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Phytochemical and Pharmacognosy study of Cassia tora (Chakramarda) Medicinal plant of Leguminosae family

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Abstract: The present study investigates the phytochemical and pharmacognostic characteristics of Cassia tora L. (Chakramarda), a medicinal plant widely distributed across Rajasthan, India. Taxonomically classified under the Fabaceae family, Cassia tora is commonly found as a weed during the rainy season. The plant exhibits distinct morphological features including an erect, foetid herbaceous structure with yellow flowers and falcate pods. Detailed macro- and microscopic analyses of the root and stem reveal characteristic features such as lignified vascular tissues, presence of calcium oxalate crystals, and various types of parenchyma, xylem, and phloem tissues. Powder microscopy of the whole plant demonstrates diagnostic elements like scalariform and spiral xylem vessels, starch grains, septate fibers, trichomes, and stone cells. Additionally, chromatographic analysis using winCATS software showed consistent results across three tracks, each dominated by a primary peak (~87–90% area), indicating the presence of a major phytoconstituent, with several minor peaks suggesting additional components yet to be identified. These findings support the pharmacognostic authentication and chemical profiling of Cassia tora, and further studies involving reference standards or mass spectrometry are necessary for comprehensive compound identification.

Keywords: Medicinal plants, powder microscopy, pharmacognosy

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INTRODUCTION

Cassia tora L. (Chakramarda), a species from the Fabaceae family, is a widely distributed annual herb across India, especially prevalent during the monsoon season. Traditionally recognized for its medicinal value in Ayurveda, it has been utilized for various therapeutic applications. The present study focuses on the pharmacognostic and phytochemical evaluation of this species to provide detailed insights into its morphological, microscopic, and chemical characteristics. Through comprehensive analyses—including macroscopic and microscopic examination of root and stem tissues, powder microscopy, and HPTLC fingerprinting—the study aims to authenticate the identity and explore the bioactive potential of *Cassia tora*. The presence of specific anatomical features and consistent chromatographic peaks highlight its diagnostic value and lay the groundwork for further phytochemical investigations.

Results: After study of selected plant following results were obtained:

Cassia tora L. Roxb. (Fam. Fabaceae)

Chakramarda

Synonyms: *Cassia toroides* Roxb., *Cassia obtusifolia* Linn., *Senna toroides* Roxb., *Cassia foetide* Salisb.

Taxonomical Classification:

Kingdom – Plantae

Division – Angiosperm

Class – Dicotyledonae

Order - Fabales

Family – Fabaceae

Genus – *Cassia*

Species – *C. tora*

Distribution: It is widely distributed throughout India. It is very common weed during rainy season, growing sub-gregariously on road side, waste lands and follow grounds, rich in humus and forest under-growth as well as in the hills up to 1200 m. height.

Flowering and fruiting: flowering occurs in July to September and fruiting in early winter season.

Morphological Characters:

It is an annual plant which is an erect, sparsely branched herb or growing up into undershrub. It attains height up to 30-100 cm or more with a disagreeable or foetid odour. Plant stem and branches having alternate leaves. Leaves are stipulate, 7-10 cm or more long, having three pairs of unequal oblong, entire, rounded or obtuse leaflets, the lower pair of leaflet being the smallest. Flowers are with short peduncles, yellowish, basifixed, slightly zygomorphic. Fruits pods are flattened, sickle shaped, falcate to curved, slender, subtetragenous.

Figure 1: Showing *Cassia tora* plant morphology

Root (Rt.)

Description

Macroscopy:

The root of the *Cassia tora* plant, commonly known as Foetid Cassia, displays distinct macroscopic features:

Shape and Size: The roots are typically cylindrical and tapering, ranging in size from a few centimeters to several decimeters in length. They may vary in thickness, with some roots being relatively thin and others more robust.

Surface: The surface of the root is generally rough and uneven, with a brownish to dark brown color. The outer surface may also show longitudinal striations or wrinkles.

Texture: The root has a fibrous texture, and when broken, it reveals a pale, woody interior. The break is typically fibrous and can be somewhat splintery.

Odor and Taste: The root has a faint, earthy odor and a slightly bitter taste.

Internal Structure: On a cross-section, the root shows a central core of xylem surrounded by phloem, with a visible bark layer on the outer side. The inner part is lighter in color compared to the outer surface. These macroscopic characteristics help in identifying the root of the *Cassia tora* plant in herbal medicine and botanical studies.

Microscopy:

Epidermis: The outermost layer, the epidermis, consists of a single layer of rectangular cells. These cells are relatively thin-walled and may be slightly elongated.

Cortex: Below the epidermis lies the cortex, which is made up of several layers of parenchyma cells. These cells are large, thin-walled, and loosely arranged, with intercellular spaces. The cortex may also contain some starch grains and oil globules.

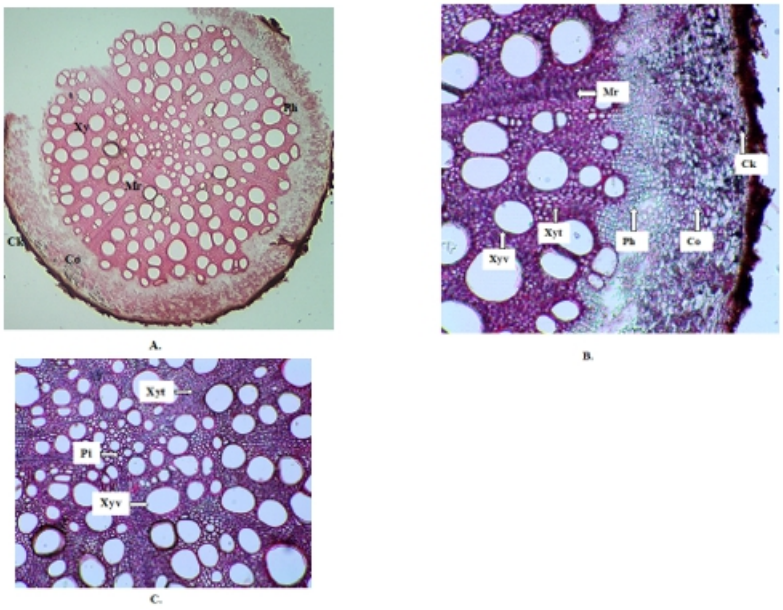
Endodermis: The innermost layer of the cortex is the endodermis, which is characterized by a single layer of cells with thickened, lignified walls forming the Casparian strip. This layer controls the flow of water and solutes into the vascular cylinder.

Pericycle: Just inside the endodermis, the pericycle is composed of thin-walled parenchyma cells. In some sections, the pericycle may show the presence of sclerenchymatous cells, which provide structural support.

Vascular Bundle: The vascular cylinder contains the xylem and phloem arranged in a radial pattern. The xylem is composed of lignified vessels, tracheids, and fibers, which are thick-walled and provide strength to the root. The phloem consists of sieve tubes, companion cells, and phloem parenchyma, responsible for the transport of nutrients.

Pith: In the center, the pith is either absent or represented by a small amount of parenchyma tissue, depending on the age of the root. In younger roots, the pith may be more prominent, but in older roots, it may be obliterated.

Starch Grains and Crystals: Starch grains are often present within the parenchyma cells of the cortex and pith. Additionally, calcium oxalate crystals may be observed in the form of prisms or rosettes scattered throughout the root tissues.



***Cassia tora* L. : A.-C.** Root T.S., **A.** Outline, **B.** Outer layer, **C.** Pith, Ck(Cork), Co(Cortex), Ph(Phloem), Xy(Xylem), Mr(Medullary ray), Xyt(Xylem tracheid), Xyv(Xylem vessel), Pi(Pith)

Stem (St.)

Description

Macroscopy:

The stem of *Cassia tora*, also known as *Senna tora* or Foetid Cassia, displays distinct macroscopic features:

Shape and Size: The stem is typically erect, cylindrical, and varies in thickness depending on the age and part of the plant. It can grow to a height of 30 to 90 cm.

Surface: The surface of the stem is smooth or slightly ribbed, with a green to purplish-green color in younger stems. As the stem matures, it may become more brownish and develop fine longitudinal striations or ridges.

Texture: The stem is firm and somewhat brittle when young, becoming more rigid and woody as it ages. The younger parts of the stem are tender and succulent, while the older portions are tougher and harder.

Nodes and Internodes: The stem exhibits prominent nodes, which are the points where leaves, branches, and flowers emerge. The internodes, or the segments between the nodes, vary in length and are generally longer in younger stems and shorter in older, more mature parts of the plant.

Color: The color of the stem can range from bright green in younger parts to a dull green or brownish hue

in older sections. The color may deepen to a purplish tint under certain environmental conditions.

Branching: The stem of *Cassia tora* exhibits a branched pattern, with branches arising from the axils of the leaves. The branching is usually alternate and gives the plant a bushy appearance.

Odor: The stem, when freshly cut, may emit a faint, earthy, and slightly unpleasant odor, which is more pronounced in younger stems.

Internal Structure: Upon cutting, the stem reveals a greenish to whitish interior with a central pith surrounded by vascular bundles arranged in a ring. The pith is soft and spongy in younger stems and may become hollow or reduced in older stems.

Microscopy:

The microscopic examination of the Cassia tora stem reveals several detailed structural features, which are essential for the identification and study of the plant. Here is a description of the key microscopic characteristics:

Epidermis: The outermost layer of the stem is the epidermis, consisting of a single layer of closely packed, rectangular to slightly oval cells. The epidermal cells are covered by a thin cuticle that provides protection. In some regions, the epidermis may also contain stomata and trichomes (hair-like structures), which are multicellular and unbranched.

Cortex: Beneath the epidermis lies the cortex, composed of several layers of parenchyma cells. These cells are large, thin-walled, and usually contain chloroplasts, contributing to photosynthesis. The cortex may also have collenchyma cells, which are slightly thickened at the corners and provide mechanical support to the stem. In some sections, cortical cells may contain starch grains or other inclusions.

Endodermis: The endodermis is the innermost layer of the cortex and is characterized by a single layer of cells with Casparian strips. These strips are visible as thickened, lignified bands in the radial walls of the cells. The endodermis regulates the movement of water and nutrients into the vascular tissue.

Pericycle: Inside the endodermis, the pericycle is composed of parenchyma cells that may include sclerenchymatous fibers, which are thick-walled and provide structural strength. The pericycle plays a role in the formation of lateral roots and branches.

Vascular Bundles:

The vascular bundles are arranged in a ring within the stem. Each vascular bundle is conjoint, collateral, and open, meaning it contains both xylem and phloem tissues, with a cambium layer between them.

Xylem: The xylem is located towards the inner side of the vascular bundle and is composed of vessels, tracheids, and xylem fibers. These elements are lignified, providing rigidity and facilitating water and nutrient transport.

Phloem: The phloem is situated on the outer side of the vascular bundle and contains sieve tubes, companion cells, and phloem parenchyma. The phloem is responsible for transporting photosynthetic

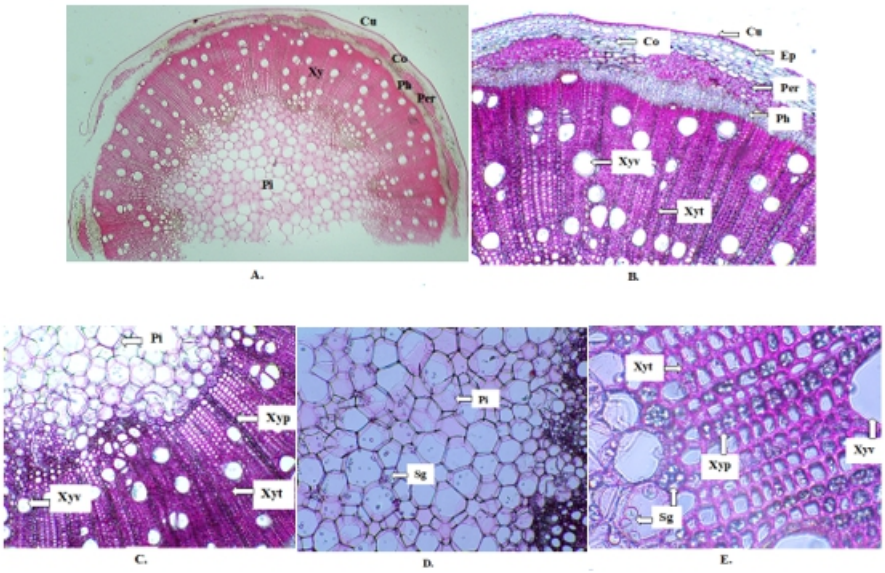
products throughout the plant.

Cambium: The cambium is a thin, meristematic layer located between the xylem and phloem. It is responsible for secondary growth, producing new xylem cells towards the inside and new phloem cells towards the outside.

Medullary Rays: Medullary rays are radial bands of parenchyma cells that extend from the pith to the cortex. These rays facilitate the lateral transport of nutrients and water across the stem and may also store starch.

Pith: The central part of the stem is occupied by the pith, which consists of large, loosely packed parenchyma cells. The pith cells are thin-walled and may contain starch grains or other storage products. In older stems, the pith may become hollow or reduced.

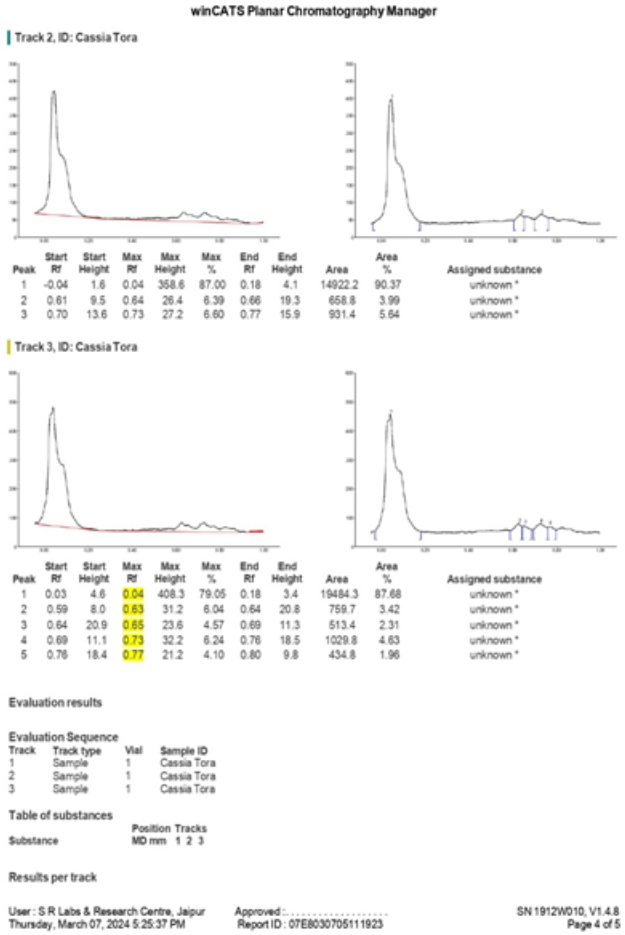
Calcium Oxalate Crystals: Calcium oxalate crystals, in the form of prisms or rosettes, are often observed within the parenchyma cells of the cortex, pith, and sometimes in the medullary rays. These crystals are identifiable by their birefringence under polarized light.



***Cassia tora* L. : A.-E.** T.S. of Stem**, A.** Outline, **B.** Outer layer, **C.** Xylem and pith region, **D.** Pith contain starch grain, **E.** Xylem and Pith region contain starch grain, Cu(Cuticle), Ep(Epidermis), Co(Cortex), Per(Pericycleic patches), Xy(Xylem), Ph(Phloem), Xyt(Xylem tracheid), Xyv(Xylem vessel), Xyp(Xylem parenchyma), Pi(Pith), Sg(Starch grain)

The chromatographic analysis of *Cassia tora*, conducted using winCATS Planar Chromatography Manager software, reveals consistent results across two additional tracks (Track 2 and Track 3). In Track 2, the 2D chromatogram displays three peaks, with Peak 1 being the dominant component (90.37% area), while Peaks 2 and 3 contribute minorly (~4% and ~6%). Similarly, Track 3 exhibits five peaks, where Peak 1 remains the most prominent (87.68% area), and Peaks 2 through 5 show minor contributions (~2% to ~6%). The evaluation sequence confirms that all three analyzed tracks correspond to the same *Cassia tora* sample (Vial: Sample 1). The table provided lists substance positions across tracks without specific compound identification. Overall, the results demonstrate a consistent presence of a primary compound

across all tracks, with additional minor peaks suggesting the presence of other constituents. However, all peaks are currently labeled as "unknown," underscoring the need for further investigation using techniques such as reference standard comparison or mass spectrometry to identify the compounds.


winCATS Planar Chromatography Manager

Track 2, ID: Cassia Tora

Peak	Start Rf	Start Height	Max Rf	Max Height	Max %	End Rf	End Height	Area	Area %	Assigned substance
1	-0.04	1.6	0.04	358.6	87.00	0.18	4.1	14922.2	90.37	unknown *
2	0.61	9.5	0.64	26.4	6.39	0.66	19.3	658.8	3.99	unknown *
3	0.70	13.6	0.73	27.2	6.60	0.77	15.9	931.4	5.64	unknown *

Track 3, ID: Cassia Tora

Peak	Start Rf	Start Height	Max Rf	Max Height	Max %	End Rf	End Height	Area	Area %	Assigned substance
1	0.03	4.6	0.04	408.3	79.05	0.18	3.4	19484.3	87.68	unknown *
2	0.59	8.0	0.63	31.2	6.04	0.64	20.8	759.7	3.42	unknown *
3	0.64	20.9	0.65	23.6	4.57	0.69	11.3	513.4	2.31	unknown *
4	0.69	11.1	0.73	32.2	6.24	0.76	18.5	1029.8	4.63	unknown *
5	0.76	18.4	0.77	21.2	4.10	0.80	9.8	434.8	1.96	unknown *

Evaluation results

Evaluation Sequence

Track	Track type	Vial	Sample ID
1	Sample	1	Cassia Tora
2	Sample	1	Cassia Tora
3	Sample	1	Cassia Tora

Table of substances

Substance	Position MD mm	Tracks 1	2	3

Results per track

User : S R Labs & Research Centre, Jaipur
Thursday, March 07, 2024 5:25:37 PM
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SN 1912W010, V1.4.8
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Figure 2: Showing HPTLC chromatography analysis of *Cassia tora* plant

Powder Microscopy:

Whole plant powder microscopy of *Cassia tora* L. shows Xylem vessel with scalariform thickening, Xylem vessel with tracheid, Starch grain, Group of starch grain in cell, Group of fibre, Different type parenchyma Cell, Xylem vessel with spiral thickening, Tracheid, Tracheids with starch grain, Cortex cell, Group of fibre, Pith cell contain starch grain, Parenchymatous cell longitudinal view, Annular thickening, Saptate fibres, Calcium oxalate crystal, Pitted parenchymatous cell. While Surface view of parenchymatous cell, unveils about Trichome and Longitidinal view of cell shows Stone cell, Cortical cell and Surface view of leaf epidermal cell.

CONCLUSION

The pharmacognostic and phytochemical assessment of *Cassia tora* L. confirms its significant medicinal potential, reinforced by distinct anatomical features such as lignified vascular tissues, calcium oxalate crystals, and various diagnostic microscopic structures. The HPTLC analysis revealed a consistent primary

phytoconstituent along with several unidentified minor compounds, indicating the need for advanced analytical studies. These findings contribute valuable data for the standardization, quality control, and future development of herbal formulations based on Cassia tora. Continued research using reference standards and mass spectrometry is recommended to fully characterize its phytochemical profile and support its traditional use in modern phytopharmaceutical applications.

References

1. Awasthi, S., & Dixit, V. K. (2009). Standardization of Cassia tora Linn. leaves. Pharmacognosy Journal, 1(2), 71–75. https://doi.org/10.1016/S0975-3575(09)60012-5
2. Dighe, N. S., Pattan, S. R., Nirmal, S. A., Dhasade, V. V., Dake, S. G., Shelar, M. U., Hole, M. B., & Gaware, V. (2009). A Review on Phytochemical and Pharmacological Profile of Cassia tora Linn. Research Journal of Pharmacognosy and Phytochemistry, 1(3), 173–176.
3. Gupta, M., Mazumder, U. K., Kumar, R. S., & Gomathi, P. (2007). Antioxidant and hepatoprotective effects of Cassia tora leaf extract. Acta Pharmaceutica, 57(4), 437–445. https://doi.org/10.2478/v10007-007-0035-1
4. Kirtikar, K. R., & Basu, B. D. (2001). Indian Medicinal Plants (Vol. 2, pp. 856–858). Dehradun: International Book Distributors.
5. Nadkarni, K. M. (2007). Indian Materia Medica (Vol. 1, pp. 293–294). Mumbai: Popular Prakashan.
6. Patel, S. S., & Savjani, J. K. (2015). Systematic review of medicinal plants used for the treatment of obesity. International Journal of Green Pharmacy, 9(3), 151–161. https://doi.org/10.4103/0973-8258.161245
7. Rajurkar, N. S., & Gaikwad, K. (2012). Evaluation of phytochemical content and antioxidant activity of Cassia tora leaves. Asian Journal of Pharmaceutical and Clinical Research, 5(3), 189–192.
8. Sarwa, K. K., Rudrapal, M., Debnath, M., Kumar, A., & Verma, V. K. (2014). Phytochemical and biological potential of Cassia tora Linn. European Journal of Medicinal Plants, 4(8), 946–963. https://doi.org/10.9734/EJMP/2014/8549
9. Sharma, P. C., Yelne, M. B., & Dennis, T. J. (2001). Database on Medicinal Plants Used in Ayurveda (Vol. 3, pp. 118–121). New Delhi: CCRAS, Ministry of Health and Family Welfare.
10. Telrandhe, U. B., & Gunde, M. C. (2022). Phytochemistry, Pharmacology, and Multifarious Activity of Cassia tora L.: A Comprehensive Review. Annals of Phytomedicine, 11(2), 182–188.