

# *Cassia tora* Linn: A medicinal herb for skin diseases

Mohd Shadab<sup>1</sup>, Shariq Shamsi<sup>2</sup>, Imtiyaz Ahmad<sup>3</sup>

<sup>1</sup>Lecturer, Department of Ilmul Saidla (Unani Pharmacy), Rajasthan Unani Medical College & Hospital, Jaipur 302031, Rajasthan (corresponding author)

<sup>2</sup>Lecturer, Department of Ilmul Saidla (Unani Pharmacy), National Institute of Unani Medicine, Bangalore 560091, Karnataka.

<sup>3</sup>Lecturer, Department of Ilmul Saidla (Unani Pharmacy), Jamia Tibbiya Deoband, Saharanpur 247554, UP.

Source of support: Ministry of AYUSH

## Abstract

*Cassia tora* Linn. Leguminosae is an annual herbaceous fetid herb which is mostly found in South-East Asia and the South-West Pacific as an important weed. It is one of the recognized anthraquinone (organic compound) containing plants. The seeds and leaves constitute a valuable remedy in skin diseases, chiefly for ringworm and itch. As per Unani literature, the seeds of *Cassia tora* are *Musaffi-e-khoon* (Blood purifier) and *Jali* (Detergent) in action that is why used in skin diseases such as *Judham* (Leprosy), *Quba* (Ringworm), *Bahaq* (Pityriasis), *Bars* (Vitiligo) and *Kalf* (Melasma) internally as well as externally. Paste of leaves with lime-juice is used to treat vitiligo. Several chemical compounds such as anthraquinone, naphthopyrone glycosides, and phenolic compounds have been isolated from this plant. The aim of this review is to collect data about its medicinal uses described in Unani literature as well as ethnobotanical literature. Phytochemical and pharmacological studies of different parts of this plants which have been done in different parts of the world are also discussed.

Key words: *Cassia tora*, ringworm, Panwar

## INTRODUCTION:

*Cassia tora* is a traditional Unani medicine, popularly known as Panwar. It is known by its different vernacular names such as Sanjsaboya<sup>[1,2]</sup>, Qalb<sup>[2,3,4,5,6]</sup> (Arabic), Sang Saboya<sup>[1,2,3,4,5,6]</sup> (Persian), Panwar<sup>[2,7]</sup> (Urdu), Penwaad Taarutaa<sup>[8]</sup> (Unani), Ringworm Plant<sup>[2,6,7,8]</sup>, Sickie Senna<sup>[2,7,8,9,10,11,12]</sup>, Foetid cassia<sup>[1,2,9,13]</sup> (English), Chakunda<sup>[1,2,3,4,5, 7,9,10,11,12,13,14,15]</sup>, Pamad<sup>[1,2,7]</sup>, Chakavat<sup>[1,2,9,7]</sup>, Panewar<sup>[1,2,7,9,10,11,12,13,15]</sup> (Hindi), Chakramarda<sup>[1,2,9,14]</sup>, Dadrugghna<sup>[2]</sup>, Praputrat<sup>[2]</sup>, Kharjugna<sup>[13]</sup>, Dadamari<sup>[1,14,9,10,11,12,15]</sup> (Sanskrit). The whole plant has a fetid smell [17]. The seeds, roots and leaves from this plant have been shown to be very beneficial. The leaves and seeds constitute a valuable remedy in skin diseases, chiefly for ringworm and itch. Chrysophanic acid-9-anthrone, extracted from seeds, was found to be active against ringworm fungi. Seeds of *Cassia tora* are blood purifier and therefore used in skin diseases such as leprosy, ringworm, pityriasis, vitiligo and melasma internally as well as externally<sup>[6]</sup>. The seeds are official in Japanese Pharmacopoea, they can be used as a tonic and stomachic used for ringworm and other skin diseases. Seeds are also used in eye-diseases, liver complaints and earache. The filtrate obtained from the boiled powder of seeds is considered a blood-purifier and is given in the inflammation of skin. The extracts of seeds showed marked contraction of the uterus of guineapig<sup>[9]</sup>. In China, the seeds are used externally and internally for all sorts of eye diseases<sup>[1]</sup>. Mature leaves possess purgative activities. The leaf extract exhibited antifungal activity against the ringworm fungus *Microsporon nanum*<sup>[8]</sup>. A decoction of leaves is given to children suffering from feverish attacks during teething<sup>[3,9,13,18,19]</sup>. Leaves of *Cassia tora* resembles with the leaves of senna, therefore, sometimes the true senna is adulterated with the leaves of this plant<sup>[18,8]</sup>. The roots are reported to possess bitter, tonic, purgative and anthelmintic properties<sup>[9]</sup>. A paste of root with lime juice is a specific remedy for ringworm<sup>[18,13,9,19]</sup>.

## LITERATURE REVIEW

### Morphological Description of Plant in Unani System of Medicine

The plant of *Cassia tora* is small, equal to 2 feet in height (Fig. 1) <sup>[18]</sup>. Leaves are just adjacent to stem, small in size, reverse conical in shape that is wider portion upper and narrower portion below, unpleasant in smell and bitter in taste <sup>[20]</sup>. Leaves resemble with the leaves of senna. They remain open during day time and come to each other at the time of sun set. This is the characteristic feature of *Cassia tora* <sup>[18,6]</sup>. Flowers are long and yellow in colour. Seeds of *Cassia tora* are light green in colour, oblong in shape and are enclosed in a pod measuring 6 to 7 cm <sup>[3,5]</sup>. Seeds are so hard that even after soaking in water they can't be soften <sup>[3]</sup>. The seeds fall on the ground after being fracture of pod due to dryness that prepares the plant for the next year (Fig. 2) <sup>[5]</sup>.



Figure 01: Plant of *Cassia tora*  
(Source: Agro's Colour Atlas of Medicinal Plants)



Figure 02: Seeds of *Cassia tora*  
(Source: Laboratory Sample)

### Habitat and Distribution

This plant is common everywhere in Bengal and widely spread and abundant throughout the tropical parts of India <sup>[1,21,19]</sup>. It grows wild on roadsides and field margins in the midlands and mountains <sup>[11,12]</sup>. It is very stress tolerant and is an easy plant to grow. The plant can be grown in dry soil throughout tropical parts and high hills of elevation (Himalayas) of up to 1800 meters as well as the plains <sup>[22]</sup>. Plant occur throughout the rainy season but flowering and fruiting occur in August to November <sup>[7]</sup>. It can withstand polluted environment <sup>[9]</sup>. This plant is propagated through seeds <sup>[11,12]</sup>. No specific farming techniques are needed <sup>[12]</sup>.

## Botanical Description

*Cassia tora* is an annual fetid herb 30-90 cm in height. **Leaves** are 7.5-10 cm long; rachis is grooved with more or less pubescent and having a conical gland between each of the two lowest pairs of leaflets; stipules are 1.3-2 cm long in length and linear-subulate in shape. Leaflets are 3 pairs in numbers, opposite to each other, 2.5-4.5 cm long and 1.3-2.5 cm wide in dimension, obovate-oblong in shape, membranous, glabrous or more or less pubescent. The lowest pair of the leaflet is smallest. Petiolules are pubescent and 2.5 mm long. **Flowers** are usually in subsessile pairs in the axils of the leaves. Calyxes are glabrous and divided to the base into 5 mm long ovate spreading segment. Petals are 5 in numbers and pale yellow in colour, 8 mm long and 2.5 mm wide in dimension. They are oblong, obtuse, spreading. Stamens are 10 in numbers, the 3 upper reduced to minute staminodes, the remaining 7 are perfect and are sub equal in size. Pods are 12.5-20 cm long and 4-5 mm wide, much curved when they are young and are obliquely septate. Seeds are 25-30 in numbers, rhombohedral in shape, green in colour with the long axis in the direction of the pod <sup>[1]</sup>.

## Phytochemical Studies

### Seeds

Seeds contain amino acid, fatty acids, aloë-emodin, chrysophanol, emodin, rhein and sitosterol. Myricyl alcohol, chrysophanic acid and its 9-anthrone derivative were also isolated from the seeds. Rubrofusarin, and its triglucoside, 6-O- $\beta$ -D-glucoside, and 6-O- $\beta$ -D-gentiobioside; norrubrofusarin and its gentiobioside, torachrysone and its gentiobioside, teragluconide, apiogluconide, demethylflavaspermone gentiobioside, obtusin, aurantio-obtusin, isotalactone, cassia-lactone, naphthalenic lactone, quercetin were also isolated from the seeds <sup>[21]</sup>. Seeds also contain anthraquinone glycoside, naphthopyrone glycosides, cassiaside and rubrofusarin-6-beta-gentiobioside <sup>[8]</sup>. Seeds also yield a fatty oil consisting of oleic, linolic, palmitic and lignoceric acids and sitosterol <sup>[11]</sup>. A new anthraquinone glycoside – 8-hydroxy-3-methylanthraquinone-1- $\beta$ -gentiobioside (III) are found in seeds. A water soluble polysaccharide composed of D-galactose and D-mannose in molar ratio of 1:3:1 is found in seeds <sup>[23]</sup>. Two new lactones – isotalactone and cassialactone are present in seeds along with torosachrysone <sup>[24]</sup>. Two new naphthopyrone glycoside – 9-[( $\beta$ -D-glucopyranosyl(1 $\rightarrow$ 6)-O- $\beta$ -D-glucopyranosyl)oxy]-10-hydroxy-7-methoxy-3-methyl-1H-naphthol[2,3-C]pyran-1-one (I) and 6-[( $\alpha$ -apiofuranosyl(1 $\rightarrow$ 6)-O- $\beta$ -D-glucopyranosyl)oxy]-rubrofusarin (II) are also present in seeds <sup>[25]</sup>. Analysis of the seeds gave the following values: moisture, 4.48; crude protein, 23.77; fat, 2.74; crude fibre, 13.14; carbohydrates, 48.53; ash, 7.34; iron, 0.187; and phosphorus, 0.362%. The amino acid composition of protein is as follows: lysine, 3.7; histidine, 2.4; threonine, 9.2; phenylalanine, 4.8; valine, 6.4; methionine, 1.6; tryptophan, 0.9; leucine and isoleucine, 15.1; serine, 7.4; glycine, 10.2; tyrosine, 3.8; cystine, 0.8; arginine, 6.6; glutamic acid, 10.6; aspartic acid, 6.8; alanine, 8.4; and proline, 0.6% <sup>[9]</sup>.

### Leaves

The leaves contain chrysophanol, aloë-emodin, rhein and emodin <sup>[8]</sup>. Presence of emodin and kaempferol-2-diglucoside is also reported in the leaves. The leaves also contain d-mannitol, myricyl alcohol,  $\beta$ -sitosterol, glucose, togonelline, 1-stachydine and choline <sup>[9]</sup>. Triacontan-1-ol, stigmasterol,  $\beta$ -sitosterol- $\beta$ -D-glucoside, friedelin. Palmitic, stearic, succinic and d-tartaric acids, uridine, myo-inositol, d-ononitol, kaempferol, quercetin, juglanin, astragalin, quercitrin and isoquercitrin are also isolated from leaves <sup>[23]</sup>. Analysis of the leaves gave the following values: moisture, 82.5; protein, 4.5; fat, 1.1; fibre, 2.2; carbohydrates, 8.0; minerals, 1.7%; calcium, 520; phosphorus, 39; iron, 12.3; thiamine, 0.19; riboflavin, 0.83; nicotinic acid, 0.83; vitamin C, 82 mg/100g <sup>[9]</sup>.

### Roots

Root contain choline, 1,3,5-trihydroxy-6, 7-dimethoxy-2-methylanthraquinone, leucopelargonidin-3-O- $\alpha$ -L-rhamnopyranoside <sup>[9]</sup> and  $\beta$ -sitosterol <sup>[16]</sup>.

## Medicinal Action

### As per Unani literature

*Musaffi-i-Dam* (Blood purifier) [3,4,5,6], *Mushil* (Purgative) [4,20], *Jadhib* [18,20,26,27], *Qabid* (Astringent) [18,20], *Hadim* (Digestive) [18,20], *Dafe Surkh-e-Bada* [18,20], *Dafe Fasade-e-Balgham* [20], *Dafe Fasad-e-Dum* [20], *Dafe Sailan-e-Mani* [20], *Mudirr-i-Bawl* (Diuretic) [20], *Dafe Salas al-Bawl* (Urinary incontinence) [5], *Fsad-e-Riyah* [20], *Fasad-e-Safra* [20], *Dafe Bars wa Bahaq* [6], *Dafe Judham* (Anti-leprotic) [20], *Dafe Kharish* (Anti-pruritic) [20], *Dafe Kalf* [20], *Dafe Quba* [20], *Muhallil* (Resolvent) [18,20,26,27], *Nafe Bad-i-Safra* [26], *Nafe Bad-i-Shikam* [26], *Mukhrij-i-Balgham* [3,4], *Mushil-i-Balgham* (Phlegmagogue) [5,19], *Mushil-i-Sauda* (Melanogouge) [5,7], *Mukhrij-i-Sauda* [3,4], *Dafe Waba* (Antiepidemic) [3,4,19,26,27,28], *Dafe Bawaseer* (Antihæmorrhoidic) [3,4,5,28], *Mufarreh* (Exhilarant) [18,20], *Jali* (Detergent) [3,4,6,7].

### As per Ethnobotanical literature

Blood purifier (*Musaffie Khoon*) [9], Purgative (*Mushil*) [15], Laxative (*Mulayyin*) [11,12,21] Hepatoprotective (*Muhafiz-e-Jigar*) [18], Antioxidant [8], Antiparasitic [13], Tonic (*Muqawwi*) [9], Stomachic (*Muqawwi-i-Mi'da*) [9]. Skin diseases (*Amraz-e-Jild*) [1,9,13,14,15,17,19,21].

## Pharmacological Activities:

### Hypolipidemic activity

Umesh K. Patil et al investigated the Ethanolic extract of seeds of *Cassia tora* L. and its fractions for hypolipidemic activity on triton induced hyperlipidemic profilet in albino rats (Wistar strain) of either sex weighing 90–120 gm. Ethanolic extract and its ether soluble and water soluble fraction decreased serum level of total cholesterol. On the other hand ethanolic extract, ether soluble fraction and water soluble fraction decreased triglyceride as well as LDL-cholesterol and on the other hand increased the serum HDL-cholesterol level by different percentage [29].

### Hypoglycemic activity

Jeongsu Nam and Hyunju Choi studied the effects of *Cassia tora* L. seed butanol fraction (CATO) on postprandial glucose control and insulin secretion from the pancreas of the normal and diabetic rats. Adult male Sprague-Dawley rats, weighing 330-390 g, were used for the study. Diabetes was induced by intraperitoneal injection of Streptozotocin at a dose of 55 mg/kg body weight. Rats showing above 300 mg/dL of 12 hours fasting serum glucose level were used for the diabetic groups. The postprandial glucose control was monitored during a 240 min-period using a maltose loading test. In normal rats, rats fed CATO (20 mg/100 g BW/d) showed lower postprandial glucose levels in all the levels from 30 min up to 180 min than those in the control rats without CATO. Findings indicated that constituents of *Cassia tora* L. seeds have beneficial effect on postprandial blood glucose control which may be partially mediated by stimulated insulin secretion from the pancreas of the diabetic rats [30].

### Anthelmintic activity

Deore S. L. et al investigated anthelmintic activity of alcohol and aqueous extracts from the seeds of *Cassia tora* against *Pheretima posthuma* and *Ascaridia galli*. Each extract was used in concentration of 25, 50 and 100 mg/ml which involved the determination of time of paralysis and time of death of the worm. Piperazine citrate as a standard reference and distilled water as a control in same concentration as that of extract was used. The earthworms (*Pheretima posthuma*) of 3-5 cm in length and 0.1-0.2 cm in width were used for all the experimental protocol. Six groups of earthworm having six earthworms in each were released in to 50 ml of solutions of piperazine citrate, aqueous and alcoholic extracts of seeds of *Cassia tora* (25, 50 and 100 mg/ml each) in distilled water. Same experiment was done for *Ascaridia galli* worms only the difference was

solutions were prepared in normal saline solutions instead of distilled water. The alcoholic seed extract of *Cassia tora* demonstrated paralysis as well as death of worms in a less time as compared to piperazine citrate especially at higher concentration of 100 mg/ml. While water extract also showed significant activity [31].

### Antimutagenic activity

Jae Sue Choi *et al* demonstrated the antimutagenic activity of a methanol extract of seeds of *Cassia tora* seeds against aflatoxin B1 (AFB1) with the *Salmonella typhimurium* assay. The MeOH extract sequentially partitioned with dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>), n-butanol (n-BuOH) and water (H<sub>2</sub>O). When this extract and its fraction were added to the assay system using *Salmonella typhimurium* TA100 and/or TA98 then numbers of revertants per plate were found to decrease significantly. When 1.25 mg/plate MeOH extract of *Cassia tora* was added to the assay system containing *S. typhimurium* TA100, the numbers of revertant per plate decreased by about 96% of those obtained in the absence of the extract. The effect of each fraction purified from the MeOH extract was also examined. When a 0.5mg/plate fraction of CH<sub>2</sub>Cl<sub>2</sub> and n-BuOH obtained from the MeOH extract was added to the assay system, the numbers of the TAI00 revertants decreased by 85 % and 16%, respectively. The numbers of revertants per plate for *S. typhimurium* TA98 also showed significant decreases by 98% and 70%, respectively. The inhibitory effect was further increased when the concentration of the fractions was raised to 1.25 mg/plate. These antimutagenic activities of the fractions were higher than that of the MeOH extract. Among these fractions, the CH<sub>2</sub>Cl<sub>2</sub> fraction showed the highest activity. On the other hand, the H<sub>2</sub>O fraction did not display any activity [32].

### Antifungal activity

Mukherjee PK *et al* determined the antifungal activity of the dealcoholized extract of *Cassia tora* leaves against different fungal organisms. Standard antifungal agent griseofulvin was used to compare the effect produced by leaf extract. Study showed the significant inhibition growth of *C.albicans*, *A.niger*, *S.cerevistiae*, and *T.mentagophytes* when crude leaf extract was tested by turbidity and spore germination methods in concentration dependent manner [33].

In another study, Young-Mi Kim *et al* determined the fungicidal activities of *Cassia tora* extract and their active principles against *Botrytis cineria*, *Erysiphe graminis*, *Phytophthora infestans*, *Puccinia recondite*, *Pyricularis grisea* and *Rhizoctonia solani* in vivo. Results were compared with Chlorothalonil and dichlofluanid as synthetic fungicides and three anthraquinone that are commercially available. Isolated emodin, physcion and rhein showed fungicidal activities against *B. cineria*, *E. graminis*, *P. infestans* and *R. solani*. Also aloe-emodin showed strong fungicidal activities against *B. cineria* while moderate against *R. solani* and no activity against *E. graminis*, *P. infestans*, *P. recondite* and *Py. Grisea* [34].

### Hepatoprotective effects

Rajan AV *et al* investigated hepatoprotective effects of methanolic extract of dried powder leaf of *Cassia tora* against carbon tetra chloride induced liver damage in albino rats in both sexes approximately weighing 500 gm. This study demonstrated the hepatoprotective effect of *Cassia tora* because of the effective free radical scavenging property [35].

### Purgative activity

Maity TA and Dinda SC evaluated the purgative activity of the methanolic extract and aloe-emodin isolated from the *Cassia tora* leaves in male wistar rats weighing between 150-180 gm. The purgative action of crude extract (100mg and 200mg/kg P.O) and material isolated from cassia tora leaf (20mg/kg P.O) was compared with the standard drug, sennoside (7.5 mg/kg P.O). The results obtained were comparable to that of standard purgative drug sennoside [36].

### Anti-inflammatory activity

Tapan Kumar *et al* carried out anti-inflammatory effect of the methanolic extract of *Cassia tora* leaves against carrageenin, histamine, serotonin and dextran induced rat hind paw oedema. In the study, cassia tora was found having significant anti-inflammatory activity against all these agents. The maximum inhibition of oedema was found at a dose of 400mg/kg <sup>[37]</sup>.

### Antioxidant activity

Antioxidant activity of the methanolic extract of leaves of *Cassia tora* was investigated by Sirappuselvi S. and Chitra *in vitro* by using experimental parameters which were DPPH scavenging activity, total antioxidant assay activity, scavenging superoxide anion radicals, nitric oxide radical, hydrogen peroxide scavenging capacity and total phenolic content. Reduction of the DPPH radicals was found in concentration-dependent manner. A linear relationship between the antioxidant activity and phenolic content was found in this study, indicating that phenolic compounds could be major contributors to antioxidant activity <sup>[38]</sup>.

### Antimicrobial activity

Antimicrobial activity of ethanolic extract (0.15mg) and aqueous extract (0.31mg) of *Cassia tora* leaves were investigated by Sarika Sharma et al against *Pseudomonas aeruginosa*, *Lactobacillus*, *Salmonella typhi*, *P. vulgaris*, *Bacillus subtilis*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *E. coli* and *Enterobacter bacterias* by using filter paper disc method. Ciprofloxacin was used as standard reference. Aqueous Extract showed maximum activity against *Staphylococcus aureus* and *Lactobacillus* and minimum activity against *Bacillus subtilis* and *Escheria coli* but no activity against *Salmonella typhi*. Ethanolic extract show less activity as compared to aqueous extract but show maximum activity against *Staphylococcus aureus* and *Lactobacillus* as comparative to standard ciprofloxacin <sup>[39]</sup>.

### CONCLUSION

*Cassia tora* is the important valuable plant for skin diseases and other disorders. As per USM, seeds are useful in leprosy, ringworm, pityriasis, vitiligo and melasma internally as well as externally. Scientific studies also proved some of USM claims and moreover these studies also proved that the seeds and leaves of this plant may be used for hypolipidemic activity, hypoglycemic activity, anthelmintic activity, antimutagenic activity, antifungal activity, hepatoprotective activity, purgative activity, anti-inflammatory activity, antioxidant activity and antimicrobial activity.

### ACKNOWLEDGMENT

The authors record their gratitude to Professor Mansoor Ahmad Siddiqi, Director, National Institute of Unani Medicine, Bengaluru, for providing an academic research environment to work with excellence. We also thank the library staff of the institute for providing necessary books for this study.

### REFERENCES

1. Kirtikar KR. Basu BD. Indian medicinal plants. Vol. II. Dehradun: International Book Distributors; 2006: 878-9.
2. Department of AYUSH. The Unani pharmacopoeia of India. Part I (II). New Delhi: Ministry of Health and Family Welfare, Government of India; YNM: 85-86.
3. Tariq NA. Taj al-mufradat. New Delhi: Idara Kitab-us-Shifa; 2010: 203-4.
4. Kabeeruddin M. Makhzan al-mufradat. New Delhi: Aijaz Publishing House. YNM: 137-8.
5. Rafeequddin M. Kanzul advia. Aligarh: AMU; 1985: 209-10.
6. Safi-Uddin Ali. Unani advia mufrida. New Delhi: Qaumi Council Brae frogh Urdu Zuban, Government of India; 1979: 103.

7. Department of AYUSH. Standardization of single drugs of Unani medicine. Part-I. New Delhi: CCRUM; 1987: 247-251.
8. Khare CP. Indian medicinal plants. New Delhi: Springer (India) Privet Limited; 2007: 130.
9. Anonymous. The Wealth of India. Vol. III: Ca-Ci. New Delhi: CSIR; 1992: 368-370.
10. Prajapati ND, Purohit SS. Agro's colour atlas of medicinal plants. Jodhpur: Agrobios; 2010: plate 32.
11. Prajapati ND, Purohit SS, Sharma AK, Kumar T. A handbook of medicinal plants. Jodhpur: Agrobios; 2009: 120-1.
12. Purohit SS, Vyas SP. Medicinal plant cultivation. Jodhpur: Agrobios; 2008: 348-9.
13. Nadkarni KM. Indian materia medica, Vol. I. Bombay: Popular Prakashan; 1976: 291-2.
14. Chopra NR, Nayar LS, Chopra CI. Glossary of Indian medicinal plants. New Delhi: CSIR; 2010: 55.
15. Anonymous. The useful plants of India. New Delhi: CSIR; 2000: 110.
16. Asolkar LV, Kakkar KK, Chakre OJ. Glossory of Indian medicinal plants with active principles. Part-I (A-K). New Delhi; CSIR; 2005: 181.
17. Dymock W, Warden CJH, Hooper D. Pharmacographia Indica. Vol. I. New Delhi: Srishti Book Distributors; 2005: 515-8.
18. Ghani N. Khazain al-adviya. New Delhi: Idara Kitab-us-Shifa; YNM: 474-5.
19. Nadkarni KM. Indian plants and drugs. New Delhi: Srishti Book Distributors; 2005: 96-7.
20. Khan MA. Muheete azam, Vol. 1. New Delhi: CCRUM; 2012: 779-81.
21. Chatterji A, Pakrashi SC. The treatise of Indian medicinal plants. Vol. II. New Delhi: CSIR; 2006: 44-6.
22. [https://en.wikipedia.org/wiki/Cassia\\_tora](https://en.wikipedia.org/wiki/Cassia_tora). accessed on 12/01/2017.
23. Rastogi RP, Mehrotra BN. Compendium of Indian medicinal plants. Vol. II. New Delhi: CSIR; 2006: 150.
24. Rastogi RP, Mehrotra BN. Compendium of Indian medicinal plants. Vol. III. New Delhi: CSIR; 2007: 143.
25. Rastogi RP, Mehrotra BN. Compendium of Indian medicinal plants. Vol. V. New Delhi: CSIR; 2005: 176.
26. Nabi MG. Makhzan mufradat wa murakkabat (M'aroof bihi Khawas al-adviya). New Delhi: CCRUM; 2007: 85.
27. Hakeem MA. Bustan al-mufradat. New Delhi: Idara Kitab-us-Shifa; 2002: 171-2.
28. Kabeeruddin M. Ilmul advia nafeesi. New Delhi: Aijaz Publishing House; 2007: 257-8.
29. Umesh KP, Saraf S, Dixit VK. Hypolipidemic activity of seeds of *Cassia tora* Linn. Journal of Ethnopharmacology 2004; 90: 249-52.
30. Nam J, Choi H. Effect of butanol fraction from *Cassia tora* L. seeds on glycemic control and insulin secretion in diabetic rats. Nutrition Research and Practice 2008; 2(4): 240-6.
31. Deore SL, Khadabadi SS, Kamdi KS, Ingle VP, Kawalkar NG, Sawarkar PS. In vitro Anthelmintic activity of *Cassia tora*. International Journal of Chem Tech Research 2009 Apr-Jun; 1(2): 177-9.
32. Choi JS, Lee HJ, Park KY, Ha JO, Kang SS. In Vitro Antimutagenic Effects of Anthraquinone Aglycones and Naphthopyrone Glycosides from *Cassia tora*. Planta Medica 1997; 63: 11-4.
33. Mukherjee PK, Saha K, Saha BP, Pal M, Das J. Antifungal Activities of the Leaf Extract of *Cassia tora* Linn. (Fam. Leguminosae). Phytotherapy Research 1996 Feb; 10(6): 521-522.
34. Young-Mi Kim, Chi-Hoon Lee, Hyo-Gyung Kim, Hoi-Seon Lee. Anthraquinones Isolated from *Cassia tora* (Leguminosae) Seed Show an Antifungal Property against Phytopathogenic Fungi. Journal of Agriculture and Food Chemistry 2004 Sept; 52(20): 6096-6100.

35. Rajan AV, Shanmugavalli N, Sunitha CG, Umashankar V. Hepatoprotective effects of Cassia tora on CCl<sub>4</sub> induced liver damage in albino rats. Indian Journal of Science and Technology 2009 Mar; 2(3): 41-44.
36. Maity TK, Dinda SC. Purgative activity of cassia tora leaf extract and isolated aloë-emodin. Indian Journal of Pharmaceutical Sciences 2003 Feb; 93-95.
37. Maity TK, Mandal SC, Mukherjee PK, Saha K, Das J. Studies on anti-inflammatory effect of Cassia tora leaf extract (fam. Leguminosae). Phytotherapy Research 1998 May; 12(3): 221-3
38. Sirappuselvi S, Chitra M. In vitro Antioxidant Activity of Cassia tora Lin. International Research Journal of Biological Sciences 2012 Oct; 1(6): 57-61.
39. Sharma S, Dangi MS, Wadhwa S, Daniel V, Tiwari A. Antibacterial Activity of Cassia tora Leaves. International Journal of Pharmaceutical & Biological Archives 2010; 1(1): 84 - 86.

