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Phytochemistry of Some Plant Species of the Family Bignoniaceae - A Review

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Abstract : The family Bignoniaceae is the huge reservoir of variety of secondary metabolites like saponins, tannins, flavonoids, alkaloids, reducing sugars, glycosides, carbohydrates, kaempferol, iridoids, terpenes, steroids, coumarins, etc. Phytochemistry is the branch of science that deals with the study of phytochemicals. Phytochemicals as the term implies are chemical compounds that are derived from plants. The crude extracts of all the species of family Bignoniaceae were reported as antibacterial activity, anti- inflammatory activity, anti-rheumatic activity, anti - cancer activity, anti-tumoral activities, etc.

Keywords : Bignoniaceae, Phytocompounds, Tecoma, Kigelia, Tecomaria, Spathodea.

INTRODUCTION

The Bignoniaceae is a wide spread family and commonly called the Trumpet vine or Trumpet Creeper family. It gets its name from genus Bignonia. Some of the well known members of the family are Tecoma, Catalpa, Spathodea, Kigelia, Tecomaria and Jacaranda. Many species are important ornamentals and have large spectacular flowers; leaves are typically opposite or whorled. Some at maturity acts like woody trees.

In the early 1980s there was a resurgence of interest in the use of natural substances generally known today as bioactive phytocompounds. The bioactive compounds are primarily secondary metabolites and their derivatives for example, flavonoids, saponins, quinines, terpenes, steroids, alkaloids, iridoids and phenolic compounds etc. Earlier history reflects that the use of secondary compounds are for curing agents for many diseases. The anti tumour activity of bignoniaceae is probably due to its napthoquinoids for example, lapachol for clinical use (Kingston and Rao ,1982). The most common natural antioxidants are flavonoids and phenolic acids (Larson.1988). The anti-microbial activity of Kigelia pinnata (Bignoniaceae) has been shown to be due to the iridoids present (Akunyili et. al., 1991). The preliminary phytochemical screening of the ethanolic and aqueous extracts revealed that the anti dysenteric and anti diarrheal properties of medicinal plants were due to tannins, alkaloids, saponins flavonoids , steroids, terpenoids and reducing sugars (Galvez et.al., 1993: Loganga et.al., 2000). Some species of Bignoniaceae are as follows.

Spathodea campanulata p.Beauv

Uses: In Laos, Cambodia and Vietnam, the flowers of S campanulata are used to heal ulcers. Fractions obtained from a decoction of stem bark heals hypoglycaemic, anticomplementary, antimalarial and ante-HIV activity in mice (Madinke et.al., 1989; Niyonzima et. al., 1999)

Jacaranda mimosifolia D. Don Covers

Uses: J. mimosifolia has antiseptic and antibiotic qualities; Jacaranda gives out some secret natural medical gifts too. The tree is used to treat hepatitis and in folk tradition the flowers, leaves and bark are used to ease neuralgia and varicose veins. It is scientifically proven that

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Jacaranda has qualities that treat leukemia. Hot Jacaranda leaf baths treat wounds and skin infections and the tree also helps in the treatment of acne.

Kigelia africana (Lam.) Benth. Syn. K pinnata(Jacq) DC.

Uses: This plant as a whole has anti-inflammatory, anti malarial, ante-HIV, ante-syphilis and antidiabetic qualities. The tree is used to treat rheumatism, gastrointestinal disorders and stomach ulcers. It helps in treatment of many skin infections. Kigelia is a monospecific genus in the flowering plant of family Bignoniaceae.

MATERIALS & METHODS:

The leaves, barks and flowers of different plant species of the family Bignoniaceae were collected from different areas of Ranchi district and identified by using the book 'The Botany of Bihar and Orissa'(Haines, H.H). The barks, leaves and flowers were examined carefully and old, infected and fungal with damaged barks, leaves and flowers were removed. Extracts were prepared from sun dried leaves, bark and fresh flowers. 50 g of barks, leaves and flowers were collected and kept in a flask with 200 ml of different solvents (ethanol and aqueous solution) in a shaker at room temperature for 36 hours. After incubation, the extracts were filtered through Whatman No.1 filter paper and the extracts were collected and stored. The preliminary phytochemical screening was performed using standard procedures.

Reports of ethnomedicinal studies, bioactive phytochemical constituents and pharmacological activity studies on Bignoniaceae family plants were obtained from existing scientific data bases. A detailed literature search was conducted via electronic search (Web of Science, Pub Med and Google Scholar) and library search (books, theses, reports, newspapers, magazines and conference proceedings). These sources were scrutinized for information.

RESULTS

Phytochemical analysis of the family Bignoniaceae:

Several phytochemical studies revealed that the extracts from many species of Bignoniaceae contained secondary metabolites such as saponins, tannins, flavonoids, quinines, alkaloids, anthralene derivatives, reducing sugars, glycosides, carbohydrates, terpenes, steroids, coumarins, kaempferol, a^-sitosterol, etc. secondary metabolites and their derivatives.

Alkaloids

Earlier studies reported that anti-dysenteric and anti-diarrheal properties of medicinal plants have been due to the alkaloids, flavonoids, saponins and reducing sugars (Galvez et. al., 1991, 1993; Loganga et.al., 2000). Alkaloids are present in the form of salts of organic acid, oxalic acid, melica, lactic, tartarica, aconitica in plant parts. Phytochemical analysis of the plant extracts of Kigelia africana, Spathodea campanulata have been tested to determine the presence of various phytochemicals: Wagner for alkaloids, foam test for saponins ferric chloride and gelatine and lead acetate for the presence of phenolic compounds and flavonoids (Harborne and Harbonne, 1998).

Flavonoids

The plant Tecoma stans contains flavonoids like chrysin, baicalein as active principle (Chen et. al., 2003). Flavonoids namely chrysin, oroxylin-a, scutellarin, baicalein, biochanin-a and ellagic acid are responsible for the anti-inflammatory, diuretic, anti-arthritic, anti-fungal and anti-bacterial activities (Maitreyi et.al., 2008). The ethanolic leaf extracts of Kigelia africana (Bignoniaceae) has been subjected to the preliminary phytochemical screening and in-vitro antimicrobial tests. The extracts revealed the presence of flavonoids, tannins, terpenes, steroidal and cardiac glycosides (Husman and Osufi 2007). Baicalein is reported to possess an anti- inflammatory, anti-ulcer, antioxidant, hepatoprotective and immunomodulatory activities (Maitreyi et. al., 2008).

While chrysin, baicalein both are reported to have antibacterial, antifungal, antiviral activities. Furthermore, bioshanin-A possesses antifungal action and tumor necrosis factor - A. Ellagic acid is an important polyphenolic compound (Maitreyi et. al., 2008).

Antioxidants with free radical scavenging activities may have great relevance in the prevention and therapeutics of several diseases. Phytocompounds like flavonoids and phenolic acid commonly found in plants have been reported to have multiple biological effects, including antioxidant activities (Conforti et. al., 2008; Kalainvani and Mathew, 2009).

Tannins

Tannins have been widely used in the treatment of sprains, bruises and superficial wounds (Husman and Osuji, 2007). The earlier studies show that tannins are also responsible for anti-dysenteric and anti- diarrheal properties (Galvez et. al., 1991, 1993, Loganga et. al., 2000).

Steroids

Steroids are partly responsible for the anti-diarrheal activity (Hanwa et.al., 2007). The mechanism of action of some antifungal drugs is by binding to the cell membrane of pathogenic fungi in the presence of certain sterols, which subsequently disturb permeability and transport characteristics of the membrane, resulting in the loss of intracellular cations. The preliminary phytochemical screening of the ethanolic extracts revealed that the anti dysenteric and anti diarrheal properties of medicinal plants were due to tannins, alkaloids, saponins, flavonoids, steroids, terpenoids and reducing sugars (Galvez et. al., 1993 : Longa et. al. 2000). Ethanolic leaf extracts revealed the presence of flavonoids, tannins, tarpenes, steroidal and cardiac glycosides (Husman and Osufi 2007).

Phenolic compounds

Phenolic compounds have been reported to possess antioxidant activities by different mechanism (Mahmoud et. al., 2006). Tecoma stans and K. africana showed accumulation of Phenylpropanoid glycoside, the main components were identified as verbascoside, orobanchoside, isoverbascoside (Pletsch et. al., 1993). Phytochemical analyses of the plant extracts of Jacaranda mimosifolia were tested by different tests to determine the presence of various phytochemicals: Wagner for alkaloids, foam test for saponins ferric chloride and gelatine and lead acetate for the presence of phenolic compounds and flavonoids (Harborne and Harbonne, 1998). Two aglycone moieties of the isocoumarin glycosides have been isolated from the bark of K. africana, four iridoid glycoside, two lignin glycoside, three phenyl ethanoid glycosides and eight phenolic glycosides (Warashine et. al., 2004).

Saponins

Saponins have been responsible for the antioxidant activities (Kalaivani and Lazar, 2009). Qualitative tests for the presence of plant secondary metabolites such as carbohydrates, alkaloids, tannins and flavonoids have been carried out on the bark powder of Kigelia africana using standard procedure (Sofowora, 1984). The preliminary phytochemical screening of the petroleum extracts revealed that the anti-dysenteric and anti diarrheal properties of medicinal plants have been due to tannins, alkaloids, saponins, flavonoids, steroids, terpenoids and reducing sugars (Galvez et.al., 1993 : Longanga et.al., 2000).

Iridoid glycoside (Stereospermoside)

Iridoid glycoside (Stereospermoside) have been isolated from the leaves and branches of Kigelia africana (Tripetch et.al., 2006). The anti-microbial activity of Kigelia pinnata has been shown to be due to the iridoids present (Akunyilli et. al., 1991). Iridoids has also linked to the traditional uses such as treatment for tumors and antiseptic effects (Kingston and Rao, 1982).

Quinones

The anti-tumor activities of Bignoniaceae are probably due to mainly its napthaquinoids, eg, Lapachol for clinical use (Kingston and Rao, 1982). Two quinones, anthraquinones, stereochenols A and stereochenols B and napthoquinones stereokunthals A and stereokunthals B, pyranokunthones A and pyranokunthones B were reported to have antiplasmodial activity (Onegi et. al., 2002).

DISCUSSION

Extensive survey of literature regarding phytochemicals in the family Bignoniaceae revealed that extracts from some species of this family contain secondary metabolites such as tannins, flavonoids, quinines, alkaloids, reducing sugar, glycosides, carbohydrates, kaempferol, iridoids, terpenes, steroids, coumarins etc. Among these secondary metabolites flavonoids, namely chrysin, oroxylin_A, baicalein-A, and ellagic acid have been responsible for the anti-inflammatory, antidiuretic, anti-arthritic, anti-microbial and flavones are responsible for antioxidant activity. Tannins have been widely used as an application to sprains, bruises, and superficial wounds. Tannins are also responsible for anti dysenteric and anti-diarrheal property. Quinones have shown anti-tumour activity. The most common natural antioxidants are flavonoids and phenolic compounds. Presence of such wide range of phytochemicals in this family may open a new dimension in the field of discovery of new drugs.

CONCLUSION

The plants belonging to the family Bignoniaceae are one of the important sources of new bioactive compounds and as such as several new chemical entities have been isolated and tested for their efficacy as drugs. Though many plants have been evaluated in this regard, there is need for more such approaches to find out more effective phytochemical compounds. Thus, from traditional ethnobotany to the highly sophisticated drug discovery approaches may be useful in this regard.

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