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A Research On Pharmacognostical Analysis, Phytochemical Screening And Anti-Inflammatory Activity Of Scoparia Dulcis Linn. Plant

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Abstract

The conventional medical system makes extensive use of Scoparia dulcis L. to treat liver conditions. The entire plant of Scoparia dulcis Linn. is thoroughly pharmacognomically evaluated in this work, including morphology, microscopy, physicochemical screening, and phytochemical screening. To find the phytochemicals in the S. dulcis methanol leaf extract that could be responsible for its acceptance and use, phytochemical screening was done. The anti-inflammatory properties of the extract were further examined in relation to carrageenan-induced paw edema in Wistar albino rats. The findings of extracting Scoparia dulcis L. show the presence of several components. After two hours of carrageenan administration, the 200 mg/kg and 300 mg/kg hydroalcoholic extract of Scoparia dulcis L. effectively prevented paw edema.This might be the result of a stronger inhibitory effect of the lower dose on the synthesis of bradykinin and prostaglandin. The highest percentage of edema inhibition for the Scoparia dulcis L. hydroalcoholic extract was observed at 200 and 300 mg/kg oral dosages of the extract, with corresponding values of 60.19% and 63.48%, after a 4-hour injection of carrageenan.

Key-Words: Inflammation, *Scoparia dulcis* L, Phtochemicals, Extraction

INTRODUCTION

The word "inflammatory" has Latin roots, "Inflammare," which means "burn." Numerous chemical changes might occur in the afflicted area following any kind of physical damage. It was once thought that inflammation was a unique disease caused by anomalies in body fluids. Most people agree that inflammation is a typical response to a disease or other disruption. The traditional signs of inflammation are heat, redness, swelling, pain, and loss of function. Inflammation is frequently brought on by a number of mechanisms that fall into one of three categories: the acute transitory phase, the delayed subacute phase, or the chronic proliferating phase. Local edema develops in the early stages due to inflammatory exudates brought on by increased vascular permeability. The second phase is characterized by leukocyte and phagocyte migration through blood to vascular tissues, whereas the third phase is characterized by tissue fibrosis and disintegration. Endogenous mediators, including prostaglandins, histamine, serotonin, and bradykinin, are released in response to inflammation.[1]

Inflammation is not a straightforward process. Diagnosing a disease or injury is the initial stage in the inflammatory cascade. One popular method for doing this is to identify pathogen-associated molecular patterns (PAMPs), which are primarily focused on broad themes of pathogen-expressed molecules required for pathogen survival. Alarmins, also known as damage-associated molecular patterns (DAMPs), are organic molecules that the innate immune system detects as signs of injury or necrosis. One advantage of identifying these signals is a reduction in unintentional targeting of host cells and organs. Unlike adaptive immunity, the innate immune system is unable to distinguish between various pathogen strains and determine their level of toxicity [2].

Non-steroidal anti-inflammatory medicines (NSAIDs) are the medications most frequently administered globally to treat inflammation-related acute and chronic pain. The decrease of COX activity in the manufacture of prostaglandins and thromboxanes is a feature shared by the actions of the NSAID medication family.NSAIDs work primarily by inhibiting central and peripheral COX, which stops arachidonic acid from being converted into prostaglandin E2, thromboxanes, and prostacyclins. The actions of the COX-1 and COX-2 enzymes differ significantly from those of NSAIDs. COX-1 is a protein found in many cells, including those in the fetus and amniotic fluid. It is engaged in defense and control in addition to other physiological functions. On the other hand, COX-2 is stimulated by proinflammatory cytokines and inflammation. Despite the medications' early effectiveness, significant negative effects on the heart, kidneys, and gastrointestinal system have been reported since the introduction of selective COX-2 inhibitors [3,4].

Herbal medicine has been utilized for medicinal purposes since ancient times. Their plethora of medicinal properties, which may contribute to the averting of ailments, have made them highly valued throughout. With good reason, China and India are known as the "Botanical Garden of the World" since they are the world's leading producers of medicinal plants. India holds a unique position in the world since it is the cradle of several well recognized traditional medicinal systems, such as homeopathy, yoga, naturopathy, Siddha, and Unani. [5]

Scoparia dulcis Linn. is a large glabrous or pubescent shrub with smooth or lenticellate branches; leaves are elliptic to oblong or obovate, and the fruit is a purplish black berry. Common names for this plant include mithipatti (Hindi), sarakkotthini (Tamil), kallurukki (Malayalam), bon-dhonya (Bengali), sweet broom weed, or ghoda tulsi. The plant may be found growing in hedges and forgotten areas all throughout India. The herb has cooling, diuretic, sweet, astringent, and constipating properties. It helps with burning feeling, ophthalmodynia, diarrhea, skin eruptions, obesity, and vitiated pitta problems.[6–9] S. dulcis is an annual herb widely distributed in tropical and subtropical regions. In these regions, fresh or dried S. dulcis plants have traditionally been used as remedies for stomach troubles,[3] hypertension,[10] diabetes,[11] bronchitis,[12] and as analgesic and anti-pyretic agents.[13] A number of different principles such as scoparic acid A, scoparic acid B, copadulcic acid A and B, scopadulciol, and scopadulin[14] have been shown to contribute to the observed medicinal effect of the plant. These compounds were found to possess various biological activities such as inhibition of herpes simplex virus replication, gastric H+, K+-ATPase activation, antitumor activity, etc.[15] A glycoside called ammelin was extracted from fresh plants in a research on the anti-diabetic activity of S. dulcis. This glycoside quickly alleviated pyorrhea, eye problems, joint discomfort, susceptibility to cold, and other conditions that accompany diabetes and liver illnesses. Despite the plant's wide range of therapeutic applications, pharmacological and pharmacognostic data have not yet been published.[16] In order to verify the plant's traditional usage in the treatment of inflammatory disorders, a

pharmacognostical research was conducted to identify the phytochemicals contained in the plant and assess its anti-inflammatory effectiveness.

MATERIALS & METHODS:

Collection and authentication
Scoparia dulcis L. (whole plant) was collected from the Ratna Nursery, Jharkhand and authenticated.

Organoleptic Study
The organoleptic study indicates the external characters like colour, odour and taste.

Morphology of *S. dulcis*
Morphological characteristics are referred to the evaluation of herbs by color, odor, taste, size, shape, and special features like touch, texture, etc., it is a technique of qualitative evaluation based on the study of morphological and sensory profiles of herbs.

Microscopy of *S. dulcis*
A digital microscope that was connected to a computer system was used to microscopically examine the S. dulcis plant. The transverse and longitudinal portions of the plant components were thinly cut using a microtome, and the best sections were chosen for the investigation. After mounting the transverse section with glycerin and staining the lignified tissues with phloroglucinol and HCl, it was examined under a microscope. The sections were inspected using a microscope with objective pieces 10, 40, and ×100 in addition to a ×10 eye piece. ×5 eye pieces and ×10 objective pieces were utilized for leaf constants.

Leaf constants
The specification of leaf constants mentioned in quantitative microscopy includes:
• Vein-islet number and veinlet-termination
• Stomatal number and stomatal index
• Palisade ratio
The main importance of these values lies in identifying the species, whether the powder is authentic or adulterated.

Method of determination of vein-islet number and veinlet-termination number*:*
In a test tube, three to four chopped leaf sections measuring six square millimeters from the center of the lamina were boiled in methanol. A little drop of glycerin was added, and each of these pieces was maintained on a slide in methanol with the lowest portion facing upward to highlight the veins on the lower surface. 10× power goal and 5× eye piece were utilized. Camera Lucida was fixed, and the stage micrometer was focussed. The side of the microscope where camera Lucida was mounted was covered with a black sheet. Then a 1 mm square was drawn using a stage micrometer. The black sheet's square has the image of the leaf overlaid on it.. Veinislet and vein-termination were traced and counted. The vein-islet and vein-termination, including those intersected by the bottom and left side of the square were included but those intersected by the top and right side were excluded. Six such groups were counted.

Method determination of stomatal number and stomatal index
The upper and lower epidermis of the leaf were divided by the manner it was peeled. After the leaf portion was peeled, it was placed in a test tube with around 5 cc of methanol and heated over a water bath until the pieces became translucent. After placing the piece on a watch glass, a few drops of ethanol were applied, and the mixture was then cleaned with water. After that, it was quickly cleaned with water, tinted with a few drops of safranin, and mounted with the aid of glycerin. The stained item was examined under a compound microscope (5x + 10x) fitted with a Lucida camera.. The epidermal cells and stomata were drawn on the black sheet and counted within the 1 mm square. The cells and stomata in more than half portion outside the square were not counted.

Method for determination of palisade ratio
The lamina's tiny leaf fragments were removed and cooked in methanol until they become translucent. Then, four nearby upper epidermis cells were tracked using the Lucida camera. then sketched off the palisade cells beneath the four previously identified epidermal cells while focusing (×10) on the palisade layer.

Additionally tracked were the palisade cells, which were 50% more numerous inside the epidermal walls. There were six such decisions made.

Physicochemical constant

The proportion of total ash, water soluble ash, acid insoluble ash, moisture content (based on dry weight), and extractives that are soluble in water and alcohol were among the physicochemical constants that were measured.

Preparation of the plant extract: The Standard technique was employed to extract the plant material. A soxhlet apparatus was used to extract 500 grams (500 g) of the ground plant sample in 2 L of 99.8% methanol at 50ºC. The filtrate was then concentrated using a rotary evaporator to recover solvent, and the extract was finally dried using a water bath. Finally, it was preserved in a desiccator for use in experiments.

Phytochemical analysis:

Table 1: Phytochemical Tests

Alkaloids	Dragendroff's Test	The filtrates were subjected to a solution of potassium bismuth iodide, known as Dragendorf's reagent. The presence of alkaloids is shown by the formation of red precipitate.
Glycosides	Legal's Test	Sodium nitropruside was used to treat the extract with pyridine and sodium hydroxide. The presence of cardiac glycosides is indicated by the formation of a pink to blood red color.
Flavonoids	Alkaline Reagent Test	A few drops of sodium hydroxide solution were added to the extract. Flavonoids are indicated by the formation of a bright yellow color that becomes colorless when diluted acid is added.
Saponins	Froth Test	After diluting the extract with 20ml of distilled water, it was agitated for 15 minutes in a graduated cylinder. The presence of saponins is indicated by the formation of a 1 cm layer of foam.
Tannins	Gelatin Test	A 1% sodium chloride-containing gelatin solution was added to the extract. The presence of tannins is shown by the formation of white precipitate.
Phenols	Ferric Chloride Test	Three to four drops of ferric chloride solution were added to the extract. Phenols are present when blue black color begins to form.
Proteins and Amino acids	Xanthoproteic Test	A little amount of concentrated nitric acid was added to the extract. The development of a yellow hue signifies the existence of proteins.
Carbohydrates	Molisch's Test	In a test tube, filters were treated with two drops of an alcoholic α-naphthol solution. The presence of carbohydrates is shown by the formation of the violet ring at the junction.

Anti-inflammatory activity: Animal grouping

Following the protocol, 0.1 mL of λ-carrageenan (1% in NaCl 0.9%) was subplantarly injected into the right hind paw of six randomly chosen groups (n = 6) of mice. After that, they were given the following solutions as an oral dose (gavage): Group II was a reference medication containing 50 mg/kg of diclofenac sodium; Group III was an extract of Scoparia dulcis L. leaves at 200 mg/kg; and Group IV was an extract of the same at 300 mg/kg. Group I was composed of 10 mL/kg of sterile saline 0.9% NaCl. Following the carrageenan injection, an oral dose of 0.9% NaCl-diluted Diclofenac and Scoparia dulcis L. was administered. The extract was initially vacuum-evaporated at room temperature in order to remove the methanol.

RESULTS AND DISCUSSION

The leaf's morphological features were as follows: it was green in color, simple and pinnatified, with a distinct flavor and aroma. The stem had a woody texture, a rough exterior, a distinct smell, a sweet flavor, a green hue, and irregular, fibrous fractures. The fruit was smooth on the outside, green in color, had a distinct smell, and had an astringent flavor. The plant has anomocytic stomata on both the upper and bottom surfaces of its leaves. It had a special sessile glandular trichome in it.Calcium oxalate crystals and starch grains were seen in the cortical area of the stem. Its vascular bundle is made up of fiber, tracheid, spiral vessels, etc. There were uniseriate, multicellular, glandular trichomses on the stem's epidermis. Brownish matter-containing periderm was seen in the root. The single layer of phelloderm is surrounded by two rows of cells in the phellogen. Four to six layers of radially compressed, tangentially oblong parenchyma cells made up the cortex. A portion of the parenchyma cells had starch granules in them. Companion cells and sieve

components made up the phloem. Parenchyma and trachieds are examples of xylem constituents that make up the lignified xylem. The cambium divides the phloem and xylem regions. While lignified in the xylem area, medullary rays in the phloem zone are non-lignified.

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The organoleptic study indicates the external characters like colour, odour and taste. The results of the present study are indicated in Table 2

Table 2: Organoleptic study of the sample of root and shoot

S.N.	Sample	Odor	Color	Taste
1.	Root	Pleasant	Green	Bitter
2.	Shoot	Pleasant	Green	Bitter

A variety of leaf constants were observed and recorded, including the vein-islet number, veinlet termination number, stomatal number, number of epidermal cells, stomatal index, and palisade ratio [Table 1]. The results indicated that the vein-islet number ranged from 12.5 to 15.6, while the vein-termination number ranged from 15.1 to 19.4. The stomatal number ranges were 74–79 on the upper surface and 83–89 on the lower surface. The ranges of epidermal cells were 472–538 on the upper surface and 439–495 on the lower surface. The stomatal index ranges were 11.5 ± 2 on the upper surface and 13.3 ± 2 on the lower surface. The ranges of palisade cells were 5–9. [Table 3]

Table 3: Leaf Constant of *S. dulcis*

Stomatal Number	74-79 (upper surface) 83-89 (lower surface)
Vein-islet Number	12.5-15.6
Veinlet termination Number	15.1-19.4
Number of epidermal cell	472-538 (upper surface) 439-495 (lower surface)
Stomatal index	11.5 ± 2 (upper surface) 13.3 ± 2 (lower surface)
Palisade ratio	5-9

Depending on the extraction methods used, the extractive value result varied slightly. When compared to water extracts, 70% ethanolic extract performed better in maceration and Soxhlet apparatus extraction. The plant's ash content was 22.3% overall, 15.3% soluble in water, and 16.5% soluble in acid. On a dry weight basis, the moisture content was determined to be 14.4%.

The findings of extracting Scoparia dulcis L. show the presence of several components. After two hours of carrageenan administration, the 200 mg/kg and 300 mg/kg hydroalcoholic extract of Scoparia dulcis L. effectively prevented paw edema. This might be the result of a stronger inhibitory effect of the lower dose on the synthesis of bradykinin and prostaglandin. The highest percentage of edema inhibition for the Scoparia dulcis L. hydroalcoholic extract was observed at 200 and 300 mg/kg oral dosages of the extract, with corresponding values of 60.19% and 63.48%, after a 4-hour injection of carrageenan.

Table 4: Different phytochemical test and results

Constituents	Test	Result
Alkaloids	Dragendroff's Test	+
Glycosides	Legal's Test	+
Flavonoids	Alkaline Reagent Test	+
Saponins	Froth Test	+
Tannins	Gelatin Test	+
Phenols	Ferric Chloride Test	_
Proteins and Amino acids	Xanthoproteic Test	_
CarbohydrateS	Molisch's Test	+

Table 5: Anti-inflammatory activity of Hydroalcoholic extract of *Scoparia dulcis* L.on Carrageenan-induced paws edema

Treatment group	Dose (mg/kg)	The paw volume (ml), mean ± SEM				
		Basal	1 h	2 h	3 h	4 h
Negative Control	Sterile saline 0.9% NaCl	0.286±0.01	0.291 ± 0.008	0.303 ± 0.014	0.314± 0.01	0.324 ± 0.008
Diclofenac sodium	50 mg/kg, p.o	0.268 ± 0.008	0.238 ± 0.004	0.208± .003	0.189±0.007	0.181±0.004
Scoparia dulcis L. (Extract)	200 mg/kg, p.o	0.294 ± 0.012	0.253 ± 0.008	0.269±0.008	0.200±0.004	0.196± 0.002
Scoparia dulcis L.(Extract)	300 mg/kg, p.o	0.278 ± 0.012	0.247 ± 0.005	0.209±0.004	0.194±0.005	0.188±0.005

Table 6: Maximum percentage of inhibition of edema for the Hydroalcoholic extract of *Scoparia dulcis* L. at 100 and 200 mg/kg

Treatment group	Dose (mg/kg)	% inhibition			
		1 h	2 h	3 h	4 h
Diclofenac sodium	50 mg/kg, p.o	23.98 %	47.12 %	56.75 %	67.23 %
Scoparia dulcis L. Extract	200 mg/kg, p.o	15.65 %	36.46 %	50.18 %	60.19 %
Scoparia dulcis L. Extract	300 mg/kg, p.o	18.43 %	49.12 %	54.77 %	63.48 %

CONCLUSION

Physical constants and macroscopy analyses of the plant S. dulcis Linn. were carried out. This legitimate data is provided by the pharmacognostical research to assess this herb for future standardization and authenticity. In summary, the goal of this study was to investigate the anti-inflammatory qualities, phytochemical composition, and extraction method of the extract from Scoparia dulcis L. Numerous significant findings from the study improved our understanding of the potential health advantages of the plant extract. The comprehensive extraction, phytochemical screening, and assessment of anti-inflammatory activity procedures enhance our understanding of the potential therapeutic applications of Scoparia dulcis L. The study highlights the importance of traditional medicinal herbs as sources of novel bioactive compounds and the need for further research to fully understand the health benefits of these plants. The investigation's findings suggest that Scoparia dulcis L. leaf extracts with an ethanol basis have anti-inflammatory qualities. It has long been known that paw edoema inhibition is a reliable indicator of an anti-inflammatory drug's efficacy. The current study's findings indicate that the hydroalcoholic extract of Scoparia dulcis L. has a notable anti-inflammatory effect.

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