Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 5
Open Access

Phytochemical Evaluation, Isolation, Characterization and Pharmacological screening of extracts Cayratia trifolia and Alternanthera sessilis

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Cite this paper as: Hariprasad K, Abdul Wadood Siddiqui (2024) Phytochemical Evaluation, Isolation, Characterization and Pharmacological screening of extracts Cayratia trifolia and Alternanthera sessilis. *Frontiers in Health Informatics*, *Vol.13 No.5*, 741-754

Abstract
In the present scenario of pharmaceuticals, there is an increasing demand of more active therapeutic agents. Apart from the synthetic route natural source is the major source for active therapeutic agents. It has provided us Morphine, Digoxin, Quinine, Vincristine and many more very potent and active therapeutic agents. To carry out the preliminary phytochemical investigations of different extracts of Cayratia trifolia Family- Vitaceae,Alternanthera sessilis Family-Amaranthaceae. Plants are frequently used for the treatment of inflammation, cancer, arthritis, anthelmintic and diabetes. There is lack of scientific data concerning various activities of extracts of Cayratia trifolia Family- Vitaceae,Alternanthera sessilis Family-Amaranthaceae. Natural products today are most likely going to continue to survive and grow to become even more precious as sources of new drug leads. This is because of the degree of chemical variety found in natural products is broader than that from any other resource, and the scale of originality of molecular structure found in natural products is greater than that determined from any other source. Plant remedies contain active principles that are continuously being screened for their promising pharmacological significance. It is needed to screen plants for new actions. To meet this goal, sensible hard work is required in selection of plant material, time for its collection, system of processing and pharmacological screening for appropriate therapeutic effects.

Keywords: Cayratia trifolia, Alternanthera sessilis, Pharmacological screening, therapeutic effects.ect.

1. Introduction

Natural compounds have historically played a pivotal role in the therapeutic management of various diseases and disorders, garnering considerable interest from researchers and scientists in both their unmodified states and as scaffolds for synthetic modification. Currently utilized medicinal agents derived from natural sources exhibit substantial chemical diversity, underscoring their significance in contemporary drug discovery endeavors.[1] Medicinal plants have been integral to healthcare practices across diverse cultures throughout history, with their usage documented in ancient texts, such as the Vedas and the Bible, highlighting their therapeutic potential. In numerous developing countries, traditional medicine, which often relies on medicinal plants, remains a normative approach to maintaining health.These traditional practices, predominantly botanical in nature, have evolved alongside modern medical therapies. Notably, many contemporary chemotherapeutic agents have been derived from extensive screenings of medicinal plants worldwide. [2]. The extraction of bioactive alkaloids, such as atropine, quinine, and reserpine, exemplifies the initial insights garnered from traditional medical systems. The evolution of modern allopathic medicine is marked by meticulous scientific inquiry; nonetheless, its foundations are deeply rooted in traditional healing practices.[3] The trajectory of natural product drug discovery is anticipated to embrace a more integrative and holistic approach, merging ancient methodologies with modern scientific advancements to maximize benefits for patients and society.Medicinal and aromatic plants represent a significant portion of global flora, providing essential raw materials for the pharmaceutical, cosmetic, and nutraceutical industries.

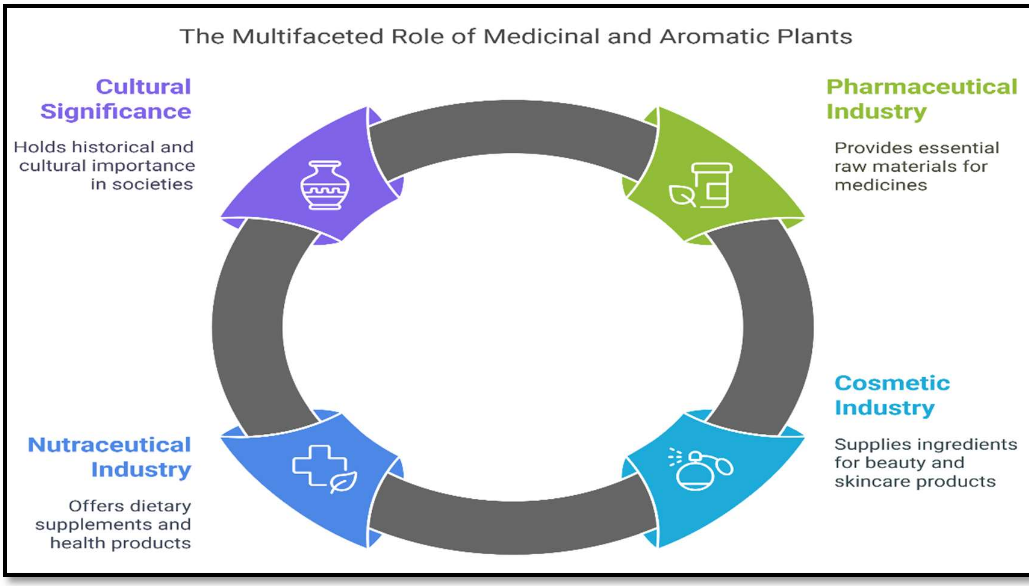

Fig.No.1: The Multifaceted role of medicinal and aromatic plants

1.2 Use of Natural Products [4,5]

Historical documentation of plant utilization as medicinal agents dates back thousands of years, with some of the earliest records originating from Mesopotamia around 2600 BC. These records indicate a diverse array of botanical agents in use, numbering up to 1,000 distinct plant-derived medications. The isolation of active principles from plants began in the early 19th century, transitioning the perception of these natural products from mystical to scientifically validated entities. Plants synthesize a wide range of secondary metabolites, which serve crucial ecological functions, including defense against herbivory and attraction of pollinators. Recent data from the World Health Organization reveals that approximately 80% of the global population continues to rely on traditional medicine, prompting significant interest among natural product chemists.[6]. The potential risks associated with herbal treatments—such as toxicity or ineffectiveness—pose serious implications for patient health, particularly in severe cases. Evaluating these remedies may benefit the minority of the population that depends on allopathic interventions. Currently, over 100 chemical entities classified as essential medicines have been derived from around 100 different plant species, with approximately 75% identified through studies aimed at isolating active compounds from traditional herbal medicines.[7]

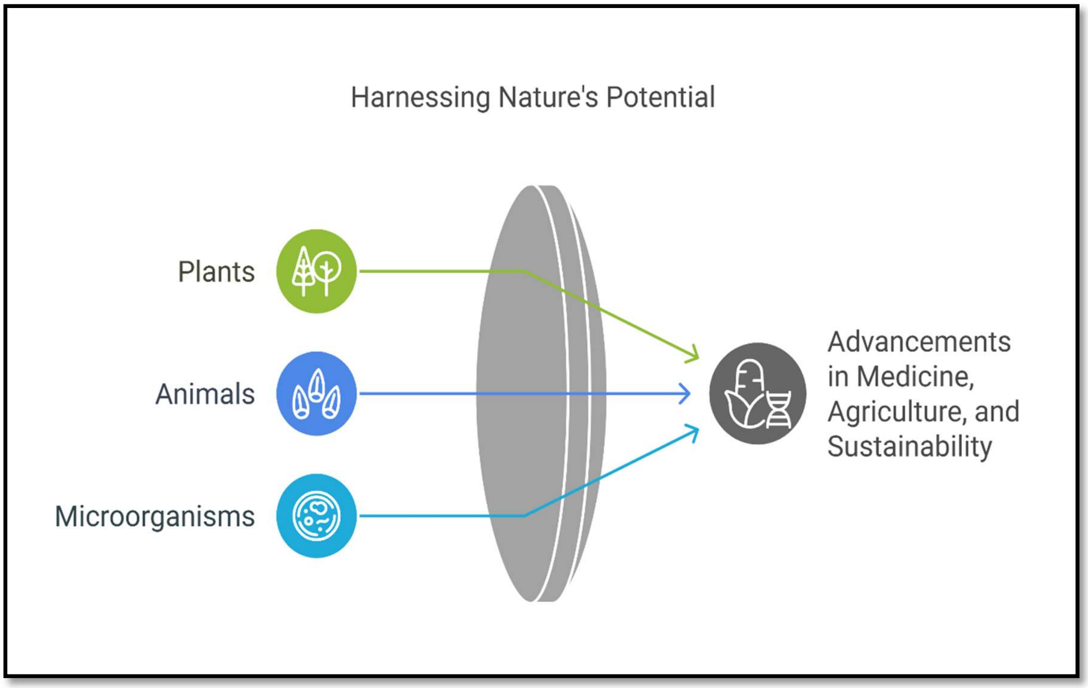

Fig.No.2: Flow diagram showing the Hamessing Nature's potential

2. Introduction of Inflammation [8-10]]

This figure illustrates the multifaceted nature of inflammation and its dual role in tumor formation. It highlights various inflammatory pathways, cellular responses, and mediators that can either promote or inhibit tumor development. Key elements include

- **Chronic Inflammation:** Prolonged inflammatory responses can lead to DNA damage, promoting oncogenesis.
- **Inflammatory Cytokines:** The role of cytokines such as TNF-α and IL-6 in fostering an environment conducive to tumor growth.
- **Immune Cell Infiltration:** The involvement of immune cells, including macrophages and neutrophils, in tumor microenvironments.
- **Tumor Promotion vs. Suppression:** Balancing the tumor-promoting effects of
- inflammation against its potential to activate antitumor immunity.
- **Microenvironment Interactions:** The impact of extracellular matrix components and stromal cells on inflammatory signaling and tumor progression.

Overall, the figure encapsulates the complexity of the inflammatory process in relation to cancer development, emphasizing the need for a nuanced understanding of inflammation in oncological research.

2.2 Acute vs. Chronic Inflammation[11-13]

Acute inflammation, typically lasting from minutes to several hours, is primarily marked by edema due to the exudation of plasma proteins and the infiltration of leukocytes, predominantly neutrophils. In contrast, chronic inflammation persists over a longer duration, is less uniform in presentation, and is histologically characterized by the presence of lymphocytes, macrophages, the proliferation of small blood vessels, and connective tissue changes.

Inflammation serves as a pivotal factor in a diverse range of diseases, affecting both systemic and organ-specific conditions, including classical rheumatic disorders, bronchial hyper-responsiveness, inflammatory bowel disease, renal pathologies, psoriasis, and atopic eczema.

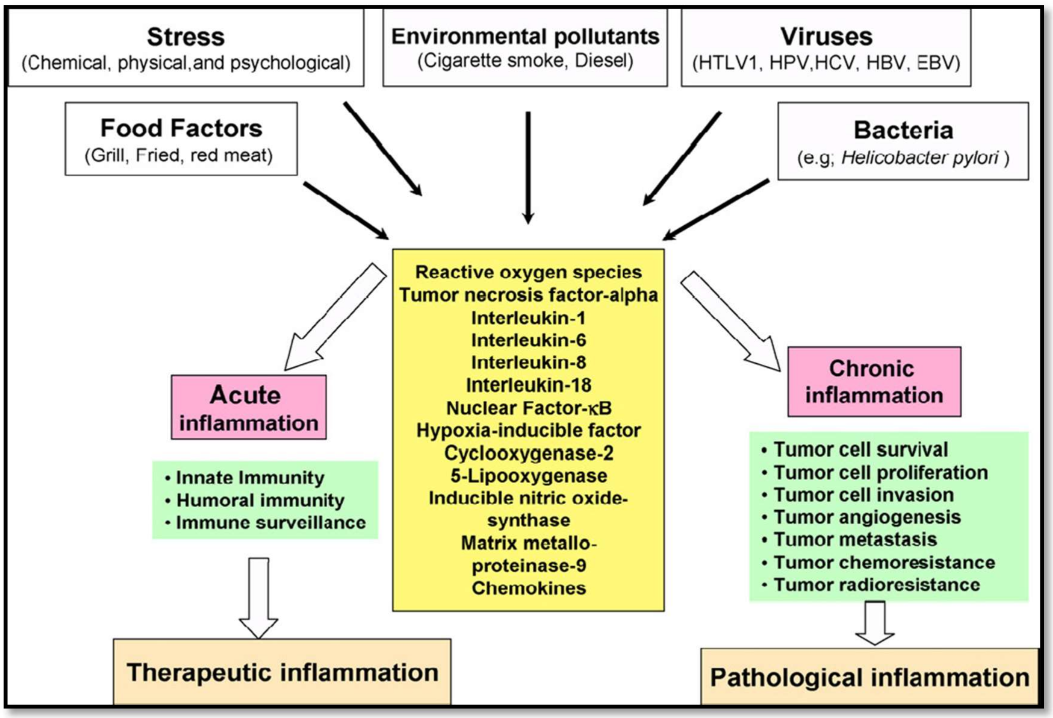

Fig.No.3: Diverse Aspects of Inflammation and Tumorigenesis

2.3 Mediators of Inflammation [14]

The inflammatory process is sustained by the local synthesis of various mediators, which may serve as potential targets for pharmacological interventions. Recent research has indicated that dietary modifications can modulate the inflammatory response, presenting a novel therapeutic avenue for treating various human ailments. Specific dietary components can be supplemented in pharmacological quantities, creating effective dietary-based interventions.[15]

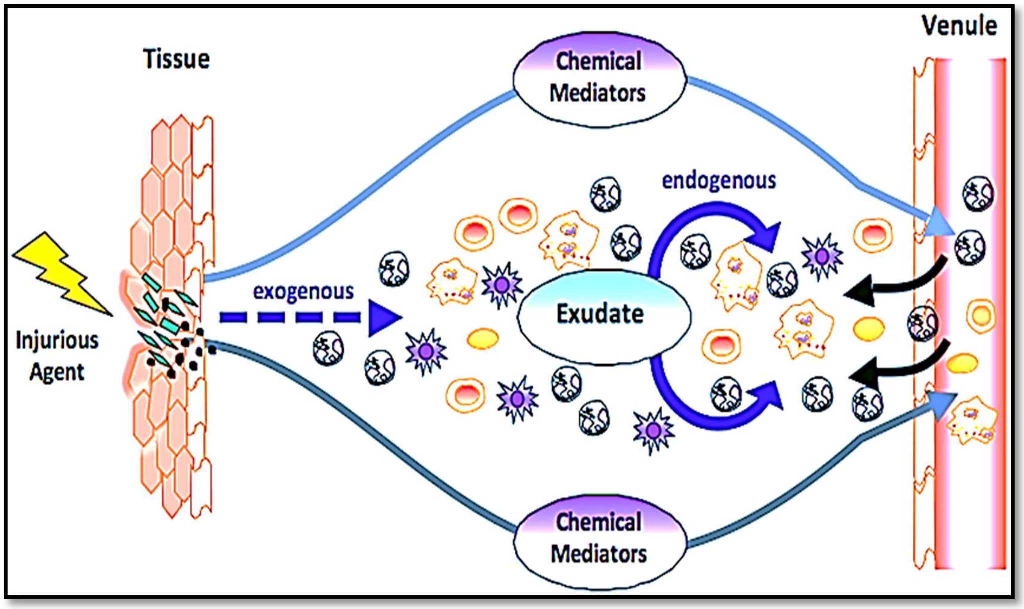

Fig.No.4: Role of chemical mediators in the aute inflammatory response

2.4 Pathophysiological Mechanisms [16-18]

At the tissue level, both acute and chronic inflammation involve a sequence of interrelated events: alterations in blood flow and vessel diameter, changes in vascular permeability, leukocyte migration, adhesion, and phagocytosis. Key inflammatory mediators include vasoactive amines (such as histamine and serotonin), plasma proteases (including components of the complement system, bradykinin, and coagulation factors), and metabolites of arachidonic acid (primarily prostaglandins, thromboxanes, and leukotrienes). Additional mediators encompass reactive oxygen species, interleukins (notably IL-1 and IL-4), chemokines (such as IL-8), and matrix metalloproteinases, all of which contribute to the inflammatory milieu.[19]

2.5 Inflammation and Cancer: The Interconnected Pathways[20]

The relationship between inflammation and cancer is complex and multifaceted. Inflammatory responses share several mechanisms with the processes of tumor development and progression. Inflammatory cells, including macrophages and neutrophils, produce cytokines and chemokines that can promote tumor growth, angiogenesis, and metastasis. Notably, the following points highlight this relationship:

Cytokine Profiles: Certain cytokines, such as tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6), are associated with both inflammation and tumor development. Polymorphisms in cytokine genes can influence an individual's susceptibility to cancer.

Chronic Inflammation: Persistent inflammation creates a microenvironment conducive to tumor growth, often termed the "inflammatory milieu." This environment can enhance cellular proliferation and inhibit apoptosis, thus favoring cancer progression.

Therapeutic Implications: The development of cytokine and chemokine antagonists has emerged as a promising strategy for targeting inflammatory pathways in cancer therapy. Early clinical applications of TNF antagonists have shown efficacy in reducing inflammation and potentially mitigating tumor growth.

In summary, the interplay between antioxidants, oxidative stress, and inflammation is critical in understanding the etiology of various diseases, particularly degenerative conditions and cancer. Continued research is essential to elucidate these mechanisms further and to develop effective therapeutic strategies leveraging the protective roles of antioxidants.

3. PLANT PROFILE

3.1. Plant Profile of Cayratia trifolia[21]

Cayratia trifolia is a perennial vine belonging to the grape family (Vitaceae).

Description of plant Cayratia trifolia[22]

Growth Habit: A climbing vine that can grow up to 10 meters long, often using other plants or structures for support.

Leaves: The leaves are trifoliate (three leaflets) with a simple, lobed shape. They are typically dark green, glossy, and can measure about 3-12 cm in length.

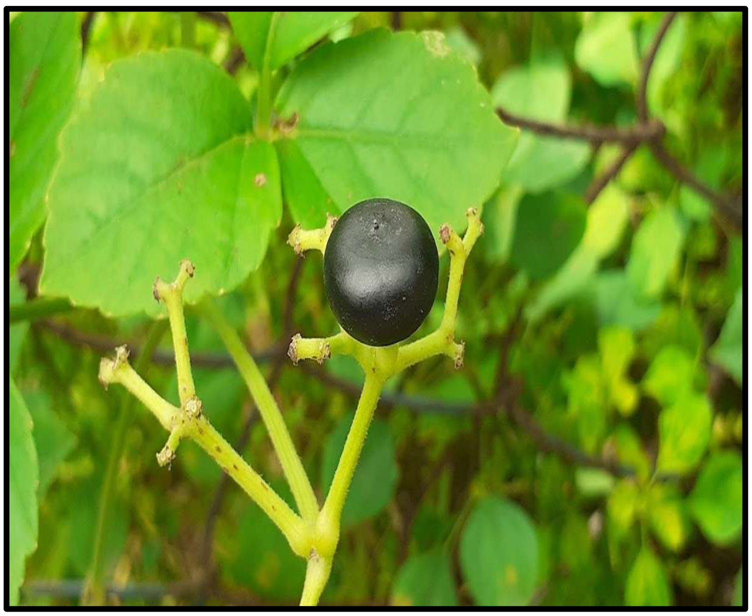

Fig.No.5 Plant profile of Cayratia trifolia

Flowers: Small, greenish-white flowers that are usually borne in clusters. They are not very showy but attract various pollinators.

Fruits: The fruit is a small berry, usually round, turning from green to black or dark purple when ripe. The berries are edible but can be somewhat astringent.

Medicinal uses of Cayratia trifolia

Culinary: The berries can be eaten, although they may require processing to improve flavor.
Medicinal: Some traditional uses include treatment for various ailments, though specific

medicinal properties are not well-documented.

Ornamental: It can be used for ground cover or as a climbing plant in gardens.

3.2 Plant profile of Alternanthera Sessilis [23-25]

Alternanthera sessilis is a perennial herb commonly known as **Sessile Joyweed** or **Mara Kanchi**.This classification situates **Alternanthera sessilis** within the Amaranthaceae family, highlighting its relationship with other plants in the order Caryophyllales.

Description

Growth Habit: A sprawling or erect herbaceous plant that can reach heights of about 30-60 cm.
Leaves: The leaves are ovate to elliptical, typically measuring 3-10 cm long. They are usually green, sometimes with a reddish tint, and have a smooth or slightly wavy margin.
Flowers: Small, inconspicuous, white to pale purple flowers clustered in axillary or terminal

Fig.No.6: Plant profile of Alternanthera Sessilis

spikes. The flowering season can vary but is often year-round in suitable climates.
Fruits: The fruit is a small, hard capsule that contains seeds. Seeds are dispersed by water or animals.[26]
Medicinal: Traditionally used in folk medicine for various ailments, including digestive issues and inflammation. However, more research is needed to validate these uses.

4. Results and Discussion

4.1 Extractive value

The extracts were derived from Sesbania grandiflora, yielding the following percentages: 1.21% for petroleum ether, 2.46% for chloroform, and 13.32% for methanol. Similarly, the extracts from Cayratia trifolia were obtained with the following percentages: 0.89% for petroleum ether, 3.6% for chloroform, and 16.63% for methanol (see Table 1).
Table No. 1 Extractive values (% w/w yield) of plant material with different solvents.

Plant Extract	**% of extract obtained**	
	Cayratia trifolia	**Alternanther sessilis**
Petroleum ether	1.22	1.20
Chloroform	2.47	2.54
Methanol	13.33	13.31

Table No. 2 Phytochemical analysis of different extracts of pods of Cayratia trifolia & Alternanther sessilis.

Test for Phyto -constituents	**Testname**	**Plant Extracts**					
		Cayratia trifolia			**Alternanther sessilis**		
		Pet ether	Chloroform	Methanol	Pet ether	Chloroform	**Methanol**
Testfor Sterols	Salkovaski TestLiberman test	+	-	-	+	-	-
Testfor Glycosides	β-naptholtest	-	-	+	-	-	+
Test forAlkaloids	Dragendorff test,Mayer’stest, Wagner’stest, Hager’stest	-	-	-	-	+	-
Testfor Triterpenoids	Libermann-Burchardtest	+	+	-	+	-	-
Test for Flavonoids	ShinodhaTest Antimony trichloridetest Ferric chloride test	-	-	+	-	-	+
Testfor Anthraquinones	Juglonetest	-	-	-	-	-	-
Test for Carotenoids	Ferric chloridetest, Matchstick test	-	-	-	-	-	-
Testfor Tannins	Carr-pricetest	-	-	+	-	-	+

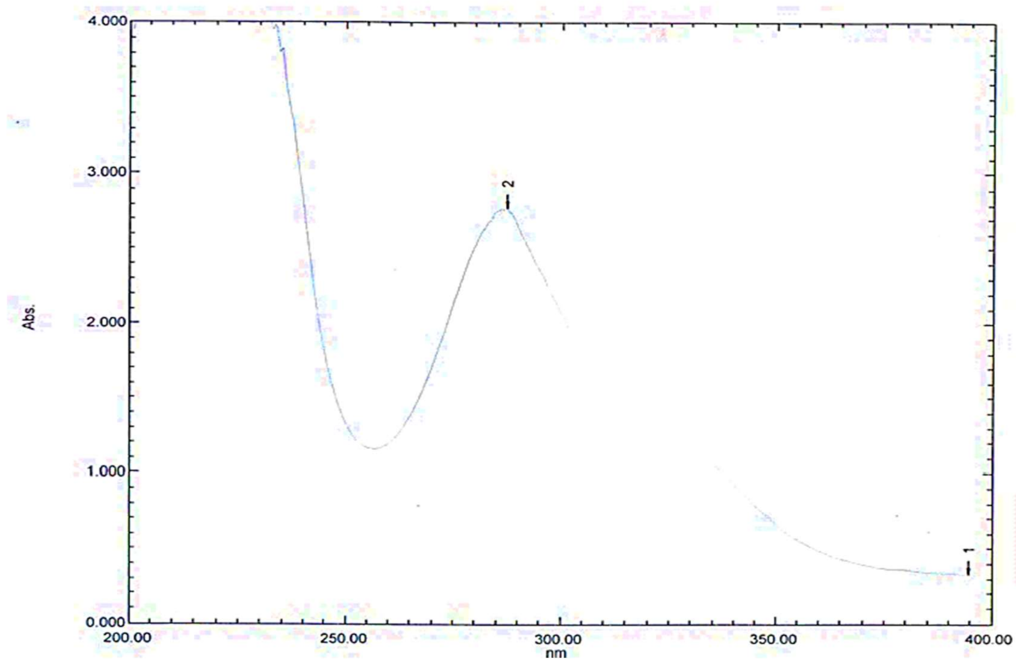

Fig.No.7: UV Graph of Cayratia trifolia & Alternanther sessilis

+ indicate Positive test - indicate Negative test

4.2 Charecterization of Cayratia trifolia & Alternanther sessilis (Sample No. 1)

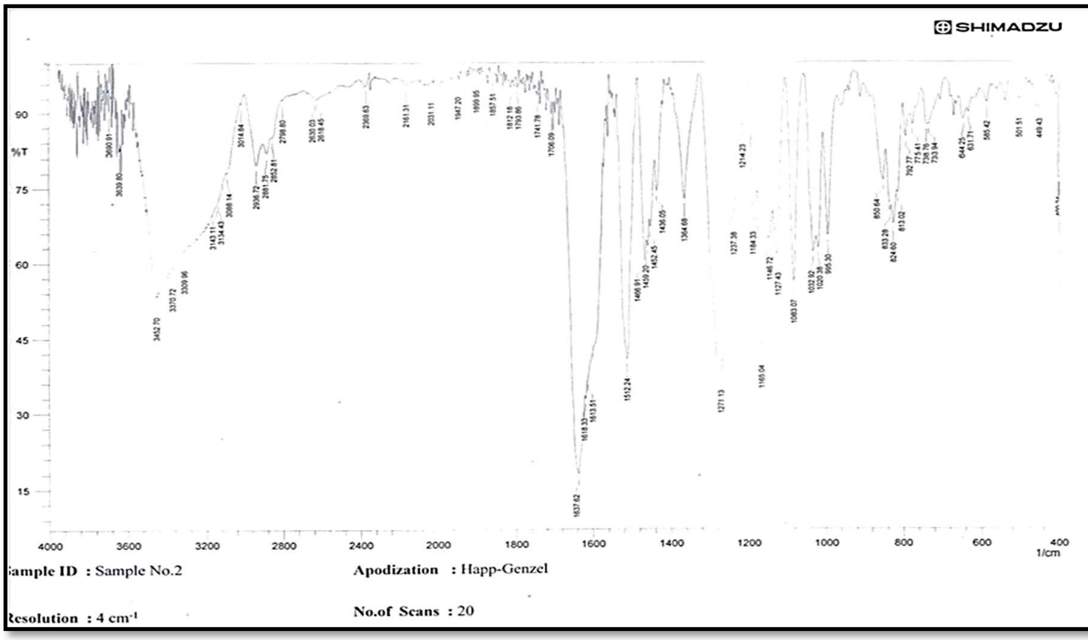

Fig.No.8: FTIR Graph of Cayratia trifolia & Alternanther sessilis

Table No.3: Interpretation of FTIR data of 5,7– dimethyl flavanone Cayratia trifolia & Alternanther sessilis (Sample No. 2)

S.No.	Range IR (KBr cm^{-1})	Detection of Group
01	**3088.14**	C-H stretching for aromatic compounds
02	**1637.62**	C=O stretching for ketones)
03	**2936.72**	C-H stretching for alkanes
04	**1165.04**	C-O stretching for ethers
05	**1512.24**	C=C stretching for aromatic structures

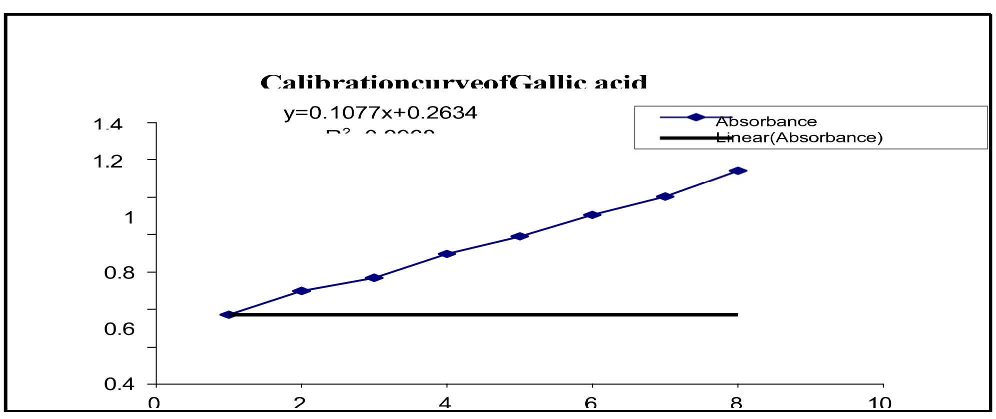

Fig.No.9: Calibration curve for Gallic acid

Table No.4: Calibration Curve data of Gallic acid

Sr.No.	Concentration(µg/ml)	Absorbance
1	1	0.373
2	2	0.497
3	3	0.566
4	4	0.698
5	5	0.790
6	6	0.903
7	7	1.004
8	8	1.146
9	**Methanol Extract of *Cyratia trifolia* & *Alternanther sessilis***	1.353

4.3 Tail flick latency period induced writhing in mice

The administration of petroleum ether (100 mg/kg, p.o.) and methanol extracts (100 mg/kg, p.o.) of Cayratia trifolia and Alternanthera sessilis resulted in significant inhibition of nociception in rats, with reductions of 21.22% and 16.40%, respectively. In contrast, higher doses of petroleum ether (400 mg/kg, p.o.) and methanol extracts (400 mg/kg, p.o.) led to smaller effects, with reductions of 8.15% and 4.54%, respectively. Diclofenac treatment (5 mg/kg, p.o.) significantly decreased pain perception by 39.38% (see Table 10 and Fig. 9). Similarly, the petroleum ether (100 mg/kg, p.o.) significantly reduced nociception in rats by 24.93% and 17.05%, respectively. When administered at higher doses (400 mg/kg, p.o.), the petroleum ether and methanol extracts resulted in reductions of 12.97% and 7.04%, respectively. Diclofenac treatment (5 mg/kg, p.o.) also significantly inhibited pain perception by 39.38% .

Table No.5: Effect of *Cayratia trifolia & Alternanther sessilis* extracts in tail flick latency period.

Group	Treatment (mg/kg)	Tail flick latency(ins)	%Analgesia
I	Control	4.10±0.34	------
II	Diclofenac(05)	8.25±0.88**	39.27
III	Pet.Ether(100)	6.40±0.22*	21.11
IV	Pet.Ether(200)	6.00±0.31*	17.40
V	Pet.Ether(400)	5.08±0.41**	08.04
VI	Methanol(100)	5.87±0.28*	16.39
VII	Methanol(200)	5.05±0.32*	08.07
VIII	Methanol(400)	4.60±0.21*	04.43

Data were evaluated using ANOVA and presented as Mean ± SEM (n = 5). Dunnett's test was employed, with differences between means considered significant at * (P < 0.05) and ** (P < 0.01).

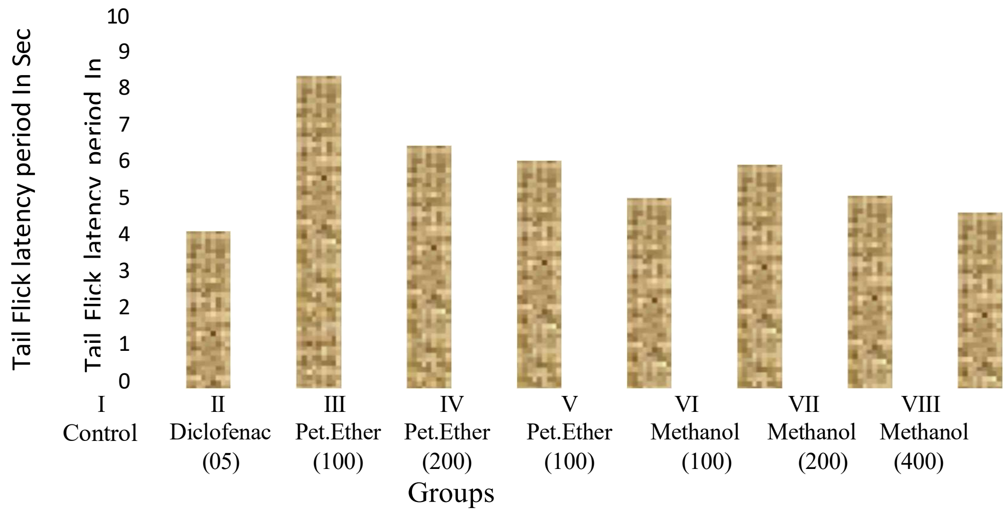

Fig.No.10 Effect of *Cayratia trifolia & Alternanther sessilis* extracts in tail flick latency period.

Discussion

This study investigates the pharmacological properties of three plant species: *Sesbania grandiflora*, *Cayratia trifolia*, and *Alternanthera sessilis*, which are prominently utilized in Ayurvedic medicine for treating a variety of ailments, including inflammation, infections, and digestive issues such as abscesses and hemorrhoids. The authentication of these plant materials confirmed their botanical identity, and a thorough physicochemical analysis was conducted in accordance with World Health Organization (WHO) guidelines, thereby affirming the purity and suitability of the samples for further study.Phytochemical screening revealed a diverse array of bioactive compounds present in the extracts of these plants, including steroids, flavonoids, tannins, and other minor constituents. These compounds are often associated with significant biological activities and contribute to the therapeutic potential of the plants.Total phenolic content was quantitatively assessed in the methanolic extracts, revealing values of 50.72% w/w for *Sesbania grandiflora*, 38.04% w/w for *Cayratia trifolia*, and *Alternanthera sessilis*.The analgesic and anti-inflammatory activities of these extracts were evaluated through a series of in vivo and in vitro experiments.In addition, the tail flick latency test, which assesses central analgesic activity, revealed significant inhibition of nociception following treatment with the extracts. The observed effects suggest a multifaceted mechanism of action, possibly involving the modulation of pain pathways and the release of endogenous analgesic substances.

Conclusion

The extensive pharmacological evaluation of *Sesbania grandiflora*, *Cayratia trifolia*, and *Alternanthera sessilis* confirms their multifaceted therapeutic potential, substantiating their historical applications in traditional medicine. The findings advocate for a renewed interest in these plants, particularly in light of contemporary health challenges such as inflammation, infection, and chronic diseases. The integration of traditional knowledge with modern scientific methodologies holds great promise for the development of effective, natural remedies that can contribute significantly to global health solutions. Through continued research and exploration, these plants may serve as a foundation for innovative treatments that address unmet medical needs.

Conflict of Interests The authors have no conflict of interests.

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