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The Chemical and Pharmacological Diversity of Cassia Tora: A Review of Its Ingredients and Applications

Mr. Gudisi Rama Krishna, *Assistant professor, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Dr. Konathala Rajesh, *Principal Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Mr. Damu Uma Sankar, *Assistant professor, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Ms. Koppala Bhavani, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Mr. Mallapureddi Venu Babu, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Ms. Kondabattula Hema Sri, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Ms. Marrapu Divya Sri, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Mr. Manchipalli Jeswanth, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Ms. Kosuru Lakshmi Gayatri, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Mrs. Yamalapalli Ramadevi, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Ms. Mariserla Kavitha, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Ms. Kota Kavya, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Ms. Mogidi Urmila, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Mr. Kottisa Hima Kiran, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Mr. Kuna Akash, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*
Ms. Monduri Jyothsna Sruthi, *Student, Bhaskara Institute of Pharmacy, Komatipalli(V), Bobbili, Vizianagaram, Andhra Pradesh, India.*

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Abstract: *Cassia tora*, also known as *Senna tora*, is a perennial herb in the Fabaceae family, valued for its diverse medicinal properties. Traditionally used across various cultures, it is known for its laxative, anti-inflammatory, and antioxidant effects. Recent research has highlighted its potential applications in treating skin disorders, improving liver function, and exhibiting antimicrobial activity. The plant contains bioactive compounds, including flavonoids and saponins, which enhance its therapeutic effects. However, further clinical trials are necessary to comprehensively assess its pharmacological efficacy and safety. Overall, *Cassia tora* holds promise for continued exploration in the field of phytotherapy.

Keywords: *Cassia tora*, *Senna tora*, Medicinal properties, Laxative, Anti-inflammatory, Antioxidant, Skin disorders, Liver function, Antimicrobial, Phytotherapy.

1. Introduction:

Cassia tora Linn., a member of the Leguminosae family, is an annual shrub that thrives in tropical regions and holds significant value in traditional medicine. The World Health Organization (WHO) reports that approximately 80% of individuals in developing countries rely primarily on traditional herbal remedies for healthcare, highlighting the importance of plants like *Cassia tora* in providing accessible health solutions. This plant is widely

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recognized for its medicinal properties, particularly its laxative and anti-inflammatory effects, making it a valuable resource in traditional healthcare systems. As interest in herbal medicine grows, *Cassia tora* stands out as a key candidate for further research and potential integration into modern medicinal practices. It is increasingly acknowledged for its therapeutic properties in traditional medicine worldwide—notably for liver health in Korea, and for treating various ailments in Indian and Chinese medicine, including fatigue, diuretic effects, high blood pressure, and eye disorders. The growing interest in herbal remedies that complement nutrition while delivering health benefits underscores *Cassia tora*'s relevance as a valuable herbal resource in contemporary healthcare. There appears to be some confusion between *C. tora* and *C. tora* Linn (or *Cercis tora*, actually a type of redbud tree). Based on your initial reference, a species known as *Cressa tora* or *C. tora*, belonging to the Apocynaceae family and native to tropical regions, is often used in traditional medicine across several countries.

Safety and Toxicity Studies

Studies of *Cassia tora* extracts have demonstrated that both ethanol and methanol extracts are safe at doses up to 2000 mg/kg body weight in Sprague Dawley rats and Swiss albino mice after 13 weeks of both consecutive and acute oral administration. These results suggest a favorable safety profile for the extracts, indicating their potential for therapeutic use. Nonetheless, further research is needed to examine long-term effects and establish safety parameters in humans prior to clinical application.

Phytochemistry

The presence of saponins, terpenoids, tannins, flavonoids, phenols, and steroids indicates a broad spectrum of bioactive phytochemicals commonly found in medicinal plants. Additionally, anthraquinone glycosides such as rhein, emodin, physcion, chrysophanol, obtusin, and chrysophanic acid suggest therapeutic potential—particularly due to their known laxative, anti-inflammatory, and antimicrobial effects.

Seeds

Several compounds belonging to the anthraquinone and naphthopyrone groups have been isolated from the seeds of *C. tora*. Three crystalline substances—tora substances A, B, and C—have been identified. Based on their properties and those of certain derivatives, tora substance C may be identical to rubrofusarin, a metabolic product of the fungus *Fusarium culmorum*, and tora substance B may correspond to nor-rubrofusarin, a demethylation product of rubrofusarin. The seeds also yielded sitosterol (from the petroleum ether extract), and chrysophanol, physcion, emodin, and rubrofusarin (from the chloroform extract). Additionally, two glycosides—rubrofusarin-6-β-gentiobioside and 8-hydroxy-3-methyl anthraquinone-1-β-gentiobioside—have been found in the ethanolic extract.

Three naphthopyrone glucosides—cassiaside, rubrofusarin-6-O-β-D-gentiobioside, and toralactone-9-O-β-D-gentiobioside—have been isolated from the butanol-soluble seed extract. The seeds also contain phenolic glycosides such as rubrofusarin triglucoside, nor-rubrofusarin gentiobioside, demethylflavasperone gentiobioside, torochrysone gentiobioside, torachrysone tetraglucoside, and torachrysone apioglucoside. Seed oil contains various fatty acids, including oleic, linoleic, palmitic, stearic, and lignoceric acids. The *C. tora* seed is composed of hull (27%), endosperm (32%), and germ (41%). Gum obtained from the seeds, known as "Panwar gum," is a neutral heteropolysaccharide of galactose and mannose (i.e., a galactomannan). The pH of Panwar gum mucilage is approximately 7. The seeds contain about 23.2% protein and are rich in essential amino acids, particularly methionine and tryptophan.

Roots

The roots of *Cassia tora* contain bioactive compounds such as β-sitosterol, a phytosterol associated with various health benefits, and 1,3,5-trihydroxy-6,7-dimethoxy-2-methyl anthraquinone—an anthraquinone known for its antioxidant and anti-inflammatory effects. These compounds may contribute to the plant's therapeutic role in traditional medicine.

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Leaves

The leaves are rich in bioactive compounds, primarily anthraquinone glycosides such as rhein, emodin, and chrysophanol (the latter serving as a marker compound). Additionally, sennosides—present at a concentration of 0.14%—contribute to the leaves' efficacy in digestive health. Flavonoids such as kaempferol-3-diglucoside and ononitol monohydrate (noted for hepatoprotective effects) further underscore the leaves' pharmacological potential.

Macroscopic Characteristics

These refer to the physical features of a specific plant part, likely the seeds or fruits, which are elongated and ovoid in shape with an oblique tip. Measuring approximately 4–5 mm in length and 1–2 mm in thickness, they have a smooth surface, which may aid in dispersal or environmental interactions.

Microscopic Characteristics

The leaves of the described plant are compound and alternate, featuring a short petiole and a rachis adorned with erect or slightly curled hairs. Each leaf consists of 20–24 pairs of opposite, glabrous leaflets that are responsive to light, with a prominent midrib. On the leaf surfaces, abundant diacytic stomata are found on the adaxial side, while anomocytic stomata dominate the abaxial side, surrounded by polygonal epidermal cells. Additionally, numerous uniseriate, unicellular trichomes are present. Chemomicroscopic analysis reveals the presence of lignin, tannin, mucilage, starch, oil, and calcium oxalate crystals. The plant also produces pentamerous yellow flowers with very slender and hairy pedicels.

Stem

Steam drying effectively reduces the moisture content in seeds, preserving them by removing excess water while also causing a slight darkening in their color as a result of the process. Additionally, the steam-drying method enhances the visibility of the seed coat's ridges, making them more pronounced compared to untreated seeds.

Flowers

The flowers of the *Cassia tora* plant are characterized by their bright yellow color and distinctive bearded appearance, typically comprising five petals. These flowers usually emerge in pairs and are located in the axils of the leaves, adding to the plant's decorative appeal.

Features of Cassia tora Flowers

The flowers of the *Cassia tora* plant display several key features: they are bright yellow in color and have a bearded texture, typically growing in pairs in the axils of the leaves. Each flower consists of five ovate to obovate petals, while the sepals are ovate to oblong in shape.

Other Features of the Cassia tora Plant

The *Cassia tora* plant is an annual herb native to regions of Southeast Asia, Northern Australia, Africa, and Latin America. It features pinnate leaves and produces rhombohedral, brown seeds. This plant typically bears flowers during the rainy season and develops fruits in the winter.

Antioxidant Activity

The methanolic extract of *Cassia tora* seeds (MECT) demonstrates significant antioxidant activity, reportedly surpassing that of alpha-tocopherol. Key phenolic compounds, including alaternin and norrubrofusarin glucoside, exhibit potent free radical scavenging capabilities, attributed to the flavonoids and polyphenols present in the plant, which mitigate oxidative stress and may help address lipid disorders. Isolated components from the seeds, identified via ^{1}H and ^{13}C-NMR data as anthraquinones and naphthopyrone glycosides—specifically norrubrofusarin-6-β-D-glucoside (cassiaside) and rubrofusarin-6-D-gentiobioside—were tested against the DPPH radical, with alaternin showing marked scavenging activity compared to other components.

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Hypolipidemic Activity

Animal studies indicate that extracts of *Cassia tora* can effectively lower total cholesterol, low-density lipoprotein (LDL), and triglycerides, while simultaneously increasing high-density lipoprotein (HDL). The hypolipidemic effects of *Cassia tora* may be attributed to several mechanisms: it reduces cholesterol absorption in the intestines, enhances lipid metabolism by boosting the activity of enzymes responsible for lipid breakdown, and inhibits lipid synthesis in the liver.

Hepatoprotective Activity

Cassia tora, commonly known as sicklepod, has been historically utilized in traditional medicine for its numerous medicinal properties, including hepatoprotective activity, which refers to its ability to safeguard the liver from damage. Research indicates that *Cassia tora* can protect the liver from toxins such as alcohol and carbon tetrachloride, as well as from inflammation, largely due to its high concentration of antioxidants that counteract the harmful effects of free radicals. Available in various forms—including capsules, tablets, powders, and herbal teas—*Cassia tora* is generally considered safe for most individuals, though it is advisable to consult a healthcare professional before using it during pregnancy or breastfeeding.

Here are some of the potential benefits of Cassia tora

Cassia tora is noted for its hepatoprotective properties, offering protection against liver damage, reducing inflammation, and potentially preventing cancer. Additionally, it may aid in improving blood sugar control and cholesterol levels. For those interested in exploring the hepatoprotective activity of *Cassia tora* further, consulting with a healthcare provider is recommended. Additional research is available, including reviews on the hepatoprotective activity, medicinal properties, and the phytochemical and pharmacological profile of *Cassia tora*, providing a deeper understanding of its benefits.

Antifertility Activity

While *Cassia tora* is recognized for its potential health benefits, it also poses risks related to reproductive health. Studies suggest that extracts can reduce sperm count and motility, leading to decreased fertility, while high doses may cause testicular toxicity with degenerative changes in testicular tissues. Additionally, it exhibits anti-implantation activity, acting as a natural contraceptive by preventing fertilized egg implantation, and may disrupt menstrual cycles due to hormonal imbalances. Furthermore, it can stimulate the uterus, which may result in early pregnancy termination, thus posing risks for pregnant women. Despite these concerns, *Cassia tora* has potential applications in herbal contraceptives and in research focusing on male contraception, as well as being used traditionally to regulate menstrual cycles and manage reproductive disorders.

Antibacterial Effect

Cassia tora has been found to exhibit significant antibacterial activity against a variety of bacteria, including both gram-positive (such as *Staphylococcus aureus* and *Bacillus subtilis*) and gram-negative strains (including *Escherichia coli*, *Salmonella* spp., and *Pseudomonas aeruginosa*). These bacteria are linked to common human infections, such as skin, gastrointestinal, and respiratory infections. In traditional medicine, *Cassia tora* is utilized for its antibacterial properties to treat infections, wounds, and digestive issues. The application of poultices made from the plant demonstrates its role in promoting healing and effectively managing infections.

Antimutagenic Activity

Research has demonstrated the antimutagenic activity of methanol seed extract of *Cassia tora*, particularly against aflatoxin B1 (AFB1) using the *S. typhimurium* assay method. The study showed a significant reduction in mutation rates with the seed extract, specifically in the TA100 and TA98 assay methods. Notably, a pure compound isolated from the n-butanol fraction displayed substantial antimutagenic properties, while the aqueous fraction showed no activity. Furthermore, while the direct-acting mutagen N-methyl-N-nitrosoguanidine was not inhibited by either fraction of the methanol extract, column chromatography revealed several compounds—including chrysophanol, chryso-obtusin, aurantio-obtusin, rubrofusarin gentiobioside, and cassiaside—all of which exhibited marked antimutagenic potential.

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Purgative Effect

Cassia tora, commonly known as sicklepod, has a long history in traditional medicine and is recognized for its purgative activity, which promotes bowel movements. The presence of anthraquinones in the plant stimulates intestinal muscles, aiding in stool softening and facilitating easier passage. Available in various forms such as capsules, tablets, powders, and herbal teas, *Cassia tora* is generally safe for most individuals but should be used with caution by pregnant or breastfeeding women. Its potential benefits include relieving constipation, softening stools, promoting bowel movements, possibly preventing hemorrhoids, and improving digestion. For those interested in its purgative properties, consulting a healthcare professional is advisable, along with reviewing relevant scientific literature on its medicinal benefits and phytochemical profile.

Oxytocic Activity

Cassia tora contains bioactive compounds such as anthraquinones, glycosides, and flavonoids, which exhibit oxytocic activity by stimulating uterine contractions. This makes the plant potentially beneficial for inducing labor, preventing postpartum hemorrhage, and addressing menstrual disorders.

Anthelmintic Activity

An experiment demonstrated the anthelmintic activity of both alcoholic and aqueous extracts of *Cassia tora* seeds against *Pheretima posthuma* and *Ascaris galli*, attributed to the presence of flavonoids. At three tested concentrations (25, 50, and 100 mg/ml), the extracts showed significant effects on the worms—particularly at the highest concentration of 100 mg/ml. The extracts were compared with Piperazine citrate and distilled water as controls, and the time of paralysis and time of death of the worms were assessed.

Anti-inflammatory Effect

Cassia tora demonstrates potent anti-inflammatory properties due to its bioactive compounds such as flavonoids, phenolic acids, and anthraquinones, which are effective in alleviating joint inflammation and pain associated with arthritis and rheumatism. Its extracts are also beneficial for managing itchy, inflamed skin conditions like eczema and psoriasis, with chrysophanic acid playing a key role in mitigating redness and irritation. Additionally, *Cassia tora* helps soothe gastrointestinal issues such as gastritis and inflammatory bowel diseases, reduces inflammation in the liver and kidneys, and alleviates lung inflammation—making it useful for conditions like asthma and bronchial infections.

Anti-tumor Activity

Cassia tora is notable for its bioactive compounds—particularly anthraquinones, glycosides, and flavonoids—which collectively exhibit anti-tumor and anti-inflammatory properties. Extracts of *Cassia tora* have been shown to induce apoptosis in cancer cells and arrest the cell cycle, thereby hindering tumor proliferation. Additionally, the plant demonstrates anti-angiogenic activity by inhibiting the formation of new blood vessels essential for tumor growth. Its antioxidant properties further contribute to protection against oxidative stress, a factor known to play a role in cancer development—underscoring the plant's potential as a natural therapeutic agent in cancer treatment.

Spasmogenic and Antinociceptive Activity

Cassia tora, or Wild Senna, exhibits spasmogenic activity, which refers to its ability to stimulate contractions in smooth muscle tissues such as those in the intestines, bladder, and uterus. This property is particularly important in therapeutic contexts, as it can promote gastrointestinal health by enhancing peristalsis and alleviating constipation, making it effective as a natural laxative. Additionally, *Cassia tora*'s spasmogenic effects may have implications for reproductive health by affecting uterine and bladder muscles. However, while these potential benefits support its traditional medicinal uses, caution is advised when considering its application for reproductive purposes.

Toxicity

While *Cassia tora* offers various medicinal benefits, it contains anthraquinones that can be toxic to the liver when consumed in high doses, potentially leading to liver damage and elevated liver enzymes. Prolonged or excessive use may result in adverse gastrointestinal effects such as diarrhea, stomach cramps, and dehydration, making it unsuitable for individuals with irritable bowel syndrome (IBS) or weak digestion. Additionally, high doses may pose a risk of neurotoxicity, manifesting as muscle weakness or tremors, particularly in animals. Topical application may cause skin irritation; therefore, a patch test is advisable before use on the skin or scalp.

Conclusion

Cassia tora (*Senna tora*) is a medicinally valuable plant with a wide range of pharmacological properties, including antioxidant, anti-inflammatory, hepatoprotective, antimicrobial, hypolipidemic, antimutagenic, and anti-tumor effects. Its bioactive compounds—such as anthraquinones, flavonoids, saponins, and glycosides—contribute to its therapeutic potential in treating various ailments, from digestive disorders to liver diseases and skin conditions. Despite its promising benefits, further clinical studies are necessary to validate its efficacy, optimal dosage, and long-term safety in humans. Additionally, certain toxicological concerns—such as potential hepatotoxicity, reproductive effects, and gastrointestinal disturbances at high doses—warrant caution. In conclusion, *Cassia tora* holds significant potential as a natural therapeutic agent. However, more rigorous research is needed to fully integrate it into evidence-based medicine while ensuring safe and effective use. Its continued exploration could lead to novel phytopharmaceutical applications, reinforcing its role in both traditional and modern healthcare systems.

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