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**INVITRO ANTI-INFLAMMATORY AND ANTI-HELMINTHIC  
ACTIVITY OF SAPINDIA MUKOROSI, LANTANA CAMARA AND  
FORMULATION OF HERBAL GEL**

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**ABSTRACT**

The present research aimed to screen the anti-inflammatory and anti-helminthic activity of *sapindia mukurossi* and *camara lantana* and formulate herbal gel using natural polymers. Both extracts showed good anti-inflammatory activity, comparable with standard drugs diclofenac and Aceclofenac and anti-helminthic activity, comparable with standard drugs tinidazole. Plant extracts were incorporated into a gel base and evaluated for their physicochemical properties such as pH, Spreadability, etc. The physicochemical evaluation of the developed formulation showed no lumps and had uniform colour dispersion. It was also observed to have easy washability and good Spreadability. The results concluded that the formulation F6 had superior properties than other formulations.

**Keywords: Anti-inflammatory, Anti helminthic activity, Sapindia mukurossi, Camara lanatana, Herbal gel**

**INTRODUCTION:**

Herbal medicine (HM) represents the cornerstone of complementary and alternative medicine, a field that has been increasingly embraced worldwide and is gradually integrating into mainstream healthcare systems [1]. The global herbal

medicine market, valued at US\$146.6 billion in 2023, is expected to increase at a compound annual growth rate (CAGR) of 6.8% to reach a revised size of US\$248.6 billion by 2030. Factors driving this surge in utilization include cost-effectiveness, widespread acceptance as a natural product with perceived low toxicity, efficacy in treating certain challenging conditions, and ease of accessibility, preparation, and administration [2].

As the use of herbal medicine becomes more widespread, safety concerns have emerged as a pertinent issue. Indeed, certain herbal medicines have been linked to significant adverse events involving cardiovascular, neurological, and renal toxicities, as well as cancer [3]. It is widely acknowledged that if a drug is effective, it will inevitably entail side effects; thus, herbal medicines, as a form of medication, may exhibit side effects or prove to be ineffective. Nonetheless, herbal medicines are generally perceived as safe and efficacious remedies, prompting individuals to increasingly opt for plant-based treatments under the assumption of minimal adverse reactions [4].

Unlike pharmaceutical drugs that target specific reactions and weigh the "risk" of side effects against the primary benefit, medicinal plants often simultaneously exert multiple broad actions on physiological systems. These actions are typically

complementary or synergistic, aligned towards a common therapeutic goal, and tend to be nonspecific and seldom detrimental. The multifaceted actions of medicinal plants defy simple categorization using conventional drug-related terms like diuretic [5]. Within the Verbenaceae (verbena) family, lantana is a tiny, evergreen shrub that can grow annually or perennially. Its woody stems give it a sprawling appearance. Every part of the lantana camara plant, which is used frequently in herbal medicine, has a unique therapeutic value; leaf oil is (antiseptic for scars), the roots (toothache), flowers for (chest complaints), leaves (anti-proliferative, antimicrobial, fungicidal, insecticidal and nematocidal activities), shoots (antioxidant activity), berries fruits (fistula, pocks, tumours and rheumatism) [6]. Common names for *Sapindus mukorossi* Gaertn., a member of the Sapindaceae family, include soapnut and soapberry. The Indigenous medical system uses *Sapindus mukorossi* for the treatment of various illnesses due to its pharmacological effects, which include antibacterial, insecticidal, spermicidal, anti-trichomonas, anti-tumour, hepatoprotective, anxiolytic, molluscicidal, fungicidal, anti-inflammatory, and piscicidal properties [7]. This investigation aimed to evaluate the anti-inflammatory and anti-helminthic properties of *Sapindus mukorossi* and

Lantana camara and develop an herbal gel utilizing natural polymers.

## MATERIALS AND METHODS

### Collection and Processing of the Plant material:

The gathering and Processing of plant material involved the collection of leaves from Camara lantana and Sapindus mukorossi, sourced from various nurseries in the Kodad, Suryapet region of Telangana, India. Subsequently, the samples were authenticated, and the plant specimen and herbarium were meticulously maintained in the college. The leaves were dried in shaded conditions, followed by powdering and storage for future utilisation.

### Preparation of Extracts:

The extraction process encompassed the utilisation of around 500 g of powdered Camara lantana and Sapindus mukorossi, which were separately subjected to hydroalcoholic solution (methanol + water) in a 1:9 ratio (solute: solvent) for continuous maceration spanning three days with intermittent shaking. Subsequently, the resulting solution was filtered through a muslin cloth, and the filtrate was concentrated into a semi-solid residue employing a rotary evaporator.

### Preliminary Phytochemical Investigation:

The preliminary phytochemical investigation involved standard strategies

for analysing hydroalcoholic concentrate of Camara lantana, Sapindus mukorossi. Various tests were conducted, including Alkaloids tests (Dragendorff's test, Mayer's test, Hager's test, Wagner's test), Protein and Amino Acids tests (Biuret's tests, Millon's test, Ninhydrin test, Xanthoprotein test), Steroids tests (Salkowski Reaction, Liebermann-Burchard Reaction, Libermann's Reaction), Tannins and Phenolic compounds tests, Flavonoids tests (Ammonia test, Shinoda's/Paw test), Saponins tests (Foam test, Libermann-Burchard test), and Glycosides tests (Borntrager's test, Keller-Killiani test, Legal test) [8-10].

### Anti-inflammatory activity of Lantana camara and Sapindus mukorossi:

The dried powder of the hydroalcoholic extract is dissolved in distilled water to achieve the desired concentration of (10, 20, 30 µg/ml solutions) of Lantana camara and (1,5, 10 µg/ml solutions) of Sapindus mukorossi were formulated. A 10 ml test solution comprises 1 ml of BSA (prepared by dissolving 5 gm of BSA in 100 ml of distilled water, i.e., 5% w/v) and 1 ml of extracts in various concentrations. The control solution comprises 1 ml of BSA (5% w/v) and distilled water. The standard solution comprises 1 ml of BSA (5% w/v), 1 ml of diclofenac sodium solution (10 µg/ml), and Aceclofenac (10 µg/ml)

separately. The pH of the solutions above was adjusted to 6.3 using a small quantity of 1N HCl. The samples were then incubated at 37°C for 20 minutes and heated at 60°C for 10 minutes, followed by cooling. Subsequently, their Absorbance was assessed at 660 nm using a pure blank. The percentage inhibition of protein denaturation was calculated using the formula:

$$\text{Percentage inhibition} = \frac{\text{Absorbance (control)} - \text{Absorbance (sample)}}{\text{Absorbance (control)}} \times 100$$

#### Anthelmintic activity:

The assessment of in vitro anthelmintic activity was conducted using adult earthworms. The earthworms were procured from the vicinity of Anurag Pharmacy College, with an average length of 7-8 cm. Extracts from both plants were prepared in distilled water at varying concentrations of 50, 100, and 150 mg/ml. Three earthworms, similar in size, each of *Pheretima posthuma*, were positioned in petri dishes. Each petri dish was filled with 25 ml of the test solution containing the extracts. For the reference

standard, Tinidazole (200 mg in 25 ml water each) was utilised as the positive control, while distilled water was the negative control. The time taken for paralysis and death was recored [11-13].

#### METHOD OF PREPARATION OF GEL:

The gel was formulated utilising the desiccated methanolic extract derived from *Sapindus mukorossi*, *Camara lantana*, and HPMC K-100, in addition to Sodium CMC and Xanthan gum, serving as the gelling agent. The polymers were introduced into distilled water and left undisturbed for 24 hours to ensure full swelling. After the complete swelling process, the desiccated plant extracts were incorporated and homogenised. A specific quantity of methyl and propyl paraben was added to the gel and dissolved in 5 ml of distilled water by heating it in a water bath. Furthermore, Propylene glycol and Triethanolamine were incrementally introduced with constant agitation to the formulation to achieve skin pH adjustment (6.8-7) and attain the desired viscosity [14, 15].

Table 1: Formulation Composition of Herbal Gel

S. No	Ingredients	F1	F2	F3	F4	F5	F6
1	Lantana Camara	500	500	500	500	500	500
2	Sapindus mukorossi	500	500	500	500	500	500
3	HPMC K-100	500	1000	----	----	----	----
4	SodiumCMC	----	----	500	1000	----	----
5	Xanthan gum	----	----	----	----	500	1000
6	Methyl paraben	200	200	200	200	200	200
7	Propyl paraben	100	100	100	100	100	100
8	Propylene glycol	5 ml					
9	Triethanolamine	1.2 ml					
10	Distilled water (ml)	upto 100					

## Evaluation of physicochemical characteristics [16]:

### Macroscopic study:

The macroscopic examination was conducted to assess formulations within 48 hours of their preparation, focusing on macroscopic balance, which includes characteristics such as the absence of palpable and follicular particles, colour, and transparency.

### Microscopic study:

The examination at the microscopic level involved checking formulations for uniformity, gel texture, and air bubble presence using an optical microscope set at magnifications of 10X and 40X, all within a 48-hour timeframe.

### Centrifugation test:

Centrifugation test was performed to test the stability of the formulations against gravity. Each formulation underwent centrifugation individually in a tube measuring 10 cm in length and 1 cm in diameter for 5, 15, 30, and 60 minutes at 2000 rpm. Subsequently,

sedimentation levels of each formulation were assessed.

### pH determination test:

The pH determination test was carried out immediately after the product was prepared, with the pH of each product being measured three times to ensure accuracy and consistency.

### Thermal Changes Test:

A thermal changes test was conducted by subjecting the products to varying temperatures including refrigerator conditions (2°C–8°C), room temperature (25°C), and oven conditions (45°C–50°C).

## RESULTS AND DISCUSSION:

### Phytochemical screening:

The prepared extracts were evaporated on hot plate and stored for further use (**Figure 1**). The phytochemical screening of Hydroalcoholic extracts of *Sapindus mukorossi* and *Lantana camara* was performed. The identification of phytochemical constituents present in the extracts was documented in **Table 2** and **Figure 2** as part of this study.

**Table 2: Phytochemical screening of Hydroalcoholic extract of *Sapindus mukorossi*, *Lantana camara***

Phytochemicals	MESM	MELC
Alkaloids	++	+++
Flavonoids	+++	++
Tannins	++	++
Saponins	+++	++
Glycosides	-	-
Terpenoid	+++	+++
Steroids	-	++
Phenols	++	++
Volatile oils	-	-
Carbohydrates	-	+++
Proteins and amino acids	++	-

+ ve indicates present; - ve indicates absent

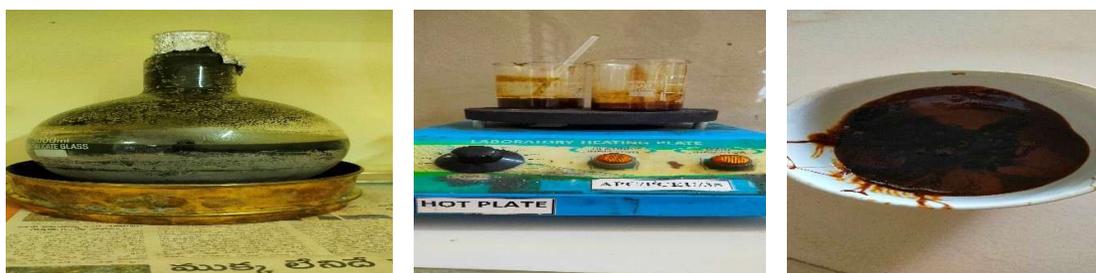


Figure 1: Extracion of plant leaves



Figure 2: Phytochemical tests performed for plant extracts

From the results of this study, hydroalcoholic extracts effectively caused protein denaturation (albumin). Table 3 shows significant protein inhibition (80%) at Lantana camara+Sapindia mukorrosi (30 $\mu$ g/ml+10  $\mu$ g/ml) whereas diclofenac

sodium ((10  $\mu$ g/ml) produced 80% and aceclofenac (10  $\mu$ g/ml) produced 93.3 % of inhibition. As the concentration of plant increases then the percentage of protein inhibition is also increases.

Table 3: Anti-Inflammatory activity of Lantana camara and Sapindus mukurosis leaf extract

concentrations	Absorbance	% of protein inhibition
Albumin	0.15	
<b>Lantana camara</b>		
10 $\mu$ g/ml	0.12	20
20 $\mu$ g/ml	0.10	33.3
30 $\mu$ g/ml	0.06	60
<b>Sapindia mukorrosi</b>		
1 $\mu$ g/ml	0.10	33.3
5 $\mu$ g/ml	0.08	46.6
10 $\mu$ g/ml	0.05	66.66
<b>Lantana camara+Sapindia mukorrosi (30<math>\mu</math>g/ml+10 <math>\mu</math>g/ml)</b>	0.03	80
<b>Standard</b>		
Diclofenac (10 $\mu$ g/ml)	0.03	80
Aceclofenac (10 $\mu$ g/ml)	0.01	93.33

Results for anthelmintic activity against the test parasites are the crude extract of lantana camara and sapindus mukurossi showed

dose dependent response against the test parasites. The crude saponins of lantana camara and sapindus mukurossi showed

comparable efficacy to tinizole against earthworm (Table 4 and Figure 3).

Table 4: Anthelmintic Activity of *Lantana camara* and *Sapindus mukurosis* leaf extract

S. No	Dilution		Paralysis Time	Death Time
	<i>Lantana camara</i>	<i>Sapindus mukurosis</i>		
I	50 mg/ml	150 mg/ml	8 mins 56sec	38 mins
II	100 mg/ml	100 mg/ml	12 mins 45sec	45 mins
III	150 mg/ml	50 mg/ml	18 mins 36sec	53 mins
IV	Tinidazole	200 mg/ml	7 mins 20 sec	34 mins

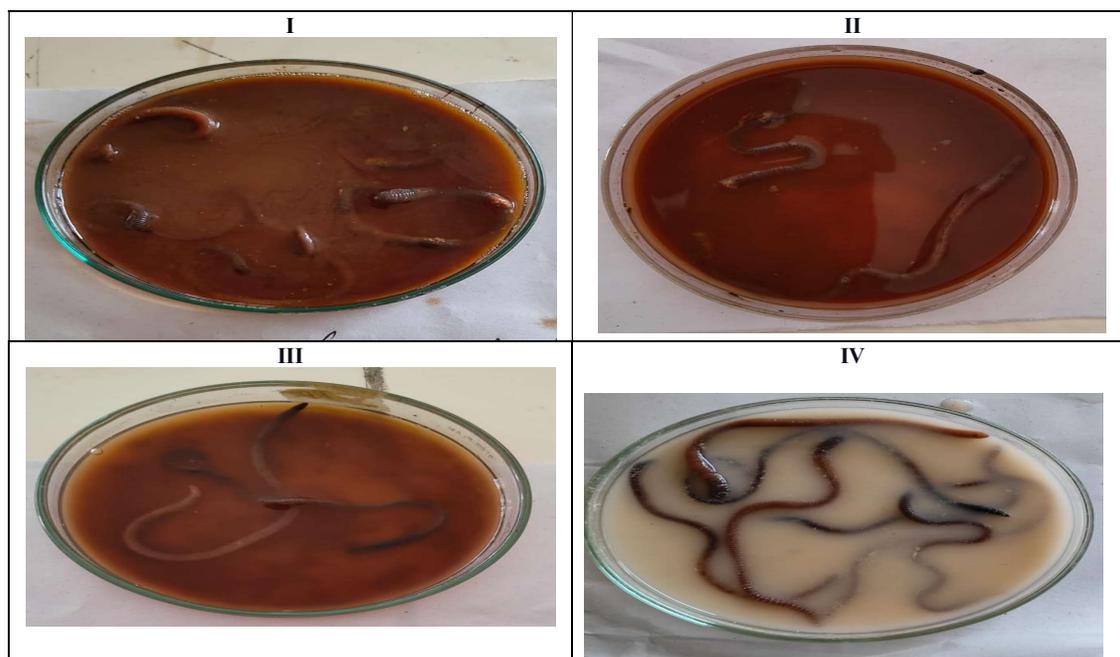


Figure 3: Anthelmintic Activity of *Lantana camara* and *Sapindus mukurosis* leaf extract

#### Evaluation tests for herbal gels:

The physical parameters such as pH, Appearance, Centrifugation test, microscopic evaluation, Thermal change test, and Spreadability are observed and shown in Table 5.

#### Microscopic evaluation:

Air bubbles formed in the formulations of (F1, F2, and F4) and formulations (F3, F5, and F6) were clear and free of bubbles.

#### Physical parameters

Physical parameters such as colour and appearance were checked.

#### Measurement of pH

The pH of the gel was measured using a pH meter. In all formulations, the pH will range between 5-6 [17].

#### Appearance:

White appearance was checked in all formulations (F1-F6). The gel appeared translucent, and it was smooth when applied.

#### Centrifugation test:

sediment was formed in the formulations (F1-F4) and formulations (F5, F6) there is no formation of sediment (Figure 4).

#### Thermal change test:

No change in the properties of the gel was observed under the influence of heat in all formulations.

### Spreadability:

Spreadability is calculated using the spreadability apparatus, and the gel is

applied to two slides. The weight required (in mgs) to move the slide was recored. All the prepared herbal gel formulations show desirable spreadability values.

Table 5: Evaluation parameters of herbal gel

Formulation	F1	F2	F3	F4	F5	F6
pH	5	5	6	5	5	5
Appearance	White	White	White	White	White	White
Centrifugation test	Sediment formed	Sediment formed	Sediment formed	Sediment formed	No sediment	No sediment
Microscopic evaluation	Air bubbles	Air bubbles	Clear	Air bubbles	Clear	Clear
Thermal change test	No change	No change	No change	No change	No change	No change
Spreadability (Mg)	110	125	90	110	125	150



Figure 4: Sediment formed in formulations (F1, F2) and no sedimentation in formulations (F5, F6).

### CONCLUSION:

In the present study phytochemical of the screening in the Hydroalcoholic extract of *Sapindus mukorossi*, *Lantana camara* was done. The phytochemical constituents that were present in the extracts were Alkaloids, Flavonoids, Tannins, Saponins Terpenoids, Phenols. protein inhibition (80%) was observed at *Lantana camara* + *Sapindia mukorossi* (30µg/ml+10 µg/ml) and was comparable with diclofenac sodium and aceclofenac. At concentration of 50mg/ml of *lantana camara* and 150mg/ml of *sapindus*

*mukorossi* induced paralysis and death in earthworm. Gels prepared with Xanthan Gum (F6) showed superior properties when compared to HPMC and Sodium CMC.

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### Conflict of Interest:

The authors declare that there is no conflict of interest.

**Abbreviations:**

HM: Herbal medicine, HPMC: Hydroxy propyl methyl cellulose, HCL: Hydrochloric acid, BSA: bovine serum albumin

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