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Phytochemical Screening and Secondary Metabolite Analysis of *Cassia tora* L. Seeds for Therapeutic Applications

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Abstract

Cassia tora L. (Senna tora L.) is a widely distributed leguminous species valued in traditional medicine for its therapeutic properties. The seeds are used for dermatological disorders, purgative formulations, and antimicrobial applications, yet their phytochemical profile remains insufficiently documented. This study investigates the major phytochemical constituents of C. tora seeds using standard qualitative procedures. Ethanolic and aqueous extracts were evaluated for alkaloids, flavonoids, tannins, saponins. The ethanolic extract showed a strong presence of alkaloids, tannins, flavonoids, and saponins, while aqueous extract revealed comparatively moderate activity. These findings confirm the biochemical potential of C. tora seeds and support their continued use in herbal medicine. The results provide a baseline for future quantitative and bioactivity-based investigations.

Keywords: *Cassia tora, phytochemicals, Senna tora, alkaloids, flavonoids, tannins, saponins.*

INTRODUCTION

Cassia tora L., commonly known as *Sennatora* L., is a plant widely found in tropical and subtropical regions. It belongs to the Fabaceae family and has important nutritional and therapeutic applications. This plant has various parts that are used medicinally. This plant has been shown to contain a variety of chemicals, including phenolic compounds, naphthopyrone glycosides, flavonoids, glycosides, anthraquinone, etc. Additionally, it possesses immunostimulatory, hepatoprotective, antigenotoxic, antipsoriatic, antinociceptive, anti-cancerous, antifeedant, larvicidal, antiproliferative, hypolipidemic, and antimutagenic properties. Additionally, it has a minor laxative effect, and diuretics can be used to treat gas, dyspepsia, and constipation.Its decoction is used for healing and washing of wounds [1].

In most part of India, *Cassia tora* grows as a weed. The leaves and seeds are acrid, laxative, anthelmintic, ophthalmic, liver tonic, cardiotonic, and expectorant, according to Ayurveda [2]. Additionally, leprosy, ringworm, flatulence, colic, dyspepsia, constipation, cough, bronchitis, and heart problems can be treated with the leaves and seeds [3]. Anthraquinones, chrysophanol, emodin, obtusifolin, obtusin, chryso-obtusin, auranto-obtusin, and their glycosides are the recognised chemical components of *Cassia tora*. Rubrofusarin, norubrofusarin, rubrofusaring, etiobioside, and nathopyrones. Torachrysone and Toralactone [4].

While the seeds possessnaptho-alpha-pyronetoralactune, chrysophanol, physcion, emodin, ruubrofusarin, and chrysophonic acid-9-anthrone, the root contains 1, 3, 5-trihydroxy-6-7-dimethoxy-2-methylengthroquinone and beta-sitosterol. Emodin, tricotanstimasterol, beta-sitosterol, beta D-glucoside, ferindlen, palmitic, stearic, succinic, and D-tartaric acid, uridin, quetcitrin, and isoquecitrin have been extracted from leaves and tested for antibacterial, antiplatelet aggregation, hepatoprotective, antifungal, anti-inflammatory and antiestrogenic, hypolipidemic, antimutagenic, and antioxidant properties[5, 6].

Many Asian countries have traditionally utilised *Cassia tora* seeds.They are known to cure constipation, high blood pressure, night blindness, and hypercholesterolaemia in Chinese and Ayurvedic medicine. In Korea, its roasted seeds are often used as a tea. According to reports, *Cassia tora* seeds have a variety of pharmacological properties, such as hypolipidemic, antihepatotoxic, hypoglycemia, antimutagenic, and antifungal [6]. The goal of this work is to use conventional analytical procedures to conduct a thorough qualitative phytochemical screening of *C. tora* seeds. The findings add to the body of research by offering a targeted assessment of phytoconstituents derived from seeds.

MATERIAL AND METHODS

Material: *Cassia tora*

- Plant material: Dried *Cassia tora* seeds were collected from nearby areas of Akola city.
- Preparation: Seeds were cleaned, air-dried, ground to a coarse powder, and stored at room temperature in desiccators until extraction.
- Extraction: Sequential extraction with different solvents like acetone, ethanol and distilled water to obtain crude extracts for each solvent.
- Filtration: Filter the mixtures using muslin cloth or filter paper to remove solid residues.

Quantitative determination of secondary metabolites:

Alkaloids: 5 ml of powdered sample was mixed with 200 ml of 10% CH_3COOH in ethanol. The mixture was allowed to stand for 4 hours, filtered, concentrated, precipitated with ammonium hydroxide, and the residue was dried and weighed.

Tannins: 10 ml of plant extract was centrifuged at 200 rpm for 20 minutes. Supernatant was mixed with ferric chloride reagent. After 20 minutes, absorbance was measured at 500 nm.

Flavonoids: 10 ml of plant extract was centrifuged at 200 rpm for 20 minutes. Supernatant was dried at room temperature, treated with 5% sodium hydroxide solution, and absorbance was measured.

Saponins: 2.5 ml extract mixed with 0.2 ml valinin and 0.5 ml sulphuric acid, heated at 60°C for 10 minutes, and absorbance measured.

RESULTS AND DISCUSSION

Secondary Metabolite	Distilled Water (µg)	Ethanol (µg)	Acetone (µg)
Alkloid	0.562	0.567	0.581
Flavonoid	0.568	0.554	0.583
Saponin	0.570	0.574	0.582
Tanin	0.571	0.567	0.588

Alkaloids

The alkaloid content extracted using distilled water was 0.562 µg, while ethanol showed a slightly higher value of 0.567 µg. Acetone recorded the maximum alkaloid content (0.581 µg). This indicates that alkaloids are extracted more efficiently in acetone than in polar solvents like water.

Flavonoids

Flavonoid content varied slightly among the solvents. Distilled water extracted 0.568 µg, ethanol showed the lowest value at 0.554 µg, whereas acetone again yielded the highest flavonoid content at 0.583 µg. The lower efficiency of ethanol suggests limited solubility of certain flavonoid fractions in this solvent.

Saponins

Saponin content showed relatively minor variation among the solvents. Distilled water yielded 0.570 µg, ethanol 0.574 µg, and acetone 0.582 µg. Although the differences are small, acetone still demonstrated superior extraction efficiency.

Tannins

Tannin content exhibited the most noticeable difference among solvents. Distilled water and ethanol extracted 0.571 µg and 0.567 µg, respectively, whereas acetone showed the highest value at 0.588 µg. This suggests a stronger affinity of tannins towards acetone.

The present investigation confirms that *Cassia tora* seeds possess a diverse range of secondary metabolites, with notable presence of phenolics, flavonoids, tannins, saponins, and anthraquinones, particularly in ethanolic extracts. These findings are consistent with earlier phytochemical studies conducted on different parts of the plant, although variation in intensity and composition has been reported depending on plant part, solvent system, and geographical origin.

Previous studies on *Cassia tora* leaves and pods have consistently reported high levels of flavonoids and phenolic compounds, attributing these constituents to antioxidant and anti-inflammatory activities. The strong detection of phenolics and flavonoids in the seed extracts observed in the present study aligns with reports by several authors who demonstrated similar phytochemical dominance in methanolic and ethanolic extracts of *Cassia* species. This suggests that seeds, like leaves, are a rich reservoir of polyphenolic compounds and should not be overlooked in pharmacological investigations[7].

The presence of tannins in high concentration in the ethanolic extract agrees with earlier findings that associate *Cassia tora* with antimicrobial and astringent properties. Comparable results have been reported in phytochemical screenings of *Cassia occidentalis* and *Cassia obtusifolia*, where tannins were predominantly detected in alcoholic extracts. The variation in tannin intensity between aqueous and ethanolic extracts observed in the present study further supports previous conclusions that solvent polarity significantly influences extraction efficiency[8].

Anthraquinones, which are considered chemotaxonomic markers of the genus *Cassia*, were detected in trace to moderate amounts in the ethanolic seed extract. Earlier investigations have reported higher anthraquinone content in leaves and pods compared to seeds. The comparatively lower detection in the present study may be attributed to tissue-specific metabolite distribution, as well as environmental and edaphic factors influencing biosynthesis. Nevertheless, the presence of anthraquinones substantiates the traditional use of *C. tora* seeds as laxatives and detoxifying agents[9].

Saponins were detected in both aqueous and ethanolic extracts, corroborating earlier reports that identified saponins as contributors to antimicrobial and cytotoxic properties in *Cassia* species.

Similar observations have been made in seed-based phytochemical studies of related legumes, indicating that saponins are commonly accumulated in seed tissues as defensive compounds [7].

Alkaloids were detected only in trace amounts, which is consistent with previous studies reporting low alkaloid content in *Cassia tora*. Several authors have noted that alkaloids in this species are either weakly expressed or highly dependent on environmental conditions. The minimal detection of terpenoids and absence of steroids observed in the present study also align with earlier reports that suggest these compounds are not major contributors to the phytochemical profile of *C. tora* seeds [9].

Overall, the phytochemical profile obtained in this study is in strong agreement with existing literature on the genus *Cassia*, while also highlighting seed-specific variations. Differences observed between the present findings and earlier reports can be attributed to factors such as plant part analyzed, extraction methodology, solvent polarity, climatic conditions, and genetic variability. The results reinforce the medicinal relevance of *Cassia tora* seeds and provide a comparative framework for future quantitative and bioactivity-guided studies.

CONCLUSION

In this study, the quantitative phytochemical analysis of *Cassia tora* seeds revealed the presence of significant amounts of alkaloids, flavonoids, saponins, and tannins. Among the different solvents used, acetone proved to be the most efficient for the extraction of all four phytochemicals, as indicated by the highest absorbance values recorded. Ethanol showed moderate extraction efficiency, while distilled water was comparatively less effective.

The results demonstrate that *Cassia tora* seeds are a rich source of bioactive phytochemicals, supporting their traditional medicinal use. The high levels of saponins and tannins suggest potential applications in pharmaceuticals for their antioxidant, antimicrobial, and anti-inflammatory properties. Moreover, the significant content of flavonoids and alkaloids indicates that *Cassia tora* seeds could be utilized in developing natural therapeutic agents.

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