

TOXICOLOGICAL AND TOXICOGENETIC EFFECTS OF PLANTS USED IN POPULAR MEDICINE AND IN CATTLE FOOD

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Toxicological and toxicogenetic effects of aqueous (tea) and hexanic fruit extract of Indigofera suffruticosa Mill. and hydroalcoholic root extract of Solanum agrarium Stendt. were evaluated in Balb C male mice intraperitoneally exposed. A hepatotoxic effect was observed just for animals treated with aqueous fruit extract of I. suffruticosa.

In relation to the toxicogenetic effect, just the group treated with 12.5% of toxic dose of aqueous fruit extract of I. suffruticosa showed a statistically significant increase in the frequency of cells with chromosome aberrations (cytogenetic effect), although a slight increase was also observed for the highest dose (25% of LD₅₀) of hydroalcoholic root extract of S. agrarium.

The results obtained show that before S. agrarium is used as medicine and before the wide use of I. suffruticosa in cattle food, careful evaluation must be done.

Key words: chromosome aberration – *Indigofera suffruticosa* – *Solanum agrarium* – poisonous plants

In Brazil, some poisonous plants have been used in folk medicine and as animal food. However, little or no information about their toxicological and toxicogenetic effects currently exist. Many of these plants contain chemical substances that could be toxic and/or mutagenic, and their constant use can constitute a potential risk to human or animal health.

The *Solanum agrarium* Stendt., (Solanaceae) popularly known as “camapu” and “melancia de praia”, is a plant widely used in the northeast of Brazil as medicine for mycosis, diarrhea and gonorrhoea. Ribeiro et al. (1989a), using this specie of *Solanum*, observed some behavior alterations and a increase of chromosome aberrations (cytogenetic effect) in mice treated with aqueous root extract (tea). This result suggests that this plant has a clastogenic compound, and shows the necessity of more investigation about its effect.

Another plant widely used in the northeast of Brazil, is the *Indigofera suffruticosa* Mill. (leguminous popularly known as “anileira” and

“timbó mirim”). This specie has an economic importance because a large number of cattle are fed with it due to its high protein level. A hystopatological effect on liver and kidney was observed when hexanic root extract of *I. suffruticosa* was evaluated for both oral and parenteral routes in mice (Bautista et al., 1979, 1980). Ribeiro et al. (1989b) and Salvadori et al. (1989) working with aqueous and hexanic leaf extract also found liver and kidney damages although no clastogenic effect was detected.

The aim of the present study was to increase the toxicogenetic evaluation of both plants and to establish the presence or not of a relationship between the toxicological and toxicogenetic effects.

MATERIALS AND METHODS

Balb C male mice were kept in the laboratory until exposure (8-10 weeks old) with food and water *ad libitum*.

The extracts of *I. suffruticosa* were obtained from dry fruit powder. Part of this powder was boiled with distilled water for 3 min, then filtered and the water was removed by liofi-

TABLE

Cytogenetic effects of hexanic and aqueous fruit extract of *Indigofera suffruticosa* Mill. and hydroalcoholic root extract of *Solanum agrarium* Stend. in mice bone marrow cells

Extract Name	Dose g/kg	Number of		Types and number of aberrations			Total of aberrations	Cells with aberration (%)
		Animals	Metaphases analyzed	Chromatid gap	Chromatid break	Fragment		
Hexanic fruit of <i>I. suffruticosa</i> (TD = 7,500 mg/kg) ^d	0 ^a	6	300	3	2	6	11	2.3
	0.94	6	300	—	1	4	5	1.3
	1.88	6	300	3	4	5	12	3.0
	3.75	6	300	1	—	3	4	1.3
Aqueous (tea) fruit of <i>I. suffruticosa</i> (TD = 5,000 mg/kg)	0 ^b	6	300	3	1	1	5	1.6
	0.625	6	300	8	1	7	16	4.9 ^e
	1.250	6	300	4	—	3	7	2.3
	2.500	6	300	6	1	2	9	2.6
Hydroalcoholic root of <i>S. agrarium</i> (LD ₅₀ = 588.8 ± 29 mg/kg)	0 ^b	6	300	3	—	—	3	0.7
	0.0781	6	300	3	—	2	5	1.3
	0.1563	6	300	—	1	5	6	1.0
	0.3125	6	300	3	2	2	7	2.0
CPA ^c	6	300	20	12	62	52	17.3 ^f	

a: negative control (Tween 80: distilled water); b: negative control (NaCl 0.9%); c: positive control (cyclophosphamide, 20 mg/kg); d: toxic dose (obtained by Bautista et al., 1989); e: significant at the 5% level; f: significant at the 1% level.

lization, to obtain the aqueous (tea) extract. The other part of the powder was extracted with cold hexane, filtered and the solvent evaporated under reduced pressure and controlled temperature. The hexanic extract was dissolved in Tween 80: distilled water (10:1) just before use. The root powder was extracted with ethanol: water (1:1), to obtain the hydroalcoholic root extract of *S. agrarium*. This extract as well as the aqueous (tea) fruit extract of *I. suffruticosa* were dissolved to the desired concentration in NaCl 0.9%, just before use.

The toxic dose (TD) of aqueous fruit extract of *Indigofera* was obtained according to Bautista et al. (1989), and the LD₅₀ of hydroalcoholic root extract of *Solanum* was obtained according to Carlini (1973).

For toxicogenetic tests, groups of six animals were injected intraperitoneally with 12.5, 25 and 50% of the TD of the extracts of *I. suffruticosa* and 6.25, 12.5 and 25% of LD₅₀ of the extract of *S. agrarium*. A negative control group and a positive control treated with cyclophosphamide (CPA) — 20 mg/kg — were also used. The animals were killed by cervical dislocation 24 h after the treatment to obtain metaphases of bone-marrow cells (Hsu & Patton, 1969; Zambrano et al., 1982), for chromosome aberrations analysis, including chromatid and chromosome gaps, breaks and fragments, and rearrangements.

From each animal, 50 metaphases were analyzed and the statistical evaluation of the data was done using a conditional test based on an approximation to the Poisson distribution (Chakravarti et al., 1967).

RESULTS

All the animals exposed to the aqueous (tea) fruit extract of *I. suffruticosa* showed liver damage, but no hystopathological damage was found in the animals exposed to hydroalcoholic root extract of *S. agrarium*.

The Table shows the TD, LD₅₀ and the frequency of cells with chromosome aberrations for the three extracts tested. A statistically significant increase ($P < 0.05$) was observed just for the lower dose of aqueous fruit extract of *I. suffruticosa* Mill. A slight increase, but not statistically significant, in the frequency of cells with aberrations was seen with the highest dose of the hydroalcoholic root extract of *S. agrarium*.

DISCUSSION

During the last decades, popular medicine has been practiced and used in the fight against disease in Brazil. This folk medicine is consistent with the culture of northeastern Brazilian people.

The toxicological effect (LD_{50}) observed for hydroalcoholic root extract of *S. agrarium* in this study was higher than that observed by Ribeiro et al. (1989a) using aqueous root extract of the same plant. This fact suggests that the toxic compound of the plant would be present in the hydroalcoholic extract and not in the aqueous extract, or its concentration in the former may be higher than in the latter. On the other hand, the aqueous root extract (Ribeiro et al., 1989a) was more effective in inducing cytogenetics damage when compared with the hydroalcoholic root extract. The absence of relationship between toxicological and cytogenetic effects shows that each plant before use as medicine must be carefully investigated.

For *I. suffruticosa*, the results show a cytogenetic effect occurring just for the lower dose of aqueous (tea) fruit extract. This result could be explained by cytotoxic effects and cell cycle delay caused by usage of the highest doses. Because many plants are responsible for loss of adult cattle in Brazil, the *I. suffruticosa* needs more criterious evaluation before constituting widely used food for livestock.

For both plants, the positive results can not be correlated with the presence of some bioactive components because they are still not isolated.

Further studies using other medicinal and animal food plants are being developed by our group.

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