number of golden snails tested. While the results of the LC50 test using probit analysis obtained a concentration of 7%. The value of the LC50 test results was not found in the concentration of the treatment filtrate given to the golden snails being tested.

Based on the LC50 test, it was obtained with a concentration value of 7%, which means that at that concentration it was able to kill the golden snail with a percentage of 50% or half of the number of gold snails tested. It was obtained that the results of the LC50 test had a lower concentration value compared to the treatment concentration. Based on this, that the toxic substances contained in the filtrate of *Jatropha* leaves have high toxic activity. This is supported by (Miles & Chang, 2004), that the low LC50 value of a substance indicates that the substance has a higher toxic activity in killing test animals because the substance or compound at that concentration is capable of killing test animals.

Bioactive compounds as toxic substances contained in the filtrate of *Jatropha* leaves affect the mortality of golden snails. Saponin compounds are reported to be molluscicides capable of killing gold snails (Yismawanto et al., 2022). Saponins are plant compounds that can form foam in water and if the solution penetrates into the animal's body, hemolysis will occur because it reacts with cholesterol in cell membranes and causes irritation of mucous membranes (Khan et al., 2012). This reaction has the effect of lowering the surface tension of the membrane, causing porosity in the membrane and resulting in cell leakage or intracellular fluid will come out. Irritation of the mucous membranes is characterized by gold

snails that often secrete mucus, causing obstruction of the digestion of nutrients and causing the death of golden snails.

The accumulation of molluscicides in the body of the golden snail can affect the metabolic process of the golden snail, causing death. Phenol compounds are reported to cause leakage of cell nutrients by destroying the hydrophobic bonds of cell membrane components (such as proteins and phospholipids) and the dissolution of hydrophobically bound components resulting in increased membrane permeability (Windarwati, 2011). Other toxic compounds contained in the filtrate of *Jatropha* leaves are flavonoid compounds. This compound works as a respiratory inhibitor (Mulyanti et al., 2022). The mechanism of action of this compound causes the cessation of respiratory activity in the siphon channel which interferes with the respiratory process, causing death of the golden snail.

Alkaloid compounds are toxic compounds that cause paralysis and cessation of breathing (Gassa, 2011). This is caused by the compound penetrated into the body of the golden snail which attacks the nervous system, causing disturbances to the nerve cell impulse delivery system to the muscles and resulting in spasms in muscle organs and paralysis. This situation causes the snail's body to come out of the shell and exudate / mucus.

These compounds are toxic or poison that penetrates into the body of the golden snail at a young stage, which is 7 days old which causes the death of the golden snail, so that the molluscicidal effect of these toxic compounds can break the life cycle of the golden snail. The high mortality of gold snails was caused by the accumulation of toxic compounds and easily penetrated into the body of the golden snail. This is because the golden snail in the young stage has a thin shell structure and the operculum is still in the developmental stage.

Toxic compounds in the class of saponins, alkaloids, and flavonoids found in several plants can be applied to agricultural land (Wibowo et al., 2011). Toxic compounds in *jatropha* leaf filtrate can also be applied to adult snails in an agricultural land. Provision of *jatropha* leaf filtrate in killing adult snails is when the snails carry out activities and mobility in the afternoon, because based on their rhythm of life, golden snails are nocturnal animals that are active at night. When the golden snail is carrying out living activities, the operculum of the golden snail will come out of the shell, so that the content of the filtrate of *jatropha* leaves will penetrate into the snail's body and attack the organs of the golden snail. The control of golden snails by using *jatropha* leaf filtrate as a vegetable/botanical molluscicide agent is an effective and efficient way because it is easy to do, can kill snails, and is environmentally friendly.

## CONCLUSION

Based on the results of the research, the toxicity test of *jatropha* leaf filtrate positively affects the mortality of golden snails, it can be seen from the mortality at each concentration by showing symptoms of damage to the mucous membrane that causes the body to be covered with mucus, as well as muscle spasms so that the golden snail body comes out of

the shell. Based on the results of the LC50 test value, it can be seen that the concentration of jatropha leaf filtrate that can kill golden snails is 7%.

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