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SHORT COMMUNICATION

Studies on Antiinflammatory Effect of *Cassia tora* Leaf Extract (Fam. Leguminosae)

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The antiinflammatory effect of the methanol extract of the leaves of *Cassia tora* was investigated against carrageenin, histamine, serotonin and dextran-induced rat hind paw oedema. It exhibited significant antiinflammatory activity against all these agents. The extract (400 mg/kg) showed maximum inhibition of oedema of 40.33%, 31.37%, 53.57% and 29.15% at the end of 3 h with carrageenin, dextran, histamine and serotonin-induced rat paw oedema, respectively. Using a chronic test, the granuloma pouch in rats, the extract exhibited a 48.13% reduction in granuloma weight. © **1998 John Wiley & Sons, Ltd.**

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INTRODUCTION

Cassia tora Linn. (family Leguminosae) is an annual undershrub which grows all over the tropical Asian countries and grows well in wasteland. It is commonly known as 'Sicklepod'. Various medicinal properties have been attributed to this plant in the traditional system of Indian medicine. Various parts of the plants are reputed for their medicinal value (Nadkarni 1954). The seeds of *C. tora* have been used in Chinese medicine as an aperient, anti-asthenic and diuretic agent and also to improve visual activity (Kirtikar and Basu, 1975; Asolkar *et al.*, 1992). The leaves of *C. tora* contain several anthraquinone glycosides which are well known for their therapeutic value. The extract of *C. tora* leaves showed purgative action (Pal *et al.*, 1977). The leaf extract of this plant has been reported to have significant antifungal activity (Mukherjee *et al.*, 1996). The plant is also reported to have a significant hepatoprotective effect against the toxicity of galactosamine in primary cultured rat hepatocytes (Wong *et al.*, 1989). The plant has been used as a laxative and in the treatment of skin disorders (Hooker *et al.*, 1879; Chatterjee and Pakrashi, 1992; Jain, 1968). Antiinflammatory activity of *Leucas lavandulaefolia* Rees (Labiatae) has been reported from this laboratory (Saha *et al.*, 1997). *Cassia tora* leaves have been reported to have antirheumatic activity in folklore practices (Hooker, 1879). To substantiate this claim the present study was undertaken to evaluate the antiinflammatory potential of this plant extract on different mediator induced inflammation and in the granuloma pouch test in rats.

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MATERIALS AND METHODS

Plant material. *Cassia tora* herbs were collected from Berhampur, Orissa, India and identified by Botanical Survey of India, Shibpur, Howrah. A voucher specimen (C-03) has been kept in our laboratory for future reference. The leaves were separated and dried under shade, powdered and passed through a 40 mesh sieve and stored in a closed vessel for future use.

Preparation of the extract. The powdered material was first extracted with 90% methanol (SD Fine Chemicals) in a percolator. The total extract was distilled under reduced pressure to remove the solvent. A brownish semisolid mass obtained (yield 4.215% w/w in respect of dry starting material) was stored and used for evaluation of antiinflammatory activity by suspending with Tween 80 and water in different doses. On phytochemical screening the extract showed the presence of an anthraquinone glycoside, characterization of which is in progress.

Animals used. Albino rats 130–150 g of Wistar strain purchased from M/S. B.N. Ghosh & Co. Ltd., Calcutta, were used for this experiment. The animals were housed in standard metal cages and provided with food and water *ad libitum.*

Carrageenin induced rat paw oedema. 1% solution/suspension of carrageenin was prepared. 0.1 mL of this

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Table 1. Effect of *C. tora* leaf extract on carrageenin-induced rat paw oedema

Group	Dose (mg/kg)	Oedema rate (mean ± SE) ($n = 6$)				
		1 h	2 h	3 h	4 h	5 h
Control (carrageenin)	1%	37.08 ± 2.45	51.92 ± 2.02	74.17 ± 2.75	56.86 ± 3.44	49.99 ± 3.05
Leaf extract	200	31.23 ± 2.38 (15.77%)	40.57 ± 3.57 (21.86%)	51.24 ± 3.25[a] (31.08%)	40.57 ± 2.57[b] (28.64%)	38.84 ± 2.70 (22.30%)
Leaf extract	400	27.96 ± 3.11 (24.59%)	34.64 ± 3.36[a] (33.28%)	44.64 ± 2.07[a] (40.33%)	39.80 ± 2.80[b] (30.00%)	36.92 ± 2.84[b] (26.14%)
Phenylbutazone	100	26.47 ± 3.05 (28.61%)	30.52 ± 3.03[a] (41.21%)	40.54 ± 4.83[a] (45.34%)	33.13 ± 2.56[a] (41.73%)	31.68 ± 2.62[a] (36.62%)

Figures in parenthesis indicate the percentage inhibition.
p value was calculated by Student's t-test compared with control [a] $p < 0.001$, [b] $p < 0.01$.

solution was injected into the right hind paw of male rats as per the procedure described by Winter *et al.* (1962). The extract (200 and 400 mg/kg), phenylbutazone (100 mg/kg) and control vehicle were injected intraperitoneally (i.p.) 30 min prior to the injection of carrageenin. The paw volume was measured by plethysmometer just before and 1, 2, 3, 4 and 5 h, after administration of carrageenin (Winter *et al.*, 1962).

Mediator induced inflammation. The antiinflammatory activity of the extract was measured with some agents which act as mediators of inflammation to study the selectivity of the leaf extract. 0.1 mL solution of histamine base (10^{-3} g/mL), serotonin (10^{-3} g/mL) and dextran were injected into the right hind paw and the oedema volume was determined. The extract at doses of 200 and 400 mg/kg was injected along with the mediators which served as the drug treated group, the other group injected only with mediators and saline served as control (Parmar and Ghosh, 1976). The reference standard group was treated with phenylbutazone 100 mg/kg, i.p. The paw volume was measured 30 min after injection of the agents.

In the above cases the degree of oedema formation was assayed by measuring the hind paw volume plethysmographically. The volume displacement was expressed in units, one unit being equivalent to 0.072 mL. The oedema rate and inhibition rate were calculated as follows (Lin *et al.*, 1994).

$$\text{Oedema rate } (E)\% = \frac{V_r}{V_c} \times 100$$

$$\text{Inhibition rate} = \frac{E_c - E_t}{E_c} \times 100$$

where V_c is the contralateral paw volume of the rat (left hind paw without carrageenin). V_r is the right hind paw volume of the rat with carrageenin at t-hour. E_c is the oedema rate of control group. E_t is the oedema rate of treated group.

Chronic test. The rats were anaesthetized and 10 mg of sterile cotton pellets was inserted one in each axilla of rats. Extracts (200 and 400 mg/kg), phenylbutazone (100 mg/kg) and control vehicle were administered, i.p. for 7 consecutive days from the day of cotton pellet implantation. The animals were anaesthetized again on day 8 and cotton pellets were removed surgically, freed from extraneous tissue; incubated at 37°C for 24 h and dried at 60°C to constant weight. The increment in the dry weight of the pellets was taken as a measure of granuloma formation (Winter and Porter, 1957).

RESULTS AND DISCUSSION

The antiinflammatory activity of *C. tora* against acute pedal oedema is shown in Tables 1–4 showing significant antiinflammatory activity comparable to that of phenylbutazone, a prototype nonsteroidal antiinflammatory agent. The extract at 400 mg/kg i.p. showed 40.33% inhibition in carrageenin induced rat paw oedema, 31.37% inhibition in dextran, 58.6% inhibition in histamine, 35.26% inhibition in serotonin induced rat paw oedema Tables 1–4.

It is evident that carrageenin induced oedema is mediated by the release of histamine and 5HT in the early stage, followed by kinin protease release and then by prostaglandin in the later phase (Castro *et al.*, 1968). So the effect of the extract against inflammation produced by these individual mediators was studied. The extract effectively suppressed the inflammation produced by histamine and serotonin. So it may be

Table 2. Effects of *C. tora* leaf extract on dextran-induced rat paw oedema

Group	Dose (mg/kg)	Oedema rate (mean ± SE) ($n = 6$)				
		1 h	2 h	3 h	4 h	5 h
Control (dextran)	1%	18.43 ± 2.41	23.63 ± 1.28	36.81 ± 1.728	27.18 ± 1.54	20.27 ± 1.81
Leaf extract	200	17.46 ± 2.04 (5.26%)	20.45 ± 1.95 (13.45%)	30.35 ± 2.42 (17.00%)	23.17 ± 2.61 (14.75%)	17.99 ± 1.546 (11.24%)
Leaf extract	400	15.08 ± 1.47 (18.17%)	17.45 ± 1.68[a] (26.15%)	25.26 ± 1.364[b] (31.37%)	21.085 ± 1.35 (22.44%)	16.81 ± 1.455 (17.06%)
Phenylbutazone	100	14 ± 1.43 (24.03%)	15.59 ± 1.44[b] (32.33%)	22.26 ± 1.45[b] (39.52%)	19.72 ± 1.58[a] (27.44%)	14.90 ± 1.60[a] (26.49%)

Figures in parenthesis indicate the percentage inhibition.
p value was calculated by Student's t-test compared with control [a] $p < 0.01$, [b] $p < 0.001$.

Table 3. Effects of *C. tora* leaf extract on histamine-induced rat paw oedema

Group	Dose (mg/kg)	Oedema rate (mean ± SE) ($n = 6$)				
		1 h	2 h	3 h	4 h	5 h
Control (histamine)	1%	34.81 ± 2.10	42.22 ± 2.15	41.01 ± 3.10	38.67 ± 2.65	32.22 ± 2.37
Leaf extract	200	30.37 ± 2.10 (12.75%)	26.67 ± 1.11[a] (36.83%)	24.22 ± 1.85[a] (40.99%)	23.33 ± 2.75[a] (38.71%)	21.70 ± 1.81[b] (32.65%)
Leaf extract	400	27.26 ± 3.20 (21.68%)	22.22 ± 2.35[a] (47.37%)	19.04 ± 2.39[a] (53.57%)	17.77 ± 3.04[a] (53.32%)	16.82 ± 2.33[a] (47.79%)
Phenylbutazone	100	23.7 ± 2.103[b] (31.91%)	19.70 ± 3.06[a] (53.33%)	15.25 ± 2.66[a] (62.81%)	13.99 ± 2.61[a] (63.25%)	12.44 ± 2.29[a] (61.39%)

Figures in parenthesis indicate the percentage inhibition.
p value was calculated by Student's t-test compared with control [a] $p < 0.001$, [b] $p < 0.01$.

Table 4. Effect of *C. tora* leaf extract on serotonin-induced paw oedema in rats

Group	Dose (mg/kg)	Oedema rate (mean ± SE) ($n = 6$)				
		1 h	2 h	3 h	4 h	5 h
Control (serotonin)	1%	31.16 ± 2.87	39.99 ± 2.17	49.39 ± 2.95	45.74 ± 2.91	41.83 ± 2.04
Leaf extract	200	26.66 ± 2.17 (14.44%)	30.08 ± 2.60[b] (24.78%)	39.08 ± 2.60[c] (20.87%)	34.99 ± 2.17[b] (23.50%)	31.49 ± 2.89[b] (24.71%)
Leaf extract	400	23.24 ± 2.14[d] (25.41%)	26.66 ± 2.18[a] (33.31%)	35.00 ± 2.17[a] (29.15%)	29.74 ± 2.49[a] (34.98%)	27.08 ± 2.30[a] (35.26%)
Phenylbutazone	100	19.24 ± 2.76[b] (38.25%)	24.16 ± 2.74[a] (39.58%)	29.164 ± 2.78[a] (40.95%)	24.91 ± 2.31[a] (45.54%)	22.91 ± 2.00[a] (45.23%)

Figure in parentheses indicate percentage inhibition.
p value was calculated by Student's t-test compared with control [a] $p < 0.001$; [b] $p < 0.01$; [c] $p < 0.02$; [d] $p < 0.05$.

suggested that its anti-5HT activity is possibly responsible for its antiinflammatory activity. The extract also reduced the oedema produced by dextran which is known to be mediated both by histamine and serotonin.

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