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PHYTOCHEMICAL AND ACUTE TOXICITY EFFECT OF THE ROOT AND LEAF ETHANOLIC EXTRACT OF AFRICAN MAHOGANY *(KHAYA GRANDIFOLIOLA)* ON ALBINO-MICE INFECTED WITH *PLASMODIUM BERGHEI BERGHEI*

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ABSTRACT

The study investigated the phytochemical and acute toxicity effect of the ethanolic extracts of the root and leaf ethanolic extract of African Mahogany *(Khaya Grandifoliola)* on albino-mice infected with *plasmodium berghei berghei*. 30 Swiss adult albino mice of 6 groups of n=5 each was used for the study. phytochemical screening of the plant parts was carried out, and acute toxicity test of mice infected with *Plasmodium berghei berghei* at various doses of (250mg/kg, 500mg/kg, & 1000mg/kg). The results revealed that *khaya grandifoliola* contains alkaloids, tannin, cyanogenic glycoside, flavonoid, steroid, and saponin. Quantitatively the leaf and the root reavelaed alkaloids to be (2.81 and 1.80 %) , tannin (3.19%) and 2.55%), cyanogenic glycoside (0.13 and 0.08%), flavonoid (4.50 and 4.11%), steroid (3.74 and 2.18%), and saponin (1.42 and 1.38%) varying quantities. The acute toxicity test revealed no mortality after seven days in the different doses of the plant extracts. Conclusively *Khaya Grandifoliola* can be used for the treatment of malaria without any toxicity.

Keywords: Phytochemicals, Acute toxicity, *Khaya Grandifoliola, Plasmodium berghei berghei*

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INTRODUCTION

Malaria, the world's most important tropical parasitic disease to humans, is a serious global health challenge (Uraku, 2014). Malaria is a disease spread by the bite of a female Anopheles mosquito infected with a *Plasmodium* parasite (WHO, 2021). Malaria is currently ranked third among the world's six deadliest diseases, and it is the deadliest disease in Africa (Uraku, 2014). Malaria kills one child every 30 seconds, according to reports (Tripathi, 2013), and approximately 300-500 million cases, with a mean death rate of 2 million, are reported each year (Uraku et al., 2015). The research on vaccine development is still at a preclinical stage and it is predicted that a malarial vaccine is still several years away (White et al., 2015). However, the emergence of *Plasmodium* parasite resistance to existing antimalarial drugs, as well as *Anopheles* mosquito resistance to insecticides could render some of the current management tools ineffective and trigger a new rise in malaria mortality (Haldar et al., 2018). As a result, it is necessary to look for new, safe, and affordable antimalarial drugs to treat the disease (Pan et al., 2018).

In the search for antimalarial agents, medicinal plants could be useful.This is because most of these plants contain secondary metabolites such as favonoids, terpenoids, alkaloids, and quercetin, which have been shown to have antimalarial activity (Okon et al., 2014).

Khaya grandifoliola, also known as African mahogany, is a plant species in the Meliaceae family. During the dry season, it is usually deciduous; the young leaves are strikingly reddish and frequently occur together with flowers. It is grown in plantations in its natural range on occasion, such as in Côte d'Ivoire and Ghana, and trial plantations have been established in Indonesia.The tree is also used as a street tree and an ornamental shade tree (Ibrahim & Alu, 2017). It is widely used to treat malaria fever, and decoctions are also used to treat stomach complaints such as gastric ulcers and diarrhoea caused by intestinal parasites; pain after

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childbirth; and gonorrhoea. Externally, the pulverized root bark is used to treat skin diseases (Ismaila and Bewaji, 2017). Interestingly, this study anticipates cheering results from its investigation because there is evidence from laboratory studies that phytochemicals in Khaya grandifoliola leaf and root may reduce the risk of parasitic disease like malaria, possibly due to dietary fibres, polyphenol antioxidants and anti-inflammatory effects (Ross, 2004). Also, due to the absence of standard dosages, which may result to over-dosage or under-dosage, investigating the acute toxicity is deemed important to determine the dose that will minimize mortality or serious toxicological effects when given once or over a few administrations.

MATERIALS AND METHODS

Collection of Plant Materials

The fresh leaves and roots of Africa Mahogany were sourced from the forest located in Akabuka in Egni Kingdom, Ogba/Egbema/Ndoni Local Government Area of Rivers State, Nigeria. Akabuka lies in coordinates of $5^0$14'25" N latitude and $6^0$38'58" E longitude.

Extraction and Phytochemical Screening of the leaf and root

The leaf and root of the plant were washed separately, chopped into pieces with sterile pen-knife and pounded with porceline, after drying for a period of 21-28 days in the laboratory conditions, then stored in an airtight bottle before the analysis. Five hundred grams (500 g) of the grinded powder was soaked in absolute ethanol, stirred and left for 72 hours with continues shaking. The mixture were filtered using a Whitman filter paper (pore size 0.7 µm), the reddish-brown was concentrated into dryness in a ceramic container using water bath at 40°C. and the sample was kept in an air tight container before use.

Phytochemical screening

Phytochemical analysis of the leaf extract of *Khaya grandifoliola* was determined using the method of (Sofarawa, 1993).

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Acute toxicity

The median lethal dose (LD_{50}) of the extract of *Khaya grandifoliola* that can kill 50% of the animals in a population was determined orally using the method described by (Alaribe et al., 2011).

30 Swiss adult albino mice was used for the acute toxicity test *Khaya grandifoliola* leaf and root extract, the mice were dosed in a stepwise procedure using the fixed doses of 250, 500,750 and 1000 mg/kg body weight was administered according to the OECD guideline, The animals were then observed for 3 hours for general behavioral, neurological, and autonomic profiles and every 30 minutes for the next 3 hour and finally for mortality after 24 hours till 7 days.

RESULTS

Qualitative phytochemicals analysis of *Khaya grandifoliola* leaf and root extract

The result showed that the qualitative ethanolic analysis of the extracts revealed that alkaloid was moderately present in the leaf extract, while present in the root. Also, tannin was moderately present in the leaf and root extracts, cyanogenic glycoside was present in the leaf and root, flavonoid was highly present in the leaf, while moderately present in the root extract, the steroid was moderately present in the leaf and root extract, and saponin was present in the leaf and root extract (Table 1).

Quantitative phytochemicals analysis of *Khaya grandifoliola* leaf and root extract

In a further investigation, the quantitative ethanolic analysis of the leaf and root extract revealed that the Alkaloid content in the leaf extract was higher (2.81%) than that of the root extract (1.80%), Tannin content in the leaf extract was higher (3.19%) than that of the root extract (2.55%), Cyanogenic Glycoside content in the leaf extract was slightly higher (0.13%) than that of the root extract (0.08), Flavonoid content in the leaf extract was higher (4.50%) than that of the root extract (4.11%), Steroid content in the root extract was higher (3.74%) than that

of the leaf extract (2.18%), and Saponin content in the leaf extract was higher (1.42%) than that of the root extract (1.38%) (Table 2).

Acute Toxicity Studies (LD_{50}) of *Khaya grandifoliola* ethanolic extract at different levels of the concentration

The result of the acute toxicity test showed that no mortality was observed after seven days in all dose levels of concentrations. However, behavioral changes like paw licking, restiveness, aggressiveness and extreme calmness were also observed. Loss of weight associated with a reduction in food consumption was observed in groups administered with 500mg/kg and 1000mg/kg of the root extract. The reverse happened in other groups were increase in concentration led to a rise in appetite and subsequently a recorded increase in body weight.

DISCUSSION

Phytochemicals of *Khaya grandifoliola* leave and root extract

The phytochemicals found in the leaves and root extract of *Khaya grandifolio* corroborate with Deharo and Ginsbury (2011), in their study observed parasites clearing with ethanolic extract of medicinal plants such as *Khaya grandifoliola* as attributed to the presence of phytochemicals constituent like Alkaloids and others in the leaves extract. Awe et al (2013), in their findings indicated that the leaves extract of *Khaya grandifoliola* was found to contain phenolic, flavonoids, tannin, alkaloids, terpenoids, glycosides, saponins and these secondary metabolites have been reported to cure several debilitating diseases including malaria. Furthermore, the finding is also corroborated by Stephen et al (2009), in their study revealed that the result obtained from the qualitative phytochemical test carried out on the leave and roots extracts of *Khaya grandifoliola* indicated that the leaves and roots extracts contained a wide array of phytochemicals. These include carbohydrate, saponins, tannins, flavonoids, anthraquinones,

alkaloids, and specific alkaloids such as emetine (isoquinoline alkaloid) and strychnine (indole alkaloids). The absence of tropane alkaloids and brucine (indole alkaloid) was also observed.

Acute toxicity of *Khaya grandifoliola* ethanolic extract at a different level of the concentration

The Acute toxicity level found in the leaves and root extracts of *Khaya grandifolio* is corroborated by Oche et al. (2019); in their study found that in the acute toxicity test, the behavioural signs of toxicity observed in the mice were salivation, rubbing of nose and mouth on the floor of the case and restlessness. Bashir et al. (2012), in their findings indicated weight decrease in the infected mice with *Plasmodium berghei berghei*, which was attributed to the occurrence of anorexia-loss of appetite which is usually associated with malaria infection. Finally, Barber (2013) found that the extract of the root showed efficacy as an antimalarial agent on *P. berghei*-infected mice, and the extract of *Khaya grandifoliola* has wide spectrum antimicrobial activity, antimalarial, and antipyretic properties.

CONCLUSION

This study investigated the phytochemical and acute toxicity effect of the ethanolic extracts of the root and leaf African Mahogany *(Khaya Grandifoliola)* on albino-mice infected with *plasmodium berghei berghei*. The implication of the finding indicated that the plant part contains phytochemicals such as; alkaloid, Tannin, cyanogenic glycoside, flavonoid, steroid and saponin. the phytochemical content of the plant are secondary metabolites that have the potency to cure debilitating diseases like malaria and the level of the content were found to have less anti-inflammatory effects.

The results of the acute toxicity test in this study revealed no observable behavioral signs of toxicity or mortality, implying that the ethanolic extract of K. grandifoliola is not toxic to the

experimental mice at dosages of 250mg/kg, 500mg/kg, and 1000mg/kg of the root and leaf extracts used, and thus be considered safe for consumption in the treatment of malaria.

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Table 1: Qualitative phytochemicals analysis of *Khaya grandifoliola* leaf and root extract

	Alkaloid (%)	Cyanogenic Glycoside (%)	Flavonoid (%)	Saponin (%)	Steroid (%)	Tannin (%)
Leaves	++	+	+++	+	++	++
Roots	+	+	++	+	++	++

Key: - = negative; + = present; ++ = moderately present; +++ = highly present

Table 2: Quantitative phytochemicals analysis of *Khaya grandifoliola* leaf and root extract

	Phytochemical parameters					
	Alkaloid (%)	Cyanogenic Glycoside (%)	Flavonoid (%)	Saponin (%)	Steroid (%)	Tannin (%)
Leaves	2.81	0.13	4.50	1.42	2.18	3.19
Roots	1.80	0.08	4.11	1.38	3.74	2.55