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SNAKE REPELLENT PROPERTIES OF *Canarium schweinfurthii* IN LABORATORY ANIMALS: A PRELIMINARY STUDY

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ABSTRACT
The snake repellant property of *Canarium schweinfurthii* was evaluated in laboratory animals. The effect of the gum exudates of the stem bark on respiratory system and serum enzyme were investigated. There was a significant (P<0.05) decrease in rate and depth of respiration in guinea pigs. There was also a significant (P<0.05) increase in the serum enzymes analysed (alkaline phosphatase, serum glutamate oxaloacetic transaminase and serum glucomate-pyruvate transaminase). From this study, it is possible that the repellant property of the plant is due to the toxicological effect and the possible respiratory depressant activity produced in the animals.

Keywords:

INTRODUCTION

The threat from snake bite is a constant problem, not just when you venture out into the wild regions of the country, but where we live, whether it be in rural areas or cities, in our gardens where our families play, in our garden sheds, even our homes, they are always around but unfortunately, often we do not realise it until we have an unpleasant encounter with one.

Snakes bites are common in rural areas throughout the tropical and sub tropical region and are responsible for a large number of deaths worldwide [1,2]. According to these authors, poisonous species of snake fall into the following families: viperidae (true vipers, such as russells vipers and the puff adder), crotalidae (pit vipers), elapidae (cobras, kraits and coral snakes), hydrophidae (sea snakes), and colubridae (mangrove snake). Akubue [3] observed that snake types in Nigeria are mainly the elapidae (cobras) and the viperidae and that the elapidae snakes produce venoms that consists of neurotoxin, cardiotoxin, and enzymes including phospholipase A_2, phosphodiesterase, phosphomonoesterase, hyaluronidase and acetylcholinesterase that produce death readily due respiratory paralysis; while viperidae venom produce severe local reactions with pain, swelling, ecchmosis, haemorrhage and tissue damage, with internal haemorrhage, intravascular clotting, blood loss and cardiovascular shock which may lead to death.

The only effective treatment is the administration of a specific univalent antiserum (if available), where the snake is known, or a polyvalent antiserum is used [4]. This treatment is very costly to the common man, more so, that the cost of antiserum therapy, the effective treatment with antiserum may be dangerous because of serum sensitivity; and fear tends to complicate the treatment, as people have been known to suffer from shock after being bitten, even by non-poisonous snakes. Therefore, as an alternative way of preventing the loss of lives resulting from snake bites, there is need for the used of safe snake repellents to keep snakes away from coming into close contact with humans.

Snakes possess exceptionally sensitive 'taste' and 'smell' organs. A snake can actually perceive odour in the air around it and it has been documented that specific responses of snakes to known snake-repellents are presumably mediated by the interaction of odourant molecules with specific odour perceiving structures of the tongue and vomeronasal system [5].

Canarium Schweinfurthii (family-Burseraceae) also called 'incense tree', is a perennial giant rocky plant grown in Nigeria for its economic importance as fruit and oils. It is called '*itili*' in '*hausa*', '*pet*' in '*ngas*'. The plant thrives well in the rocky areas of Plateau, some parts of Bauchi, Benue, Kaduna and Niger States of Nigeria [6]. It has been reported that when the bark of this plant is cut, it yields resinous aromatic gum which has many uses, including its oral application to victims of snake bite, its oral intake to suppress peptic ulcer, its use as a worm expeller, cure for small pox, eye problem, dysentery [7], and in the treatment of wounds such as circumcision, hot water burns, fire burns and umbilical cord [6,8]. In addition, the resin has long been used as a 'fumigant' to repel mosquitoes [9]. Also, in India, the resin is burnt as a sweet-smelling incense and as an insect repellant as well as for making candles [10].

It is claimed by the local inhabitants of Vel, in Pankshin Local Government Area, Plateau State, Nigeria, that the oil extract of this plant can reduce the risk of snake bite when rubbed on the body before going to the bush.

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Similarly, these inhabitants also claim that the exudates from the stem bark, is a snake repellant. The aim of this study, therefore is to verify the 'repellent activities' of the plant in laboratory animals, and also to determine the probable mechanism(s) by which they are repelled.

MATERIALS AND METHOD

Plant material

The plant was obtained from Vel in Pankshin Local Government Area of Plateau State, Nigeria, in January, 2006. It was identified as *Canarium schweinfurthii*, by Prof. D.L. Wonang of the Department of Botany, University of Jos. The solid gum exudate from the stem bark of the plant was obtained and reduced to powder using a mortar and pestle.

Animals

Ten (10) guinea pigs (600-800 g body weight) and fifteen (15) albino rats, wistar strain (120-200 g body weight) bred and housed (under standard environmental conditions) in the Animal House of University of Jos, and fed with standard animal feed and water *ad libitum*. Before the commencement of the study, the animals were kept in the laboratory for about 24 hours to acclimatize to the laboratory environment.

Phytochemical study

The extracts were screened for the presence/absence of secondary phytochemical metabolites using the standard qualitative phytochemical methods [11].

Serum enzyme study

A total of 15 rats randomly divided into 3 groups of 5 rats each were used in this study. The first group was exposed to the smoke of the burning stem exudate (50 g) in a fume chamber for four (4) hours, the second group of animals were exposed to burning coal (50 g) in a fume chamber for the same period (4 hours), while animals in the third group were kept in the fume chamber for the same hours without being exposed to smoke. All animals were then sacrificed and the serum (centrifuged from collected blood) used for enzyme analysis. The enzymes studied were alkaline phosphatase, serum glutamate oxaloacetic transaminase (SGOT), and serum glucomate-pyruvate transaminase (SGPT).

Effect on the Respiratory System

Ten (10) guinea pigs were divided into two groups of five animals each. The normal respiratory movement patterns of the animals were recorded using spirometer before and after treatment. The animals in the first group were exposed to the smoke of the burning exudate in a fume chamber for four (4) hours. After the exposure, respiratory movement pattern of the animals were recorded. The second group were exposed to burning coal in the fume chamber for four (4) hours, and similarly, the respiratory movement pattern was also obtained and recorded. On removal from the fume chamber, the animals were allowed to stabilise for 10 minutes before the respiratory patterns were assessed.

RESULTS

The phytochemical analysis of the gum exudate of *C. schweinfurthii* indicates the presence of tannins, flavonoids, saponin, carotenoids, carbohydrates and anthraquinone. However, alkaloids were absent (Table 1).

Table 1: *Phytochemical components of Canarium schweinfurthii gum extract*

Phytochemical substance	Remarks
Alkaloids	Absent
Tannins	Present
Saponins	Present
Flavonoids	Present
Anthraquinones	Present
Carotenoids	Present
Carbohydrates	Present

In the study of enzyme levels, the animals exposed to smoke of the burning exudate produced significantly (P<0.05) higher values of serum enzyme levels. SGPT increased from 5.56±3.14 iu/L in the control group to 12.97±2.23 iu/L, SGOT increased from 27.27±3.50 iu/L in the control group compared to the test group that was 181.83±0.01 iu/L. Similarly, ALP changed from 14.34±1.74 iu/L in control to 41.93±1.3 iu/L in test group (Table 2). The effect of exposure of guinea pigs to coal and extract smokes showed significant variation in the depth and rate of respiration as revealed by changes in respiratory movement. Tables 3 and 4 showed that the exudate produced a significant (P<0.05) decrease in depth and rate of respiration.

Table 2: *Effect of exposure to smoke on serum enzymes in rats*

Exposure	SGPT (iu/l)	SGOT (iu/l)	ALP (iu/l)
Extract	12.97 ± 2.34*	181.83 ± 0.01**	41.93±1.2**
Coal	11.11 ± 0.09*	151.52 ±34.97*	23.40 ± 0.89*
Normal control	5.56 ± 3.14	27.27 ± 3.50	14.34 ±1.74

*P<0.05; **P<0.02

Key: SGPT (serum glucomate pyruvate transaminase), SGOT (serum glutamate oxaloacetic transaminase), ALP (alkaline phosphatase)

Table 3: *Effect of exposure to smoke on the depth of respiration in guinea pigs*

Exposure	Maximum depth of respiration before exposure	Maximum depth of respiration after exposure
Coal	100 ± 0.00	75 ±35.30
Exudate	75 ±35.30	15 ±7.07*

*P<0.05

Table 4: *Effects of exposure to smoke on respiratory rate in guinea pigs*

Exposure	Respiratory rate before exposure (beats per minute)	Respiratory rate after exposure (beats per minute)
Coal	116 ±5.56	114 ±14.14
Exudate	124±2.82	83±4.24*

*$P<0.05$

DISCUSSION

The results of the phytochemical analysis showed that *Canarium schweinfurthii* has many secondary metabolites, which may be responsible for its incense odours, colours, therapeutic and/or toxicological activities [6,11].

The enzymes, alkaline phosphatase, serum glutamate oxaloacetic transaminase (SGOT) and serum glutamate- pyruvate transaminase (SGPT) are present in the cytoplasm of cells of various body tissues, especially in the bone, intestine, liver, placenta, and are usually used as indices of tissue damage [12,13]. It has also been documented that both SGOT and SGPT are present in the liver and that necrosis or membrane damage releases the enzymes into blood circulation, therefore, it can be measured in serum without resorting to taking liver sample. High serum levels of these enzymes, is therefore, indicative of liver damage [14].

From the result above, the increase in the serum levels of these enzymes of the exudate-smoke-exposed-rats relative to coal-burning-exposed-rats strongly suggests possible organ tissue damages. From the body distribution of these enzymes, it is likely that exposure to smoke of the burning exudates has a tissue damaging effect of organs including liver, heart, skeletal muscles and lungs. There was also a significant ($P<0.05$) decrease in the depth and rate of respiration (hypoventilation) in the guinea pigs exposed to fumes of the burning exudates and coal, however, the exudate produced the highest effect. It has been reported that gas exchange in the lung is sub optimal, unless there is sufficient ventilation distributed uniformly to different parts of the lungs, and matched by uniform distribution of blood flow. Also abnormal diffusion of oxygen or carbondioxide across the alveolar-capillary membrane impairs gas exchange leading to hypoxaemia (possibly due to blood flow wasted on perfusing poorly ventilated lung-as a result of bronchial obstruction, destruction of elastic tissues, pulmonary collapse fibrosis, and chest wall deformities), hypercapnia (resulting from hypoventilation or ventilation perfusion mismatch) and hypoventilation, which may be caused by the depression of the respiratory centre in the medulla [15].

Many accidental or suicidal deaths occur yearly from the inhalation of carbon monoxide released from air pollution including those from coal [16]. The decrease in the rate and depth of respiration observed in the guinea pigs exposed to the burning coal and exudate may be due to the release of carbon monoxide which either reacts with the haemoglobin (methcarb-oxyhaemoglobin), thereby reducing the oxygen carrying capacity of blood, or by depression of the respiratory centre in the medulla [15].

Since snakes have been known to have exceptionally sensitive taste and scent organs, and *C. schweinfurthii* have been known as incense tree, and have been used in the past as mosquitoes and other insects repellent [9,10,17], considering the above biochemical and respiratory effect produced in the experimental animals, it can be postulated that when snakes are encountering an area with the burning exudate of *C. schweinfurthii,* and the scent transferred to its Jacobson's organ (taste and scent receptor), they may experience signs of toxicities and become irritated and repelled.

CONCLUSION

From this study, it is possible that the toxicological effects as reflected in enzyme changes and the possible respiratory depressant activity could be responsible for the repellent properties of the plant. Further studies are currently being investigated in our laboratory.

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