

Acalypha wilkesiana: Therapeutic and Toxic Potential

Forcados GE^{1*}, Chinyere CN¹ and Shu ML²

¹National Veterinary Research Institute, Vom, Nigeria

²Department of Chemistry, University of Buea, Cameroon

*Corresponding author: Forcados GE, National Veterinary Research Institute, Vom, Nigeria, Tel: +12345678912; E-mail: gileadforcados@yahoo.com

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Abstract

Acalypha wilkesiana is a plant that is attracting research interest due to its widely reported application in traditional health care systems. *Acalypha wilkesiana* is reportedly used in the treatment of a number of diseases including diarrhea, gastrointestinal disorders, fungal skin infections, hypertension and diabetes mellitus among others. Such claims are currently undergoing investigation by scientists in different laboratories across the globe. Toxicologists are also examining safety of the use of the plant extracts by locals, since studies on the therapeutic index of the plant is not yet available and general use of the plant at present does not follow any established dose, which could result in toxicity to vital organs depending on the nature and amount of active compounds present in the plant extracts. This review provides relatively concise information gathered from studies carried out in our laboratory and data published by other scientists who have worked on the plant. The review focuses on the therapeutic and toxic profile of *Acalypha wilkesiana* to serve as a guide for people who use the plant in herbal health care systems.

Introduction

Acalypha wilkesiana is a member of the spurge family (Euphorbiaceae) belonging to the genus *Acalypha*, and is commonly called copper leaf, Joseph's coat and fire dragon [1]. *Acalypha wilkesiana* is a popular outdoor plant native to Fiji and nearby islands in the South Pacific, but has spread to most parts of the world, especially the tropics of Africa, America and Asia.

Despite advancement in medical sciences, millions of people in various traditional systems still resort to the use of medicinal plants to treat their ailments. In Southern Nigeria, expressed juice or boiled decoction of the leaves of *A. wilkesiana* is used in traditional health care practice, for the management of gastrointestinal disorders, fungal skin infections, hypertension and diabetes mellitus. The leaf-poultice is used in the treatment of headache, swellings, colds and malaria [2].

Therapeutic Potential Studies on *Acalypha wilkesiana*

The large armamentarium of diseases reportedly treated using *A. wilkesiana* has necessitated scientific inquiry into the biochemical basis of its therapeutic value. Due to the reported use of the plant in the treatment of gastrointestinal disorders, Gotep et al. carried out *in vitro* antimicrobial screening using ethanol extracts of *A. wilkesiana* [3]. They reported from their study that the ethanol extract of the plant had varying antimicrobial activity against *Staphylococcus aureus*, *Yersinia enterocolitica*, *Escherichia coli*, *Salmonella typhi*, *Pseudomonas aeruginosa* and *Klebsiella aerogenes*. Since some of these organisms have been implicated in gastrointestinal diseases and skin diseases, their results provide insight into the acclaimed therapeutic effect of this plant on skin and gastrointestinal related diseases.

The use of *A. wilkesiana* in the treatment of diabetes and cardiovascular related diseases, spurred investigation by Ikewuchi and Ikewuchi who examined the effect of the plant extract administration on blood sugar and cholesterol levels using a rat model [4]. They reported that the aqueous extract of *A. wilkesiana* had a lowering effect

on blood cholesterol level as well as blood sugar, thereby explaining its use in the treatment of cardiovascular related diseases.

Further studies on fractions of the plant extract report its inhibitory effects on the production of methicillin-resistant *staphylococcus aureus* [5] as well as bactericidal activities [6] and antioxidant activities [7].

Oxidative stress, a condition where generation of free radicals and reactive oxygen species, overwhelms physiological antioxidant capacity, has been implicated in a number of diseases, including the aging process. Some plants like curcumin, tumeric among others are currently known as good antioxidant sources [8]. Ogbuehi et al. investigated the protective effect of *A. wilkesiana* on biomarkers of oxidative stress in liver homogenates. 70% methanol was used for the extraction of *A. wilkesiana* leaves and the rats were intraperitoneally administered 50 mg/kg and 100 mg/kg of the extract for 14 days [9].

The results showed significant decreases in malondialdehyde levels in the liver. There was a significant increase in the liver activity of superoxide dismutase and catalase in both the 50 mg/kg and 100 mg/kg administered groups compared to control. There was an insignificant increase in glutathione peroxidase activity in the *A. wilkesiana* administered groups compared to control and an increase in glutathione levels in liver homogenates of *A. wilkesiana* administered groups compared to control. The results suggest that *A. wilkesiana* enhanced the antioxidant capacity of the animals and decreased reactive oxygen species mediated oxidation of lipids.

Toxicity Studies on *Acalypha wilkesiana*

A plant with great therapeutic potential has no potential for use as a drug candidate if it has a high toxic effect on vital organs at the reported therapeutic dose. Many plants reportedly used in herbal medicine systems, have not been subjected to extensive toxicity studies [1]. Studies carried out by Makoshi et al. examined the toxic effect of *A. wilkesiana* at doses of 300, 600 and 1200 mg/kg using rats as a

model [1]. The results obtained showed a dose dependent increase in serum aspartate amino transferase (AST), alkaline phosphatase (ALP) and alanine amino transferase (ALT) levels and decrease in serum albumin level at 300, 600 and 1200 mg/kg compared to the control group administered distilled water, suggesting hepatocellular damage at the doses administered. Liver histology results of the same animals showed necrosis, hemorrhage centrilobular degeneration and sinusoidal dilatation at all doses of our study when compared to control. The damage to liver cytoarchitecture we observed is consistent with the increase in some serum markers of tissue damage (AST, ALT), and decreased albumin concentration, further suggesting that the leaf decoction was hepatotoxic at all doses of the study [1].

Sule et al. tested the effect of *A. wilkesiana* leaf inclusion on dietary performance and serum biochemical profiles in Albino rats [10]. At 30% diet inclusion for 28 days, the results showed significant increases in serum AST, ALT, ALP and lactate dehydrogenase levels compared to the control, suggesting possible liver and extra hepatic damage at that level and duration of use.

Ikewuchi et al. evaluated the effect of subcutaneous administration of aqueous extract of *A. wilkesiana* on hepatoprotection [11]. The results showed that there was a decreased AST, ALT and ALP level in Albino rats administered 100mg/kg *A. wilkesiana* compared to control. However for the rats treated with 200 and 300mg/kg *A. wilkesiana*, there were elevated levels of ALT, AST and ALP compared to control. The results showed that *A. wilkesiana* provided protection against carbon tetrachloride induced hepatotoxicity, but only at 100 mg/kg.

Ogbuehi et al. investigated the protective effect of *A. wilkesiana* on malaria infected rats. 70% methanol was used for the extraction of *A. wilkesiana* leaves and the rats were intraperitoneally administered 50 mg/kg and 100 mg/kg of the extract for 14 days [9]. From their results, there was increase in AST and ALT levels, while the increase in ALP levels was insignificant in the *A. wilkesiana* administered group compared to control. Their histology results did not indicate liver damage as the histology results showed no infiltration by inflammatory cells or fatty degeneration. The normal physiological architectural integrity of the rats was maintained despite the slight increases in AST, ALT and ALP, suggesting safety to the liver of the rats at doses of 50 and 100 mg/kg of the extract.

Conclusion

From the studies carried out so far on *A. wilkesiana*, we can conclude that at doses of 100mg/kg and below, the plant is hepatoprotective, as administration of *A. wilkesiana* leaf extracts in Albino rats in different studies caused a reduction in the serum levels of AST, ALP and ALP. This is corroborated by oxidative stress markers which showed that administration of *A. wilkesiana* reduced malondialdehyde levels, enhanced glutathione levels and stimulated activity of the antioxidant enzymes; superoxide dismutase and catalase. However at doses between 200 and 1200 mg/kg there are reports of hepatotoxicity and nephrotoxicity. Thus, care must be exercised with

respect to the amount or dose of the plant used by herbal health care practitioners. Also, further studies are needed to evaluate the active compounds present in the plant, which show promise for drug development.

Conflict of Interest

The authors declare that they have no conflict of interest.

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