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Review Article

A REVIEW OF CASSIA PHYTOPHARMACOLOGY

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Abstract:

Because of its natural origin and significant therapeutic value, the usage of medicinal plants has grown in prominence. Many unique phytochemical components with significant pharmacological activities, including anti-inflammatory, antioxidant, antibacterial, and antidiabetic properties, may be found in the various species of the genus Cassia. These compounds can be used to treat a wide range of medical conditions. This paper discusses the significance of the genus Cassia and many experimental studies done on diverse species of this genus that can help develop a new herbal medication.

Keywords: Cassia, Phytoconstituents, Pharmacological Activity, Medicinal Plant

Introduction:

For thousands of years, the natural world has provided medicinal substances, and an astounding number of brand-new medications have been discovered there, many of them based on their traditional medical use [1]. The development of novel medications is greatly aided using medicinal plants. It is now well acknowledged that Indian medicinal herbs hold considerable promise to produce clinically beneficial medications that may even be utilised by allopathic doctors [2]. The Cassia species (*Caesalpinaceae*) are well-known medicinal plants that are widely distributed in tropical nations like India. In the conventional Indian medical system, this plant has been given credit for a variety of therapeutic characteristics. The seeds of various Cassia species have yielded several anthraquinones. Sennosides have been found in the leaves of this plant, which are well-known for their therapeutic value [3]. There are 580 species of trees, shrubs, and plants in the genus Cassia. There are only twenty species that are

indigenous to India, yet it is extensively distributed throughout the globe. Several Cassia species have a significant number of medical characteristics, and a few of them provide tanning materials, which are quite important economically [4].

Importance of cassia species

Ancient ayurvedic texts already mention the cassia species, and a literature review revealed that it has been used to treat a variety of skin conditions, including ringworm, eczema, and scabies. It was thought important to conduct study on this plant because of the high frequency of skin illnesses, particularly among the weaker segment of the Indian population [5]. The leaves and seeds are bitter, laxative, antiperiodic, anthelmintic, ophthalmic, liver tonic, cardio tonic, and expectorant, according to Ayurveda. Leprosy, ringworm, flatulence, colic, dyspepsia, constipation, cough, bronchitis, and heart diseases can all be treated with the leaves and seeds. On organic agriculture in India, the Cassia species is employed as a natural insecticide. Many skin conditions, rheumatic diseases, and laxatives have all been treated with Cassia species extracts [3]. It has been discovered that the leaf extract from the Cassia species has considerable anti-inflammatory and hepatoprotective properties. The entire plant is used as a purgative and to cure impetigo, ulcers, and helminthiasis [6].Family Leguminosae is one of the largest families of the flowering plants. It comprises about 650 genera and 18000 species [2]. The Fabaceae or Leguminosae, commonly known as the legume, pea or bean family, is a large and economically important family of flowering plants. Plants of this family are found throughout the world, growing in many differentenvironments and climates. The plants range in habit from giant trees to small annual herbs, with the majority being herbaceous perennials. The plants have indeterminate inflorescences, which are sometimes reduced to a single flower. The flowers have a short hypanthium and a singlecarpel with a short gynophore, and after fertilization produces fruits that are legumes. The leaves are usually alternate compounds and are even - or odd-pinnately compound. One of the largest families of flowering plants is the Leguminosae. There are roughly 650 genera and 18000 species in it [2]. A sizable and significant family of flowering plants, the Fabaceae or Leguminosae, is sometimes known as the legume, pea, or bean family. This family of plants includes species that may flourish in a wide range of climatic and environmental conditions. The plants range in size and habit from enormous trees to tiny annual herbs, with herbaceous perennials making up the bulk. Inflorescences on the plants are uncertain and occasionally only contain one bloom. After fertilisation, the flowers, which have a brief hypanthium and a solitary carpel with a short gynophore, yield fruits that are legumes. Usually alternating compounds, the leaves might have even or odd pinnates. "*Cassia*" means "cinnamon-like bark" in Latin. Moreover, the genus Cassia has long been poorly defined in relation to the allied Cassiinae, particularly Senna (which has numerous medicinally significant species) [3]. The three subfamilies of Leguminosae are *Caesalpinioideae*,

Papilionoideae, and *Mimosoideae*. Due to their large number of species, these subfamilies are now regarded as distinct families and have been given the names *Caesalpinioideae*, *Papilionaceae*, and *Mimosaceae* [4]. The family name Caesalpinia is where the word *Caesalpinioideae* originates. Most of the trees in the *Caesalpinioideae* family are found in humid tropical regions. With 152 genera and 2800 species, *Caesalpinaceae* makes up around 11% of the known legume flora [5]. With roughly 600 species, *Cassia* is a significant genus of the *Caesalpinioideae* family [6].

Taxonomical classification

The following are the taxonomical divisions of the genus Cassia:

- Kingdom: Plantae
- Class: Eudicots
- Class: Rosids
- Order: Fabales
- Family: Fabaceae
- Subfamily: Caesalpinioideae
- Genus: Cassia. L

Cassia auriculata

Escherichia coli, Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, and *Candida albicans* are all susceptible to the chloroform extract of *Cassia auriculata. Candida albicans and Aspergillus niger* are susceptible to the chloroform extract as well. Alkaloids, carbohydrates, fixed oils, lipids, tannins, gum and mucilage, flavonoids, saponins, terpenoids, lignin, and sterols are the phytochemical components identified in this plant [12]. With a zone of inhibition of 12–20 mm against *Vibrio cholorae, Staphylococcus aureus, Bacillus cereus, Escherichia coli, Klebsiella pneumonia,* and *Proteus mirabilis,* the methanolic extract of Cassia auriculata was reported to have the highest antibacterial activity [8, 9]. It was discovered that the chloroform extracts had very little effect on *Pseudomonas aeruginosa*. The total phenolic and flavonoid content of the ethyl acetate extract is greater, indicating that it has better antioxidant activity [13]. The presence of carbohydrates, proteins, alkaloids, flavonoids, steroids, saponins, and tannins in the methanol, chloroform, and aqueous extracts was demonstrated to provide a possible explanation for their antibacterial and antioxidant action [14].

Cassia fistula

This herb is used to cure cancer of the liver, throat, glands, and abdomen. Burns, constipation, convulsions, diarrhoea, dysuria, and epilepsy were also treated with it. Carminative and laxative effects are recognized in Ayurveda medicine. In addition, it is used to treat syphilis, skin conditions, and leprosy. Investigations into phytochemistry identified a valuable therapeutic herb. Phenolic compounds are recognized to be a key source of secondary metabolites from it. It comprises a substantial base of glycosides, flavonoids, and tannins. Antibacterial, antidiabetic, antifertility, anti-inflammatory, antioxidant, hepatoprotective, anticancer, and antifungal activity are among the pharmacological actions [15].

The plant has excellent medicinal value and contains analgesic and antipyretic properties. According to reports, the plant's leaf extract

contains antitussive and wound-healing qualities. [16]. The 50% inhibition concentration (IC50) of hyphal growth for the leaf extract is 0.5 mg/ml for Trichophyton rubrum and 0.8 mg/ml for Microsporum gypseum, however the extract of *Cassia fistula* was the most effective inhibitor of *Penecillium marneffei* with an IC50 of 0.9 mg/ml [17]. The methanol extract had high activity in the inhibition of free radicals (69%), and it also prevented the stability of red blood cell membranes and heat-induced albumin denaturation with 88.61 and 79.33 g/ml, respectively. Aqueous and petroleum ether extracts were followed by methanol (83.88) and xanthine oxidase (44.83) and acetylcholinesterase (18.98) in terms of their ability to significantly inhibit proteinase activity. Methanol extract displayed the strongest anti lipoxygenase activity (62.16). The findings indicated that the antibacterial, antioxidant, and anti-inflammatory action of the *Cassia fistula* extract may be attributed to the phytochemicals (alkaloids, saponins, flavonoids, anthraquinones, and phenolic compounds) present in the extract [18].

Antioxidant activity:

The antioxidant activity of the extracts from several plant sections was ranked in decreasing order by the extracts' total polyphenolic content: stem bark, leaves, flowers, and pulp. The presence of prooxidants as chrysophanol and reducing sugars, which outweigh the antioxidant components in the extracts, may be the cause of the low antioxidant activity in the flower and pulp fractions [13].

Antifungal and Antibacterial activity:

Trichophyton mentagrophytes and Epidermophyton floccosum are two fungus species that *Cassia fistula* shows antifungal efficacy against (MIC: 0.5 mg/ml). Using 30 micro g/disc, three purified lectins, CSL-1, CSL-2, and CSL-3, were tested for their antibacterial activities against a variety of pathogenic bacteria, including *Bacillus subtilis, B. megaterium, Streptococcus haemolyticus, Streptococcus aureus, Sarcina lutea, Shigella sonnei, Escherichia coli, Klebsiella sp.* All strains of bacteria were susceptible to CSL-3, however it was particularly effective against Bacillus megaterium, Streptococcus haemolyticus, and Shigella boydii. Only *Streptococcus haemolyticus* exhibits considerable activity against CSL-2, which shown weak activity against most bacterial strains. Except for Sarcina lutea and Streptococcus haemolyticus, CSL-1 was inert against all the bacterial strains [13].

Anti-tumour activity

The Methanolic extract of *Cassia fistula* seed has an antitumor activity. Hematological studies have exposed thatmethanolic extract at the dose of 100 mg/kg has shown better results than at the doses of 200 and 300 mg/kg. The exact mechanism by which methanolic extract mediates its antitumor effect is still to be elucidated. Cytological changes indicate that methanolic extract might be having a direct tumorocidal effect on the tumour

cells [13].

Antifertility activity:

Due to its anti-implantation activity, the petroleum ether extract of *Cassia fistula* seeds can end pregnancies [13]. Impact on skin conditions: Based on the findings of this study, it can be said that *Cassia fistula* is a safe medicine of choice for purgation therapy and significantly improves skin conditions of pitta origin [19].

Cassia italica

This plant's methanolic leaf extract underwent GC-MS analysis, which identified 17 components. Phytol, Squalene, and n-Hexadecanoic acid were among the phytocomponents examined. Several of these chemicals were utilised in the manufacturing process for a wide range of purposes, including flavouring, antioxidant, anti-inflammatory, antibacterial, pesticide, and cancer prevention [20]. The anti-inflammatory, analgesic, prostaglandin (PG), antineoplastic, and antiviral effects of the ethanolic extract of *Cassia italica* complete plant parts were examined. It was discovered that the extracts decreased carrageein-induced fever and paw swelling in rats (100 mg/kg bw-31% and 37%, respectively). Using rat peritoneal leucocytes, a dose-dependent suppression of PG release action was seen [21]. Six bioactive substances were found in Cassia italica, and the anticancer potential of each active substance was examined in Ehrlich ascites carcinoma cell (EACC) and hepatoma cell (HepG2) lines. Variable antioxidant activity were present in the selected substances. *Cassia italica* has potential as a cancer treatment [22].

Cassia javanica

Anthraquinone glycosides, flavonoids, alkaloids, sterols, tannins, saponins, and reducing sugars were among the diverse phytochemical components discovered in various regions of the plant. The pharmacological effects of cassia javanica include antidiabetic, antioxidant, anticancer, antimycotic, antipyretic, laxative, antimalarial, and therapy of gastric pain. Moreover, it is understood to lessen the pathogenicity of pathogenic organisms [23].

Cassia siamea

Cassia siamea's medicinal properties include antibacterial, antimalarial, antidiabetic, anticancer, hypotensive, diuretic, antioxidant, laxative, anti-inflammatory, analgesic, antipyretic, anxiolytic, antidepressant, and sedative properties. Chromone (anhydrobarakol), Chromone alkaloids (barakol, Cassiarin A-B), anthraquinones (chrysophanol, emodin), bianthraquinones (Cassiamin A-B), flavonoids, and phenolic compounds are among the phytoconstituents. The primary components of *Cassia siamea's* leaves and blossoms were known as barakol [24]. Southeast Asia is the original home of the Fabaceae family plant known as Cassia siamea. Antibacterial, antimalarial, antidiabetic, anticancer, hypotensive, diuretic, antioxidant, laxative, anti-inflammatory, analgesic, antipyretic, anxiolytic, antidepressant, and sedative actions are all present in it. The primary components identified in this plant are chromone (anhydrobarakol), chromone alkaloids (barakol, Cassiarin A-B), anthraquinones

(chrysophanol, emodin), bianthraquinones (Cassiamin A-B), flavonoids, and phenolic compounds. The primary components of the leaves and flowers of Cassia siamea have been determined to be barakol. For use as a laxative, crushed dried *Cassia siamea* stems and Xylopia ethiopica fruit are combined. To combat diabetes, drink the stem bark decoction. The decoction of leaves is consumed to prevent malaria, while the infusion of flowers is consumed or applied topically to prevent liver diseases and malaria. Additionally useful for treating asthma and sleeplessness, this concoction. To treat snake and scorpion stings, the seeds are used as intestinal worm sand [24].

Cassia alata

Trichophyton mentagrophytes var., interdigitale and Trichophyton mentagrophytes var., mentagrophytes were both resistant to the ethanol extract of Cassia alata leaves. Trichophyton rubrum, Microsporum canis, Microsporum gypseum, Fusarium solani, Aspergillus niger, Cladosporium werneckii, and Penicillium sp. are examples of pathogens that have been identified [26]. The 50% inhibition concentration (IC50) of hyphal growth for the leaf extract against T. rubrum and M. gypseum is 0.5 and 0.8 mg/ml, respectively, whereas the extract of *Cassia fistula* was the most effective inhibitor of P. marneffei with the IC50 of 0.9 mg/ml [14].

Cassia nigricans

Emodin is present in the ethyl acetate extract of Cassia nigricans leaves and is shown to be highly cytotoxic, with an LC50 value of 42.77 (11.80 - 72.94) g/ml. Moreover, it exhibits strong antibacterial activity against certain common infections. This chemical, which was extracted from Cassia nigricans leaves, is used to treat gastrointestinal and skin conditions [27].

Cassia tora

The active ingredients of the BuOH-soluble extract of the seeds of Cassia tora were found to be three naphthopyrone glucosides: Cassiaside, rubrofusarin-6-O—D-gentiobioside, and toralactone-9-O—D-gentiobioside [28].Ethanolic extract of Cassia alata leaves exhibits antifungal activity against Trichophyton rubrum, Trichophyton rubrum var. interdigitale, Microsporum canis, Microsporum gypsum, Fusarium solani, Aspergillus niger, Cladosporium werneckii, and Penicillium sp. The extract exhibits strong in vitro activity against various dermatophytic fungus but weak activity against non-dermatophytic fungi [29].*Cassia nodosa*The first study focused on the anti-oxidant and cytotoxic properties of methanolic extracts of Cassia nodosa flowers, leaves, stem bark, and their fractions (petroleum ether, methylene chloride, ethyl acetate, and n-butanol). The stem bark methanolic extract performed particularly well as a potent cytotoxic agent against the MCF-7 and VERO cell lines. The most potent antioxidant was chystophanol (IV) (anti-hemolytic and DNA protective agent). This was the first time Kaempferol-3-O-L- rhamnopyranosyl (1 2)-D-glucoside (I) had been isolated from leaf ethyl

acetate fraction. From the methylene chloride fraction of flowers and stem bark, respectively, 1,8-dihydroxy-3-methyl anthraquinone (chrysophanol) and 4,5-dihydroxyanthraquinone-2-carboxylic acid (rhein) (III) were successfully isolated. In addition to compound (I), kaempferol 3-O-L- rhamnoside (II) was recovered from leaf ethyl acetate fraction [30].

Cassia javanica

It has been shown that Cassia javanica works well as a hypoglycemic agent. STZ was administered intraperitoneally once to rats to cause diabetes. Normal and diabetic rats received single and multiple doses of the test medication (0.5 g/kg body weight/day). The effectiveness of the test substance was compared to that of the common hypoglycemic medication, glibenclamide (0.01g/kg/day). Antidiabetic substances were found in early phytochemistry. The results revealed a highly significant drop in blood glucose levels (37.62%) in diabetic rats after 10 days. Its impact was far better than the conventional medication (63.51%) [31].

Cassia sophera

The mature seed coat of Cassia sophera has larvicidal action against Culex quinquefaciatus in both crude and ethyl acetate extracts. Larval mortality was significantly higher at all graded concentrations (0.6%, 0.7%, 0.8%, 0.9%, and 1%) than the control (0.3%). The seed coat was subjected to a preliminary qualitative phytochemical study, which found some secondary metabolites, including cardiac glycosides, alkaloids, and saponin. The findings confirm that the studied plant extract can be utilised to manage Culex quinquefaciatus larvae [32].In larger portions of India, Cassia sophera is found in deciduous and mixed monsoon forests. The traditional Indian medical system makes extensive use of it for its analgesic, anticonvulsant, antioxidant, anti-inflammatory, hepatoprotective, and antiasthmatic properties, among others. It is a rich source of anthraquinones and flavanoids [33].

In order to fractionate the dried methanol extract of Cassia sophera L. leaves, it was first diluted in distilled water and then extracted again with n-hexane, chloroform, and ethyl acetate. By using the 1, 1-diphenyl-2-picrylhydrazyl (DPPH) assay, the free radical scavenging activity (FRSA) of methanol extract and different fractions of methanol extract was assessed. Ethyl acetate fraction outperformed all other fractions in terms of free radical scavenging activity (IC50 = 15.42 g/ml), and it outperformed the synthetic antioxidant butylated hydroxyanisole, BHA (18.25 g/ml). Compared to other extracts, the EtOAc fraction had the greatest total phenolic concentration at 13.25%. This finding implies that this plant may serve as a natural source of antioxidants and preservatives [34].

Cassia augustifolia

From the leaves of *Cassia angustifolia L.*, the water-soluble polysaccharides were extracted and fractionated. One of the subfractions' methylation analysis revealed the presence of 1, 4-linked galacturonic acid (31.0%), 1,2-linked rhamnose

(14.5%), 1,2,4-linked rhamnose (15.8%), 1,3,6-linked galactose (15.3%), smaller amounts of 1,3-linked arabinose and 1.5-linked arabinose, as well as terminal galactose and arabinose residues. S1A was mildly acid hydrolyzed to reveal that the backbone is composed in a 1:1 ratio of 1, 4-linked galacturonic acid and 1, 2-linked rhamnose residues. Rhamnose is linked to arabinogalactan sidechains via C-4 per second. When the solid Sarcoma-180 tumour was used as a test subject for this polysaccharide fraction's anticancer efficacy in CD1 mice, it showed a substantial antitumor activity with a 51% inhibition rate [35]. From *Cassia augustifolia* butanolic seed extracts, a brand-new oleanen type triterpenoid glycoside has been discovered. 3-O—D-glucuronopyranosyl-(1 4)-[-D-galactopyranosyl- (1 2)] was the structure that was determined. D-xylopyranosyl-(1–3)-D-glucopyranosyl is a compound. 2,16-dihydroxy-4,20-methylolean-12-ene-28-oic acid. The antifungal action of the isolated saponin is most strongly inhibited by Colletotrichium dematium [36].

Cassia reningera

It was discovered and characterised that the novel flavonoid kaempferol-7-O-glucoside exhibits strong antibacterial properties. The greater concentrations of kaempferol (0.60 mg/gdw), kaempferol-7-O-glucoside (0.21 mg/gdw), and total quercetin (0.34 mg/gdw) were found. *Escherichia coli, Aspergillus flavus, Aspergillus niger, Fusarium moniliformae,* and *Rhizoctonia bataticola* were all successfully combatted by the isolated flavonoids. In comparison to *A. flavus, A. niger, F. moniliformae, and R. bataticola, kaempferol* was more effective [37].

Cassia australis

From the EtOAc, n-BuOH, and EtOAc-Pp fractions, the various chemicals, including flavones, flavonols, and their glycosides and condensed tannins, were discovered. At 25 g/mL, the Mayaro virus (MAYV) generation was reduced by more than 70% and 85% by the et OAc and n-BuOH fractions, respectively. At 10 ng/mL, EtOAc-Pp fraction had a higher antiviral impact by inhibiting MAYV synthesis by more than 90% [38].

CONCLUSION

The therapeutic usefulness of Cassia species is confirmed by the pharmacological, medicinal, and traditional importance stated in the current review. The genus Cassia has a wide range of pharmacological actions and is frequently used in traditional medicine for its hepatoprotective, anti-inflammatory, antibacterial, and antioxidant properties. For the creation of novel traditional medicines and for the benefit of humanity, precise information on the pharmacology and phytoconstituents of Cassia species can be helpful. This review covers several important pharmacological investigations on the genus Cassia and phytoconstituents derived from different species, which can be further researched for the development of new innovative herbal medicines.

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