



Toxicity studies and phytochemical screening of four medicinal plants in the caribbean

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Introduction

A large number of single and compound herbal drugs are used in the traditional Caribbean system of medicine for the treatment of diverse ailments (Robineau, 1989, Germosen-Robineau, 1995). Four such medicinal plants which are used against diseases where long term treatment is required were selected for the present study. The parts used in this study and various medicinal properties attributed to these plants are given in TABLE 1. There are limited reports on the phytochemical constituents and on some of the pharmacological activities of these plants. However, data are available on their side or toxic effects in the literature. In this study the acute and chronic toxicity of these plants in mice was evaluated and a phytochemical screening was performed.

Materials and methods

Plant material

The flowery plants were identified at the Jardín Botánico Nacional Dr. Rafael M. Moscoso (Santo Domingo) by Dr. F. Jimenez. The samples studied were: Tuber of *Anredera leptostachys* (Moq.) Steenis (Basellaceae) (Jimenez, 1445), seed of *Bixa orellana* L. (Bixaceae) (Jimenez, 1477), leaves of *Eryngium foetidum* L. (Apiaceae) (Jimenez, 1768) and leaves and woods of *Haematoxylon campechianum* L. (Caesalpinaceae) (Jimenez, 1617 and 1478 respectively).

Toxicity

The respective part of the plant was infused in boiling water and then macerated for 24 hours. The macerate was filtered and the solvent evaporated at low pressure. The water-free residue was suspended in normal saline and used in the experiments. Swiss mice of both sexes, aged 7-8 weeks, weighing 25-35 g, and fed Purina chow diet and water ad libitum were used.

Acute toxicity

A total of 120 Swiss mice were randomly allotted to different control and treatment groups. The extracts in each case were injected intraperitoneally in doses between 100 and 2000 mg/kg. The general symptoms of toxicity and mortality were observed for 48 h following method described by Gallego (Gallego, 1986).

Chronic toxicity

A total of 144 Swiss mice were randomly allotted to different treated and control groups. The extracts were injected intraperitoneally. The dose selected was 100 mg/kg body weight per day, which is 1/5 of the pharmacologically active dose for a period of 2 months, following method described by Gallego (Gallego, 1986). The different parameters were subjected to statistical analysis by Student's test.

Phytochemical screening

The different plants parts were pulverized and successively extracted with petroleum ether, methanol and water. The extracts were concentrated under reduced pressure and the chemical constituents of the residue were determined.

Results and discussion

The results of the acute toxicity studies (LD₅₀) are summarized in TABLE 2.

The leaf of *H. campechianum* exhibited the most highest toxicity (215,12 ± 10,70 mg d.r./Kg). However, *E. foetidum* showed no signs of toxicity in the dose range of 200 mg d.r./Kg to 1400 mg d.r./Kg.

The results of the chronic toxicity studies are summarized in TABLES 3, 4 AND 5.

During chronic treatment loss of body weight or other abnormalities of the vital organ were observed as compared to the control.

The results of phytochemical studies are presented in TABLE 6.

Animals administered with *A. leptostachys* extract showed no significant changes during the acute treatment. However, on chronic treatment, the average weight increase in this group was significant. This effect might be due to carbohydrates present in this extract. The observations of the vital organs were normal.

In acute treatment test *B. orellana* extract did not exhibit toxicity. At the higher dose, a decrease locomotor activity was observed. During the chronic treatment 5% of male mice and 2% of female mice developed hepatic toxicity but the other abnormalities were not observed. This seed contains greases, carotenes, sterols and triterpenes, leucoanthocyanins, catecols, tannins and carbohydrates. The importance of this seed in asthenia may be due to greases and carbohydrates content. This effect colouring may be attributed to carotenes. When it ingested over a period of several weeks, the seed produces carotenemia, a yellowed of the skin often firstly observed in the palms of the hands or on the soles of the feet (Tyler, 1988).

The acute toxicity studies *E. foetidum* extract did not present signs of toxicity. During chronic treatment no loss of body weight nor other abnormalities in the vital organs were observed.

The leaves of this plant contain flavonoids, catechol tannins, carbohydrates and saponins.

The leaves and the wood of *H. campechianum* produced stimulation, pilo-erection and rapid irregular respiration preceding death during acute treatment.

During the chronic treatment 37.5% and 24% of the animals died with the leaves and the wood extracts. There was significant changes in average body weight.

This leaves and the wood showed too toxic lesions in kidney and liver (TABLE 5), something less strong with the wood.

The leaves of this plant contain mainly the lactones and alkaloids and the wood contains especially the alkaloids and saponins. These compounds may be responsible for the observed toxicity and the undesirable effects.

The acute and chronic toxicity as a result of the present investigation may provide important evidence concerning the therapeutic safety of these drugs and assist in assessment of possible measures to be introduced before these plants can be safely used in the health care system of the Caribbean.

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Plant	Part used	Uses or disease treated	References
<i>Anredera leptostachys</i> (Moq.) Steenis (Basellaceae)	Tuber Leaf	Bone fracture Anti-inflammatory Analgesic Vulneraly Emollient	Germosen-Robineau 1995 Adjanohun, 1985 Adjanohun, 1985 Nuñez, 1975 Beuzer, 1973
<i>Bixa orellana</i> L. (Bixaceae)	Seed Root Leaf	Shock, Asthemia Emollient Diabetes Emmenagogue, Diu- retic, Antidiarrheal	Germosen-Robineau 1995 Martinez, 1959 Wong, 1976 Aguilar, 1966
<i>Eryngium foetidum</i> L. (Apiaceae)	Leaf Whole plant	Gastralgia, Diarrhea, Hypertension Vulneraly Febrifuge, Antirheumatic Emmenagogue	Robineau, 1989 Weniger, 1985 Stehle, 1962 Wong, 1976
<i>Haematoxylon campechianum</i> L. (Caesalpinaceae)	Leaf Wood	Amenorrhoea, Anemia Shock Anemia Amenorrhoea Diarrhea	Germosen-Robineau 1995 Wong, 1976 Germosen-Rob. 1995 Martinez, 1959

TABLE 1. Medicinal uses of the plants under investigation for the presents studies



	mg d.r./Kg ± SE	g plant/Kg ± SE
<i>Anredera leptostachys</i> (Moq.) Steenis Tuber	1043.38 ± 137.14	61.07 ± 7.93
<i>Bixa orellana</i> L. Seed	1092.25 ± 202.64	19.50 ± 3.62
<i>Eryngium foetidum</i> L. Leaves	1470.03 ± 124.35	11.12 ± 0.94
<i>Haematoxylum campechianum</i> L. Leaves Woods	215.12 ± 10.70 498.14 ± 66.38	0.76 ± 0.04 24.05 ± 3.20

TABLE 2. LD₅₀ obtained with different plants

	n° of mice treated	Mortality (days) 15 30 45 60	Total of dead animals	Lethality (%)
Control	24	0 0 1 1	2	8.3
<i>A. leptostachys</i> Tuber	24	0 1 1 1	3	12.5
<i>Bixa orellana</i> Seeds	24	0 1 1 1	3	12.5
<i>E. foetidum</i> Leaves	24	0 0 2 2	4	16.6
<i>H. campechianum</i> Leaves Wood	24 24	1 2 2 4 0 1 2 3	9 6	37.5 ** 24.0 *

* p ≤ 0.05 ** p ≤ 0.001

TABLE 3. Quantitative data on the mortality induced in mice on chronic treatment with different plant extracts.

	Male mince Pre-treatment average body weight	Female mince Pre-treatment average body weight	Male mince Post-treatment average body weight	Female mince Post-treatment average body weight
Control	33,60 ± 0,30	27,02 ± 0,32	36,84 ± 0,39 *	29,01 ± 0,38 *
Tuber of <i>A. leptostachys</i>	32,32 ± 0,27	29,17 ± 0,25	34,80 ± 0,32 *	30,90 ± 0,42 *
Seeds of <i>B. orellana</i>	34,40 ± 0,32	28,43 ± 0,27	33,90 ± 0,42	28,06 ± 0,50
Leaves of <i>E. foetidum</i>	34,82 ± 0,31	28,94 ± 0,38	35,20 ± 0,49	27,86 ± 0,49
Leaves of <i>H. campechianum</i>	32,70 ± 0,28	29,43 ± 0,20	30,23 ± 0,41 *	27,10 ± 0,57 *
Wood of <i>H. campechianum</i>	34,90 ± 0,25	32,98 ± 0,24	32,20 ± 0,49 *	30,89 ± 0,49 *

* p0,05 ** p0,001

TABLA 4. Quantitative data on the average body weight in mice on chronic treatment with different plants extracts.



	Kidney (Glomerular inflammation)		Degeneration on the renal tubule		Liver (Hepatic toxicity) (Kupffer's cel.)		Spinal cord males females	
	males	females	males	females	males	females	males	females
Control	0	0	0	0	0	0	normal	
Tuber of <i>A. leptostachys</i>	0	0	0	0	0	0	normal	
Seeds of <i>B. orellana</i>	0	0	0	0	5%	2%	normal	
Leaves of <i>E. foetidum</i>	0	0	0	0	0	0	normal	
Leaves of <i>H. campechianum</i>	10%	20%	30%	50%	20%	40%	normal	
Wood of <i>H. campechianum</i>	5%	15%	20%	30%	10%	25%	Normal	

TABLE 5. Disease observed on the vital organs.

	<i>A. leptostachys</i> (Tuber)	<i>B. orellana</i> (Seed)	<i>E. foetidum</i> (Leaf)	<i>H. campechianum</i> (Leaf)	<i>H. campechianum</i> (Wood)
greases	+	++	-	-	-
carotenes	-	+++	+	++	+
sterols and triterpenes	+	+++	+	++	-
quinones	-	-	-	+	-
lactones	-	+	-	+++	+
leucoantho- cyannins	-	++	-	++	+++
flavonoids	-	+	++	++	+
catechol tannins	-	++	+++	-	-
pyrogallol tannins	-	-	-	+++	+++
alkaloids	-	-	-	+++	++
carbo-hydrates	+++	+++	+++	+++	+++
saponins	++	+	++	-	+++

+ (weakly positive), ++ (positive), +++ (very positive), - (negative)

TABLE 6. The compounds identified in the phytochemical study.