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Research Article

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ANTI-INFLAMMATORY ACTIVITY OF LEAVES OF *TYPHA ANGUSTATA* (TYPHACEAE)

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ABSTRACT
The aim of this study was to investigate the Anti-inflammatory Activity of methanol, petroleum ether and aqueous extracts of leaves of *Typha angustata*. Anti-inflammatory Activity of methanol, petroleum ether and aqueous extracts of leaves of *Typha angustata* (100, 200, 400 mg/kg, p.o.) was studied in rats using Carrageenan induced hind paw edema and Histamine induced hind paw edema method. All extracts showed maximum anti-inflammatory effect when compared with control group. The results shows that methanol extract (100, 200 and 400 mg/kg, p.o.) significantly ($p<0.05$) inhibited Carrageenan induced hind paw edema and also Histamine induced hind paw edema. The studies clearly indicate that the anti-inflammatory activity of methanol extract is due to the bioactive principles of methanol extract of *Typha angustata* leaves.

Key words: *Typha angustata*, Anti-inflammatory activity, Carrageenan, Histamine.

INTRODUCTION

Typha (meaning "marsh" in Greek) is a monocot genus of the monotypic family Typhaceae with about 12 species distributed in the tropical and temperate regions of the world in marshes and wetlands of varied depth[1]. The leaves of *Typha angustata* are long and thick. These are yellowish-green in colour. It contains flavonoids (Quercetin, isorhamnetin-3-0-rutinoside); sterols (β-sitosterol, lanosterol, cholesterol) [2]. Xu *et al.* (1986) isolated seven crystalline compounds from the inflorescence of *Typha angustata.* These compounds were vanillic acid, E-p-hydroxy-cinnamic acid, protocatechuic acid, E-Pro-penoic acid-3-(hydroxyphenyl)-2, 3-dihydropropyl ester, succinic acid, p-hydroxybenzaldehyde and D-mannitol. Plant contains three steroids [β-sitosterol, (20S) 24-methylenlophenol, and stigmast-4-ene-3,6-dione] and three fatty acids [α– linolenic, linoleic, and an unidentified $C_{8:2}$]. Roots are rich in polysaccharides. Flavonoids are present in shoots and flowering heads. An allelopathic sterol - (20S)-4 alpha-methyl-24-methylenecholest-7-en-3 beta-ol has been reported from *Typha latifolia*, and it is probably also present in *T. angustata.*

Medicinally active principles in *T. angustifolia* have been mainly identified as flavonoids[3]. Folk people of the Mithila region have been using the long fibrous leaves of the plant to weave 2-2.5 inch-thick strong mattresses ("Shitalpati") for use as a course kind of bed-sheet since olden times. Plant leaves of *T. angustata* may probably be used with memory foam and high resiliency base foam to create an innovative and modern bed mattress with help from modern technology. Pollens are yet another source of protein used as additive in making bread, porridge etc. It is also known as elephant grass. The whole plant, woody soft inflorescence, root and pollens are used medicinally. Wood inflorescence was applied like medicated cotton wool on wound and ulcers for healing[4].

The leaves are diuretic[5]. The pollen is astringent, desiccant, diuretic, haemostatic and vulnerary and used in the treatment of nose bleeds, haematemesis, haematuria, uterine bleeding, dysmenorrhoea, postpartum abdominal pain and gastralgia, scrofula and abscesses. The seeds are haemostatic. The rootstock is supposedly astringent and diuretic[6]. Its pollen has been used medicinally from remote antiquity in the east as a diuretic and a styptic. A literature survey revealed that inflorescence of *Typha angustata* possess Anti-inflammatory activity[7] and is also used by medicine men of Ratnagiri, Maharashtra for treatment of hemorrhage and Gastro-intestinal disorders[8].

MATERIAL AND METHODS

Plant Collection and Identification

The leaves of *Typha angustata* were collected from wild sources in August 2010 from Babhulgaon road, Yeola, District Nasik (Maharashtra) India. Then the leaves were shade dried at room temperature. The plant was authenticated at Department of Botany, K.T.H.M. College of Art, Commerce and Science, Nashik (M.S.) India.

Preparation of Extracts

The leaves of *Typha angustata* were shade dried, coarsely powdered (1kg) and successively extracted with petroleum ether (60-80°), methanol in the increasing order of polarity in a soxhlet extractor. Also aqueous extract was obtained by maceration. The crude extracts were subjected to preliminary phytochemical screening; which showed the presence of tannins, flavonoids, sterols and triterpenes.

Qualitative Chemical Investigation

Petroleum ether and methanol extract obtained by successive extraction method and aqueous extract by maceration method. All extracts were subjected to proximate chemical analysis.

Proximate chemical analysis

Preliminiary phytochemical constituents were investigated by standard chemical tests.

Chemicals and reagents

Carrageenan and histamine was obtained from Sigma Ltd., USA and Difco laboratories, USA respectively. Diclofenac sodium injection (Voltaren inj, Novartis, India) was purchased from market. Instruments used in study include Digital Plethysmometer (Ugo Basile, Italy).

Test animal

Albino wistar rats (100-150 gm) were used for study. Animals were housed in groups of five at an ambient temperature of 25 ± 1ºC. Animals had free access to food and water. Animals were deprived of food but not water 4 h before the experiment.

Test Samples and standards

Pet ether extract (100, 200 and 400 mg/kg), methanolic extract (100, 200 and 400 mg/kg) and aqueous extracts (100, 200 and 400 mg/kg). Carrageenan and Diclofenac sodium were prepared in 2% gum acacia suspension before oral administration.

ANTI-INFLAMMATORY ACTIVITY

Carrageenan Induced Rat Paw Edema

The method of Winter *et al.* (1962) was used to study acute inflammation. Rats in groups of five each were treated with vehicle,

Pet ether extract (100, 200 and 400 mg/kg), methanol extract (100, 200 and 400 mg/kg) and aqueous extract (100, 200 and 400mg) one hour prior to Carrageenan injection. 0.1 ml of 1% Carrageenan was injected into the sub plantar tissue of left hind paw of each rat. Swelling of Carrageenan injected foot was measured at 0, 1, 2, 3, 4 hr using Plethysmometer (UGO Basile, Italy). The right hind paw was injected with 0.1 ml of vehicle. Diclofenac sodium (10 mg/kg p.o.) was used as reference agent.

Histamine Induced Rat Paw Edema

Inflammation in rats was produced by Histamine according to the method described by (Vogel, 2002). Rats in groups of five each were treated with vehicle, Pet ether extract (100, 200 and 400 mg/kg), methanol extract (100, 200 and 400 mg/kg) and aqueous extract (100, 200 and 400 mg) one hour prior to Histamine injection. 0.1 ml of 1% Histamine was injected into the sub plantar tissue of left hind paw of each rat. Swelling of Histamine injected foot was measured at 0, 1, 2, 3, 4 hr using Plethysmometer (UGO Basile, Italy)[9]. The right hind paw was injected with 0.1 ml of vehicle. Diclofenac sodium (10 mg/kg p.o.) was used as reference agent.

Statistical Analysis

All values shown as mean ± SEM. Statistical analysis was performed using one-way analysis of variance (ANOVA) followed by Dunnett's test $P<0.05$ was considered statistically significant

RESULT AND CONCLUSION

The leaves of *Typha angustata* (100, 200 and 400mg/kg p.o.) significantly ($p<0.05$) inhibited Carrageenan induced paw edema. But the methanol extract showed maximum inhibition of carrageenan induced rat paw edema when compared to the control group (Table 1). The methanolic extract also showed significant inhibition of histamine induced rat paw edema when compared to control group (Table 2). In the present study, maximum anti-inflammatory effect of leaves of *Typha angustata* may be attributed to the presence of flavonoids as evident by preliminary phytochemical investigation.

Thus, it can be concluded that methanol extracts (100, 200, and 400 mg/kg) of the leaves of *Typha angustata* possess anti-inflammatory properties which are probably mediated via inhibition of prostaglandin synthesis and may have a potential benefit for the management of pain and inflammation.

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Table 1.Effect of Methanol, pet ether and aqueous extract (100, 200 and 400 mg/kg) on Carrageenan Induced Rat Paw Edema.

Treatment (mg/kg)	Mean increase in paw volume (ml)				% rise in paw volume
	1 hr	2 hr	3 hr	4 hr	
Control	0.4673± 0.0060*	0.62± 0.01*	0.9233± 0.0084*	1.168± 0.014*	---
Diclofenac sodium	0.2667± 0.0055#	0.335± 0.0076#	0.44± 0.0044#	0.3283± 0.011#	44.20
TAW(100)	0.075± 0.0056*#	0.1483± 0.0070*#	0.6083± 0.0030*#	0.1767± 0.0055*#	29.05
TAW (200)	0.09± 0.0057*#	0.1733± 0.0066*#	0.2917± 0.0060*#	0.2± 0.0044*#	31.43
TAW (400)	0.07333± 0.0055*#	0.1583± 0.0040*#	0.2617± 0.0060*#	0.225± 0.0076*#	36.90
TAM (100)	0.05167± 0.0087*#	0.12± 0.0073*#	0.6283± 0.0040*#	0.1867± 0.0114*#	29.76
TAM (200)	0.135± 0.013*#	0.19± 0.0126*#	0.3267± 0.0117*#	0.24± 0.0044*#	45.25
TAM (400)	0.07± 0.0025*#	0.22.± 0.0044*#	0.1333± 0.0055*#	0.2383± 0.0087*#	54.03
TAP (100)	0.07± 0.0085*#	0.245± 0.0056*#	0.62± 0.0057*#	0.145± 0.0095*#	23.46
TAP (200)	0.08± 0.0057*#	0.1267± 0.0088*#	0.31± 0.0106*#	0.1217± 0.0083*#	23.41
TAP(400)	0.05667± 0.0042*#	0.1517± 0.0047*#	0.3517± 0.0065*#	0.1517± 0.0065*#	27.37

Each value is presented as Mean ± SEM ($P<0.05$) one way ANOVA followed by Dunnett's test
*compared with standard, #compared with control

Table 2.Effect of Methanol, Pet ether and aqueous extract (100, 200 and 400 mg/kg) on Histamine Induced Rat Paw Edema.

Treatment (mg/kg)	Mean increase in paw volume(ml)				% rise in paw volume
	1 hr	2 hr	3 hr	4 hr	
Control	0.4517± 0.0040*	0.6867± 0.0049*	0.8917± 0.0079*	0.985± 0.0215*	---
Diclofenac sodium	0.3033± 0.0042#	0.51± 0.0051#	0.69± 0.0057#	0.565± 0.0042#	63.08
TAW (100)	0.1033± 0.0071*#	0.1717± 0.0060*#	0.7683± 0.0030*#	0.3257± 0.0027*#	42.39
TAW (200)	0.0833± 0.0049*#	0.2017± 0.0047*#	0.4707± 0.0033*#	0.21± 0.0044*#	28.91
TAW (400)	0.06833±0.0083*#	0.1833± 0.0102*#	0.3717± 0.0083*#	0.1833± 0.01022*#	24.26
TAM (100)	0.3017± 0.0030*#	0.6± 0.0044*#	0.75± 0.0118*#	0.7967± 0.0021*#	106.34
TAM (200)	0.3033± 0.0049*#	0.5817± 0.0155*#	0.7517± 0.0016*#	0.6867± 0.0021*#	94.34
TAM(400)	0.2967± 0.0033#	0.595± 0.0022*#	0.785± 0.0034*#	0.7067± 0.0042*#	86.91
TAP(100)	0.155± 0.0061#	0.3267± 0.0084*#	0.755± 0.0042*#	0.4018± 0.0098*#	53.25
TAP(200)	0.1567± 0.0512#	0.325± 0.0522*#	0.4967± 0.0484*#	0.2267± 0.0493*#	34.69
TAP(400)	0.1533± 0.0122*#	0.245± 0.0067*#	0.4773± 0.0058*#	0.145± 0.00957*#	20.19

Each value is presented as Mean ± SEM ($P<0.05$) one way ANOVA followed by Dunnett's test
*compared with standard
#compared with control

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