A Complete Review on Costus Igneus of Phytochemical Study and Pharmacological Activities

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Abstract- *Costus Igneus commonly known as insulin plant in India belongs to the family costaceae. Consumption of the leaves is believed to lower blood glucose levels and diabetics who consumed the leaves of this plant did report a fall in their blood glucose levels. Leaf of this Costus Igneus herbal plant helps to build up insulin by strengthening Beta cells of pancreas in the human body thus popularly known as insulin plant. The present review attempt has been made to explain various phytochemical, distribution and pharmacological parameter of the plant known as Costus Igneus. This plant has anti diabetic activity.*

Keywords- Costus Igneus, Medicinal Plant, Phytochemical, pharmacological study.

I. INTRODUCTION

Medicinal plants used in traditional medicine are considerably useful and are readily available in rural areas at relatively cheaper than modern medicine. The *Costus igneus* are commonly grown as medicinal and ornamental plants. The rhizome is the major source of diosgenin, which is anti diabetic in nature and is used in the treatment of diabetes mellitus. [1] The plant belongs to the family Costaceae. The Costaceae was first raised to the rank of family by Nakai on the basis of spirally arranged leaves and rhizomes being free from aromatic essential oils. Before the elevation to family status, Engler and Prantl recognized Costoideal as a subfamily under Zingiberaceae. Several anatomical and morphological features support this isolated position including well developed aerial shoot with distinct, rigid, and commonly branched stems. The leaves are inserted in a low spiral with divergences. The family Costaceae consists of four genera and approximately 200 species. The genus *Costus* is the largest in the family with about 150 species that are mainly tropical in distribution.[2,3] The present review deals with the recent research carried out in the area of phytochemistry, pharmacological, biological activities, and safety of *Costus igneus.*[4]

Infectious disease can become a threat to public health in this world. Medicinal plants have a long history of use and their use is widespread in both developing and developed countries. Multifarious biologically active compounds that are found in plants possess antibacterial properties. Plant produced compounds are of interest as sources of safer or more effective substitutes for synthetically produced antimicrobial agents. Antimicrobial properties of medicinal plants are being increasingly reported from different parts of the world. According to the report of the World Health Organization, 80% of the world populations rely mainly on traditional therapies which involve the use of plant extracts or their active substances. The plant grows in all variety of soils. It ensures that soil can drain water easily and roots grow. The plants can be propagated through cutting or roots. It is cultivated in India for its use in traditional medicine and elsewhere as an ornamental. The catchphrase of this plant is "a leaf a day keeps diabetes away". In ayurvedic treatment diabetes patients are advised to chew down the insulin plants leaves for months. The patients have to take two leaves per day in the morning and evening for one weak which helps to keeps the blood sugar level normal.

Insulin plant (Costus pictus) is one of the folk medicines used for the treatment for Diabetes mellitus. This plant belongs to Costaceae family, which has been separated from Zingiberaceae on the basis of the presence of spirally arranged leaves and rhizomes being free from aromatic essential oils. The plant commonly known as spiral ginger is originated in Mexico and is found to have antidiabetic properties. Dichloromethane and methanol extracts of the plants belonging to Zingiberaceae, from Alpinia, Costus and Zingiber genera were found to be antibacterial, while methanolic extract of Costus discolour exhibited potent antifungal activity against Aspergillus ochraceous (MIC-15.6 µ/disc) . All these extracts showed antioxidant activity comparable or higher than that of α-tocopherol. The methanolic extract of the leaves of the insulin plant showed no toxicity in both acute and sub acute toxicity studies conducted in mice and rats, respectively.

(A) Flower in Stage

(B) Fruiting Stage

(C) Mature Fruit Stage

(D) Seeds of *Costus Igneus*

Fig 1: Different Stages of *Costus Igneus*

II. HISTORY AND DISTRIBUTION

Costus (Family: Costaceae*)* is an important medicinal plant widely used in several indigenous systems of medicine for the treatment of various ailments. *Costus Igneus* is native to the Malay Peninsula of Southeast Asia. In India the plant naturalizes in Sub-Himalayan tract, in parts of central India and in the Western Ghats of Maharashtra, Karnataka and Kerala.[5]

III. BOTANICAL DESCRIPTION:

It is a perennial, upright, spreading plant reaching about two feet tall, with the tallest stems falling over and lying on the ground. Leaves are simple, alternate, entire, oblong, evergreen, 4-8 inches in length with parallel venation. The large, smooth, dark green leaves of this tropical evergreen have light purple undersides and are spirally arranged around stems, forming attractive, arching clumps arising from underground rootstocks. Beautiful, 1.5 inch diameter, orange flowers are produced in the warm months, appearing on cone like heads at the tips of branches. [6] Fruits are inconspicuous, not showy, less than 0.5 inch, and green colored.

Costus is perennial rhizomatous herbs with erect or spreading stems. Leaves are simple, smooth, persistent, spirally arranged around the trunk. The leaves are sub sessile and appear dark green in colour, elliptic or obovate in shape. Leaves are simple, alternate, entire, oblong, evergreen, 4-8 inches in length with parallel venation. There is some variation in different species of *Costus* like flower colour and texture of the leaves. This plant had silky texture beneath. The inflorescence is a spike around 10 cms long with large bracts in sub terminal position. Bracts are ovate or mucronate forming a cone like structure. Fruit is a capsule ellipsoidal in shape. Seeds are black, five in number with a white fleshy aril

.The flowers appear in late summer or early fall. The flowers look like crepe paper, thus commonly called crepe ginger. After the flowers fade away, the attractive cone shaped bracts remain. Generally, the stems sprout during the month of April and flowering commences during July and continues till the end of September. The flowers ripen during middle of the November after which the leaves shed off and majority of stems start drying up. The underground portions (rhizomes) remain dormant from December to March or even April.

IV. PHYTOCHEMICAL STUDIES

Phyto' is the Greek word for plant. There are many families of phytochemicals and they help the human body in a variety of ways. Phytochemicals may protect human from a host of diseases. *Costus igneus* leaves revealed that it is rich in protein, iron, and antioxidant components such as ascorbic acid, α-tocopherol, β-carotene, terpinoids, steroids, and flavonoids. [7,8] It was revealed in another study that methanolic extract was found to contain the highest number of phytochemicals such as carbohydrates, triterpenoids, proteins, alkaloids, tannins, saponins, and flavonoids. [9] Preliminary phytochemical evaluation of Insulin plant revealed that the leaves contain 21.2% fibers. Successive extracts gave 5.2% extractives in petroleum ether, 1.06% in cyclohexane, 1.33% in acetone, and 2.95% in ethanol. Analysis of successive extracts showed presence of steroids in all extracts. The ethanol extract contained alkaloid also. The rhizomes of the genus *Costus* are the major source of a compound, diosgenin. Dasgupta and pandey reported diosgenin as the major constituent isolated from rhizomes of *Costus* species. Diosgenin was also reported from other parts of *Costus* such as leaves, stems and flowers. Other constituents isolated from *Costus* species are Tigogenin, dioscin, gracillin β- sitosterol glucoside. [10,11]

The major component of the ether fraction was bis (2"-ethylhexyl)-1,2-benzenedicarboxylate (59.04%) apart from α-tocopherol and a steroid, ergastanol. [12] Stem showed the presence of a terpenoid compound lupeol and a steroid compound stigmasterol. [13] Bioactive compounds quercetin and diosgenin, a steroidal sapogenin, were isolated from *C. igneus* rhizome. [14] Trace elemental analysis showed that the leaves and rhizomes of *C. pictus* contains appreciable amounts of the elements K, Ca, Cr, Mn, Cu, and Zn. [15] Steam distillation of stems, leaves, and rhizomes of *C.ostus* D. Don yielded clear and yellowish essential oils.

The major genin reported was diosgenin. Two new furostanol saponins Costusosides I and J were characterized as 3-O-[β-D-glucopyranosyl (1-4)-β-D-glucopyranosyl]-26-O-(β-D glucopyranosyl-22α-methoxy (25R) furost-5-en-3β, 26-diol and its 22-hydroxy derivatives respectively. B-sitosterol-β-D-glucoside, prosapogenins A and B of dioscin, gracillin, 3-O-[α-L-rhamnopyranosyl (1→2)-β-D-glucopyranosyl]-26-O[βDlucopyranosyl]-22α-methoxy-(25R) furost-5-en-3β,26-diol,protodioscin and methylprotodioscin were isolated from seeds. Mahmood et al reported dihydro phytyl plastoquinone and its 6-methyl derivative along with α- tocopherol quinone and 5α-stigmast-9(11) en-3β-ol from seeds. Methyl hexadecanoate, methyloctadecanoate and tetracosanyl octadecanoate were also isolated from seeds . A tocopherol is noticed from seeds and identified as G2 tocopherol. Defatted seeds contain diosgenin, glucose, galactose and rhamnose.

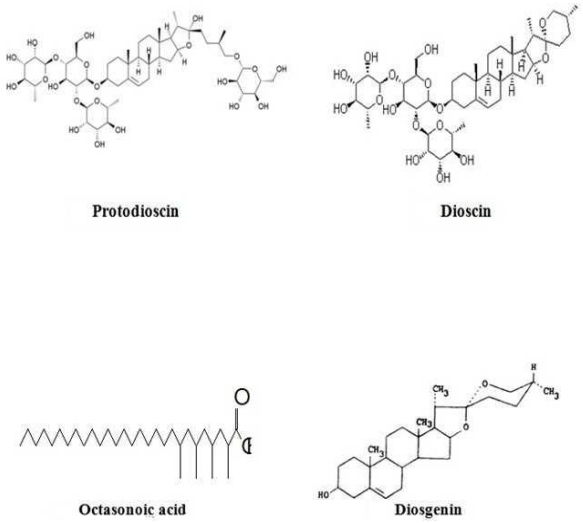

Fig 2: Costus Phytochemical Structure

The seeds possess 6% of pale yellow sweet smelling fatty oil. The fatty acid composition of the oil was reported to contain Palmitic- 55.97%; stearic- 8.3%; oleic-22.75%; linoleic- 6.8%; arachidic- 1.7% . The analysis of roots showed the presence of chemical constituents like 24-hydroxytriacontan-26-one and 24-hydroxytriacontan-27-one together with methyl triacontanoate, diosgenin, sitosterol 8-hydroxy triacontane-25-one and methyl triacontanoat. 5α-stigmast-9(11)-en-3β-ol was also characterized by Madan Gupta et al. The roots of this plant also contain β-sitosterol-β-D-glucoside, prosapogenins A and B of dioscin, dioscin, gracillin. Other components identified from seeds were 31-norcycloartanone, cyloartanol, cycloartenol and cycloalaudenol.

V. PHARMACOLOGICAL STUDIES:

Antidiabetic activity & hypolipidemic activity:

Diabetes mellitus is a chronic disease characterized by high blood glucose levels due to absolute or relative deficiency of circulating insulin levels. [16] Diabetes mellitus is a chronic metabolic disorder affecting approximately 4% population

worldwide and is expected to increase to 5.4% in 2025. Epidemologic studies and clinical trials strongly support the notion that hyperglycemia is the main cause of complications such as coronary artery disease, cerebrovascular disease, renal failure, blindness, limb amputation, neurological complications and premature death [17]. Daisy et al. investigated the possible protective effects of *Costus* sm. rhizome extracts on biochemical parameters in streptozotocin (STZ) induced male diabetic Wistar rats. STZ treatment (50 mg/kg, *i.p.*) caused a hyperglycemic state that led to various physiologic and biochemical alterations. Hexane, ethyl acetate and methanol crude extracts administered at the dose of 250 mg/kg, 400 mg/kg and 400 mg/kg respectively for 60 days to STZ induced hypoglycemic and normo glycemic rats. The plasma glucose concentration was significantly ($p < 0.05$) decreased by all three extract compared with controls. The hexane extract of the plant is known to possess antihyperglycemic and hypolipidemic activity is able to ameliorate the diabetic state and is probably a source of hypoglycemic compounds. The hexane crude extract of Costus rhizome was effective in decreasing the serum glucose level and normalizing other biochemical parameters in diabetic rats [18, 19].

Aqueous extract and methanolic extracts of Costus were highly effective in bringing down the blood glucose level [20]. Bavara et al. evaluated the antihyperglycemic, antihyperlipemic and antioxidant potency of an ethanol extract of *Costus root* in alloxan-induced diabetic male rats. It is concluded that *Costus* root extract possesses anti hyperglycemic, antihyperlipemic and antioxidative effects, which may prove to be of clinical importance in the management of diabetes and its complications. [21] The effect of freeze-dried rhizome juice of *Costus* on body weight, liver and kidneys of normal and STZ induced diabetic rats were studied. [22]

Antimicrobial studies:-

Medicinal plants are the rich source of number of antimicrobial agents and extensively used in the cure of several human and animal diseases. Due to a rapid rate of infections and antibiotic resistance in microorganisms, medicinal plants are gaining importance over synthetic drugs. The therapeutic use of medicinal plants is becoming popular because of their lesser side effects and low resistance in microorganisms. Antimicrobial activities of many plants have been reported by the various researchers and this may be due to the presence of secondary metabolites such as alkaloids, flavanoids, tannins, terpenoids etc.

Antioxidant activity:-

Medicinal plants possess various bioactive components like steroids, terpenoids and alkaloids. Besides these, phenolic compounds and flavonoids are abundantly distributed in plants which have been reported to exert multiple biological effects, including antioxidant, free radical scavenging abilities, anti inflammatory, anti carcinogenic etc. Plants with phenols and flavonoids are widely used as they are known to possess free radical scavenging activity. Free radicals are regenerated as a result of oxidative stress. Formation of free radicals within the body leads to several diseases like diabetes, cirrhosis, cancer and cardiovascular diseases. Therefore, there is an increased demand for evaluation of plants with antioxidant ability

VI. CONCLUSION

The plant serves as an important source of many therapeutically efficient chemicals like diosgenin, steroidal saponins like prosapogenin, α & β of dioscin, furostanol saponins like Costusoside I & J, octasanoic acid, cycloartenol and various other constituents. Many different pharmacological activities are attributed to it like antidiabetic activity and antioxidant activity. Various traditional uses are also known to be possessed by the plant like in rheumatism and many more. Many activities are not studied till date and needs attention to explore further medicinal properties of the plant.

As *Costus* has been successfully used in many health problems since a long time it provides a wide area of interest for the research purposes in development of newer drug molecules.

VII. FINANCIAL SUPPORT AND SPONSORSHIP

Nil

VIII. CONFLICTS OF INTEREST

None declared.

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