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REVIEW ON ETHNOPHARMACOGNOSY OF DILLENIA PENTAGYNA – A MEDICINALLY IMPORTANT PLANT

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Abstract- Ethnopharmacognosy relevance: Dillenia Pentagyna Roxb. (Dilleniaceae) is an endangered plant, flourishing mainly in widely distributed randomly in hilly areas of north east states of India and Bangladesh. Due to the location of India between North and East, Indian phytotherapy has accumulated and adopted approaches that originated in European and Asian traditional medicine. A scrutiny of literature revealed some notable pharmacological activities like Antitumour, anti-alpha glucosidase, antioxidant, antidiabetic, antimicrobial, antifungal, antidiarrheal, cytotoxic, and wound healing. This review describes the history of herbal medicine in Indian, the current situation and the pharmacognostical effects of specific plants in India. The various parts of the plant (leaf, stem, and fruit) investigation is carried out to assess in vitro carbohydrates, saponins, phenols, flavonoids, alkaloids, Anthraquinone, tannins, and glycoside of the methanolic extracts of dry sample. The present review is an attempt to highlight the various ethnopharmacognosy and traditional uses as well as in folklore medicine for several purposes like, diabetes, wound healing, cough, carcinogenic, etc. Many articles about other medicinal plants were giving more information has never been made available to the international community. Such knowledge can be applied in future studies aimed at a safe, evidence-based use of traditional Indian medicinal plants in global phytopharmacotherapy as well as for the discovery of novel leads for drug development.

Key words: Medicinal plant, Indian phytotherapy, Herbal medicine, Ethnopharmacognosy, Uttar Pradesh**.**

1. INTRODUCTION

Plants have provided man with all his needs in terms of shelter, clothing, food, flavours and fragrances as not the least, medicines. These plant-based systems continue to play an essential role in health care and the World Health Organisation estimates that 80% or the world's inhabitants continue to rely mainly on traditional medicines systems for their health care. The tribe's communities use various parts of it for treatment of their different ailments and diseases, viz. delivery (bark), bone fracture (leaf), body pain (root), piles (leaf), diabetes (bark), diarrhoea and dysentery (bark) [1]. Unripe fruits are used as vegetable or sourness and ripe fruits are eaten. Plants have provided man with all his needs in terms of shelter, clothing, food, flavours and fragrances as not the least, medicines. Plants have formed the basis of sophisticated Traditional Medicine (TM) systems that have been in existence for thousands of years and continue to provide mankind with new remedies [2]. Indeed, more than 90% of current therapeutic classes derive from a natural product prototype and interestingly, even today, roughly two-thirds to three quarters of the world's population relies upon medicinal plants for its primary pharmaceutical care [3]. The effect of Dillenia pentagyna stem bark extract on the levels of sialic acid and lipid peroxidation were determined in various tissues of Dalton's lymphoma-bearing mice in order to find their possible role in the antitumor activity [4]. The search for new molecules, nowadays, has taken a slightly different route where the science of ethnobotany and ethnopharmacognosy are being used as guide to lead the chemist towards different sources and classes of compounds [5]. Plant derived natural products hold great promise for discovery and development of new pharmaceuticals [6]. Two

new flavonoid glycosides, naringenin 7- galactosyl and dihedral quercetin 5-glactoside were isolated from D. pentagyna have been found to exhibit cytotoxic and lymphocytic activity [7]. A new diterpene, dipoloic acid isolated from the stem of Dillenia pentagyna exhibited cytotoxic activity [7]. Rhammentin 3-glucoside also isolated from the Dillenia pentagyna [8]. It has been reported that bark and stem of the plant contains lupeol, betulin, and betulinic acid and morolic acids [9].

2. FOLKLORE MEDICINAL VALUE OF D. PENTAGYNA

D. pentagyna is rich for ascorbic acid. The seed and the bark of Dillenia pentagyna are used against cancer by the Koch-Rajbanshi people of western Assam [10]. To cure the wound, bark of Karmal (Dillenia pentagyna) tree (25-50 gm) was lavigated in water and the paste formed was applied on the wound for 3-5 days by the village people in Konkan region of Maharashtra [11]. The leaf extract is used as anticancer disease [12]. 5ml of fruit decoction of Dillenia pentagyna is mixed with 3g rhizome paste of Zingiber montanum and the mixture is taken thrice a day for three days before food against blood dysentery by the tribals of the Deogarh district [13]. Unripe fruits are taken like vegetable or two ripe fruits are taken regularly to treat diabetes [14].

2.1. Taxonomic classification

According to the botanical scheme of Engler, the plant is classified as follows [15]:

Kingdom : Plantae
Division : Phanerogamae
Sub-division: Angiospermae
Class : Dicotyledonae
Subclass : Polypetalae
Order : Dilleniales
Family : Dilleniaceae
Genus : Dillenia
Species : pentagyna Roxburgh or hainanensis Merrill.

2.2. Regional Names

Dillenia Pentagyna is known under different vernacular or local names throughout the regions it is distributed [16, 17].

Hindi : Aggai, Kallai
English : Dog Teak
Sanskrit : Aksikiphal, Punnaga
Tamil : Naytekku
Oriya : Rai
Kannada : Kanigala, Kadu-Kanigala
Bengali : Korkotta
Gujarati : Karmal
Assam : Akshi
Chinese : Xiao hua wu ya guo
Cambodian : Pheng
Nepalese : Agaaai, Taatarii
Java : Janti, Sempu

2.3. Geographical Distribution

Dillenia pentagyna are widely distributed in many Asian countries. It is distributed in rain forests, thickets, hills; below 400 m. Hainan, Yunnan in Bhutan, India, Indonesia, Malaysia, Myanmar, Nepal, Thailand, and Vietnam [18, 19]. The genus Dillenia has 60 species, of which only two Dillenia indica Linn and Dillenia pentagyna Roxb available in India, and distributed in Himalayan terrain, also from Punjab to Assam, South India, Andamans, Gujarat, Mizoram and West Bengal.

2.4. Macroscopic Characters

Bark is grayish in colour, smooth, exfoliating; branchlets glabrous, stout and leaves are petiolate 2–5 cm, glabrous, with narrow wings. shape is oblong to obovate-oblong, 20–60 × 10–25 cm in size, leathery surface, secondary veins 25–50 on either side, showing parallel margin with shallowly undulate teeth, apex obtuse to subacute (Figure 1a). Flower are 2–7 in number, small, fascicled at top of lateral spurs, 2–3 cm in diameter, less than 2 cm in diameter in bud; pedicels 2–4 cm, bractlet is deciduous. Total 5 sepals and petals, yellow coloured and obovate [16]. Seed: It is black in colour and glacous. (Fig. 2) It is ovoid in shape. When fruit is removed a rosette of androecial remnant is visible.

2.5. Microscopic Characters

Epidermis is single layered, rarely with unicellular trichomes. Cortex is with 11 layers of collenchyma, rest, and parenchyma. Secretory cells and idioblasts with raphides of calcium, oxalates are present. Pericylic fibres are continuous or discontinuous. It is made of thick walled parenchyma with pitted wall. Vascular bundles are 9 – 13 in a circle, sometimes with extra bundles enclosed by sclerenchymatous bundle sheeth. (Fig. 2) Pith is parenchymatous with Secretory cells and idioblasts. Tannin is present. In cross section epidermis is single layered on both upper and lower ends. Trichomes are up to 104 microns long. Hypodermis is 5 to 12 layered on both sides. Most of the cells contain tannin. Vascular strand is in a line enclosed by thick walled sheath. Fruit wall is thin and parenchymatous. Testa of seed contains colour pigments. Cells are cutinized and Sclerenchymatous. Endosperm is parenchymatous with oil globules and protein granules [20].

Fig 1a: Mature fruit condition of Dillenia pentagyna Roxb.

Fig 1b: Raw fruits

Fig 2a: T.S. section cutting of the D. pentagyna fruit

Fig 2b: L.S. section cutting of the Dillenia pentagyna fruit through compound microscope.

3. Phytochemical screening

Phytochemical screening for secondary metabolites was performed by using following standard methods [21, 22-23]. The tests for flavonoids are Shinoda test. To identify the presence of tannin and phenols, ferric chloride test was followed. Guignard test was employed to qualitatively determine the glycoside. Dragendorff's test, Keller-kiliani test and modified Borntrager's test were done to test for the presence of Alkaloids, Flavonoids, Saponins and Anthraquinone, respectively. Phytochemical screening results presented in table No.1 showed that the plants that contain various secondary metabolites. In particular, the presence of polyphenols, flavonoids and glycosides was noted in all parts and was very prominent in the methanolic extracts of D. pentagyna fruits.

Table1. Results of phytochemical screening for secondary metabolites.

Test	Leaves	Stem	Fruits
Carbohydrate	+	+	+
Phenols/Tannins	++	++	++
Flavonoids	++	++	++
Saponins	++	++	+
Glycosides	++	++	++
Anthraquinone	++	+	+
Alkaloids	+	++	++

(++)= Present, (+) = slightly present

4. Pharmacological activities

4.1. Antitumour activity

Dillenia pentagyna extract treatment (10 to 200mg/kg) was given for five consecutive days starting from day 1 of tumour transplantation. Among different doses of the plant extract studied, 20mg/kg exhibited maximum Antitumour potential (%ILS~70) [24]. Phenolics acids usually significantly minimize the formation of the specific cancer-promoting nitrosamines from the dietary nitrites and nitrates. Glucosinolates from various vegetable sources sprouts exert a substantial protective support against the colon cancer. The ethanol extract of D. Pentagyna showed the most potent antitumor activity, i.e. % ILS ~ 55% and % ILS ~ 48% at a dose of 50 and 100 mg/kg/day. Different plant parts of these species, such as, root, leaf, fruit, bark and seed were used as medicine [25]. D. pentagyna extract mediated decrease in the lipid peroxidation in the tissues of tumor bearing mice indicated its possible protective function against tissue damage caused by oxidative stress in tumorous condition. Decrease in sialic acid content in the tissues of tumorbearing mice and paricularly in the tumor cells after this plant extract treatment may also help in facilitating / increasing host survivability [26, 27].

4.2. Antibacterial activity

The antibacterial activities of the crude extracts as well as for the isolated pure compounds were determined in vitro by disc diffusion technique [28]. Fifteen bacterial strains, which included seven gram-positive (Bacillus cereus, Bacillus subtilis, Bacillus polymyxa, Bacillus megaterium, Sarcina lutea, Staphylococcus aureus, Staphylococcus β-haemolyticus) and eight gram-negative organisms i.e. Shigella soni, Shigella dysenteriae type-1, Vibrio mimicus, Shigella basic, Pseudomonas aeruginosa, Vibrio cholerae, Shigella flexneri-type I, Shigella boydii. Nutrient agar media was used for culture of bacteria. Crude extracts were dissolved respectively in CHCl3 having 3 mg of extract in each 30 ml of solvent. Selected Fractions were dissolved in the same way. Isolated compounds were dissolved with CHCl3. The sreile Matricel filter paper discs were impregnated with known amounts of the test substances and dried. Standard ampicillin disc (l0μg/disc) and disc on which CHCl3 was adsorbed and dried (blank disc) were used as positive and negativre controls, respectively. The antimicrobial activities were measured by zone of inhibition expressed in mm. All the gram-positive strains showed sensitivity to EtOAc extract (3mg/disc). Most of the gram-negative bacterial strains demonstrated promising sensitivity against EtOAc extract. But Pet. Ether extract showed less activity to some of the gram-negative strains [29]. Dillenia pentagyna showed little activity (5 to 8mm) against all pathogenic microorganisms of a study in which evaluation of antimicrobial activity of different plant was studied [30].

4.3. Antifungal activity

The antifungal activities of the crude extracts as well as for the isolated pure compounds were determined in vitro by disc diffusion technique [28]. Nine fungi strains i.e. Aspergillus fumigatus, Candida albicans, Rhizopus oryzae, Trichoderma sp., Candida arriza, Candida Krusei, Saccharomyces cerevisiae, Aspergillus niger, Rhizopus oryzae and potato dextrose agar media was used for the culture of fungi. Standard grisofulvin disc (25 mg/disc) used in case of fungi. Studies on the antifungal activities showed that EtOAc extract, its fraction F-15 to F-18 and Grisofulvin have shown promising zone of inhibition against the fungi except Candida albicans and Candida krusei (Table 3). MeOH extract had no activity [29]

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4.4. Anti-diabetic activity

The most commonly employed species, used for the treatment of diabetes such as Casearia tomentosa Roxb. (root), Cassia fistula Linn. (flowers), Catharanthus roseus (L.) G. Don (flowers), Coccinia grandis (L.) Voigt. (fruits), Dillenia pentagyna Roxb. (fruits) and Momordica charantia Linn. (fruits) were selected for phytochemical analysis. The aim of the present study was to investigate the presence of phytochemicals and to determine the ascorbic acid, total phenolic and flavonoid contents of the selected plants [14]. The leaf and fruit extracts were tested for its anti-diabetic activity using α-glucosidase inhibitory assay and all experiments were performed five times and the results averaged.

4.5. Free radical scavenging activity

Free radicals are associated with various physiological and pathological events such as inflammation, aging, mutagenicity and carcinogenicity. Reactive oxygen species (ROS) capable of damaging DNA, proteins, carbohydrates and lipids are generated in aerobic organisms. These ROS include superoxide anion radical ($O^{2\bullet-}$), hydrogen peroxide (H_2O_2), hydroxyl radical ($OH^{\bullet}$), and singlet molecular oxygen [30]. The different part of the plant extracts are used if the

ROS can be scavenged by these extracts and can save the host cell.

4.6. Antioxidant activity

Ethanolic extract, aqueous extract and powder of the leaves of Dillenia pentagyna were tested for antioxidant activity. Powder form and ethanolic extract so good antioxidant property where as aqueous extract did not showed any significant activity [14]. The leaf and fruit extracts were tested for its free radical scavenging property using superoxide radical scavenging activity and all experiments were performed five times and the results averaged.

4.7. Anti-alpha glucosidase activity

The enzyme inhibition assay was done by taking 50 µl of α-glucosidase (0.15 unit/ml) and 50 µl of sample added to start the reaction with 100µl of 3 mM p-nitrophenyl glucopyranoside (pNPG) in 0.2 M sodium phosphate buffer (pH 6.8) as a substrate. The reaction was conducted at 37ºC for 15 min and stopped by the addition of 750 µl of 0.1 M Na2CO3. α-Glucosidase activity was assessed by measuring the release of p-nitrophenol as color measurement from pNPG at 405 nm [31].

4.8. Medicinal plants and biochemical ecology

Here we discuss ecological and biochemical evidence that may help to explain the preponderance of weeds in medicinal floras. Secondary compounds in plants are important for ecological functions such as allelopathy, where they inhibit germination and growth of other plants; as insect and animal attractants for pollination and seed dispersal; and for chemical defense against microbes and insects and herbivory [32]. These qualitative [33] low molecular weight compounds are the ones that exhibit bioactivity and can serve as medicinals for humans [34]. The evidence from human ecology and biochemical ecology suggests the need for a closer examination of the relationship between weeds and medicinal floras. In doing so we may find that the next plant-derived pharmaceutical is in the abandoned lot down the street [35].

CONCLUSION

It is interesting to note that a single plant species finds use for treatment of a wide spectrum of health disorders in traditional and folk medicine. Fungal diseases represent a critical problem to health and they are one of the main causes of morbidity and mortality worldwide. Human infections, particularly those involving the skin and mucosal surfaces, constitute a serious problem, especially in tropical and subtropical developing countries. The results obtained in this study demonstrated that the medicinal plant, Dillenia pentagyna displays in vitro phytochemical analysis and the present study supports that Dillenia pentagyna plant extracts containing compounds with pharmacological properties can be used as anti-carcinogenic and antibacterial agents in new drugs for the therapy of infectious diseases caused by pathogens and further work may be carried out for phytochemical evaluation. Further, it needs to biochemical studies, isolation, characterize the active component of toxicities and elucidate more insight on the mechanism of antitumor activity.

CONFLICT OF INTEREST STATEMENT

We declare that we have no conflict of interest.

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