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THE TOXICOLOGICAL EFFECTS OF AQUEOUS LEAF EXTRACT OF *SYNEDRELLA NODIFLORA* IN RATS

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ABSTRACT

The toxicological effects of *Synedrella nodiflora* Gaertn was evaluated in albino rats using aqueous crude extract of the plant. The plant extract was administered orally for 14 days, alterations observed in haematological parameters, serum biochemical parameters and hispathological reports were used as indices of toxicosis. The aqueous extract of *S. nodiflora* caused significant reduction in PCV, TRBC and Hb levels. It also caused a statistically significant ($p<0.05$) decrease in lymphocyte count but increase in the level of circulating neutrophil. This may suggest that the plant may cause anaemia in animals consuming them. The anaemia is macrocytic hypochromic. The serum biochemistry revealed that the extract of *S. nodiflora* at dosage of 100 mg/kg b.w. caused a statistically significant ($p<0.05$) increase in alkaline phosphatase (ALP) and aspartate aminotransferase (AST) level. This may suggest hepatocellular damage which is further confirmed by increase in the total bilirubin (TB) and serum triglyceride (TRIG) levels and the histopathologic lesions of multifocal vacuolar degeneration, necrosis and thinning of hepatic cords in the centrilobular regions with moderate congestion of the sinusoids. Furthermore, the plant extract also produced degenerative changes in the germinal epithelial cells of the seminiferous tubules.

Keywords: *Synedrella nodiflora*, toxicity, extract, rats

INTRODUCTION

The tropical condition prevalent in Nigeria gives it a very rich flora. With this rich flora can be found many poisonous plants which are yet to be scientifically investigated (Nwude and Parson, 1977).

Synredrella nodiflora (Fig.1) has been characterized as a weed in Nigeria, and can also be found over a wide range of locations worldwide. There have been reports that this plant has medicinal value (Abade *et al.*, 1996), potent anti-inflammatory effect, effective analgesic and antipyretic activities in rodents (Forestieri *et al*., 1996).

There are also reports that it has insecticidal activity and that is now been tradi-

tionally used in Ghana to control insect pests of stored grains and legumes. This is confirmed by the study of (Belmain *et al.,* 2001) that observed the antifeedant activity of *Synedrella nodiflora* against *Pieris raphae* (an insect).

S. nodiflora was screened in the laboratory at three concentrations (0.5, 1 and 5% w/v) against 4 common storage pests (*Rhyzopertha dominica, Callosobruchus maculatus, Sitophilus zeamis* and *Prostephamus truncatus*). This plant showed the ability to control most of the test insect species and the level of efficacy varied according to test concentration, with the highest concentration tested providing the best control (Belmain *et al.,* 2001).

The aim of this study is to determine if *Synedrella nodiflora* has any toxic effect in rats.

MATERIALS AND METHODS

The animals used in this study were twenty four healthy rats of the wistar albino strain of both sexes, ages between 12 – 16 wks and weighing between 150 – 250 grams. They were maintained at the Experimental Animal House of The Faculty of Veterinary Medicine, University of Ibadan, fed rat cubes, (Guinea Feeds Nigeria Limited) and allowed free access to clean fresh water *ad-libitum*.

Preparation of Leaf extracts

Hundred grams of the leaves of *S. nodiflora* were harvested freshly for the preparation of the extract daily. The leaves were macerated using an electric blender (Philip), with the addition of 1000 mls of water to ensure proper maceration. Thereafter the solution was filtered using filter paper to produce aqueous crude extract of *S. nodiflora*.

The animals were divided into four groups A, B, C and D, each consisting of six (6) animals per group which were administered with doses of 100, 200 and 400 mg/kg, respectively. The last group D received water and served as control. The crude aqueous extract of *S. nodiflora* was administered to the animals orally using stomach canula on a daily basis for 14 days.

Sample Collection and Processing

Blood was collected by cardiac puncture from diethylether anaethesized rats, into heparinized and non-heparinized (for serum) bottles for haematological and serum biochemical studies respectively. PCV was done according to the method described by (Schalm et al., 1975); RBC was determined by the haematocytometry method (Jain, 1986), and the erythrocyte indices were obtained by calculation.

Total protein (TP) was determined by the Biuret reaction (Gornall et al., 1949); the bilirubin by diazo reaction (Jendrassik and Goff, 1938; Nosslin, 1960; Michealson, 1961). Alkaline Phosphatase (ALP), aspartate amino transferase (AST) and alanine amino transferase (ALT) were determined according to the improved methods by Sigma diagnostics (Sigma diagnostics, 1985).

Histopathological Technique

Samples from the liver, spleen, kidney and lung were isolated and fixed in 10% buffered formalin and then dehydrated in ethanol (70 – 100%), cleared in xylene and em-

bedded in paraffin. Tissue sections were examined under a light microscope after staining with haematoxylin and eosin (H & E) dye (Culling, 1963; Lillies, 1965).

Statistical Analysis

Results are expressed as the mean ± standard error of the mean. Significant differences between means were determined by the student't test (Bradford and Hill, 1991; Bailey 1992).

RESULTS

The aqueous crude extract of *S. nodiflora* at the dosage of 100 mg/kg b.w. and 200 mg/kg b.w. caused significant ($p<0.05$) reduction in the PCV values. It also caused significant ($p<0.05$) reduction in the haemoglobin (Hb) concentration and RBc count at 200 mg/kg b.w. (Table 1). The result of the erythrocyte indices showed that *S. nodiflora* extract led to a statistically significant ($p<0.05$) increase in the values of MCV and MCHC respectively (Table 1). The haematological analysis further revealed that the crude extract of *S. nodiflora* produced a significant ($p<0.05$) reduction in the level of the blood lymphocyte and an elevated circulating neutrophil at 200 mg/kg b.w. (Table 1).

Effects of Crude Extract of S. nodiflora on Serum Biochemistry of Rats

The crude extract of *S. nodiflora* caused a statistically significant ($p<0.05$) increase in the level of serum ALP at 100 mg/kg b.w. It also caused a significant ($p<0.05$) increase in the serum AST level at dosage 100 mg/kg b.w. (Table 2).

The aqueous crude extract of *S. nodiflora* at 100 mg/kg b.w. caused a significant ($p<0.05$) increase in the level of the TB and TRIG level (Table 2)

Histopathology Results

Histopathology of the liver showed moderately severe multifocal vacuolar degenerations of the hepatocytes, necrosis and thinning of hepatic cords in the centrilobular regions with moderate congestion and expansion of sinusoids in these areas. These were observed at 100, 200 and 400 mg/kg dosage of the crude extract of the plant.

At 400 mg/kg b.w. of the plant extract, the Spleen has moderate lymphoid depletion in the lymphoid follicle, with the splenic cord containing haemosiderin laden macrophages and the testis showed degeneration and necrosis of germinal epithelial cells of the seminiferous tubules.

DISCUSSION

The study revealed that aqueous crude extract of *S. nodiflora* resulted in a statistically significant ($p<0.05$) decrease in packed cell volume (PCV), haemoglobin concentration (Hb) and red blood cell count (RBC). This may suggest that the aqueous crude extract of *S. nodiflora* has adverse effect on the erythron of rats and may cause anaemia which is macrocytic hypochromic and of the haemolytic type (Guyton and Hall, 1994).

The decrease in the lymphocyte counts caused by the extract of this plant signifies lymphopaenia which may suggest immuno -suppressive effect. Abade *et al. (*1996) and (Foriestieri et al. (1996) reported that *S. nodiflora* has a potent anti-inflammatory effect. The steroidal anti-inflammatory drugs produce their effect through inhibition of lymphocytes and

granulocytes into inflammatory sites (Meech, 1985).

S. nodiflora extract caused a statistically significant ($p<0.05$) increase in the level of serum ALP and AST which may suggest extrahepatic and/or intrahepatic obstruction of the biliary system (Thompson, 1988; Cornelius, 1989). This observation may be the reason for the increased levels of total bilirubin. The elevated level of AST in this study points to the fact that it has toxic effects on other parenchymatous organs (Kaneko, 1980). The degenerative effects of the crude plant extracts is further shown by the histopathologic changes produced in liver including multifocal vacuolar degeneration, necrosis and thinning of hepatic cords in the centrilobular regions with moderate congestion of sinusoids (Fig. 2). Lipoprotein synthesis and transport are dependent on oxidative metabolism (Jubb et al., 1993), and hypoxia of hepatocytes leads to triglyceride accumulation.

The two most common causes of hepatocellular hypoxia are anaemia and reduced sinusoidal perfusion in passive venous congestion (Jubb *et al.,* 1993).

Furthermore, the histopathology revealed damages to the testicular tissue by the extract of *S. nodiflora*, with degeneration and necrosis of germinal epithelia cells of the seminiferous tubules (Fig. 3). This could be dangerous since even periodic consumption of the plant may result in infertility in animals (Montanari et al., 1998). This may suggest contraceptive potential for this plant. All these show that the crude extract of *S. nodiflora* is toxic to rats in the dosages used.

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Table 1: Effects of *S.nodiflora* on Heamatological Parameters of Rats

DOSAGES	PCV	HB	RBC	MCV	MCH	MCHC	WBC	LYMP	NEUT
100 mg	32.7* ± 4.2	10.5 ± 1.4	5.4 ± 0.3	61 ± 9.3	19.7 ± 2.8	32.3 ± 0.8	10.2 ± 1.5	69 ± 5.6	30.7 ± 5.6
200 mg	32.5* ± 3.7	10.4* ± 1.2	3.1* ± 0.1	65 ± 28	33.5 ± 3.5	32 ± 0.6	13.2 ± 1.6	59* ± 5.3	41.5* ± 5.3
400 mg	36 ± 4.9	12 ± 1.6	3.9 ± 1.4	104.5* ± 29.5	35 ± 10.0	33* ± 0.2	7.9 ± 0.7	69 ± 2.9	31.5 ± 2.9
CONTROL	37.3 ± 1.5	12 ± 0.4	5.7 ± 0.4	66 ± 4.7	21 ± 1.6	32.3 ± 0.4	9.35 ± 1.4	74.3 ± 3.9	25.7 ± 3.9

PCV = Packed Cell Volume (%)

Hb = Haemoglobin Concentration (g/dl)

Rbc = Red blood cell ($X10^6/mm^3$)

WBC = White blood cell ($X10^3/mm^3$)

LYMP = Lymphocyte

NEUT = Neutrophil

MCV = Mean Corpuscular Volume (fl)

MCH = Mean Corpuscular Haemoglobin (pg)

MCHC = Mean Corpuscular Haemoglobin Concentration (%)

Note: * = Superscripted figures are statistically significant at $p<0.05$.

Table 2: Effects of *S. nodiflora* on Serum Biochemistry of Rats

DOSAGES	TB	ALP	AST	ALT	TP	ALB	TRIG	UREA	GLUC
100 mg	0.6*±0.1	1000*±129	370*±29	152±27	7.3±0.9	2.43±0.2	103*±7.5	61.6±5.9	58.3±7.5
200 mg	0.55±0.1	778±33	258±4.1	150±2.5	7.9±0.7	2.7±0.1	95.5±14	53±8.9	83.5±17.5
400 mg	0.5±0.1	511±2.4	241±1.2	60±0.5	7.4±0.6	2.6±0.1	100±2.1	49±7.6	96±3.5
CONTROL	0.47 ± .03	490 ± 113	220.3 ± 14	110.7 ± 7.2	6.53 ± 0.4	2.53 ± 0.1	97.67 ± 7.8	52.67 ± 7.8	78 ± 19.0

TB = Total bilirubin (mm/L)

ALP = Alkaline Phosphatase (U/L)

AST = Asparlate aminotransferase (U/L)

ALB = Albumin (g/dl)

TP = Total protein (g/dl)

GLUC = Glucose (mg/dl)

TRIG = Triglycende (mg/dl)

UREA = Urea (millimole/L)

Note : * Superscripted figures are significant at ($p<0.05$)

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FIG. 1: Plate showing the picture of *S. nodiflora* plant

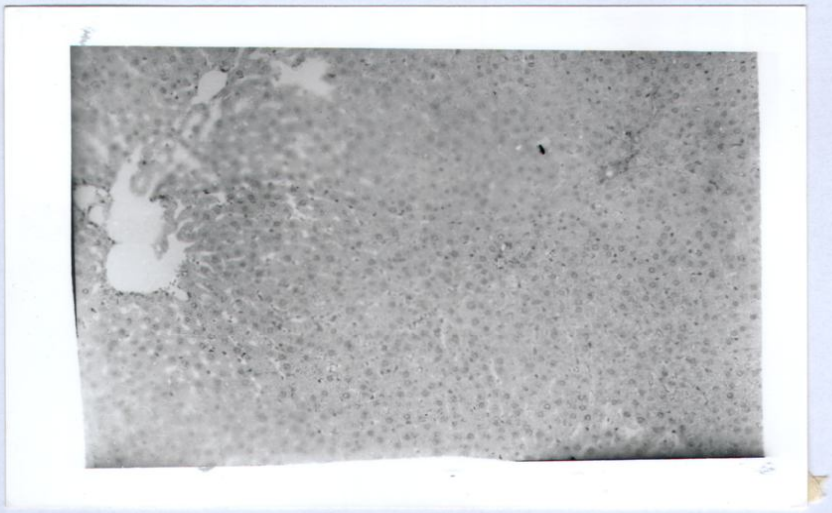

FIG. 2: Section of Liver showing severe multifocal vacuolar degeneration, necrosis and thinning of hepatic cords with congestion of the sinusoids by administration of *S. nodiflora* extract (100mg/kg.bw, H & E stain, X 16)

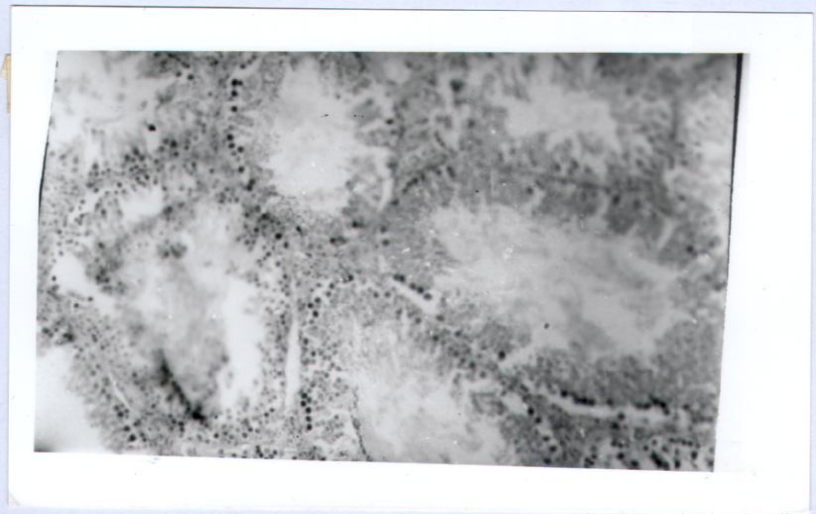

FIG. 3: Section of testis showing degeneration and necrosis of the germinal epithelia cells of the seminiferous tubules by administration of *S. nodiflora* extract (400mg/kg.bw, H & E stain, X16)