Review Article

A Review on *Cassia* species: Pharmacological, Traditional and Medicinal Aspects in Various Countries

Shivjeet Singh, Sandeep Kumar Singh*, Ashutosh Yadav

Department of Pharmacology Babu Banarasi Das University Lucknow (UP)

Address for Correspondence

Department of Pharmacology Babu Banarasi Das University Lucknow (UP)

E-mail: sandeepbbdu@gmail.com

ABSTRACT

Background: The World Health Organization (WHO) estimates that about 80% of people living in developing countries rely on traditional medicines for their primary health care need. Medicinal herbs are moving from fringe to mainstream use with a greater number of people seeking remedies and health approaches free from side effects caused by synthetic chemicals. India officially recognizes over 3000 plants for their medicinal value. It is generally estimated that over 6000 plants in India are in use for traditional, folk and herbal medicine.

Aim of the Study: This article aims to provide a comprehensive review on pharmacological, medicinal and traditional value of *Cassia* species (caesalpinaceae) plant(s) in developing countries.

Material and Methods: *Cassia* species are well known plant widely distributed in India and other tropical countries. It is an annual under shrub and grows in wild wasteland. Different parts of the plant (leaves, seed, and root) are reputed for their medicinal value. Several chemical compounds such as Anthraquinone glycosides, Naphthopyrone glycosides, Phenolic compounds, Flavonoids etc. have been isolated from this plant and well recognized traditional medicine as laxative and is useful for treatment of leprosy, ringworm infection, ophthalmic, skin diseases and liver disorders.

Result: The pharmacological, medicinal and traditional value reported in present review to confirm the therapeutic value of *Cassia* species to different developing countries. Thus, this review may provide the compiled information which will guide to develop the novel agent for various disorders from different *Cassia* species.

Conclusion: On the basis of scientific studies and review articles on *Cassia* species suggest an enormous biological potential of these plants.

Keywords: Glycosides, Ringworm infection, Tannins, Anthraquinone glycosides.

 ISSN 2321 – 2748

INTRODUCTION

The World Health Organization (WHO) estimates that about 80% of people living in developing countries rely exclusively on traditional medicines for their primary health care need[1] India is virtually a herbarium of the world, using plants and herbs as the basic source of medicine. Herbals which form a part of our nutrition and provide us an additional therapeutic effect are in demand and *Cassia* species is one of such plant[2].

Cassia species (Caesalpinaceae) are well known medicinal plant commonly found in India and other tropical countries[3]. Various medicinal properties have been attributed to this plant in the traditional system of Indian medicine. Several anthraquinones have been isolated from the seeds of *Cassia* species[4, 5]. Sennosides, which are well known for their medicinal importance, have been detected in the leaves of the plant[5].

Cassia species are already reported in the ancient ayurvedic literatures and literature survey indicated its use against various skin diseases such as ringworm, eczema, and scabies. Because of the high incidence of skin diseases, especially among the weaker section of the Indian population, it was felt worthwhile undertaking research on this plant. According to ayurveda the leaves and seeds are acrid, laxative, antiperiodic, anthelmintic, ophthalmic, liver tonic, cardiotonic and expectorant. The leaves and seeds are useful in leprosy, ringworm, flatulence, colic, dyspepsia, constipation, cough, bronchitis, cardiac disorders. *Cassia* species powder made from *Cassia* species seeds and *Cassia* species splits are some ancient natural ingredients. In India, *Cassia* species is used as a natural pesticide in organic farms. Roasted seeds are substituted for coffee, like tephrosia seeds. *Cassia* species powders are most popularly used in the pet-food industry. It is mix with guar gum for use in mining and other industrial application. The extracts of *Cassia* species have been used as a remedy for various skin ailments, rheumatic disease and as laxatives[6, 7, 8].

The extract of *Cassia* species leaves has been found to possess significant hepatoprotective activity and anti-inflammatory activity[9,10] .The seeds of *Cassia* species have been used in Chinese medicine as aperients, antiasthma, diuretic agent and also improve the visual activity[11]. *Cassia* species are well known oriental herb used in traditional medicine which grows up to 1-2 m in height and is found as a rainy season weed throughout India. It constitutes an ayurvedic preparation “Dadrughan-vati” which is used for ringworm, leucoderma, etc. Chakramardha tailamu, a compound ayurvedic oil of this herb is beneficial in eczema, ringworm and other skin diseases[11,12] . Whole plant is employed in the treatment of impetigo, ulcers, helmenthiasis and as a purgative[13] .

Geographical Source and Distribution of *Cassia* species

Cassia species are annual under shrub grows all over the tropical countries (throughout India, Pakistan, Bangladesh and West-China) and grows well in wasteland as a rainy season weed[7]. It grows in low lying coastal area, river banks, abundant in waste places and other moist places like uncultivated fields, up to 1000-1400 meters[2]. Near about hundreds of *Cassia* species are present, but the exact number is still not clear. Because *Cassia* was long used as a wastebin taxon for Cassieae in general, most notably *Senna* and *Chamaecrista* with which it makes up the Cassiinae. Some of them *Cassia* plants used as herbal medicine according there nativity and other *Cassia* species are recorded in Red data book.

Phytography

Cassia species are wild crop and grown in most parts of India as a weed. It is an annual foetid herb, 30–90 cm high. Leaves are green in colour, pinnate, up to 6-8cm long, leaflets are in 3 pairs, distinctly petiole, opposite, conical at one end, ovate, oblong and base oblique [2]. Flowers are pale yellow in colour usually in nearly sessile pairs in the axils of the leaves with five petals, upper one are very crowded. Pods are subteret or 4 angled, very slende, 6-12 inch long, incompletely septate, membranous with numerous brown oblong rhombohedral seeds[8] .

Phytochemistry

Phytochemical screening of the plants extracts employing TLC indicated that these extracts as well as callus extracts contains-glycoside, flavonoids, and anthrone, anthrancene derivatives. It contains 1-2% volatile *Cassia* oil, which is mainly responsible for the spicy aroma taste. The primary chemical constituents of *Cassia* include cinnamaldehyde, gum, tannis, mannitol, coumarins, and essential oils (aldehydes, eugenol and pinene); it also contains sugars, resins, and mucilage, among other constituents[103].

Root

Eight compounds were isolated from the ethyl acetate fraction of *Cassia obtusifolia*, which are betulinic acid, chrysophanol, physcion, stigmasterol, 1-hydroxy-7-methoxy-3-methyl-anthraquinone, 8-O-methylchrysophanol, 1-O-methylchrysophanol and aloe-emodin[103].

Seed

Seed contains anthraquinones, namely; (aurantio-obtusin, chryso-obtusin, obtusin, chrysoobtusin-2-O-beta-D-glucoside, physcion, emodin, chrysophanol, obtusifolin, obtusifolin-2-O-beta-D-glucoside, alaternin 2-O-*β*-Dglucopyranoside)[15], brassinosteroids (brassinolide, castasterone, typhasterol, teasterone, and 28-norcastasterone), and monoglycerides (monopalmitin and monoolein)[16]. Phenolic glycosides such as rubrofusarin triglucoside, nor-rubrofusarin gentiobioside, demethylflavasperone gentiobioside, torachrysone gentiobioside, torachrysone tetraglucoside and torachrysone apioglucoside were also isolated [17].

The seeds yield a gum (7.65%) which is the most efficient suspending agent for calomel, kaolin and talc[18]. Extraction of the dried and crushed seeds with petroleum ether (b.p.60-80˚C) in a specially modified soxhlet apparatus gave 5.0% brownish yellow oil. Subsequently, Chrysophanic acid was also isolated from this oil[19]. Mucilage (25.8%) was isolated from the seeds by extraction with hot water [20].

Thirteen phenolic glycoside including six new compounds were isolated from seed of *Cassia* species. These are rubrofusarin triglucoside, nor-rubrofusarin, gentiobioside, demethyflavasperone gentiobioside, torachrysone gentiobioside, torachrysone tetraglucoside and torachrysone apioglucoside. Two new naphtha-pyrone glycosides, 9(beta-D-glucopyranosynl-(1—6)-O-beta-D-glucopyranosyl)oxy]-10-hydroxy-7-methoxy-3-mehtyl-1H-naptho[2,3-c]pyran-1-one and 6-O-beta-D-glucopyranosyl)oxy]-rubrofusarin, together with *Cassia*side and rubrofusarin-6-beta-gentiobioside were isolated from the seeds of *Cassia* species.

Stem Bark

The isolation of a anthraquinone, 1-hydroxy-5-methoxy-2-methyl anthraquinone and its glycoside, 5-methoxy-2-methyl anthraquinone-1-O-α-L-rhamnoside along with chrysophanol,emodin and β-sitosterol from the stem of *Cassia* species Linn. is reported[18]. The stem also contains d-mannitol, myricyl alcohol, β-sitosterol, glucose, tigonelline, 1-stachydnine and choline. The

stem-bark yields ethyl arachidate and behenic acids, marginic and palmitic acids, euphol, aurapterol, basseol, rhein, 3, 5, 8, 3′4′5′-hexahydroxy flavones[21].

Leaves

The leaves showed mainly the presence of Anthraquinone glycosides and Flavonoids. The Anthraquinone glycoside includes rhein, emodine, physion, chrysophanol (marker), Obtusin, chryso-obtusin, chryso-obtusin-2-O-β-D-glucoside, obtusifolin and chryso-obtusifolin-2-O- β -D-glucoside[103].

PHARMACOLOGICAL ACTIVITIES

All over the world scientific research is getting momentum to evaluate the pharmacological activities and medicinal properties of *Cassia* species. On the basis of various experimental researches, the following pharmacological activities or medicinal properties of *Cassia* species have been reported.

Hepatoprotective Activity

Hydro-alcoholic extracts of *Cassia* species, whole plant showed significant decrease in the levels of serum markers, indicating the protection of hepatic cells and significant dose dependent protection against paracetamol induced hepatocellular injury[24]. Methanolic extract of *Cassia* species leaves at a dose of 400 mg/kg showed significant hepatoprotective effect by lowering the serum levels of transaminase (SGOT and SGPT), bilirubin and alkaline phosphatase (ALP) [8].

Anti-Inflammatory Activity

Methanolic extract of the *Cassia* species leaves was investigated against carrageenin, histamine, serotonin and dextran induced rat hind paw oedema. It exhibited significant anti-inflammatory activity against all these agents. The extract (400 mg/kg) showed maximum inhibition of oedema of 40.33%, 31.37%, 53.57% and 29.15% at the end of 3 hr with carrageenin, dextran, histamine and serotonin induced rat paw oedema, respectively. Using a chronic test, the granuloma pouch in rats, the extract exhibited a 48.13% reduction in granuloma weight [8].

Hypolipidemic Activity

Ethanolic extract of *Cassia* species seeds and its ether soluble and water soluble fraction decreased serum level of total cholesterol by 42.07, 40.77 and 71.25% and increased the serum HDL cholesterol level by 6.72, 17.20 and 19.18%, respectively. Ethanolic extract, ether fraction and water fraction decreased triglyceride level by 26.84, 35.74 and 38.46%, respectively. The reduction in LDL-cholesterol level by ethanolic extract, ether soluble fraction and water soluble fraction were 69.25, 72.06, and 76.12%, respectively.[25]

Antimutagenic Activity

Antimutagenic activity of a methanol extract of *Cassia* species seeds were demonstrated against aflatoxin B1 with the *Salmonella typhimurium* assay. The numbers of revertants per plate decreased significantly when this extract was added to the assay system using *Salmonella typhimurium* TA100 and/or TA98. The methanol extract was then sequentially partitioned with CH_2Cl_2, n-butanol and H_2O. The CH_2Cl_2 and n-butanol fractions possessed antimutagenic activity but the H_2O fraction was inactive. Column chromatography using silica gel yielded pure chrysophanol, chrysoobtusin and aurantio obtusin from CH_2Cl_2 fraction *Cassia*side and rubro-fusarin gentiobioside from the n-BuOH fraction. Each of these compounds demonstrated significant antimutagenic activity [26].

Antishigellosis Activity

The ethyl acetate fraction of the crude extract of *Cassia* species showed maximum activity with the zone of inhibition ranging between 23-25 mm at the concentration of 200 µg disc-1. The minimum inhibitory concentration (MIC) of ethyl acetate, chloroform and ethanol extracts was found between 32-64 µg ml-1 whereas the methanol and petroleum fractions showed MIC values between 128-512 µg / ml [27].

Antibacterial Activity

De-alcoholized extract of *Cassia* species seeds inhibited the growth of *Micrococcus pyogenes* var. albus, *Micrococcus citreus*, *Cornebacterium diphtheria*, *Bacillus megatherium*, *Salmonella typhosa*, *Salmonella paratyphi*, *Salmonella schottmuelleri* and *Escherichia coli*[103.]

Antiulcer Activity

Antiulcer effect of methanolic extract of *Cassia* species seed extract was evaluated using pylorus ligation and indomethacin induced ulcers in wistar albino rats. Various biochemical parameters such as gastric volume, free and total acidity were estimated. A significant reduction of ulcer index as well as gastric acid output in extract treated animals was observed with respect to control animals. The extract exhibited 75% protection in pylorus ligation model and 70.31% protection in indomethacin induced ulcers [30.]

Antifungal Activity

The leaf extract has shown the significant antifungal activity to inhibit the growth of *Candida albicans*, *Aspergillus niger*, *Sachharomyces cerevisiae* and *Trichophyton mentagrophyte*[31]. It shows antifungal activity due to chrysophenol and crysophanic acid- 9- anthrone and other anthraquinones such as emodine, physcion and rhein.[32,33]

Antioxidant Activity

The methanolic extract of *Cassia* species seeds shows stronger antioxidant activity. It was found that it exhibits stronger antioxidant activity as compared to Alpha-tocopherol [34]. The phenolic active component, alaternin and nor-rubrofusarin glucoside isolated from extract of *Cassia species* also showed a potent free radical scavenging activity.

Medicinal and Therapeutic Use of Different *Cassia* species In Various Countries

It is used as tonic, carminative and stimulant. Its leaves, seeds, and roots are used medicinally, primarily in Asia. It is believed to possess a laxative effect, as well as to be beneficial for the eyes. As a folk remedy, the seeds are often roasted, then boiled in water to produce a tea. Roasted seeds have also been used as a substitute for coffee. According to ayurveda the leaves and seeds 1are acrid, laxative, antiperiodic, anthelmintic, ophthalmic, liver tonic, cardio-tonic, expectorant, leprosy, ringworm, flatulence, colic, dyspepsia, constipation, cough, bronchitis[4].

According to Chinese materia medica, it promotes blood circulation, and its cold nature makes it effective in the treatment of heat syndromes. Seed tarts ailments due heat such as blindness, conjunctivitis, hyperdacryosis[3].

Traditional Uses of Different *Cassia* Species in Various Countries

Traditionally, the leaves of *Cassia* Species are popular as pot herb. It is used as a natural pesticide in the organic farms of India. It has been reported that *Cassia* species contain chrysophanic acid-9-anthrone which is an important fungicide. The intake of these seeds can cure skin diseases like ring worm, itch and psoriasis. These herbal seeds can also remove intense heat from the liver and improve the acuity of sight and loosen the

bowels to relieve constipation. The leaves contain anthroquinones, and are employed in weak decoction for treating childhood teething, fever and constipation. The paste of the ground, dried root is used in Ayurveda as a treatment for ringworm and snakebite.

Herb-Drug Interactions

Cassia species as been predicted to interact with a number of drugs that lower potassium (such as the corticosteroids, or drugs where the effects become potentially harmful when potassium is lowered, there appears to be little or no direct evidence that this occurs in practice.

DISCUSSION[9,10,11,13]

Demands of traditional herbal medicines are increasing day by day not only by the developing countries but also by the developed countries throughout the world. The demand is due to the increased acceptance of ayurvada and traditional herbal medicines, because of having their safe therapeutic effect and no side effects, as such modern peoples relies more on drug resources of plant origin.

Several chemical compounds such as Anthraquinone glycosides, Naphthopyrone glycosides, Phenolic compounds, Flavonoids etc. have been isolated from *Cassia species* plants. These chemical compounds are responsible for Pharmacological activities such as hepatoprotective, anti-inflammatory, antigenotoxic, hypolipidemic, spasmogenic and antinociceptive, antiproliferative, hypotensive, purgative, antidiabetic, estrogenic and antiestrogenic, antiulcer, antioxidant, antifungal, antishigellosis, anthelmintic, antimutagenic, antibacterial and antiplasmodial.

In different countries *Cassia* species medicinally used in many diseases such as anemia, constipation, dermatitis, dyspepsia, fever, hydropsy, liver problems, menstrual disorders, skin problems, venereal disease, as a diuretic, emmenagogues, laxative and as a purgative, abortifacient, insecticide, purgative, vermifuge, for ascites, craw-craw, dhobeyitch, eczema, gonorrhea, herpes, leprosy, mycosis, parturition, ringworm, shingles, skin problems, sores, wounds.

Traditionally, leave Juice of *Cassia* species made into plaster with sandal wood or mixed with lime juice, used for ringworm and dhobi itch. Externally, used for washing syphilitic sores. *Cassia* root taken internally with black pepper for the treatment of snake bite. Infusion or decoction of leaves, with black pepper, used for asthma and hiccups. In Bangladesh, root juice used for fevers and as diuretic; paste from leaves used for ringworm and sores. In India, different species of *Cassia* used for diarrhoea, osteoarthritis, common cold, asthma, allergic rhinitis, and other respiratory disorders.

There is no doubt that these plant species are reservoir of potentially useful chemical compounds which can serve as a drug, as newer leads and clues for modern drug design by synthesis. It is thought that thorough information as presented in this review on Pharmacological, Traditional and Medicinal values of *Cassia* species may provide strong evidence for the use of this plant in different medicines.

CONCLUSION

The scientific studies and review articles on *Cassia* species suggest an enormous biological potential of these plants. Pharmacological, medicinal and traditional studies with standardized extracts and isolated constituents need to be performed to investigate unexploited potential of this plant. In different countries use of *Cassia* species in different manner would create attention about this plant for their pharmacological, traditional and medicinal values. There is huge scope for research on *Cassia* species and

could be further exploited in future as a source of useful phytochemical compound for the pharma industry.There are many other traditional uses of *Cassia* species in ayurveda which serves as basis for further studies. This review will definitely help the researchers to explore its different properties and interactions of *Cassia* species.

REFERENCES

1. Dabriyal RM, Narayana DBA. Ayurvedic Herbal Raw Material, The Eastern Pharmacist 1998;31-35.
2. Harshal A, Pawar, Priscilla, mello MD. *Cassia species* linn. an overview 2011; 2(9): 2286-2291.
3. Nadkarni R.M., Indian Materia Medica, Popular Book Depot, Mumbai, 1954;1:291.
4. Shibata S, Morishita E, Kaheda M., Kimura Y, Takido M, Takashashi S. Chem.Pharm.Bull 1969; 17:454.
5. Raghunathan K, Hariharan V, Rangaswami S, Chrysophanol-1-β-gentiobioside, a new anthraquinone glycoside from *Cassia species* Linn. Indian J.Chem 1974; 12: 1251-1253.
6. Hooker, J.D., the Flora of British India, Vol.II, L.Reeve and Co., England, 1879, p.26. Kirtikar, K.R. and Basu, B.D., Indian Medicinal Plants, Vol II, Periodical Experts D- 42, Vivek Vihar Delhi, 1975, pg.877.
7. Jain, S.K., Medicinal Plants, National Book Trust, New Delhi., 1968, p.37.
8. Maitya TK, Mandal SC, Mukherjee PK. Saha K, Dass J, Saha BP, et al Evaluation of hepatoprotective potential of *Cassia species* leaf extract, Nat. Prod. Sci 1997; 3:122.
9. Maitya TK, Mandal SC, Saha BP, Pal M., Evaluation of hepatoprotective potential of *Cassia species* leaf extract. Nat. Prod. Sci. 1998; 4(4): 226.
10. Asolkar LV, Kakkar KK, Chakre OJ. Second supplement to glossary of Indian medicinal Plants. PID, CSIR, New Delhi, 1992; 180-181.
11. Chauhan NS. Medicinal and aromatic plants of Himachal Pradesh. Indus Pub. Co. New Delhi. 1999;151-52.
12. Anonymous. The Wealth of India A dictionary of Indian raw materials & Industrial products, Publications & Information Directorate, C.S.I.R., Vol.3, p. 368-70.
13. Manojlovic I, Bogdanovic-Dusanovic G, Gritsanapan W, Manojlovic N. Isolation and Identification of anthraquinones of *Caloplaca cerina* and *Cassia species*. Chemical Pap 2006; 60(6):466-68.
14. Jang DS, Lee GY, Kim YS, et al. Anthraquinones from the seeds of *Cassia species* with inhibitory activity on protein glycation and aldose reductase. Biol Pharm Bull 2007; 30 (11):2207-2210.
15. Lee HJ, Choi JS, Jung JS, Kang SS. Alaternin glucoside isomer from *Cassia tora*. Phytochemistry 1998; 49 (5):1403-1404.
16. Park KH, Park JD, Hyun KH, Nakayama M, Yokota T. Brassinosteroids and monoglycerides in immature seeds of *Cassia species* as the active principles in the rice lamina inclination bioassay. Biosci Biotechn Biochem 1994; 58 (7):1343-1344.
17. Hatano T, Uebayashi H, Ito H, *et al*. Phenolic constituents of *Cassia* seeds and antibacterial effect of some naphthalenes and anthraquinones on methicillin-resistent *Staphylococcus aureus*. Chem Pharm Bull 1999; 47 (8):1121-1127.
18. Anonymous. The Wealth of India: A Dictionary of Indian Raw Materials & Industrial Products, Publications & Information Directorate, C.S.I.R., Vol.3:368-370.
19. Farooq MO, Aziz MA, Ahmad MS. Seed oils from *Cassia fistula*, *C.occidentalis*, and
20. *C.tora* (Indian Varieties). J Am Oil Chem Soc 1956; 33: 21-23.
21. Kapoor VP, Farooqi MIH, Kapoor LD. Chemical investigations of seed mucilages from *Cassia species*. Indian For 1980; 106 (11):810-812.
22. Rai KN, Kumari S. Phytochemical investigation of the stem of *Cassia species* Linn. Asia J Chem 2006; 18(1):763-765.
23. Shibata S, Morishita E, Kaheda M, Kimura Y, Takido M, Takashashi S.Chem.Pharm.Bull 1969; 17:454.

24. Raghunathan K, Hariharan V, Rangaswami S. Chrysophanol-1-β-gentiobioside, a new anthraquinone glycoside from *Cassia species* Linn. Indian J.Chem. 1974; 12: 1251-1253.
25. Tiwari P, Kumar K, Panik R., Hepatoprotective effects of *Cassia species* whole plant. International Journal of Pharmacy & Technology 2011; 3(2):2798-2806.
26. Patil UK, Saraf S, Dixit VK. Hypolipidemic activity of seeds of *Cassia species* Linn. J. of Ethnopharmacol 2004;90 (2-3):249-252.
27. Choi JS, Lee HJ, Park KY, Ha JO, Kang SS. In vitro antimutagenic effects of anthraquinone aglycones and naphthopyrone glycosides from *Cassia species*. Planta Med 1997; 63 (1):11-14.
28. Awal MA, Hossain MS, Rahman MM, Parvin S. Antishigellosis activity of the root extracts of *Cassia species* Linn. Pak J Biol Sci 2004; 7(4):577-579.
29. Patel RP, Patel KC. Antibacterial activity of *Cassia species* and *Cassia obovata*. Indian Journal of Pharmacy 1957; 19: 70-73.
30. Gill NS, Sharma A, Arora R, Bali M. Evaluation of *Cassia species* seeds for their antioxidant and antiulcer activity. J Med Sci 2011; 11 (2):96-101.
31. Lemli J, Cuveela, J. Chromatography of anthrone glycosides of purgative drug, Planta Med. 1974; 26:193 (Chemical Abstract, 1975, 82,35074X)
32. 42. Mukharjee PK, Saha K, Das J, Saha BP, Pal M. Antifungal activity of the leaf extract of *Cassia species* linn, Phytother. Res. 1996; 10:521-522.
33. Acharya TK, Chatterjee IB, Isolation of chrysophanic acid –9-anthrone, a fungicidal compound from *Cassia species*, Sci.Cult. 1974; 40:376.
34. Chakrabarty K. Chawla H. Terpenoids and phenolics from *Cassia species* stem bark", Indian J. Chem. 1983;22(B): 1165-1166.
35. "*Cassia* Fistula (aburnum, Purging Fistula, Golden Shower, Amaltas)", *Ayurveda - Herbs* (4 to 40), retrieved 2011;01:20
36. Duncan AS. Standardized Senna as a Laxative in the Puerperium *British Medical Journal* **1.** 1957;5016: 439–41
37. *Flora of Tropical Africa* 2: 271. 1871. GRIN (December 19, 2007). "*Cassia abbreviata* information from NPGS/GRIN". *Taxonomy for Plants*. National Germplasm Resources Laboratory, Beltsville, Maryland: USDA, ARS, National Genetic Resources Program. Retrieved December 6, 2011.
38. Dr Hans Martin & Bindanda M'Pia (2008) Natural Medicine in the Tropics I: Foundation text anamed, Winnenden, German.
39. David G. Frodin (2004). "History and concepts of big plant genera". *Taxon* **53** (3): 753–776.
40. Brennan, J.P.M. 1967. Leguminosae, Sub family Caesalpinioideae. *In* Milne-Redhead, E. and Polhill, R.M., eds. *Flora of tropical east Africa.* London, Crown Agents for Overseas Govts and Admin.
41. Kokwaro, J. O. (1976). *Medicinal Plants of East Africa*, East African Literature Bureau, Nairobi
42. MR. Phytochemical investigations on *Cassia* abbreviata. Fitoterapia. 1995; 66(2): 184.
43. Parry O, Duri ZJ. The spasmolytic action of *Cassia* abbreviata. Fitoterapia. 1994; 65(3): 260-264.
44. USDA, Natural resources conservation services, Classification for Kingdom Plantae Down to Genus *Cassia* L. http://plants.usda.gov/java/ClassificationServlet?source=display&classid=CASSI [Last accessed on 2013 Jan 2]
45. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_biflora.html [Last accessed on 2013 Jan 2]
46. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_excelsa.html [Last accessed on 2013 Jan 2]
47. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_fistula.html [Last accessed on 2013 Jan 2]
48. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_leptophylla.html[Last accessed on 2013 Jan 2]
49. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_nemophila.html [Last accessed on 2013 Jan 2]

50. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_phyllodinea.htm1 [Last accessed on 2013 Jan 2]
51. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_splendida.html [Last accessed on 2013 Jan 2]
52. http://www.desert-tropicals.com/Plants/Fabaceae/Senna_alata.html [Last accessed on 2013 Jan 2]
53. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_spectabilis.html [Last accessed on 2013 Jan 2]
54. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_multijuga.html [Last accessed on 2013 Jan 2]
55. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_artemisioides.html [Last accessed on 2013 Jan 2]
56. http://www.desert-tropicals.com/Plants/Fabaceae/Senna_bicapsularis.html [Last accessed on 2013 Jan 2]
57. Duncan, As (Feb 1957), "Standardized Senna as a Laxative in the Puerperium", *British Medical Journal* **1** (5016): 439–41
58. http://www.desert-tropicals.com/Plants/Fabaceae/Senna_candolleana.html [Last accessed on 2013 Jan 2]
59. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_spectabilis.html [Last accessed on 2013 Jan 2]
60. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_lindheimeriana.html [Last accessed on 2013 Jan 2]
61. http://www.desert-tropicals.com/Plants/Fabaceae/Senna_hirsuta.html [Last accessed on 2013 Jan 2]
62. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_corymbosa.html [Last accessed on 2013 Jan 2]
63. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_marilandica.html [Last accessed on 2013 Jan 2]
64. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_oligophylla.html [Last accessed on 2013 Jan 2]
65. http://www.desert-tropicals.com/Plants/Fabaceae/Senna_polyphylla.html [Last accessed on 2013 Feb 15]
66. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_purpusii.html [Last accessed on 2013 Feb 15]
67. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_sturtii.html [Last accessed on 2013 Feb 15]
68. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_surattensis.html [Last accessed on 2013 Feb 15]
69. http://www.desert-tropicals.com/Plants/Fabaceae/*Cassia*_wislizenii.html [Last accessed on 2013 Feb 15]
70. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?300111 [Last accessed on 2013 Feb 15]
71. International Legume Database & Information Service. November 2005. Version 10.01. Retrieved December 20, 2007 [Last accessed on 2013 Feb 15]
72. WORLD CONSERVATION MONITORING CENTRE (WCMC) (1998). *Cassia aubrevillei*. 2006.
73. Jackes, Betsy (17 Jan 2012). "*Cassia brewsteri* (Brewster's*Cassia*)" (webpage). *Discover Nature at JCU. Plants on Townsville Campus*. Australia: James Cook University. Retrieved 17 May 2013
74. Assi, A. 1998. *Cassia fikifiki*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. [Last accessed on 2013 Feb 15]
75. Cantino, Philip D.; James A. Doyle, Sean W. Graham, Walter S. Judd, Richard G. Olmstead, Douglas E. Soltis, Pamela S. Soltis, & Michael J. Donoghue (2007). "Towards a phylogenetic nomenclature of *Tracheophyta*". *Taxon* **56**(3): E1–E44.
76. The panang story , the celebration of cultural diversitywww.penangstory.net.my. [Last accessed on 2013 Feb 15]
77. Floyd, A.G., *Rainforest Trees of Mainland South-eastern Australia*, Inkata Press 2008, ISBN 978-0-9589436-7-3 page 110
78. Holly L. Williams and Charles B. Fenster (1998). "Ecological and genetic factors contributing to the low frequency of male sterility in Chamaecrista Fasciculata (Fabaceae)". *American Journal of Botany* (Botanical Society of America)

79. Miller, James Howard; Miller, Karl V. (2005). *Forest plants of the Southeast and their wildlife uses*. University of Georgia Press. p. 2.
80. http://www.hear.org/pier/species/senna_alata.html [Last accessed on 2013 Feb 15]
81. http://apps.rhs.org.uk/plantselector/plant?plantid=4133 [Last accessed on 2013 Feb 15]
82. Maneemegalai, S. and T. Naveen. (2010).Evaluation of antibacterial activity of flower extracts of *Cassia auriculata*. *Ethnobotanical Leaflets* 14 8-20.
83. PACIFIC ISLAND ECOSYSTEMS AT RISK (PIER) (2006): *Senna Bicapsularis*. Version Of 2006-Oct-25.
84. INTERNATIONAL LEGUME DATABASE & INFORMATION SERVICE (ILDIS) (2005): genus *canavalia*. version 10.01, november 2005.
85. FIERO, BRAD (2001): desert ecology of tucson, az - desert senna (*senna covesii*). version of 2001-aug-01.
86. UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) (2007): *senna hebecarpa*.
87. Irwin, H.S. & Barneby, R.C. (1982). "The American Cassinae: a synoptical revision of Leguminosae, tribe Cassieae, subtribe Cassinae in the New World". *Senna italica (Mill.)* **35** (2): 482–484.
88. http://www.hear.org/pier/scientificnames/..%5Cspecies%5Csenna_multiglandulosa.html [Last accessed on 2013 Feb 15]
89. Spiller, Ha; Winter, Ml; Weber, Ja; Krenzelok, Ep; Anderson, Dl; Ryan, Ml (May 2003). "Skin breakdown and blisters from senna-containing laxatives in young children". *The Annals of pharmacotherapy***37** (5): 636–9.
90. *Germplasm Resources Information Network*. United States Department of Agriculture. 2004-01-22. [Last accessed on 2013 Feb 15]
91. Anthony Huxley, Mark Griffiths, and Margot Levy (1992). *The New Royal Horticultural Society Dictionary of Gardening*. The Macmillan Press,Limited: London. The Stockton Press: New York.
92. V. Singh. 2001. *Monograph on the Indian Subtribe Cassiinae* Scientific Publishers (India): Jodhpur, India
93. Philip Miller. 1754. *The Gardeners Dictionary, Abridged* 4th edition.
94. Howard S. Irwin and Rupert C. Barneby. 1982. "The American Cassiinae: A synoptical revision of Leguminosae tribe Cassieae subtribe Cassiinae in the New World". *Memoirs of the New York Botanical Garden* 35.
95. Brigitte Marazzi, Peter K. Endress, Luciano Paganucci de Queiroz, and Elena Conti (2006). "Phylogenetic relationships within Senna (Leguminosae, Cassiinae) based on three chloroplast DNA regions: patterns in the evolution of floral symmetry and extrafloral nectaries". *American Journal of Botany* **93** (2): 288–303.
96. INTERNATIONAL LEGUME DATABASE & INFORMATION SERVICE (ILDIS) (2005): Genera *Cassia*, *PalmeroCassia*, *Senna*. Version 10.01, November 2005.
97. http://www.iucnredlist.org/search [Last accessed on 15/02/2013]
98. http://eol.org/pages/27790/details [Last accesed on 2013 April 9]
99. http://www.ildis.org [Last accesed on 2013 April 10]
100. http://www.webmd.com/vitamins-supplements/ingredientmono-SENNA.aspx?activeIngredientId=652&activeIngredientName=SENNA [Last accesed on 2013 April 10]
101. http://medicinalplants.us/herb-drug-interactions-senna [Last accesed on 2013 April 10]
102. http://www.hillgreen.com/pdf/*CASSIA*TORA [Last accesed on 2013 june 14]
103. Singh VK, Khan A M. Medicinal Plants and Folklores - A Stratergy towards Conquest of Human Ailments. Vol. 9. Today & Tomorrow Printers & Publishers, 1990:67.

Table 1. Taxonomical classification[44]

Kingdom:	Plantae	
Subkingdom:	Tracheobionta	
Superdivision:	Spermatophyta	
Division:	Magnoliophyta	
Class:	Magnoliopsida	
Subclass:	Rosidae	
Order:	Fabales	
Family:	Fabaceae	
Genus:	*Cassia* L	

Table 2 Common name of *Cassia* species [99]

Cassia species	Common names
Astraptes fulgerator	Two-barred Flasher
Catopsilia pomona	Common Emigrant or Lemon Emigrant
Catopsilia pyranthe	Mottled Emigrant
Phoebis sennae	Cloudless Sulphur
Cassia afrofistula	Kenyan Shower *Cassia*
Cassia bakeriana	Pink *Cassia*, Wishing-tree
Cassia fistula	Golden Shower Tree
Cassia grandis	Pink Shower *Cassia*
Cassia javanica	Apple-blossom *Cassia*, and Palawan cherry
Cassia nealii	Rainbow Shower Tree
Chamaecrista fasciculata	Large-flowered Partridge Pea, Showy Partridge Pea
Chamaecrista nictitans	Wild Sensitive Pea, Wild Sensitive-plant
Senna alata	Candle Bush, Candelabra Bush, Empress Candle Plant, Candlestick Tree, Ringworm Tree,
Senna alexandrina	Alexandrian Senna, Egyptian Senna, Tinnevelly Senna, East Indian Senna
Senna artemisioides	Silver Senna, Feathery Senna
Senna auriculata	Avaram Senna, avaram, ranawara
Senna bicapsularis	Rambling Senna, Christmas Bush, Money Bush, Yellow Candlewood
Senna corymbosa	Argentine Senna, Argentina Senna, Buttercup Bush, Flowering Senna, (Texas) Flowery Senna, Tree Senna
Senna covesii	Desert Senna, Coues' Senna, Rattleweed
Senna durangensis	Durango Senna
Senna hebecarpa	American Senna, Wild Senna
Senna italica	Neutral Henna
Senna obtusifolia	Chinese Senna, Sicklepod, Foetid Senna, Sickle Senna, Coffeeweed, Arsenic Weed
Senna occidentalis	Coffee Senna, Mogdad Coffee

Table 3. Geographical Source and Distribution of *Cassia* species

S.NO	Plant Name	Synonyms	Geographical Sources	R.f
1	*Cassia biflora*	*Cassia biflora var. semperflorens, Cassia marimari, Cassia oxyadena, Peiranisia oxyadena, Cassia pallida, Cassia gualanensis, Cassia semperflorens, peiranisia jamaicensis, Cassia tenuissima, Cassia venustula, Cassia xiphoidea, Senna pallida, Peiranisia biflora, Cassia nemorosa, Panisia biflora, Cassia geminiflora, Cassia acapulcensis, Cassia berteroana, Cassia crista, Peiranisia crista, Cassia deamii, Peiranisia deamii, Grimaldia deamii, Cassia frondosa*	America	45
2	*Cassia didymobotria*	-	Eastern Africa	46
3	*Cassia excelsa*	*Senna spectabilis var. excelsa, Cassia fastigiata*	Brazil, Ecuador	47
4	*Cassia fistula*	-	India	48
5	*Cassia leptophylla*	-	Brazil	49
6	*Cassia nemophila*	*Senna artemisioides Senna nemophila, Cassia eremophila*	Australia	50
7	*Cassia phyllodinea*	*Senna phyllodinea,* Senna *artemisioides*	Central Australia	51

8	*Cassia splendida*	-	Brazil	52
9	*Senna Alata*	*Cassia alata,* *Herpetica alata*	Argentina	53
10	*Senna spectabilis*	*Cassia trinitatis, Cathartocarpus trinitatis, Cassia humboldtiana, Cassia totonaca, Cathartocarpus speciosus, Cassia speciosa, Cathartocarpus humboldtianus,* *Cassia edulis,* *Cassia carnaval,* *Cassia amazonica, PseudoCassia spectabilis, Cassia spectabilis,* *Cassia excelsa var. Acutifolia*	Tropical America	54
11	*Senna multijuga*	*Cassia multijuga.,* *Cassia ampliflora,* *Cassia calliantha,* *Cassia fulgens,* *Cassia richardiana, Peiranisia aristulata*	Brazil, Guyana	55
12	*Senna artemisioides*	*Cassia artemisioides*	Australia	56
13	*Senna bicapsularis*	*Cassia emarginata,* *Cassia limensis,* *Cassia sennoides,* *Adipera spiciflora, Chamaefistula inflata, Cassia inflata, Isandrina emarginata, Cassia berterii, Isandrina arborescens, Cathartocarpus bicapsularis, Adipera bicapsularis, Cassia bicapsularis,* *Cassia spiciflora,* *Cassia collae*	South America	57
14	*Senna alexandrina*	*Cassia acutifolia* *Cassia alexandrina* *Cassia angustifolia* *Cassia lanceolata* *Cassia lanceolata* *Senna sophera* *Cassio lanceolata Chamaecrista desvauxii* var. *mollissima* *Cassia lenitiva* *Cassia senna* *Senna acutifolia* *Senna alexandrina* *Senna angustifolia*	India and Somalia Egypt, Nubian Khartoum (Sudan)	58

15	*Cassia totonaca*	*Cassia trinitatis, Cathartocarpus trinitatis, Cassia humboldtiana, Cassia totonaca, Cathartocarpus speciosus, Cassia speciosa, Cathartocarpus humboldtianus, Cassia edulis, Cassia carnaval, Cassia amazonica, PseudoCassia spectabilis, Cassia spectabilis, Cassia excelsa var. acutifolia*	Tropical America	59
16	*Senna lindheimeriana*	*Cassia lindheimeriana, EarleoCassia lindheimeriana*	USA (Texas, New Mexico, Arizona), Mexico	60
17	*Senna Hirsute*	*Cassia hirsuta, Cassia tomentosa, Ditremexa hirsuta*	Argentina	61
18	*Senna corymbosa*	*Cassia corymbosa, Adipera corymbosa, Cassia crassifolia, Cassia falcata, Chamaefistula corymbosa*	Argentina, Brazil and Uruguay	62
19	*Senna marilandica*	*Cassia marilandica, Cassia medsgeri, Ditremexa marilandica, Ditremexa medsgeri*	Eastern USA	63
20	*Senna artemisioides*	*Cassia oligophylla*	Central Australia	64
21	*Senna polyphylla*	*Cassia polyphylla, Peiranisia polyphylla*	Caribbean	65
22	*Senna Purpusii*	*Cassia purpusii, Adipera purpusii*	Baja California (Mexico)	66
23	*Senna artemisioides*	*Senna artemisioides Cassia sturtii, Senna sturtii*	Central Australia	68
24	*Senna surattensis*	*Cassia suffruticosa, Cassia surattensis, Cassia surattensis var. suffruticosa*	Central Australia	69
25	*Senna Wislizeni*	*Cassia wislizeni, PalmeroCassia wislizeni*	Mexico (Chihuahua, Hidalgo), USA (Texas, New Mexico, Arizona)	70
26	*Cassia abbreviata*		Botswana,Kenya, Mozambique, Namibia, Somalia, South Africa (in the provinces of Limpopo and Mpumalanga), Swaziland, Tanzania, Zambia,	71

			and Zimbabwe	
27	*Cassia Artensis*		New Caledonia	72
28	*Cassia aubrevillei*		tropical West Africa	73
29	*Cassia brewsteri*		Queensland, Australia	74
30	*Cassia Fikifiki*		Côte d'Ivoire	75
31	*Cassia Grandis*		southern México, Venezuela Ecuador	76
32	*Cassia Javanica*		Southeast Asia	77
33	*Cassia marksiana*		North eastern New South Wales and in south eastern Queensland.	78
34	*Chamaecrista fasciculata*	*Chamaecrista Chamaecristic,* "*Cassia fasciculata*" *Cassia brachiata,* *Cassia chamaecrista Cassia chamaecrista . robusta,* *Cassia depressa, Cassia fasciculata,* *Cassia fasciculata* var. *puberula,* *Cassia fasciculata* var. *rostrata ,* *Cassia fisheri, Cassiagreenei,* *Cassia littoralis,* *Cassia mississipiensis, Cassia pulchella* Salisb., *Cassia robusta,* *Cassia rostrata,* *Cassia triflora,Cassia venosa*	eastern United States	79
35	*Chamaecrista nictitans*	*Cassia aeschinomene, Cassia aspera* *Cassia chamaecrista Cassia mimosoides* *Cassia multipinnata* *Cassia nictidans* *Cassia nictitans* *Cassia nictitans* *Cassia procumbens*	Temperate and tropical Americas	80
36	*Senna artemisioides*	*Cassia artemisioides* *Cassia eremophila* *Cassia helmsii* Symon *Cassia oligophylla* *Cassia sturtii*	Australia	81
37	*Senna auriculata*	*Cassia auriculata* *Cassia densistipulata*	India and Sri Lanka	82
38	*Senna bicapsularis*	*Adipera bicapsularis* *Adipera spiciflora*	South America, from Panama south	83

		Cassia berterii *Cassia bicapsularis* *Cassia aristata* *Cassia collae* *Cassia emarginata* *Cassia inflate* *Cassia laevigata* *Cassia limensis* *Cassia sennoides* *Cathartocarpus bicapsularis* *Chamaefistula inflata* *Isandrina arborescens* *Isandrina emarginata*	to Venezuela and Colombia, West Indies	
39	*Senna corymbosa*	*Cassia corymbosa* *Cassia crassifolia* *Cassia falcata*	Argentina	84
40	*Senna covesii*	*EarleoCassia covesii*	California, United States, and northern Baja California in Mexico	85
41	*Senna hebecarpa*	*Cassia hebecarpa*	North America, specially Canada and the United States	86
42	*Senna italica*	*Cassia italica* *Cassia obovata*	India	87
43	*Senna multiglandulosa*	*Cassia multiglandulosa* *Cassia tomentosa*	Mexico, Guatemala, and western parts of South America	88
44	*Senna obtusifolia*	*assia humilis* *Cassia numilis* *Cassia obtusifolia* *Cassia tora* *Cassia toroides* *Diallobus uniflorus* *Senna toroides* Roxb. *Senna obtusifolia*	North, Central, and South America, Asia, Africa, and Oceania	89
45	*Senna occidentalis*	*Cassia caroliniana, Cassia ciliata* *Cassia falcata* *Cassia aevigata* *Cassia macradenia,* *Cassia obliquifolia, Cassia Coccidentalis, Cassia occidentalis* *Cassia occidentalis.* *Cassia planisiliqua* *Cassia torosa* *Ditrimexa occidentalis*		90

46	*Senna septemtrionalis*	*Cassia aurata*, *Cassia elegans*, *Cassia floribunda* *Cassia laevigata* Willd., *Cassia laevigata* Willd. var. floribunda sensu Ghesq., *Cassia quadrangularis*, *Cassia septemtrionalis*, *Cassia vernicosa*	Maui, Makawao	91
47	*Senna siamea*	*Cassia arayatensis* *Cassia arborea* *Cassia gigantea* *Cassia siamea* *Cassia sumatrana*	South and Southeast Asia	92
48	*Senna sophera*	*Cassia sophera*	India	93
49	*Senna spectabilis*	-	-	94
50	*Senna tora*	*Cassia boreensis* *Cassia borneensis* *Cassia gallinaria* *Cassia numilis* *Cassia tora* *Emelista tora*	Sri Lanka	95
51	*Senna wislizeni*	*Cassia wislizenii* *PalmeroCassia wislizenii*	Chihuahua and Hidalgo in Mexico; and Texas	96
52	*Cassia afrofistula*		Africa	97

Table 4. The International Union for Conservation of Nature [IUCN] Red List of Threatened *Cassia* Species* [97]

1.	*Aeschynomene brasiliana*	**31.**	*Chamaecrista newtonii*
2.	*Cassia aldabrensis*	**32.**	*Chamaecrista nictitans*
3.	*Cassia artensis*	**33.**	*Chamaecrista paraunana*
4.	*Cassia aubrevillei*	**34.**	*Chamaecrista pedicellaris*
5.	*Cassia fikifiki*	**35.**	*Chamaecrista pohliana*
6.	*Chamaecrista absus*	**36.**	*Chamaecrista pratensis*
7.	*Chamaecrista apoucouita*	**37.**	*Chamaecrista rigidifolia*
8.	*Chamaecrista astrochiton*	**38.**	*Chamaecrista robynsiana*
9.	*Chamaecrista boyanii*	**39.**	*Chamaecrista rufa*
10.	*Chamaecrista brevifolia*	**40.**	*Chamaecrista seticrenata*
11.	*Chamaecrista caracensis*	**41.**	*Chamaecrista souzana*
12.	*Chamaecrista caribaea*	**42.**	*Chamaecrista trachycarpa*
13.	*Chamaecrista ciliolata*	**43**	*Chamaecrista urophyllidia*
14.	*Chamaecrista cotinifolia*	**44.**	*Chamaecrista viscosa*
15.	*Chamaecrista cytisoides*	**45.**	*Senna artemisioides*
16.	*Chamaecrista desvauxii*	**46**	*Senna baccarinii*
17.	*Chamaecrista ensiformis*	**47.**	*Senna bicapsularis*
18.	*Chamaecrista glandulosa*	**48.**	*Senna caudata*
19.	*Chamaecrista jaegeri*	**49.**	*Senna ferraria*
20.	*Chamaecrista kolabensis*	**50.**	*Senna foetidissima*
21.	*Chamaecrista lineata*	**51.**	*Senna glutinosa (*
22.	*Chamaecrista lomatopoda*	**52.**	*Senna macranthera*
23.	*Chamaecrista myrophenges*	**53.**	*Senna multifoliolata*
24.	*Senna oxyphylla*	**54.**	*Senna spectabilis*
25.	*Senna pendula*	**55.**	*Senna tonduzii*
26.	*Senna rigida*	**56.**	*Senna truncata*
27.	*Senna skinneri*	**57.**	*Senna viminea*

Endangered Plants of *Cassia* Species*

Table 5. Medicinal and Therapeutic Use of Different *Cassia* species in Various Countries

Sr. No.	Plant Species	Common Name	Plant Part Used	Chemical Constituents	Medicinal Uses/Activity	Ref No.
1	*Cassia fistula*	Sonhali, Amultus, Nripadruma	Leaves, Pod	anthraquinone glycosides, sennosides,rhein	Antitussive activity CNS activities Leukotriene inhibition activity India	35
2	*Cassia acutifolia*	True senna, Alexandrian senna	Whole plant	Anthracene derivates (2-3% in leaves and pods)	purifies the blood, helps piles, tonic for nervous system, Sudan, Syrian Arab Republic	36
3	*Cassia abbreviata*	Long pod *Cassia*, Mbaraka, Malandesi	Dried leaves,	guibourtinidiol,	antiplasmodial activity, malaria, pneumonia Somalia, South Africa	37
4	*Cassia grandis*	Canandonga	Leaves	Steroles, Anthraquinones, Flavonoids	Anti-inflammatory Activity Mexico, Surinam and Brazil	38
5	*Cassia senna*	Bhuikhakha-sa, Hindisana Sonamukhi	Leaves, Pods and Root	Sennasoides, rhein, aloe-amine, Kaempferein, iso-rhein, chrysophenol, imodin, aloe-imodin,	Febrifuge, splenic enlargements, anaemia, typhoid, cholera, biliousness, jaundice, gout, rheumatism, tumours, foul breath. India	38
6	*Cassia occidentalis*	Badikanodi, Chakunda, Kasonda	All parts of the plant	Sennasoides, rhein, aloe-amine, Kaempferein, iso-rhein, chrysophenol, imodin, aloe-imodin,	haematuria, rheumatism, typhoid, asthama and disorders of haemoglobin India	39

7	*Cassia* obovata	Neutral henna	All parts of the plant	chrysophanic acid , anthraquinones	inhibitors of skin fungus, mite infestations, bacterial India	40
8	*Cassia* augustifolia	Tinnervelly Senna, C. Senna, Locust Plant, Rajavriksha,	All parts of the plant	Flavenol, , anrathquinone (rhein, emodin), sennoside- A, sennoside B, menitol, sodium potassium tartarte, salisilic acid, crisophenic acid, volatile oils, resins, calcium oxalate	purgative, anthchiintic, antipyretic, cathartic, laxative, vermifuge and diuretic propert India	41
9	*Cassia spectabilis*	Spectacular *Cassia*	Leaves	Flavenol, , anrathquinone (rhein,emodin), sennoside	Antifungal,antibacterial and antioxidant Brazil, India	42
10	*Cassia auriculata*	Avaram	Root	cardiac glucoside (sennapicrin) oxymethylanthraqun one	fevers, diabetes, diseases of urinary system constipation India, Srilanka	43

Table 6. Herb-Drug Interactions

S.No	Plant Chemical Constituents and Drug Intraction	Efffects	R.F
1	Digoxin+Anthraqunone glycosides	Decrease potassium level	101
2	Warfarin+ Anthraqunone glycosides	Increase the risk of bleeding	
3	Diuretic drugs+ Anthraqunone glycosides	Decrease potassium level	
4	Corticosteroids+ Anthraqunone glycosides	Hypokalaemia	
5	Estradiol+ Anthraqunone glycosides	Anthraqunone glycoside effect decrease(clinical evidence)	102
6	Ketoprofen+ Anthraqunone glycosides	Reduced the absorptive permeability of ketoprofen	
7	Paracetamol+ Anthraqunone glycosides	Absorption of paracetamol not significantly altered	
8	Propranolol+ Anthraqunone glycosides	Absorption of propranolol not significantly altered	
9	Quinidine+ Anthraqunone glycosides	Quinidine plasma levels reduced	