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Spectral Analysis of Compounds from Different Cassia Species

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ABSTRACT
The genus Cassia, which contains around 580 species, is known for its physiologically active constituents. "Cassia" originates from the classical name of aromatic bark allied to Chinese Cinnamon (Cinnamomum Cassia). In the present paper, Mass spectral analysis of different compounds isolated from different Cassia species has been discussed. The compounds discussed for Mass spectral analysis include 3-formyl-1-hydroxy-8-methoxyanthraquinone, 2-hydroxy-1,6,8-trimethoxyanthraquinone, emodin-9-anthrone and didecyl phthalate. Mass spectral data of these compounds proved to be very helpful in the structural elucidation of these compounds.

I. INTRODUCTION

In the middle age, Cassia stood for the pods of the plant and later to the plant itself. About 20 Cassia species found in India are extensively. used as medicine for the treatment of cheloid tumours, ring worm, insectbites and rheumatism (Jain and Yadava, 1994).

Cassia fistula Linn. (Syn. *C. excelsa, C. rhombifolia*), locally known as Amaltas, Argvadh, Gurmala, Pudding Pipe Tree, Golden Shower, Indian Laburnum, Purging Cassia, is a tree distributed throughout India and cultivated as an ornamental for attractive yellow blossoms. It is a moderate sized deciduous tree 30-50 ft. high with a straight trunk and slender branches; flowers large, scented, bright yellow, pods cylindric upto 60 cms long, shining dark brown; seeds numerous, in black sweet pulp, separated by transverse partitions. A shower of loveliest golden flowers streams from the branches throughout May and June and hence the name Indian Laburnum. The long pods which are ripe in the following February or March have earned the tree the alternate name of Pudding Pipe Tree. The tree is decidous for a shortwhile in March, the new leaves appearing almost immediately. An alcoholic extract of the root bark is used for black water fever. The leaves are emolient, laxative, antiperiodic and heal ulcers. Flowers have a flavour with a bitter acrid taste and are used as a purgative, astringent and cooling agent. It is used to lessen inflammation and heat of body and also cures leprosy, diseases of heart, liver complaints and abdominal pains. Fruit pulp is given in diabetes and also used to flavor tobacco. A decoction of the root is applied locally during severe toothache. An infusion of the fruit is reported to be used for kidney problems, the dissolution of kidney stones and for relieving constipation.

C. renigera Wall., the Burmese Pink Cassia, is a small decidous tree growing about 20 ft. high. It grows in rather drier places and was introduced in India in the early 1890's and soon caught the popular fancy. The original species have a distinct type of growth; stems standing erect, or slightly arched and covered with bunches of flowers having a soft shade of salmon pink and lasting for about two months. The tree is grown in gardens. The pale rose pink flowers appear from May to July.

C. grandis L., also known as Horse Cassia, Pink Shower, Canafistula, Caramano, Cargo, is a native of Central America. It is a medium sized spreading tree bearing rose pink flowers in a leafless state in February-March. This is the first to bloom in the season. It is grown as a hedge plant. The pods of *C. grandis* are of larger size than those of *C. fistula* and also very rough on their surface. The pulp is very strong smelling with a bitter and astringent taste which has laxative properties. In Mexico, it is used locally to treat fever. It is sometimes used in veterinary practices also and hence known as Horse Cassia. In Guatemala, leaves crushed in lard are used to treat mange (Duke, 1986). The juice from the pods consumed fresh is reported to strengthen the blood.

C. fruticosa Koen. (Syn. *C. glauca, C. surrattensis*), commonly known as Mothatarvad, is a shrub or small tree distributed throughout India. Branches numerous spreading; leaflets 2-8 cm long; flowers yellow; pods. stalked, 15-20 x 1.3-2.0 cm, marked with raised lines between the seeds; seeds 20-30, 6 x 3 mm; smooth, dark brown. It flowers in the months of September-October (Kirtikar and Basu, 1984). The bark and leaves of *C. fruticosa* are prescribed in diabetes and gonorrhoca. In Indonesia, the young leaves are boiled and consumed as vegetable; a decoction of roots is used for gonorrhoea. In Guadeloupe, the leaves pounded with sugar and milk are famous cure for blennorrhagia. It is grown as hedge in gardens.

II. REVIEW OF LITERATURE

In *Cassia* spp, a luxuriant natural occurrence of anthraquinones has been reported. Chrysophanol, emodin, physcion, rhein and their derivatives form the major part of anthraquinonic constituents. Many of these compounds have medicinal values. 1,8-Dihydroxyanthraquinone has been reported for its purgative effect and its monoglucoside show still better activity (Auger *et al.*, 1975). Chrysophanol has been shown to have potent antiviral activity, especially against common cold causing rhinovirus. Physcion itself is inactive but its mono- and di-glucoside have laxative properties (Chirikdjian et al., 1983). 1-Hydroxyanthraquinone, 2-hydroxyanthraquinone and their derivatives have been shown to have antitumor activity (Hilgert *et al.*, 1977). Emodin is also reported to have antibiotic properties (Ubbink-Kok *et al.*, 1986). Aloe-emodin has been used as the active ingredient in the preparation for the treatment of pain from burns (Alexa, 1986). Cathartic action is in the order of anthraquinone < anthrone < dianthrone < glycosides.

Cassia plants are also known to be rich source of flavonoids. Quercetin derivatives are the most abundant flavonoids in these plants, though a good number of kaempferol derivatives have also been isolated. The great majority of flavonoids has oxygenation at C-5 and C-7 and the B-ring in all the flavonoids is oxygenated at C-4' or C-3',4' or C-3', 4,5'. Several flavonol glycosides are known to have antibacterial activity. Quercetin, rutin and luteolin are found to have antiulcer activity (Khrenova et al., 1986). The antiviral activity of a wide range of naturally occurring flavonoids has also been reported. A literature survey shows that, though other parts of C. fistula have been investigated but its pods are not extensively studied for their chemical constituents. In *C. renigera*, studies on stems are not available. There is no report of chemical study on the stems of *C. grandis*. In the flowers of *C. fruticosa*, only one phenolic component has been reported so far. There is no report on chemical components of *C. biflora* stems. The present work has, therefore, been undertaken with objective to Isolate and characterize the chemical components present in Cassia fistula (pods), Cassia renigera (stems), Cassia grandis (stems) and Cassia fruticosa (flowers). Leaf extracts of Cassia fistula have broad-spectrum activity and suggest its possible use in treatment of infectious diseases (Panda et al., 2011). In study of Phytochemical constituents of Cassia fistula, the antioxidant and free radical propensities of plant parts and cell culture extracts has been found (Bahorun *et al.*, 2005)

Experimentation and Results:

In this work, materials/chemical used are Petroleum ether (LR),, ethyl acetate (LR), methanol (LR), ethanol (LR), toluene (AR), acetone (AR), dimethyl sulphate (LR), benzene (LR), acetic anhydride (synthesis), vanillin, potassium carbonate (LR), sodium hydroxide (LR), potassium hydroxide (LR), diethyl ether (LR), N-Methyl-N nitrosotoluene-p-sulphoanamide, potassium permanganate (LR), ferric chloride (LR), glacial acetic acid, hydrochloric acid(LR), Aniline (LR), phthalic acid, 1-butanol. The adsorbents used for chromatography were silica gel (60-120 mesh) and silica gel G. For the purpose of Purification, Acetic anhydride, Acetone and Pyridine is used.

The molecular ions, in general, form the base peak. Successive elimination of two CO molecules results in strong $M^{+\cdot}$-CO and $M^{+\cdot}$-2 CO peaks. Other peaks depend on the nature of substituents and their α- or β-orientation. Stronger $M^{+\cdot}$-CO and $M^{+\cdot}$-OH peaks are observed for 2-hydroxyanthraquinone than for 1-hydroxy isomer and both lose a third CO molecule from the phenolic group to give a peak for $M^{+\cdot}$-3 CO. Dihydroxyanthraquinones record a peak for $M^{+\cdot}$-4 CO. α-Methoxyanthraquinones show significant peaks for $M^{+\cdot}$-CHO, $M^{+\cdot}$-OH, $M^{+\cdot}$-H_2O, whereas for β-methoxyanthraquinones only $M^{+\cdot}$-CHO peak (a weak signal) is observed.

Mass Spectral Data:

 # Cassia fistula Linn., cultivated as an ornamental, is famous for its use as laxative, antipyretic and to cure skin diseases and leprosy. Not much literature was available regarding the chemical investigations of pods of C. fistula which were, therefore, examined for their chemical constituents. Three compounds isolated by column chromatography were anthraquinones including one hitherto unreported compound i.e. 3-formyl-1-hydroxy-8 methoxyanthraquinone. Other compounds isolated from *C. fistula* pods were chrysazin, 1-octacosanol, ethyl tetratriacontanoate, chrysophanol, and β-sitosterol. Mass spectral data of 3-formyl-1-hydroxy-8-methoxyanthraquinone is as shown in Fig. 1:

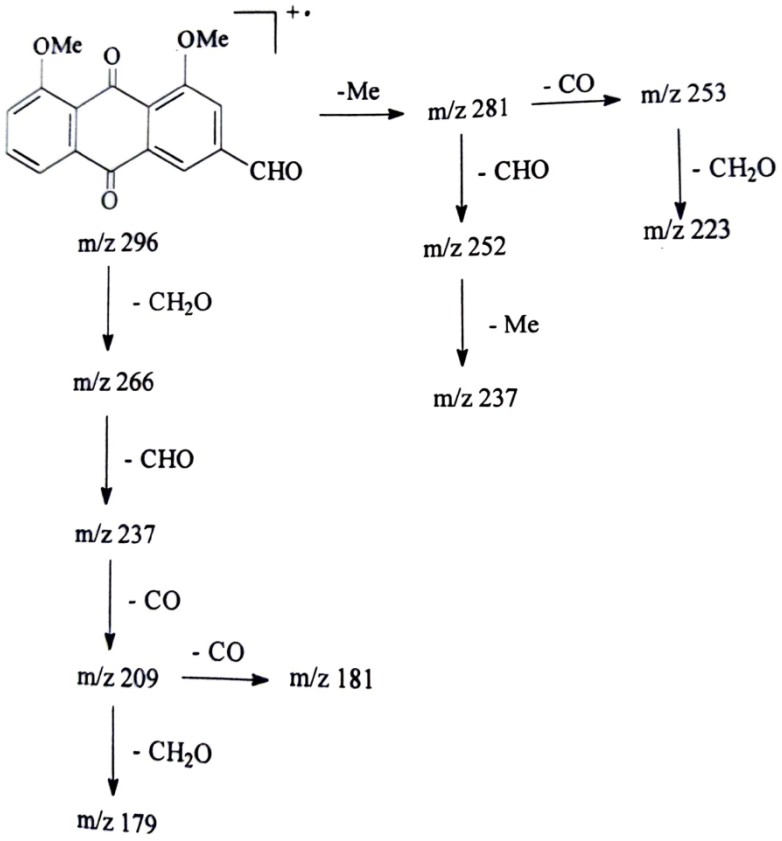

Fig. 1 Mass Spectral data of 3-formyl-1-hydroxy-8-methoxyanthraquinone

Cassia renigera Wall. is a small decidous tree grown in gardens. As there was no phytochemical report on the stems of *C. renigera*, its stems were taken up for phytochemical study. These were extracted with hot methanol. The extractives were column chromatographed over silica gel to get six crystalline compounds. One of these was a hitherto unreported anthraquinone i.e. 2-hydroxy-1,6,8- trimethoxyanthraquinone. Other compounds were arachidic acid, physcion, β-sitosterol, fallacinal, and B-sitosteryl-B-D glucoside. Mass spectral data of 2-hydroxy-1,6,8-trimethoxyanthraquinone is as shown in Fig. 2:

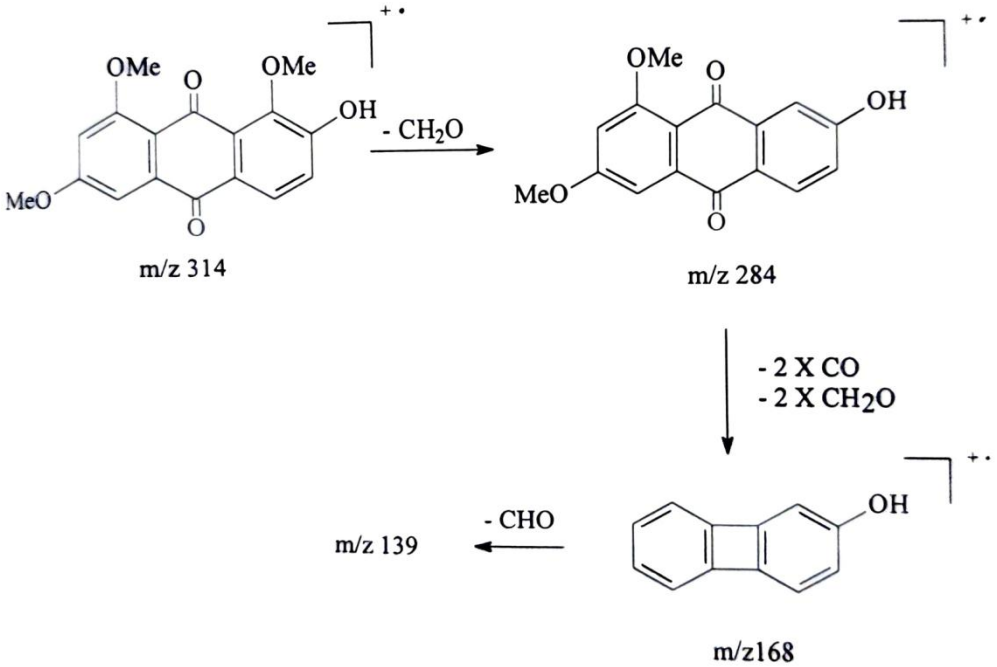

Fig. 2 Mass Spectral data of 2-hydroxy-1,6,8-trimethoxyanthraquinone

Cassia grandis L., grown as hedge plant, is reported to strengthen the blood, treat fever and mange and posses laxative properties. There was no report on chemical investigations of stems of *C. grandis*. Therefore, the stems of this plant were studied for their chemical constituents. These were extracted with hot methanol. Three compounds were isolated by silica gel column chromatography of the extractives of stems of *C. grandis*. These were palmitic acid, β-sitosterol and emodin-9-anthrone. Mass spectral data of emodin-9-anthrone is as shown in Fig 3:

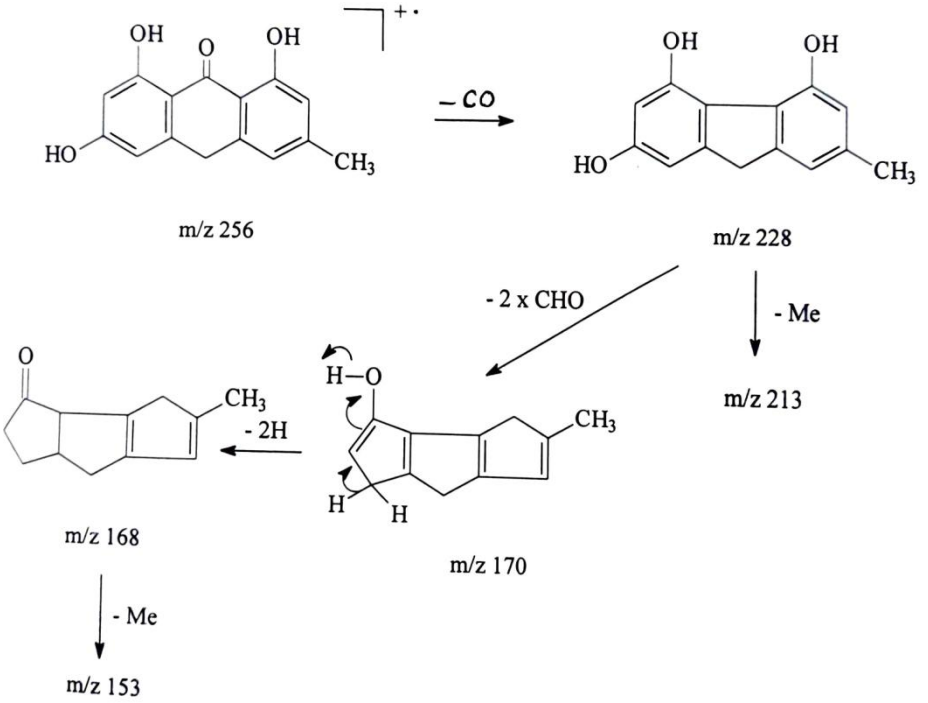

Fig. 3 Mass Spectral data of emodin-9-anthrone

Cassia fruticosa Koen., grown as hedge in gardens, is prescribed in diabetes and gonorrhoea. As there was no extensive phytochemical report on flowers of *C. fruticosa*, its flowers were screened for their chemical constituents extracted with hot methanol. Compounds obtained from this plant, namely, ethyl stearate, 1-docosanol, ethyl tetratriacontanoate and didecyl phthalate. This is the first report of isolation of these four components from C. fruticosa. Mass spectral data of didecyl phthalate is as shown in Fig. 4:

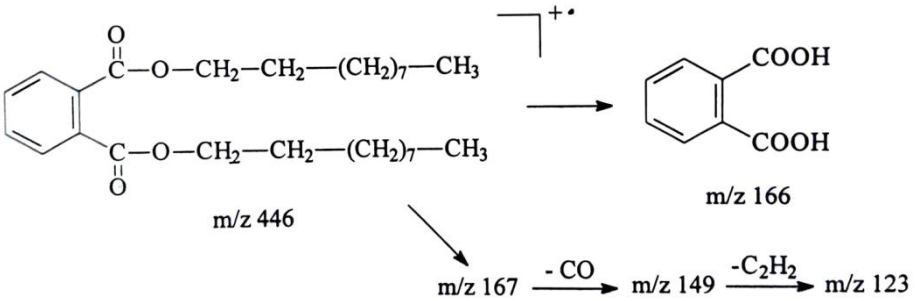

Fig. 4 Mass Spectral data of didecyl phthalate

III. CONCLUSION :

Cassia, a genus famous for a number of physiologically active constituents and well known for its cathartic and laxative properties, belongs to the family Leguminoseae. Keeping in view the medicinal properties of these plants, phytochemical investigations were carried out on *C. fistula* pods, *C. renigera* stems, *C. grandis* stems, *C. fruticosa* flowers and *C. biflora* stems. After isolating various compounds from these plant parts, their structure was elucidated on the basis of IR, UV-visible, ^{1}H-NMR and Mass spectral data along with other properties of these compounds and their derivatives. In the present work, Mass spectral data of those compounds, which were isolated for first time has been discussed.

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