Journal of Pharmaceutics and Drug Research
JPDR, 8(1): 867-873
www.scitcentral.com
ISSN: 2640-6152
Original Research Article: Open Access

Phytochemical Evaluation of *Cassia alata*, *Trachelospermum jasminoides* and *Caesalpinia pulcherrima*

Ravi Kumar A[1*], Srikala Kamireddy[1], V Raja Rajeswari Kola[1], Ch Vidyulatha[1], Shabana Parveen[1], CHKVLSN Anjana Male[2], Ch Supriya[3], Gundapanen Naga Jaya Krishna Prasad[4] and Vankayala Lakshmi Kalyan[5]

*[*1]Nimra College of Pharmacy, Vijayawada, AP, India*

[2]NIMS Institute of Pharmacy, NIMS University, Jaipur, RJ, India

[3]KVSR Siddhartha College of Pharmaceutical Sciences, Vijayawada, AP, India

[4]Nirmala College of Pharmacy, Mangalagiri, AP, India.

Received October 29, 2024; Revised Novermber 09, 2024; Accepted November 10, 2024

ABSTRACT

Phytochemical Profile of Selected Plant Species *Cassia alata, Trachelospermum jasminoides,* and *Caesalpinia pulcherrima*. A comprehensive phytochemical profile was conducted for three selected plant species *Cassia alata, Trachelospermum jasminoides*, and *Caesalpinia pulcherrima*. This study involved several analytical approaches, including the assessment of crude dry powder, ash values, solubility, extractive values, and the analysis of phytochemicals and mineral contents. Various solvents were employed to extract the phytochemicals effectively from the chosen plants.

Keywords: Phytochemical Profile of Selected Plant Extracts: *Cassia alata, Trachelospermum jasminoides*, and *Caesalpinia pulcherrima*

This study focuses on the phytochemical profiles of *Cassia alata, Trachelospermum jasminoides*, and *Caesalpinia pulcherrima*. It involves the analysis of various plant extracts to identify their chemical constituents and potential health benefits.

INTRODUCTION

Understanding the chemical constituents of plants is crucial not only for the identification of therapeutic agents but also for uncovering sources of economically valuable materials such as tannins, oils, and gums. Additionally, this knowledge can provide insights into the true efficacy of traditional remedies.

Numerous phytochemical surveys have been conducted, often employing a random sampling method to collect various plant accessions from around the globe. These surveys have primarily focused on key chemical substances like alkaloids, while essential oils have also been noted. The current study aims to identify the biologically active compounds that contribute to the flavor, color, and other distinctive characteristics of the selected plants **(Figure 1)**.

Corresponding author: A Ravi Kumar, Department of Pharmacognosy, Nimra College of Pharmacy, Vijayawada, AP 421456, India, Tel: 9849413904; E-mail: karavi315@gmail.com

Citation: Kumar RA, Kamireddy S, Kola VRR, Vidyulatha Ch, Parveen S, et al. (2025) Phytochemical Evaluation of *Cassia alata, Trachelospermum jasminoides* and *Caesalpinia pulcherrima*. J Pharm Drug Res, 8(1): 867-873.

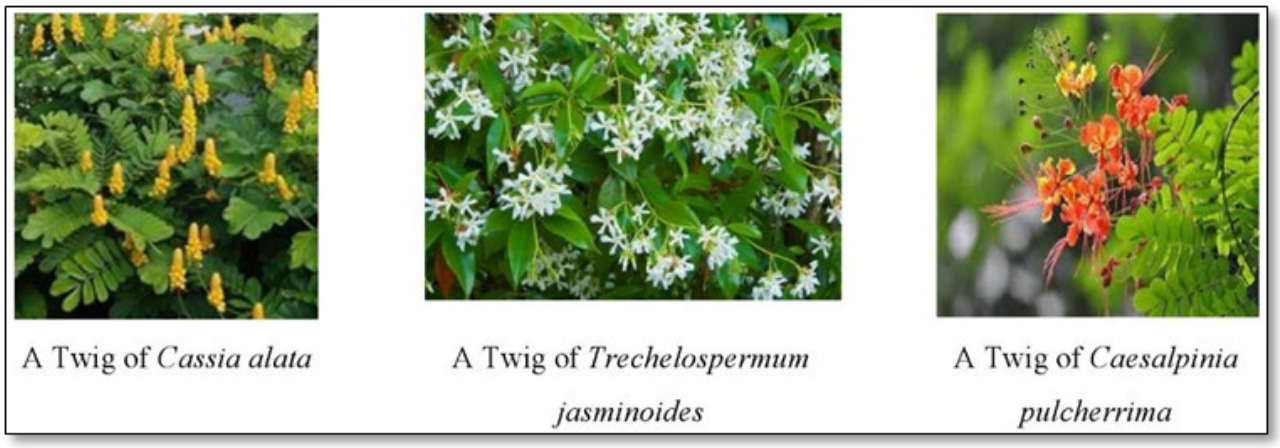

Figure 1. Images of twigs.

MATERIALS AND METHODS

Roots of three plant species-*Cassia alata, Trachelospermum jasminoides*, and *Caesalpinia pulcherrima*-were authenticated and collected from Coastal Andhra Pradesh India. The plant materials were ground into a fine powder using a Wiley mill. The crude dried powders were then extracted separately with ethanol and water. The extracts were concentrated under reduced pressure at 50°C and subsequently suspended in water. Further fractionation was performed using solvents such as hexane, benzene, chloroform, methanol, and water. The chemical evaluation also included the determination of extractive values soluble in benzene, chloroform, hexane, water, and ethanol [1].

PHYTOCHEMICAL SCREENING

Alkaloid Determination

Approximately 5 gms of the sample was weighed and placed into a 250 ml beaker. Then, 200 ml of 10% acetic acid in ethanol was added to the beaker. The mixture was covered and allowed to stand for 4 h. After this period, the mixture was filtered, and the extract was concentrated on a water bath to reduce the volume to one-quarter of the original. Concentrated ammonium hydroxide was then added dropwise to the extract until the precipitate completely dissolved. The solution was allowed to settle, and the resulting precipitates were washed with dilute ammonium hydroxide and filtered. Finally, the alkaloid residue was dried and weighed [2].

Tannin Determination

Approximately 500 mg of the sample was placed into a 59 ml plastic bottle. To this, 50 ml of distilled water was added, and the mixture was shaken for 1 h using a mechanical shaker. The solution was then filtered into a 50 ml volumetric flask and brought up to the mark with distilled water. A 5 ml aliquot of the filtered solution was pipetted into a test tube and combined with 2 ml of 0.1 M ferric chloride in 0.1 N hydrochloric acid and 0.008 M potassium ferrocyanide. The absorbance was measured at 420 nm within 10 min.

Saponin Determination

The samples were ground, and 20 g of each was placed in a conical flask, followed by the addition of 100 ml of 20% aqueous ethanol. The mixture was heated in a hot water bath for 4 h with continuous stirring at approximately 55°C. After filtering, the residue was re-extracted with an additional 200 ml of ethanol. The combined extracts were concentrated to 40 ml over a water bath at about 90°C. This concentrate was transferred to a 250 ml separatory funnel, and 20 ml of diethyl ether was added and shaken vigorously. The aqueous layer was collected, and the ether layer was discarded. This purification step was repeated, and then 60 ml of n-butanol was added. The combined n-butanol extracts were washed twice with 10 ml of 5% aqueous sodium chloride. The remaining solution was heated in a water bath, and after evaporation, the samples were dried in an oven until constant weight was achieved, allowing for content determination.

Flavonoid Determination

For the flavonoid analysis, about 10 g of the plant sample was extracted repeatedly with 100 ml of 80% aqueous methanol at room temperature. The entire solution was filtered through Whatman filter paper No. 42 (125 mm), and the filtrate was transferred to a crucible, where it was evaporated to dryness over a water bath and weighed until a constant weight was achieved.

Total Phenolic Compound Determination

To extract the phenolic compounds, the fat-free sample was boiled with 50 ml of ether for 15 min. From this extract, 5 ml was pipetted into a 50 ml flask, followed by the addition of 10 ml of distilled water. Then, 2 ml of ammonium hydroxide solution and 5 ml of concentrated amyl alcohol

were added. The samples were brought to volume and left to react for 30 min to develop color. The absorbance was then measured at 505 nm using a spectrophotometer [3].

RESULTS AND DISCUSSION

The current study conducted on the three plant samples-*Cassia alata, Trachelospermum jasminoides*, and *Caesalpinia pulcherrima*-demonstrated the presence of bioactive medicinal constituents. **Table 1** presents the chemical composition of these three plants.

Table 1. Analysis of Crude Dried Powder of Selected Plant Species.

Plant	Total ash	Water Soluble ash	Alkalinity For water Soluble ash	Acid Insoluble ash	pH 1%; Aqueous solution	Loss on drying 110°C
Cassia alata	NLT6.03	NLT2.93	0.37	NLT0.71	6.2	NMT4%w/w
Trachelospermum Jasminoides	NLT6.30	NLT1.97	0.51	NLT0.69	7.4	NMT10%w/w
Caesalpinia pulcherrima	NLT7.04	NLT2.81	0.29	NLT0.54	6.3	NMT4%w/w

NLT: Not Less Than; NMT: Not More Than

Essential minerals, including sodium, magnesium, chloride, and sulfate, were identified in all the plant species examined; however, no traces of iron were detected (**Table 2**).

Table 2. Mineral Composition of Selected Plant Species.

Plant	Calcium	Sodium	Iron	Magnesium	Chloride	Sulphate
Cassia alata	+	+	NT	+	+	+
Trachelospermum Jasminoides	+	+	NT	–	+	+
Caesalpinia pulcherrima	+	+	NT	+	+	+

NT: Not Traceable

The quantitative estimates of the percentages of carbohydrates, total polysaccharides, and tannic acid for the studied plants are summarized in **Table 3**.

Table 3. Percentage of Crude Polysaccharides, Carbohydrates, and Tannins in the Selected Plants.

Plant	Polysaccharide	Carbohydrate	Tannin
Cassia alata	9.1 mg	11.3 mg	68 mg
Trachelospermum Jasminoides	12.2 mg	14.2 mg	28.1 mg
Caesalpinia pulcherrima	15.2 mg	13.4 mg	27 mg

The crude extracts of the test samples were analyzed using five different extraction methods, with the results summarized in **Table 4**.

Table 4. Extractive Values of Selected Plants in Various Solvents.

Plant	Benzene extractive values (%)	Chloroform extractive values (%)	Water soluble extractive values (%)	Ethanol soluble extractive values (%)
Cassia alata	NMT 2.1689	NMT 3.09431	NMT 10.22825	NMT 14.1971
Trachelospermum Jasminoides	NMT 10.22721	NMT 12.71425	NMT 19.8728	NMT 4.7173
Caesalpinia pulcherrima	NMT 3.07924	NMT 3.43076	NMT 7.53356	NMT 13.849

NMT: Not More Than

Phytochemical screening of the three plants extracted using hexane, chloroform, ethanol, and water was conducted, and the results are presented in **Table 5**. The analysis revealed that the plants are rich in alkaloids and tannins, both of which are recognized for their medicinal properties and physiological activities [4].

Table 5. Qualitative Analysis of Phytochemicals in Selected Plants Using Various Solvents.

Plant	Extract	Saponin	Anthraquinone	Flavonoid	Protein	Carbohydrate	Terpene
Cassia alata	Hexane	-	-	++	-	-	+
	Benzene	-	-	++	-	-	+
	chloroform	-	++	+++	-	-	-
	Ethanol	++	-	+	+	+	+
	Water	+	-	-	+	+	-
Trachelospermum Jasminoides	Hexane	-	-	-	-	-	+
	Benzene	-	-	++	-	-	+
	chloroform	-	++	+++	-	-	-
	Ethanol	++	++	+	+	+	+
	Water	+	-	-	+	+	-
Caesalpinia pulcherrima	chloroform	-	-	+++	-	-	-
	Ethanol	+	+	++	+	+	-
	Water	+	-	-	+	+	-

+: Present; -: Absent

The plants examined in this study may serve as a valuable source of therapeutic agents. Ongoing research aims to isolate, identify, characterize, and elucidate the structures of the bioactive compounds present in these species [5].

CONCLUSION AND SUMMARY

The selected plants were examined for their phytochemical constituents, as detailed in the tables. Additional research is ongoing to focus on the isolation and structural determination of the chemical constituents found in these plants [6,7].

CASSIA ALATA

Cassia alata, known as the ringworm shrub or candle bush, is a flowering plant in the legume family (Caesalpiniaceae).

Botanical Classification

- **Family:** Caesalpiniaceae

- **Genus:** Cassia
- **Species:** *C. alata*
- **Authority:** Linn.

Description

- **Growth Habit:** This perennial shrub typically reaches heights of 1 to 3 meters (3 to 10 feet) and has an upright growth form.
- **Leaves:** The leaves are large, compound, and pinnate, comprising 5 to 8 ovals to oblong leaflets with a glossy green appearance.
- **Flowers:** It features bright yellow flowers that grow in clusters, each having five petals, resembling candles.
- **Fruit:** The fruit is a flattened pod, up to 10 cm long, containing several seeds that turn brown upon maturity.

Habitat and Distribution

- **Native Range:** *C. alata* is indigenous to tropical regions of the Americas, especially in Mexico, Central America, and parts of South America.
- **Habitat:** It thrives in tropical climates, often found in disturbed areas, roadsides, and gardens.

Uses

- **Medicinal:** Traditionally, it has been utilized in herbal medicine for its antifungal properties, particularly in treating skin conditions like ringworm. The leaves may be applied topically.
- **Ornamental:** Its vibrant flowers make it popular in landscaping, attracting pollinators such as bees and butterflies.
- **Soil Improvement:** As a legume, it fixes nitrogen in the soil, enhancing fertility.

Cultivation

- **Soil Requirements:** Prefers well-drained soils and can tolerate a variety, including sandy and clay types.
- **Light:** Best grown in full sun but can tolerate partial shade.
- **Watering:** Moderate watering is ideal; it exhibits some drought tolerance once established.
- **Propagation:** Can be propagated from seeds or cuttings, with seeds requiring scarification (scratching or soaking) to improve germination rates.

Potential Issues

- **Invasiveness:** In certain regions, *C. alata* can be invasive, outcompeting native species. Caution is advised when planting in non-native environments.

Cultural Significance

In various cultures, *Cassia alata* is symbolically significant and is often included in traditional rituals and practices.

This plant combines aesthetic appeal with practical uses, making it a valuable addition to gardens and landscapes, particularly in tropical regions.

TRACHELOSPERMUM JASMINOIDES

Trachelospermum jasminoides, commonly referred to as star jasmine or confederate jasmine, is a perennial vine belonging to the Apocynaceae family.

Botanical Classification

- **Family:** Apocynaceae
- **Genus:** Trachelospermum
- **Species:** *T. jasminoides*
- **Authority:** (L.) Decne.

Description

- **Growth Habit:** This evergreen vine can grow up to 10 meters (approximately 33 feet) long, exhibiting a twining or trailing habit. It is also used as ground cover.
- **Leaves:** The leaves are glossy, dark green, oval-shaped, and typically range from 3 to 8 cm (1 to 3 inches) in length, arranged oppositely on the stem.
- **Flowers:** Star jasmine produces small, fragrant, star-shaped white flowers, often with a yellow center. These flowers bloom in clusters during late spring and summer, attracting various pollinators like bees and butterflies.
- **Fruit:** After flowering, the plant produces slender, elongated pods containing seeds.

Habitat and Distribution

- **Native Range:** *T. jasminoides* is native to East Asia, particularly China and Japan, but it has become widely popular in gardens around the world.
- **Habitat:** It thrives in warm, subtropical to tropical climates and is commonly found in gardens, as ground cover, or climbing on trellises and walls.

Uses

- **Ornamental:** The plant is prized for its attractive foliage and fragrant flowers, making it a popular choice for landscaping. It's often used to cover fences, trellises, and arbors, as well as in container gardening.

- **Fragrance:** The sweet scent of the flowers makes it a desirable addition to gardens, enhancing sensory experiences and attracting pollinators.

Cultivation

- **Soil Requirements:** Prefers well-drained soil and can tolerate various soil types, thriving in slightly acidic to neutral pH levels.
- **Light:** Grows best in full sun to partial shade, with more prolific blooming in full sun.
- **Watering:** Requires moderate watering, keeping the soil consistently moist but not waterlogged. It is relatively drought-tolerant once established.
- **Propagation:** Can be propagated via cuttings, layering, or seeds, with semi-hardwood cuttings taken in late summer or early fall being the most successful method.

Maintenance

- **Pruning:** Pruning is recommended to maintain shape and promote healthy growth, typically done after flowering.
- **Pest and Disease Resistance:** Generally resistant to pests and diseases, though it can occasionally be affected by aphids or spider mites.

Potential Issues

- **Invasiveness:** In some warmer climates, *T. jasminoides* may become invasive, so monitoring its growth and managing its spread is essential.
- **Allergies:** The fragrance of the flowers may trigger allergies in sensitive individuals.

Cultural Significance

In various cultures, *Trachelospermum jasminoides* is associated with love and romance due to its fragrant flowers. It may also have traditional medicinal uses, though further research is needed to validate these applications.

This versatile and attractive plant enhances gardens with its beauty and fragrance, making it a valuable addition to landscapes in suitable climates.

CAESALPINIA PULCHERRIMA

Caesalpinia pulcherrima, known as the peacock flower or pride of Barbados, is a vibrant flowering plant in the Caesalpiniacea family.

Botanical Classification

- **Family:** Caesalpiniaceae
- **Genus:** Caesalpinia
- **Species:** *C. pulcherrima*
- **Authority:** (L.) Sw.

Description

- **Growth Habit:** This perennial shrub or small tree can reach heights of 1 to 3 meters (3 to 10 feet) and may spread wider, forming a rounded or upright shape.
- **Leaves:** The leaves are pinnate, featuring numerous small leaflets that create a feathery look. They are typically bright green, enhancing the plant's ornamental appeal.
- **Flowers:** Known for its striking, showy flowers, *C. pulcherrima* can produce blooms in red, orange, or yellow. The flowers have five petals, with the upper two being upright and the three lower petals larger and drooping. These clusters attract various pollinators, including hummingbirds and butterflies.
- **Fruit:** The plant produces flat pods, containing several seeds, which can grow up to 10 cm (4 inches) long and turn brown when mature.

Habitat and Distribution

- **Native Range:** *C. pulcherrima* is native to the tropical regions of the Americas, particularly the Caribbean and parts of Central and South America.
- **Habitat:** It thrives in warm tropical and subtropical climates, often found in gardens, open areas, and landscapes.

Uses

- **Ornamental:** This plant is popular in landscaping for its vibrant flowers and foliage, commonly used in gardens, parks, and as street trees.
- **Traditional Medicine:** In various cultures, parts of the plant have been used in traditional remedies for ailments such as fevers and digestive issues, although scientific backing for these uses is limited.
- **Shade and Erosion Control:** Its broad canopy provides shade, and its root system helps prevent soil erosion.

Cultivation

- **Soil Requirements:** Prefers well-drained soil and can tolerate various types, including sandy and clay soils.
- **Light:** Grows best in full sun, which promotes flowering and healthy growth.
- **Watering:** Requires moderate watering; drought-tolerant once established but benefits from regular moisture during dry periods.
- **Propagation:** Can be propagated from seeds or cuttings; seeds may need scarification for better germination.

Maintenance

- **Pruning:** Regular pruning helps maintain shape and encourages healthy growth, typically done after flowering.

- **Pest and Disease Resistance:** Generally resistant to pests and diseases, but can occasionally face issues with aphids or whiteflies.

Potential Issues

- **Invasiveness:** In some regions, particularly warmer climates, *C. pulcherrima* can become invasive, outcompeting native plants. Careful management is advised when planting.

- **Allergies:** The pollen may cause allergic reactions in sensitive individuals.

Cultural Significance

C. pulcherrima is often associated with beauty and resilience in various cultures, frequently appearing in traditional art and folklore [1-3].

ACKNOWLEDGEMENTS

The authors express their gratitude to everyone who contributed to the completion of the plant analysis.

REFERENCES

1. Abubakar I, Mann A, Mathew J (2015) Phytochemical composition, antioxidant and anti-nutritional properties of root-bark and leaf methanol extracts of *Senna alata* L. grown in Nigeria. Afr J Pure Appl Chem 9: 91-97.

2. Zhang J, Yin ZQ, Liang JY, Diao YJ (2012) Chemical constituents from petroleum ether extract of Trachelospermum jasminoids Chin. Tradit Pat Med 34: 1939-1942.

3. Srinivas KVNS, Rao YK, Mahender I, Das B, Krishna KVSR, et al. (2003) Flavonoids from *Caesalpinia pulcherrima*. Phytochemistry 63: 789-793.

4. Kumar AR, Subburathinam KM, Prabakar G (2007) Phytochemical Screening of Selected Medicinal Plants from the Asclepiadaceae Family. Asian J Microbiol Biotechnol Environ Sci 9(1): 177-180.

5. Saralla RP, Narendran R, Rani UV, Sridharan K, Brindha P (2012) Pharmacognostic Standards for the Diagnosis of *Pentatropis capensis* (Asclepiadaceae), a Plant Drug Used in Indian Medicine. Int J Pharm Pharm Sci 4(2)Supp2: 91-96.

6. Chandrasekaran K, Suseela L (2011) Anti-Inflammatory Activity of Ethanolic Extracts of *Pentatropis capensis* and *Sarcostemma secamone*. Int J Pharm Bio Sci 2(4): 77-80.

7. Nirmala K, Bonthu MG, Vegesna KR, Varma H, Naidu SK (2012) Phytochemical, Antifungal, Antimicrobial, and Antioxidant Studies on Whole Plant Extracts of *Pentatropis capensis*. Int J Pharm Chem Biol Sci 2(4): 453-463.