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# Phytochemistry, pharmacology and multifarious activity of *Cassia tora* L.: A comprehensive review

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**Abstract**

*Cassia tora* L. (Fabaceae), an essential medicinal plant (shrub) is frequently found as an annual weed in Asian and African nations. Asians are known to eat this leafy vegetable. Different portions of *C. tora* have been utilized in Ayurvedic and Chinese medicine for ages, going back to the beginning of time. It has long been believed that a common species of the genus, *Cassia* possesses a number of different medicinal benefits. One of the main sources of anthraquinone chemicals is the plant. Additionally, research has shown that numerous phytochemical components, primarily anthraquinones, cassiatorin, aurantio-obtusin, 1-desmethylaurantio-obtusin, chryso-obtusin, obtusin, chrysophanol, emodin, rhein, euphol, and basseol, are present. These researches demonstrate that *C. tora* a source of chemical compounds that have therapeutic activity and a variety of pharmacological effects such as anthelmintic, antiulcer, antidiabetic, hepatoprotective, antinociceptive and spasmogenic, antifertility, antigenotoxic, antimicrobial, anticancer, antimutagenic, larvicidal, purgative and insecticide activities. The goal of the current review is to give comprehensive information about its traditional uses, phytochemical studies, pharmacological activity, and therapeutic characteristics. A lot of study has been done recently to demonstrate its potential as a plant with medicinal use. This review effort is exciting since it highlights the plant's undiscovered qualities and may be helpful in creating new formulations that are more medicinal and in giving additional research, a focus.

## 1. Introduction

Mother nature has always been essential to the human race’s ability to stay healthy. Plants are therefore employed not just as food, but also to improve the flavour of meals, and their usage as medicines, is growing. Plants have therapeutic promise for both communicable and non-communicable disorders (Mehrotra, 2021).

We have found that natural goods are the most effective source of medicine. Almost, all societies have used medicinal plants as a source of healing from the beginning of time (Upendra *et al*., 2010).

Since ancient times, plants have been the main source of medicines for humans. Since ancient times, plants have had a significant influence on culture, thinking, and economic activity (Sharma *et al*., 2022). Although, plants and herbs are the primary source of medicine in India, the country is essentially a global herbarium. As per World Health Organization (WHO) estimate, 80% of those who reside in underdeveloped nations entirely rely on traditional medicines to meet their basic medical needs (Shivjeet *et al*., 2013).

The weed *C. tora* which belongs to Leguminosae family, is grown throughout most of India. It is a 30-90 cm tall annual foetide herb. The traditional Indian health industry has credited this plant with a number of medicinal properties. The seeds of C. *tora* have yielded a number of anthraquinones. It is a well-known Ayurvedic herb that works well as a laxative, an antiperiodic, and a treatment for leprosy, bronchitis, ringworm, skin, cardiac disorders, ophthalmic, and cough diseases, as well as for haemorroids and hepatic disorders (Deoda *et al*., 2012).

The herbal medication must be standardized by numerous rules, including GMP, GLP, GCP, WHO, and other renowned regulations, in terms of quality, safety, and efficacy (Ansari and Ahmad, 2019).

Different medical use of various parts of the *Cassia* plant are pictured in Ayurvedic and Chinese medicine texts. It has been used as an antioxidant, antibacterial, antihepatotoxic, antidiuretic, antidiarrheal, and antimutagenic herb in traditional Ayurvedic and Chinese medicine. It is said to have positive effects on everything from fever, bronchial infections, cardiovascular illness, bowl issues (piles, haemorrhoids), leprosy, and skin ailments like ringworm, itching, body scratching, and psoriasis, eczema, and dermatomycosis (Shukla *et al*., 2013).

So, search for reliable scientific experimental papers on *C. tora* began, but it seems that not much work has been done to show how important it is for medicine. Therefore, we believe that by summari zing the research that has been done so far, it will be easier for other scientists and medical professionals to quickly understand how to use *Cassia* and further develop their understanding of this plant in the context of experimental evidence.

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## 2. Taxonomical classification (Anon. 1956)

**Table 1: Taxonomical classification of *Cassia***

| Kingdom | Plantae |
|---|---|
| Division | Magnoliophyta/Angiospermae |
| Class | Magnoliopsida/Dicotyledoneae |
| Order | Fabales |
| Family | Leguminosae/Fabaceae |
| Subfamily | Caesalpinioideae |
| Tribe | Cassieae |
| Subtribe | Cassiinae |
| Genus | Cassia |
| Species | *tora* |
| Botanical Name | *Cassia tora* L. |

### 2.1 Vernacular names (Nadkarni, 1954; Kirthikar, 1999; Pawar and D'mello, 2011)

Most of the parts of India grows the weed *C. tora* as a wild crop. It goes by a multitude of names in the local dialects of its native range's neighboring areas, including Chakramardah and Prapunnatah in Sanskrit and *Foetid cassia* and ring worm plant in English. Hindi terms for 'chakunda', 'chakavat', 'panevar', and 'chakvad'; Bengali for 'chakunda' is 'panevar'; Gujarati, 'kawario', 'konariya', and 'kunvadio'; Malayalam, 'chakramandarakam', 'takara'; Marathi, 'tankli', 'tarota', 'takla'; punjabi, 'chakunda', 'panwar', 'pawas', and 'pawar'; 'ushittagarai', 'tarotah', 'senavu', 'vindu', and 'tagarai' in tamil; Telgu has a number of dialects, including 'tantemu', 'tagirisa', 'taniyamu', 'chinakasinda', 'tellakasinda', 'tagarisha-chettu'; 'kovariya', 'kowaria' in bombay; 'tagace', 'taragasi' in karnataka; 'mwango', 'swahili' in africa; 'sanjsaboyah' in arab and 'panwar' in urdu. in ayurveda, chakramard is used; in unani, panwar; and in chinese system of traditional medicine.

### 2.2 Distribution

A wide variety of habits, from huge trees to delicate flat,within its bounds, annual herbs can be spotted. There are 45 different *Cassia* species known to exist in India. There has been a strong interest among species in phytochemical and pharmacological study because of their fantastic medical benefits (Kumar *et al*., 2021).

The plant is grown and distributed not only in India but also in China, Korea, Nepal, Nigeria, and Korea. It grows enormously in waste areas, along riverbanks, on the sides of roads, and on hills with low heights up to 1000-1800 meters, as well as in plains and low-lying coastal areas. In India's uncultivated tropical fields, particularly in the centre and south, it grows in damp and dry areas (Kirtikar, 2006).

### 2.3 Traditional uses (Bhandirge *et al*., 2016; Das *et al*., 2011)

**Table 2: Traditional uses of *C. tora***

| S.No. | Organised part | Traditional uses |
|---|---|---|
| 1. | Leaf | Laxative and antirheumatic properties. Additionally used for jaundice and skin conditions.Ringworm and eczema can both be treated with the leaf paste. Bronchitis and asthma are treated internally with a decoction of leaves and flowers.The pulverized leaves are used as a poultice on cuts and wounds to speed up suppuration, much as tincture-iodine. Localized usage of a leaf poultice for gout, sciatica, and joint aches. |
| 2. | Seed | Aperients, a diuretic and antiasthenic.Additionally, it is administered to treat liver disorders and to enhance visual function (eye illnesses).It serves as a hepatoprotective agent in Korea.Treatment for skin conditions like ringworm and itching often involves the use of leaves and seeds.Additionally, seeds can treat psoriasis, leprosy, and earaches.According to traditional Chinese medicine, the seeds are helpful at lowering blood pressure, lowering cholesterol, and improving vision. They are also anti-asthenic, aperients, and diuretics. |
| 3. | Stem bark | Extracts is being used for a variety of skin conditions and as laxative. |
| 4. | Flowers | Decoction of leaves and flowers use to treat bronchitis and asthmainternally. |
| 5. | Pods | Pods are used to treat dysentery and eye conditions. |
| 6. | Roots | The root is stomachic, bitter, tonic, and useful for treating snakebites. Other applications include the treatment of worm infections, bronchitis, asthma, and malignancies of the abdomen. |
| 7. | Whole plant | The best cure for irregular childbirth, bone fractures, colds, epilepsy, night blindness, scabies, scorpion bites, and stomachaches is this herb. Additionally, it functions as a vermicide and a coffee substitute. |

## 2.4 Morphological characteristics

**Table 3: Morphological characteristics of *C. tora***

| S.No. | Organized part | Description |
|---|---|---|
| 1. | Leaves | Leaves are complex and typically 7.5-10 cm long. There are three pairs of opposing leaflets, each averaging 2.5-4.5 cm. They have base that is somewhat oblique, often rounded, 6-10 conspicuous veins, and divergent venation. They are glaucous, obovate-oblong, membranous, glabrous, and more or less pubescent (Deoda *et al.*, 2012; Mazumder *et al.*, 2005). |
| 2. | Seed | Seed is smooth and lustrous, oblong or rhombo-hedral as well as firm and 1 cm long and 3-4 mm thick. Both ends appear to have been chopped off at an angle. Cotyledons were rolled, folded, and twisted (Deoda *et al.*, 2012; Roopashree *et al.*, 2010). |
| 3. | Root | The root's outside surface is dark brown, while its inner surface is creamy with a lengthy crack. Near the foot area, the primary root is bent at a 30$^{o}$ angle (Deoda *et al.*, 2012; Sahoo *et al.*, 2011). |
| 4. | Fruit/Pod | Fruit is subtertragonous, with 15-23 cm long, obliquely septate pods with very broad sutures (Arya Vaida Sala, 2003). |

**Figure 1: Whole Plant of *C. tora*.**

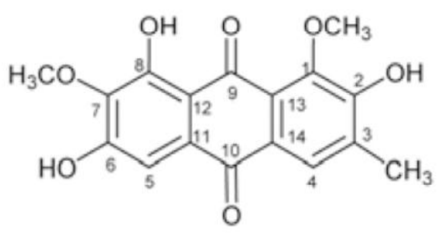
**Figure 2: Seeds, flowers and pods of *C. tora*.**

## 3. Phytochemical investigation

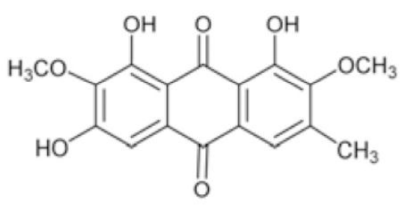
Plant-derived natural products commonly known as phytochemicals, have gained importance because of its extensive variety of therapeutic potential, great degree of stereochemistry due to the wide spectrum of pharmacophores (Arif *et al.*, 2022). From *C.tora*, five anthraquinones were purified and isolated using semi-preparative high-performance liquid chromatography (HPLC) and high-speed counter-current chromatography (HSCCC). These included aurantio-obtusin, 1-desmethylaurantio-obtusin, chryso-obtusin, and obtusin. Five anthraquinones had their structures determined using UV, MS, and 1 H NMR (Zhu *et al.*, 2008).

A novel compound termed cassiatorin and aurantio-obtusin, a well-known anthraquinone, were both identified after fractionating the active ethyl acetate extract. Two anthraquinone compounds, aurantio-obtusin and cassiatorin, outperformed the standard controls in terms of their insecticidal and ovipositor deterrent activities while exhibiting similar insect antifeedant properties to the positive controls (Mbatchou *et al.*, 2018).Chrysophanol, emodin, and rhein are just a few of the bioactive anthraquinones found in *C. tora* seeds, and these compounds are primarily responsible for the pharmacological effects of the plant (Yen *et al.*, 1998; Duke, 2001; Wu and Yen, 2004). Alaternin 2-O-D-glucopyranoside, an anthraquinone glucoside that was isolated from *C. toras* eeds (Lee *et al.*, 1998). A novel naphthopyrone glycoside known, 10-[(ß-D-glucopyranosyl-(1>6)-O-ß-Glucopyranosyl)oxy] was discovered from roasted seeds of *C. tora*. 5 hydroxy 8 methyl 2-methyl 4-hydroxy [1,2-b] pyran-4-one (isorubrofusarin gentiobioside). Alaternin and adenosine were also extracted and recognized together with isorubrofusarin gentiobioside (Lee *et al.*, 1997; Meena *et al.*, 2010).

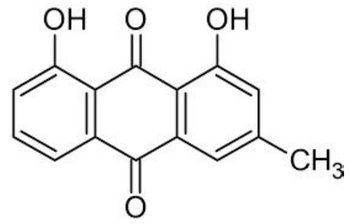
Ononitol monohydrate, a compound with structural similarities to glycoside, was isolated from the leaves of *C. tora* (Dhanasekaran *et al.*, 2009).



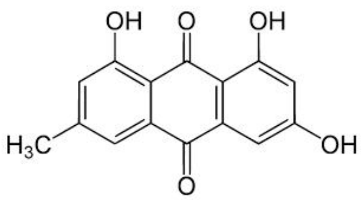

Aurantio-obtusin



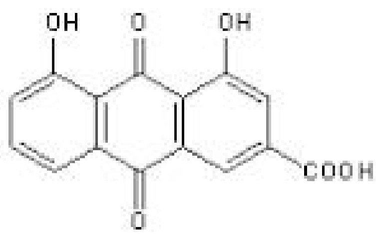

Cassiatorin



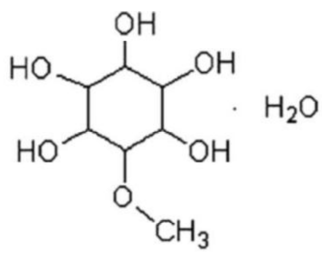

Chrysophanol




Emodin




Rhein




Ononitol monohydrate

## 4. Safety/toxicity studies

The ethanol extract of *C. tora* seeds was found to be safe up to a dose of 2000 mg/kg body weight in Sprague Dawley rats after 13 weeks of continuous oral treatment (Le *et al.*, 2019). Methanol extract of *C. tora* leaves was shown to be safe up to 2000 mg per kg when evaluated for acute oral toxicity in rats(Nwankwo *et al.*, 2017). An ethanol extract of *C. tora* leaves was tested for acute oral toxicity in Swiss albino mice, and it was shown to be safe up to 2000 mg/kg after a single dose (Vijayalakshmi and Madhira, 2014).

### 4.1 Toxicity

The toxicity *C. tora* leaves extract was examined using Swiss mice. 200 mg/kg orally administered levels were shown to be lethal. A dose of 100 mg/kg proved lethal when given intravenously or intraperitoneally. For 13 weeks, rats fed a diet containing 0.5% or more *C. tora* seed daily developed mild anaemia, peripheral leukocytosis, and myeloid hyperplasia (Deore *et al*., 2009; Sharma *et al.*,2005).

## 5. Pharmacological activities

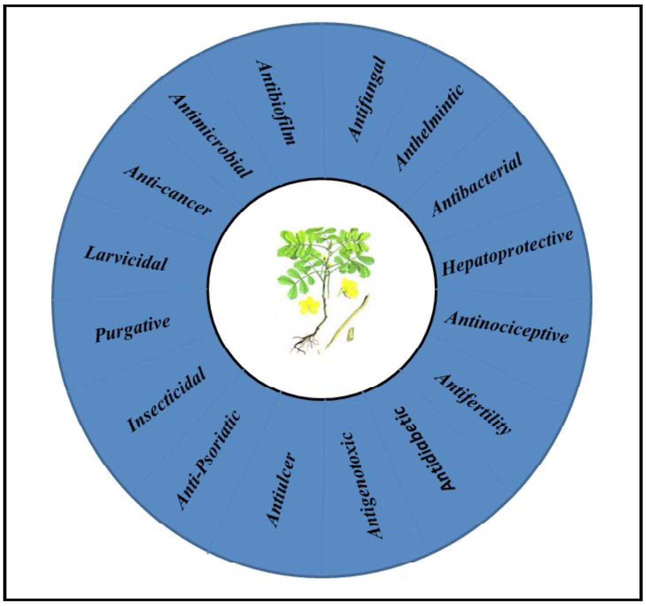



**Figure 3: Pharmacological activities of *C. tora*.**

### 5.1 Antiulcer activity

In experimental model of ulcerative colitis induced by dextran sulphate sodium, *C. tora* leaf methanol extract was tested for its antiulcer activity using BALB/c mice. The test medicine was reported to treat the symptoms of bleeding, diarrhoea, loss of body weight, and restoration of damaged colon tissues when administered for 14 days at a dose of 400 mg/kg of body weight (Anyebe *et al*., 2021).

### 5.2 Antidiabetic activity

Annual plant *C. tora* has medicinal qualities including antioxidant, hypolipidemic, and antidiabetic effects. Its effect on diabetes has been carefully studied. It is unknown, nevertheless, if it has any effect on the mitochondrial dysfunction connected to diabetes. Eun Ko and her group looked at how rats on a high-fat diet responded to the impact of emodin and rhein in *C. tora* seed ethanolic extract (ER/CSEE) on retinal mitochondrial function (HFD). The ability of enzymes in the mitochondrial citric acid cycle and electron transport chain to repair damage is thought to depend on the metabolic state. It was determined that emodin and rhein have a therapeutic role in fat metabolism by regulating the activities of enzymes within the citric acid cycle, which is associated with beta-oxidation in the retina (Eun *et al.*, 2021).Wistar rats that had been artificially rendered diabetic by alloxan were used to test the antidiabetic effects of several extracts of *C. tora* leaves (methanol, ethyl acetate, and aqueous extract). The extracts' blood sugar-lowering effects were noticeable at dosages of 200 and 400 mg/kg body weight (Vanapatla, 2018).

### 5.3 Anthelmintic activity

Antihelmintic activity of alcoholic s well as aqueous extract of *C. tora* seed was evaluated adjacent to *Pheretima posthua* and *Aacardia galli* by Deore *et al*., 2009. A substantial anthelmintic effect can be shown at a concentration of 100 mg/ml of extract when piperazine citrate was employed as the standard and pure water as the control (Deore *et al*., 2009). An ethanol-induced stomach ulcer model was used to examine the preventive potential of a hydroalcoholic leaf extract in albino rats. The extract showed dose-dependent antiulcer efficacy with the maximum activity at 500 mg/kg body weight when omeprazole was used as the reference standard (Yuvraj Gulia, 2011). Male albino rats were given 1000 mg/kg of the methanol extract of *C. tora* leaves, and it was found to reduce the elevated blood sugar levels in alloxan-induced experimental diabetes (Nwankwo *et al.*, 2017).

The effect of butanol component of *C. tora* leaves on postprandial glucose levels was examined in diabetic and healthy rats (streptozotocin induced experimental diabetes). In the maltose loading test, the test drug at 200 mg/kg body weight significantly reduced the glucose levels at 30 min and 80 min in normal rats and at 30 min in diabetic rats after administration as compared to control (Jeongsu Nam, 2008).

### 5.4 Antibacterial activity

The ecologically beneficial and pricey way of producing nanoparticles is called green production. It can be produced by plants, yeast, fungi, microbial enzymes, bacteria, algae, microbial enzymes, and other species. Mohamed and his teammate concentrated on using *C. tora* seed extract to produce silver nanoparticles in a sustainable manner. UV spectroscopy, X-ray diffraction analysis, Fourier-transform infrared analysis, scanning electron microscopy (SEM), and antibacterial activity against three distinct bacterial strains were used to investigate the produced silver nanoparticles. In UV-visible spectroscopy, the surface plasmon resonance of AgNPs synthesized using *C. tora* seed extract showed a significant absorption peak at 423 nm. The crystalline nature of synthesized AgNPs was demonstrated by X-ray diffraction, which confirmed four distinct peaks at 36.69°, 42.92°, 63.27°, and 76.46°. SEM studies of synthesized AgNPs showed particle sizes of 55.80 nm, 58.97 nm, 61.06 nm, 63.26 nm, and 64.80 nm. When treated with 25 and 50, of the synthesized nanoparticles, *S.aureus* exhibited a maximum zone of inhibition of 12 mm and 13 mm, respectively. Thus, the green synthesized silver nanoparticles generated from *C.tora* seed extract shown potent antibacterial activity (Mohamed, *et al.*, 2022).

### 5.5 Hepatoprotective activity

Studies on the effects of *C. tora* whole-plant hydroalcoholic extract on rats' blood and liver glutathione levels, serum marker enzyme levels, and serum against paracetamol-induced damage have revealed appreciable increases in the levels of these enzyme activities, which reflect the liver damage caused by paracetamol. Blood samples from the animals that had been fed the hydroalcoholic extracts of the *C. tora* likewise showed significant increases in serum enzyme levels (Tiwari, *et al*., 2011). Ononitol monohydrate, a class of glycoside isolated from the leaves of *C.tora*, decreased serum transaminase, lipid peroxidation, and tumour necrosis factor (TNF) levels while increasing antioxidant and hepatic glutathione enzyme activities in rats with hepatotoxicity brought on by carbon tetrachloride. Histo-pathological results demonstrate the safety and efficacy of ononitol monohydrate as a hepatoprotective agent. The methanol extract of *C. tora* leaves was effective in avoiding liver damage brought on by carbon tetrachloride (Rajan, *et al*., 2009).

Hepatoprotective efficacy of methanolic extract of *C. tora* leaves was examined in rats by producing acute hepatotoxicity with paracetamol. By reducing blood levels transminase (SGOT, SGPT), bilirubin, and alkaline phosphatase, the extract dose of 400 mg/kg orally displays considerable protective impact (ALP). According to theses, the extract has significant hepatoprotective potential (Maity, *et al.*, 1998).

### 5.6 Antinociceptive and spasmogenic activity

Methanolic extract from the leaves of *C. tora* possesses antinociceptive and spasmogenic properties. Mice were used to test the methanolic extract of *C.tora* leaves for antinociceptive activity. In a dose-dependent way, the extract decreased the mice's nociceptive response to increasing force. The same *C. tora* extracts also have spasmogenic properties. The extract's capacity to cause spasms and to affect intestinal transit was examined in the ileums of guinea pigs, rabbits, and mice. The extract elicited concentration-dependent contractions of the smooth muscles in the ileum and jejunum of rabbits (Chidume *et al.*, 2002).

### 5.7 Antifertility activity

Male wistar rats were given prepared ethanolic extract of *C. tora* orally for 60 days at doses 50, 100, and 200 mg/kg.b.wt./rat/day, respectively. Some treated rats were also retained for an additional 30 days to examine the effects of reversibility. Reduced amounts of protein, glycogen, ascorbic acid, fructose, and sialic acid in the extract from *C. tora* fruits may have contributed to the degenerative alterations in the germinal epithelium of the testes' seminiferous tubules. Rats treated with extract had lower levels of testosterone, which supported the treatment's anti-androgenic effects by causing a drop in sperm motility and density (Khan, 2017).The leaf extract demonstrated the most potent antifertility effects in female rats. It has been established that the drug's antifertility effects are related to oestrogenic activity (Cho, 2007; Pawar, 2011).

### 5.8 Antigenotoxic activity

The mutagenicity of 3,1-dimethyl-5H-pyrido (4,3-) indole and 2,6-dimethyldipyrido Imidazole (Glu-P-1) was greatly decreased by unroasted *C. tora* water extracts (Trp-P-1). Unroasted *C. tora* are less antigenotoxic than roasted ones, which may be due to the reduction of anthraquinones in the organisms during roasting (Wu, 2004; Yen, 1998).

### 5.9 Antifungal agent

Though *C. tora* is indeed an antifungal agent, however there is not yet an ideal formulation for increased drug penetration. Corrie and her team, create a *C. tora* extract phytosomal gel that has antifungal activity and improved therapeutic activity. The formulated gel permeated more effectively than the standard gel, and stability modifications revealed no significant changes in the CTE phytosomal gel (Corrie *et al.*, 2021).

### 5.10 Antibiofilm activity

Resveratrol, isolated from *Polygonum cuspidatum*, *C. tora*, and *Vitis vinifera*, exhibited excellent antibiofilm action *in vitro* against avian pathogenic *escherichia coli* strains including suppression of swimming and swarming motility, biofilm formation, and biofilm elimination (Ruan *et al.*, 2021).

### 5.11 Antimicrobial activity

Following fermentation on nearby rice for 21 days, ten endophytic fungi were isolated from *N. laevis* and *C.tora* leaves. Next, ethyl acetate was employed to extract the substances' secondary metabolites. The bioactive components of the extracts were identified using high performance liquid chromatography connected to diode array detector, while antibacterial activity of extracts on test organisms was assessed by means of agar diffusion and agar dilution techniques. Largest and smallest inhibition-zone dimensions for nine of the fungal isolates (NL1, NL3, NL6, NL10, NL12, CT2, CT7, CT9, and CT10) were 14 and 2 mm, correspondingly, whereas CT1 did not inhibit any of the tested microorganisms at the tested concentrations. With an inhibition-zone diameter ranging between 4-8 mm and 7-14 mm for *both C. albicans* and *Trichophyton* tested, the extracts showed significant antifungal activity. The most of the tested bacteria were suppressed by the endophytic fungus extracts CT2 and NL1, which showed the best antimicrobial activity. Some classes of chemicals, including catechin derivatives, benzoic acid derivatives, and apigenin, which have been previously reported to have antimicrobial potential, were identified using HPLC-DAD analysis of the endophytic fungal extracts (Amaechi *et al.*, 2020).

By effective zone of inhibition, the leaf and seed extracts demonstrated substantial antibacterial activity. According to the results of this study, *C. tora* leaf and seed extract has potent antimicrobial activity against a small number of pathogenic bacteria, including *Klebsiella oxytoca*, *Salmonella typhi*, and *Pseudomonas aeruginosa*, as well as antifungal activity against *Aspergillus niger* and *Curvularia lunata*. *Salmonella typhi* and *Pseudomonas aeruginosa* were most effectively inhibited by the ethyl acetate leaf extract of the *C. tora*plant. With regard to *Curvularia lunata*, *C. tora* leaf extract in ethyl acetate showed the largest zone of inhibition (Sabyasachi *et al.*, 2016). Using solutions of water, methanol, and chloroform, *C. tora* leaf material was extracted. These extracts showed antibacterial action against a variety of bacteria and fungi that have been associated with gastrointestinal issues and skin diseases (0-5000 g $ml^{-1}$). 0 to 64 mg $ml^{-1}$ of methanolic extracts demonstrated antifungal activity. Five strains of *Shigella dysenteriae*, four strains *of Staphylococcus aureus*, and three strains of *Escherichia coli* have demonstrated sensitivity against *in vitro* treatment of the methanol extracts, according to an *in vitro* investigation up to 2000 g ml (Das *et al.*, 2010).

### 5.12 Anticancer activity

The ethyl acetate and hexane fraction of the leaf extract's effect on the breast cancer cell line MCF7 were evaluated using the MTT test. The anticancer potential of *C. tora* leaf and seed extract was investigated in this work. The hexane fraction and ethyl acetate fraction of the leaf were found to have an effect on the MCF7 breast cancer cell line, respectively, using the MTT test. Hexane extract exhibited 42% as well as 55% cells vitality, respectively, after half and quarter dilutions after treating a cancerous cells line, indicating a lower percentage of cell viability. The cell survival of cancer cell lines treated with ethyl acetate fraction of half dilution and one-fourth dilution of leaf extract is 48% and 77%, respectively, in comparison to hexane fraction of leaf extract at the same dilutions. It was demonstrated that the hexane fraction of the leaf extract exhibited more potent anticancer properties than the ethyl acetate fraction (Sabyasachi *et al.*, 2016).

### 5.13 Antimutagenic activity

Aflotoxin B1 test findings utilized by Ingle and his colleagues in their research were used to demonstrate the antimutagenic effects of a methanol extract of seeds. When this extract was added to the test procedure utilizing *Salmonella typhimurium* TA10 and/or TA98, revertants per plate drastically reduced. The following partitioning step was adding water, n-butanol, and $CH_2Cl_2$ in that sequence to the methanol extract. While the $H_2O$ fraction was mutagenic, the $CH_2Cl_2$ and n-butanol fractions were not (Ingle *et al.*, 2012).

### 5.14 Larvicidal activity

*Anopheles gambiae*, the African malaria vector, and its larvae were used as test subjects for seed extract and its two isolated main anthraquinones (obtusin and aurantio-obtusin). Whereas, obtusin and aurantio-obtusin both exhibited mosquito larvicidal activity comparable to their respective fractions but less powerful than azadirachtin and the crude extract (Mbatchou *et al.,* 2017).

### 5.15 Purgative activity

Both the isolated aloe-emodin and methanolic extract from leaves of *C. tora* were tested for their purgative effects in wistar rats, and both showed clear evidence of purgative activity (Maity, 2003).

### 5.16 Insecticidal activity

Methanolic extracts of given herbs *Cardiospermum halicacabum*, *Catharanthus roseus*, *Andrographis paniculata*, *Cassia tora*, *Eupatorium riparium*, *Datura metal*, and *Mikania micarantha* were investigated in the laboratory for larvicidal and antifeedant activity against *Helicoverpa armigera* (Hubner) larvae. All of the selected botanicals' crude extracts demonstrated a dose-dependent increase in bioactivity. However, the bioactivity of four plants, *Andrographis paniculata*, *Cassia tora*, *Cardiospermum halicacabum*, and *Datura metal* was significantly higher (p 0.05) than the control and *Catharanthus roseus*, *Eupatorium riparium*, and *Mikania micarantha* extracts. Methanol extract of *Andrographis paniculata* caused most oral toxicity, with larval mortality ranging from 29.00% to 58.22% across the concentrations tested (0.2%, 0.4%, and 1% w/v), while extract of *Cassia tora* demonstrated the most feeding deterrence, with larval feeding lowered by 59.92% and 76.61% at 0.2% and 0.4%, respectively. As a result, four of the selected plants have insecticidal properties and can be studied further for the creation of an effective natural botanical pesticide (Ravi and Sundararajan, 2020).

After fractionating the active ethyl acetate extract, aurantio-obtusin, a known anthraquinone, and a brand-new substance called cassiatorin were both isolated. Aurantio-obtusin and cassiatorin, two anthraquinone compounds, displayed comparable insect antifeedant qualities to the positive controls while outperforming the standard controls in terms of their insecticidal and ovipositor deterrent activities (Mbatchou *et al.,* 2018).

### 5.17 Antipsoriatic activity

Study by Ho and her team revealed that the molecules luteolin, quercetin, and formononetin in *C.tora* lowered epidermal layer thickness in healthy male wistar rats and swiss albino mice. They also demonstrate that these effects are mediated by the suppression of pro-inflammatory cytokines such as IL-6, IL-8, and TNF-alpha (Ho *et al*., 2007).

## 6. Conclusion

The global market for medications is seeing a considerable increase in the use of natural therapies. This review is focused on the surplus and in-depth reading of *C.tora* who offers plenty of proof regarding the herb's effects on many bodily systems and supports its usage in traditional and folk medicine. Due to *C.tora* importance in the Ayurvedic and Chinese traditional medical systems, an attempt is made to concentrate on and evaluate the collected data on the traditional uses, morphological characteristics, safety/toxicity investigations, and phytopharmacological profile of the plant.There is a need for additional research because a toxicity study on the seeds and leaves of *C.tora* was conducted. To uncover the hidden aspects and their real world clinical applications, which may be exploited for the benefit of humanity, evaluation of *C.tora* must be done.It may prove to be a wizard in the future for the treatment of numerous terrible illnesses and ailments.

## Conflict of interest

The authors declare no conflicts of interest relevant to this article.

## References


**Ansari, MHR and Ahmad, S. (2019).** Herbs that heal: Natural remedies for health promotion and Longevity. Ann. Phytomed.., 8:7-18. DOI: 10.21276/ap.2019.8.1.2

**Anon.(1956).** The wealth of India: A dictionary of raw material and industrial products. 3, New Delhi; CSIR: pp:368-370.

**Anyebe, D.A.; Tajudeen, Y.O.; Shemishere, U.B.; Yaro, C.A.; Oladele, E.O and Maiyama, M.I. (2021).** Methanol extract of *Cassia tora* ameliorates dextran sulfate sodium induced ulcerative colitis in BALB/c mice. Scientific African., 13:e00865.

**Anthonia, A. A.; Angus, N.O.; Ugochukwu, M. O.; Samson, A. A.; Chika, C. A.; Ifeanyi, J. O. and Festus B.C. (2020).** Secondary metabolites of endophytic fungi from *Newbouldia laevis* and *Cassia tora* Leaves: Prospecting for new antimicrobial agents. Recent Pat Antiinfect. Drug Discov., **16**(1):50-62. **DOI:** 10.2174/1574891X159 9920 1 222152646

**Arif, S.; Sharma, A. and Mohammad, H.I. (2022).** Plant derived secondary metabolites as multiple signaling pathways inhibitors against cancer. Ann. Phytomed., **11**(1):189-200. DOI: http://dx.doi.org/10.54085/ap.2022.11.1.18

**Arya Vaida Sala. (2003)** Indian Medicinal Plant. A compendium of 500 species. Orient Longman., 2:26.

**Bhandirge, S. K.; Patel, V.; Patidar, A.; Pasi, A. and Sharma, V. (2016).** An overview on phytochemical and pharmacological profile of *Cassia tora* Linn. Int. J. Herb. Med., 4:50-55.

**Chidume, F.C.; Kwanashie, H.O.; Adekeye, J.O.; Wambebe, C. and Gamaniel, K.S. (2002).** Antinociceptive and smooth muscle contracting activities of the methanolic extract of *Cassia tora* leaf. J. Ethnopharmacol., **8**1:205-209.

**Cho, I.J.; Lee, C. and Youl, T. (2007).** Hypolipidemic effect of soluble fiber isolated from seeds of *Cassia tora* Linn, in rats fed a high cholesterol die. J. Agric Food Chem., **55**(4):1592-1596.

**Corrie, L.; Gundaram, R. and Kukatil, L. (2021).** Formulation and evaluation of *Cassia tora* phytosomal gel using central composite design. Recent Innovations in Chemical Engineering (Formerly Recent Patents on Chemical Engineering)., 14. DOI: 10.2174/24055 20414666 210525094503.

**Das, C.; Dash, S.; Sahoo, D.C.; Mohanty, A. and Rout, D. (2011).** *Cassia tora*: A Phyto pharmacological overview. International Journal of research in Ayurveda and Pharmacy. **2**(4):1162-1174.

**Deoda, R.S.; Kadam, P.V.; Shivatare, R.S.; Narappanawar, N.S.; Yadav, K.N. and Patil, M.J. (2012).** Pharmacognostic and phytopharmacological profile of *Cassia tora* Linn : A review. Inventi Rapid: Planta Activa., 1(2).

**Duke, J.A., (2001).** Handbook of Phytochemical Constituents of GRAS Herbs and other Economic Plants. 1stEdn. CRC Press, Boca Raton, ISBN-10: 0849338654, pp:654.

**Dhanasekaran, M.; Ignacimuthu, S. and P. Agastian. (2009).** Potential hepato-protective activity of ononitol monohydrate isolated from *Cassia tora* L. on carbon tetra chloride induced hepatotoxicity in wistar rats. Phytomedicine, **16**:891-895. DOI: 10.1016/j.phymed.2009.02.006

**Das, G.; Ojha, D.; Bhattacharya, B.; Samanta, M. and Ghosh, S. (2010).** Evaluation of antimicrobial potentialities of leaves extract of the plant *Cassia tora* Linn. (Leguminosae/Caesalpinioideae). J. Phytol., **2**:64-72.

**Deore, S.L.; Khadabadi, S.S.; Kamdi, K.S.; Ingle, V.P., Kawalkar, N.G. and Sawarkar P.S. (2009).** *In vitro* antihelmintic activity of *Cassia tora*. Int. J. Chem. Tech. Res., pp:177- 179.

**Eun, K.O.;Min Young, U.M.;Han, T.; Shin, S. and Choi, M.S. (2021).**Emodin and rhein in *Cassia tora* ameliorates activity of mitochondrial enzymes involved in oxidative phosphorylation in the retina of diabetic mice. Applied Biological Chemistry., **64**(1). DOI: 10.1186/s13765-021-00609-2

**Gulia, Y. and Choudhary, M. (2011).** Evaluation of antiulcer activity of *Cassia tora* leaf extract using ethanol induced ulcer model in rats. Pharmacologyonline, **2**:1038-1045.

**Ho, T.Y.; Wu, S.L.; Chen, J.C.; Li, C.C. and Hsiang, C.Y. (2007).** Emodin blocks the SARS coronavirus spike protein and angiotensin-converting enzyme 2 interaction. Antiviral Res., **74**(2):92-101.

**Ingle, A.; Ranaware, P.; Ladke, A. and Damle, M. (2012).** *Cassia tora* Phytochemical and pharmacological activity. Int. Imp. J. Pharmacog Nat Prod., **2**(1):14-23.

**Jeongsu, N. and Choi, H. (2008).** Effect of butanol fraction from *Cassia tora* L, seeds on glycaemic control and insulin secretion in diabetic rats. Nutrition Research and Practice, **2**(4): 240-246.

**Khan, S. and Mali, P.C. (2017).** Reversible Antifertility Effect of *Cassia tora* Linn in Male Rats. International Journal of Life Sciences Scientific Research, **3**(5):1415-1423.

**Kirthikar, K.R. and Basu, B.D. (1999).** Indian Medicinal Plants. Popular Publications dehradun, India, 2nd Ed, **2**:878-879.

**Kirtikar, K.R. and Basu, B.D. (2006).** Indian Medicinal Plants. International Book Distributors and Publishers, pp:878-879.

**Kumar, S.; Singh, R.; Nagar, P.S. and Dwivedi, M. (2021).** Morphological, anatomical characterization and profiling of laxative principles sennosides in fifteen species from genus *Cassia, Chamaecrista and Senna*. Ann. Phytomed., **10**(1):33-44. DOI: http://dx.doi.org/10.21276/ap.2021.10.1.4

**Lee, H.J.; Choi, J.S.; Jung, J.H. and Kang, S.S. (1998).** Alaternin glucoside isomer from *Cassia tora*. Photochemistry, **49**:1403-1404. DOI: 10.1016/S0031-9422(98)00151-4

**Lee, H.J.; Jung, J.H.; Kang, S.S. and Choi, J.S. (1997).** A rubrofusarin gentiobioside isomer from roasted *Cassia tora*. Arch. Pharm. Res., **20**:513-515. DOI: 10.1007/BF02973951

**Le, M.J; Jong H.N.; Yang, B.D.; Park, H.O.; Lee, H. J.; Lee, K.H.; Jang, J.H.; Jung, H. K.; Kim, S.R.; Cho, H.W.; Park, H.S.; Lim, J.O. and Kim, J. C. (2019).** Sub chronic toxicity evaluation of ethanol extract of *Cassia tora* L. seeds in rats. Regulatory Toxicology and Pharmacology, pp:109.

**Mehrotra, N. (2021).** Herbs that heal: Nature's pharmacy endowed remedies for better health. Ann. Phytomed., **10**(1):6-22. DOI: http://dx.doi.org/10.21276/ap.2021.10.1.2

**Mazumder, A.; Lahkar, V.; Sahay, J.; Oraon, A.; Mazumder, R. and Pattnaik, A.K. (2005).** Pharmacognostical studies on the leaves of *Cassia tora* Linn. (Fam. Caesalpiniaceae). Ancient Science of Life, **25**(2):74-78.

**Meena, A.K.; Niranjan, U.S.; Yadav, A.K.; Singh B. and Nagariya A.K. (2010).***Cassia tora* Linn: A review on its ethnobotany, phytochemical and pharmacological profile. J. Pharm. Res., **3**:557-557.

**Mohamed, S.N.;Sivaprakasam,P.; Anandasadagopan, S.K.; Begum, A.A and Pandurangan, A.K. (2022).** Green synthesis and characterization of silver nanoparticles using *Cassia tora* seed extract and investigation of antibacterial potential. *Applied Biochemistry and Biotechnology*., **194**:464-478. doi: 10.1007/s12010-021-03651-4.

**Maity, T.K.; Mandal, S.C.; Pal, M. and Shah, B.P. (1998).** Antihepatotoxic activity of *Cassia tora* leaf extract. Natural Product Sciences, **4**(4):226-229.

**Maity, T.K. and Dinda, S.D. (2003).** Purgative activity of *C. tora* leaf extract and isolated aloe emodin. Indian Journal of Pharmaceutical Sciences, pp:93-95.

**Mbatchou ,V.C.; David, P.T.; Rita, A.; Dickson , K.A.; Abraham, Y.M.; Isaac, K. A.; Julia, W. J.; Xavier, C.;Solomon, H. and Baldwyn, T. (2017).** Mosquito larvicidal activity of *Cassia tora* seed extract and its key anthraquinones aurantio-obtusin and obtusin. Parasit Vectors, **10**(1):562. doi: 10.1186/s13071-017-2512-y.

**Mbatchou, V.C.; Dickson, R.A.; Amponsah, I.K.; Mensah, A.Y. and Habtemariam, S. (2018).** Protection effect of the anthraquinones, cassiatorin and aurantio-obtusin from seeds of *Senna tora* against cowpea weevil attack. Asian Pac. J. Trop. Biomed., **8**:98-105.

**Nwankwo R.N.; Nnam N.M.; Ta'awu K. G and Ularamu J. (2017).** Effects of *Cassia tora* leaf extracts on blood glucose and lipid profile on alloxan-induced diabetic rats. Journal of Dieticians Association of Nigeria, **8**:121-130.

**Nadkarni, K.M. (1954).** Indian Materia Medica, Popular Prakashan Mumbai, **1**:291.

**Pawar, H.A. and D'mello, P.M. (2011).***Cassia tora* linn: an overview. International Journal of Pharmaceutical Science and Research. **2**(9): 2286-2291.

**Roopashree, T.S.; Raman, D.; Rani, R.H. and Narendra, C. (2010).** Standardization, phytochemical and pharmacological evaluation of *Cassia tora* seed extracts. Der Pharmacia Lettre, **2**(4):365-372.

**Rajan, A.V.; Shanmugavalli, N.; Sunitha, C.G. and Umashankar, V. (2009).** Hepatoprotective effects of *Cassia tora* on $CCl_4$ induced liver damage in albino rats. Indian J. Sci. Technol., **2**:41-44.

**Ruan, X.C.; Deng, X.L.; Tan, M.L.; Yu, C.; Zhang, M.; Sun, Y. and Jiang, N. (2021).** *In vitro* antibiofilm activity of resveratrol against avian pathogenic *Escherichia coli*. BMC Veterinary Research, **17**(249):2-9. DOI: 10.1186/s12917-021-02961-3

**Ravi, G. and Sundararaja, G. (2020).** Larvicidal and antifeedant activity of some plants extracts against the larvae of *Helicoverpa Armigera* (Hubner). International Journal of Scientific Research and Management., **8**(5):B-2020-67-76. DOI: 10.18535/ijsrm/v8i05.b02

**Sabyasachi, C.; Kaniz, W.S.; Anupam, B. and Manas, B. (2016).** Phytochemical study, antimicrobial and anticancerous activity of *Cassia tora* Linn. Research and Reviews: Research Journal of Biology, **4**(2):21-23.

**Shukla, S.A.; Anand K,; Terrence. M.; Yusuf. J.; Singh, V.P and Manish Mishra. (2013).** The probable medicinal usage of *Cassia tora*: An overview. Online J. Biol. Sci., **13**:13-17.

**Sharma, P.; Roy, M. and Roy, B. (2022).** A review on influence of floral biology, pollination efficiency and conservation strategies of endangered medicinal plant, *Rauvolfia serpentina* (L.) Benth. Ex Kurz. Ann.Phytomed., **11**(1):86-98. DOI: http://dx.doi.org/10.54085/ap.2022.11.1.9

**Sharma, P.C.; Yelne, M.B. and Dennis, T.J. (2005).** Database of Medicinal Plant used In Ayurveda, New Delhi: CISR, pp:144-148.

**Shivjeet, S.; Singh, S. K. and Yadav, A. A. (2013).** Review on cassia species: Pharmacological, traditional and medicinal aspects in various countries. Am. J. Phytomedicine Clin. Ther. **3**:291-312.

**Tiwari, P.; Kumar, K.; Panik, R.; Pandey, A.; Pandey, A. and Sahu, P.K. (2011).** Hepatoprotective effects of *Cassia Tora* whole plant. International Journal of Pharmacy and Technology, **3**(2):2798-2806.

**Upendra, S; Manju, B; Praveen, K; Geetanjali, R; Neeraj, K; Bikram, S and Saroj Arora.(2010).** Antimutagenic extract from *Tinospora cordifolia* and its chemical composition. Journal of Medicinal Plants Research, **4**(24):2488-2494.

**Vijayalakshmi, A and Madhira G. (2014).** Antopsoriatic activity of flavanoids from *Cassia tora* leaves using the rat ultraviolet B ray photodermatit is model. Brazilian Journal of Pharmacology, **2**:322-329.

**Vanapatla, S.R. and Anuradha, S. (2018).** Antidiabetic activity of different leaf extracts of *Cassia tora* in alloxan induced diabetic rats. International Journal of Pharmacy and Biological Sciences, **8**(3): 491-502.

**Wu, C.H. and Yen, G.C. (2004).** Antigenotoxic properties of Cassia tea (*Cassia tora* L.): Mechanism of action and the influence of roasting process. Life Sci., **76**:85-101. DOI: 10.1016/j.lfs.2004.07.011

**Yen, G.C.; H.W. Chen and P.D. Duh. (1998).** Extraction and identification of an antioxidative component from Jue Ming Zi (*Cassia tora* L.). J. Agric. Food Chem., **46**:820-824. DOI: 10.1021/jf970690z

**Zhu, L.; Yu, S.; Zeng, X.; Fu, X. and Zhao, M. (2008).** Preparative separation and purification of five anthraquinones from *Cassia tora* L. by high-speed counter-current chromatography. Sep. Purif. Technol., **63**: 665-669.

**Citation** **Umesh B. Telrandhe and Mahendra C. Gunde (2022). Phytochemistry, pharmacology and multifarious activity of *Cassia tora* L.: A comprehensive review Ann. Phytomed., 11(2):231-239. http://dx.doi.org/10.54085/ap.2022.11.2.25.**