

Research Article

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## Effect of jackfruit (*Artocarpus heterophyllus* Lam.) and flemingia (*Flemingia macrophylla* Willd.) leaf extract in Sprague-dawley rats (*Rattus norvegicus*)

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### Abstract

Some plant species possess medicinal properties which could be an alternative method of helminth control in livestock animals.

The study was done to determine the effect of acute toxicity of jackfruit (*Artocarpus heterophyllus* Lam.) and flemingia (*Flemingia macrophylla* Willd.) leaf extract in Sprague-dawley rats (*Rattus norvegicus*). Specifically, the LD<sub>50</sub>, toxicity rating, toxidrome response, CBC profile from surviving rats were evaluated to determine the preliminary toxic effect of the plant consumption in animals.

Dose rates of 100,150, 200,250 and 350 g/kg from each plant were used prepared in 400% decoction. Result reveals the LD<sub>50</sub> value was estimated at 410 g/kg for both plants. The value was rated practically nontoxic on the toxicity rating scale. The survivors CBC profile remains unaffected in general except for significant reduction of WBC in rats given flemingia (*Flemingia macrophylla* Willd.) dosed at 150g/kg.

### Keywords

LD<sub>50</sub>, leaf extract, *Flemingia macrophylla* Willd., *Artocarpus heterophyllus* Lam.

### 1. Introduction

Synonyms for *Artocarpus heterophyllus* Lam. includes *Artocarpus brasiliensis* Gomez., *Artocarpus heterophylla* Lam., *Artocarpus maxima* Blanco, *Artocarpus philippinensis* Lam., *Polyphema jaca* Lour., *Soccusarboreus major* Rumph., *Artocarpus integra* (Thunb.), *Artocarpus integrifolia* L.f., *Artocarpus*

*integrifolius* auct., *Artocarpus integer* auct. (1) The leaves and fruit provides food to cattle, pigs and goats with lots of veterinary and human medicinal uses (2).

Jackfruit (*Artocarpus heterophyllus* Lam.) is a monoecious tree, with evergreen, alternate, glossy, somewhat leathery leaves, sometimes oblong or deeply lobed on young shoots. All parts

contain a sticky, white latex. Short, stout flowering twigs emerge from the trunk and large branches, or even from the soil covered base of very old trees (<https://www.hort.purdue.edu>).

*Artocarpus heterophyllus* (Lam.) or jackfruit contains various chemical constituents as several flavones colorings, morin, dihydromorin, cynomacurin, artocarpin, isoartocarpin, culoartocarpin, artocarpesin, oxydihydroartocarpesin, artocarpetin, norartocarpein, cycloartinone, and artocarpanone. The heartwood of jackfruit on analysis yields moisture (6.7%), glucosides (38.0%), lipids (.7%), protein (1.7% and cellulose (59.0%). The jackfruit also contains free sugar (sucrose), fatty acids, ellagic acid, and amin acids like arginine, cystine, histidine, leucine, lysine, methionine, theonine, tryptophan, and others. Bark from the main trunk contains betullic acid, and two new flavones pigments including cyloheterophyllin. The leaves and stem have shown the presence of saponin, cycloartenone and tannins, and have shown estrogenic activity. The root contains beta sitosterol, ursolic acid, betulinic acid, and cycloartenone (<https://onlinelibrary.wiley.com> ).

Jackfruit contains vitamin A, vitamin C, thiamin, riboflavin, calcium, potassium, iron, sodium, zinc and niacin among many other nutrients. Jackfruit has a low caloric content: 100g of jackfruit only contains 94 calories. It is a rich source of potassium with 303 mg found in 100g jackfruit. Another benefit of eating jackfruit is that it is a good source of vitamin C (Umesh, *et. al.*, 2010).

*Flemingia (Flemingia macrophylla* Willd.) is a shrub or subshrub; 0.3-3m tall, branchlets ribbed, densely gray to dull brown villous. Leaves are simple and stipules are linear-lanceolate, 0.8-1.8cm, persistent or deciduous; petiole usually 0.0-1.5cm, densely hairy; leaf blade ovate, narrowly ovate, ovate elliptic, or oblong, 6-15 x 3-7cm, thinly leathery, glabrous or almost glabrous except for veins 5-9 pairs, base rounded, slightly cordate, apex acuminate, obtuse or acute. Inflorescence a thyrse, sometimes branched, inflorescence axis 5-11 cm, densely dun villous, cymules each enclosed by concave bract; bracts

1.2-3 x 2-4.4 cm , papery to almost leathery, both surfaces long hirsute, margin ciliate, apex truncate or rounded, slightly emarginated and with slender mucro. Flowers are small. Corolla longer than calyx, standard broadly orbicular; wings narrower than keels. Seeds are two, usually dark brown, flattened, suborbicular about 3x4 mm.

*Flemingia (Flemingia macrophylla* Willd.) is a legume containing rich source of tannins and alternative food to goats since this has great adaptation to arid land (3).

*Flemingia (Flemingia macrophylla* Willd.) plant extracts are reported to have numerous medical properties and applications, including anti-inflammatory, analgesic, anticonculsive, antimicrobial, anti-ulcerogenic and anti-helminth properties (Gahlot, *et. al.*, 2012; 2013; and Kumar, *et. al.*, 2011).

The present study was done to examine the effect of acute toxicity of jackfruit (*Artocarpus heterophyllus* Lam. and flemingia (*Flemingia macrophylla* Willd. leaf extract in Sprague-dawley rats (*Rattus norvegicus*).

Specifically, this study was conducted to determine the oral acute toxicity (LD<sub>50</sub>), toxicity rating (4), toxidrome and hematologic profile of rats exposed to the different dose rates of the plant extract.

This study was conducted at Philippine Institute for Traditional and Alternative Health Care (PITAHC), Tuguegarao City, Cagayan, Philippines on October 2017 to November 2017.

## 2. Materials and Methods

### Collection of leaf samples

Fifteen (15) kilograms each of fresh matured leaves of jackfruit (*Artocarpus heterophyllus* Lam.) and flemingia (*Flemingia macrophylla* Willd.) were collected. These were cleaned and air-dried for three (3) days.

### Water extract preparation

Following decoction method, the extract from each plant was cooked in boiling water for fifteen (15) minutes using 100 grams of the plant material in 50 ml water. The extract was filtered and collected into a separate container. The concentration was adjusted to 400 percent by evaporating the extract in water bath set at 60 °C. Stock decoction was used in the LD<sub>50</sub> or toxicity test in Sprague-dawley rats.

### Administration of decoction

Forty-four (44) male rats, 3-6 months old with initial bodyweight of 106-1655g, were used. Test rats were kept under fan ventilated room temperature and natural light-dark cycle). The animals were randomly distributed into 11 groups (control and experimental group) and housed in plastic cages, with 4 rats in each cage allowing free access to drinking water and a standard diet for one week. The test animals received oral doses of the plant extract while the control group received food and water alone. The following dose rates used were as follows: 100,150, 200,250 and 350 g/kg for jackfruit (*Artocarpus heterophyllus* Lam.) and flemingia (*Flemingia macrophylla* Willd.) extract prepared in 400%. Dose volume exceeding 2 ml was given in divided dose at 3 hours interval until the balance volume was consumed within 24 hours. Toxidrome response was observed from rats post treatment. Tail blood from surviving rats was collected on the 3<sup>rd</sup> day for hematology profile. Test animals showing sign of normal activity post treatment were continuously cared for until the 14<sup>th</sup> day of terminal disposal.

General observations were recorded in an observation worksheet.

### Extract preparation

Following decoction method, the extract from each plant was cooked in boiling water for 15 minutes using 100g of the plant material in 500 ml water. The extract was filtered and collected into a separate container. The concentration was adjusted to 400% by evaporating the extract in water bath set at 60 °C.

### Statistical analysis

Data for the acute toxicity test were expressed as 1, for positive death response; and zero for negative response from each group (n=4). The LD<sub>50</sub> was computed using Probit regression (Dose - response analysis).

Data for means and standard deviations of hematology profile between treatments were analyzed using one-way analysis of variance (ANOVA). P < 0.05 was considered significant. Post hoc Scheffe test was used when ANOVA yields significant result. Medcalc software was used for the analyses.

## 3. Results and Discussion

### Mortalities and toxidrome

In the group exposed to the extract, the results shows 100 and 25 % mortalities in rats were observed given 350 and 250g/kg while the lower dosed rats with zero deaths and absence of toxidrome response. The LD<sub>50</sub> was estimated to fall within 410g/kg for both the plant extract (Table 1; Figure 1 and 2).

Wald test, P value of 0.99 reveals the mortalities were not significantly affected by the varying dose rates from both plants extract (Table 1). The toxicity rating for the LD<sub>50</sub> of 410g/kg from each plant extract was considered “practically nontoxic” (4).

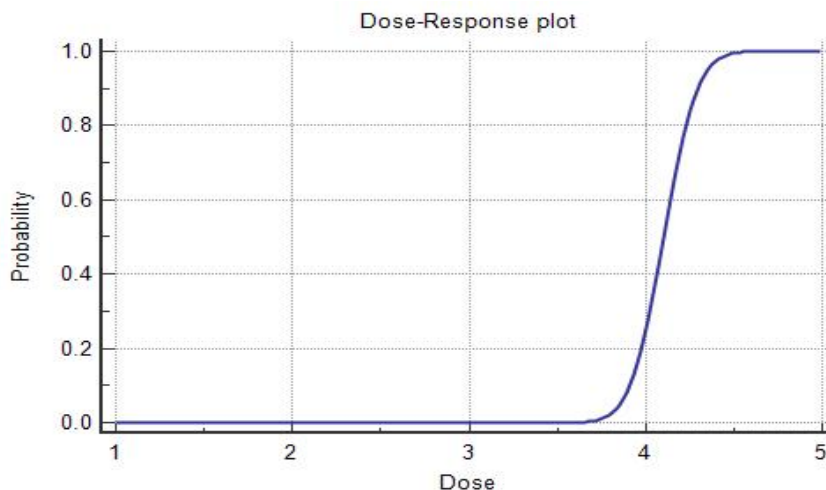
**Table 1. Dose response with varying rates of oral jackfruit (*Artocarpus heterophyllus* Lam.) and flemingia (*Flemingia macrophylla* Willd.) leaf extract 400%) to Sprague-dawley rats**

A. jackfruit ( <i>A. heterophyllus</i> Lam.)			
Dose (g/kg)	subjects	Mortalities	Toxidrome
100	4	0	Not detected
150	4	0	Not detected
200	4	0	Not detected
250	4	1	Slowed movement, moist feces, death occurring 2 days post dosing of extract
350	4	4	Slowed movement, moist feces, death occurring 2 days post dosing of extract
B) B. flemingia ( <i>F. macrophylla</i> Willd.)			
100	4	0	Not detected
150	4	0	Not detected
200	4	0	Not detected
250	4	1	Slowed movement, moist feces, death occurring 2 days post dosing of extract
350	4	4	Slowed movement, moist feces, death occurring 2 days post dosing of extract

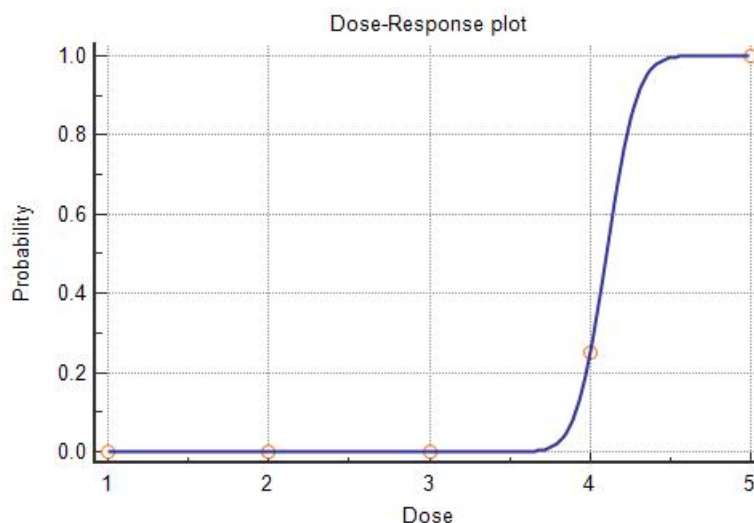
Figure 1 and figure 2 show the dose response with varying rates of oral jackfruit (*Artocarpus heterophyllus* Lam.) and flemingia (*Flemingia macrophylla* Willd.) leaf extract to Sprague-dawley rats. It shows that a dose starting from 100g/kg to 200g/kg, mortalities were not detected

on the experimental animals. However, as dose increases at a rate of 250g/kg, Sprague-dawley rats were observed to experience slow movement, moist feces and death occurring two days post dosing of the said leaf extract.

**Figure 1. Dose response curve with oral jackfruit (*Artocarpus heterophyllus* Lam.) extract killing effect in rats**



**Figure 2. Probit regression (Dose response analysis) with flemngia (*Flemingia macrophylla* Willd.) in rats**



**Hematologic Profile**

Table 2 shows the mean CBC profile of rats exposed to jackfruit (*Artocarpus heterophyllus* Lam.) and flemingia (*Flemingia macrophylla* Willd.) As reflected, blood components like the

WBC, RBC< PCV, eosinophil, lymphocyte and neutrophil of the experimental animals were tested at varying levels. Except for the WBC, the rest of the blood components did not differ across treatments, P> 0.05 (Appendix Table 6-10).

**Table 2. Comparative mean profile of CBC of surviving rats from acute toxicity test with jackfruit (*Artocarpus heterophyllus* Lam.) and flemingia (*Flemingia macrophylla* Willd.) leaf extract. (T1 untreated, T2 (A. heterophyllus 100g/kg), T3 (A. heterophyllus 150g/kg, T4.(A. heterophyllus 200g/kg), T5 *F. macrophylla* 100g/kg, T6 *F. macrophylla* 150g/kg,, T7 *F. macrophylla* 200g/kg).**

Treatment	WBC	RBC	PCV	Eosinophil	Lymphocyte	Neutrophil
1	12.9500	7.7000	57.5000	7.8750	66.0500	26.1250
2	13.7000	6.7250	48.3000	9.1500	51.1000	39.7750
3	15.9250	6.9750	51.2500	7.3750	68.6250	24.0000
4	19.2000 (6)	6.9333	50.1667	8.9000	56.4667	34.6333
5	12.9250	6.3750	49.9000	5.4750	64.2750	33.4750
6	9.8250 (4)	5.7250	41.5250	7.2000	64.2500	28.5500
7	11.0667	6.5333	47.6667	5.2000	58.5000	26.1333

Means with (suffixed number) are significantly different from the corresponding treatment compared to using Scheffe test. Plevel < 0.05 was considered significant.

**Conclusions**

1. Acute oral toxicity test of jackfruit (*Artocarpus heterophyllus* Lam.) and flemingia (*Fleminigia macrophylla*

Willd.) were determined at a probable LD<sub>50</sub> value of 410g/kg decocted extract in rats.

2. The LD<sub>50</sub> (410g/kg ) was rated “practically nontoxic” exceeding the scale of 15g/kg.

3. Slow movement, moist feces and death response were observed in rats given oral doses of 250g and 350g/kg.
4. Oral dose of 150g/kg of flemingia (*Flemingia macrophylla* Willd.) leaf extract reduces the WBC count of rats.

## Recommendations

Based on the above mentioned conclusions, the following recommendations are suggested:

1. The use of other parts like seeds of jackfruit (*Artocarpus heterophyllus* Lam.) and roots of flemingia (*Flemingia macrophylla* Willd.) should be explored.
2. Further study using other varieties of flemingia (*Flemingia macrophylla* Willd.) species shall be undertaken.

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