



INSULIN PLANT : CHAMAECOSTUS CUSPIDATUS (Costus igneus Nak)

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Abstract :

Chamaecostus cuspidatus (Costus igneus Nak) is commonly known as fiery costus ,it is a member of costaceae , and it is a newly introduced plant in India from South-central America. In India, it is known as insulin plant for its purported anti-diabetic properties. The leaves of this plant are used as directly supplement in treatment of diabetes mellitus type -2. It has been proven to posses various pharmacological activities on Anti-diabetic, antioxidant, antimicrobial and anti-cancerous.

Key words : insulin plant , antidiabetic activity ,chemical constituents,spiral flag .

Introduction :

Herbal products are extensively used globally for the treatment of many diseases where allopathic fails or has severe side effects. Psycho neural drugs are also have very serious side effects like physical dependence, tolerance, deterioration of cognitive function and effect on respiratory, digestive and immune system. So in this contest, treatment through natural source is seen with the hope that they have lesser side effects than that observed with synthetic drugs. [1][17]

This plant belongs to the family costaceae which was first raised to the rank of family by Nakai on the basis of spirally arranged leaves and hizome being free from aromatic essential oils. This family consists of 4 genera and pproximately 200 species. The genus costus is the largest family because it is having 150 species [2][5]

It is used in India to control diabetes, and it is known that diabetic people eat one leaf daily to keep their blood glucose low.[21] In Mexican folk medicine, the aerial part of C. Pictus D. Don is used as an infusion in the treatment of renal disorders.[22]



Fig-1 : Flowers of Insulin Plant



Fig-2 : Leaf of Insulin plant



Fig-3 : Fruits of Insulin Plant

Chamaecostus cuspidatus (formely known as fiery costus, spiral flag, insulin plant) it is a species of herbaceous plant in costaceae family native to eastern brazil (states of bahia and spiritosanto) in India it is known as insulin plant due to its antidiabetic property[3].

The synonyms of this plant are:

- *Costus cuspidatus*
- *Costus igneus*
- *Globba cuspidatus*
- *Costus pictus*

Scientific Classifications :

- **Botanical name [23] :** *Costus igneus* N.E.Br
- **Domains:** Eukaryota
- **Inherited blast name:** monocot
- **Kingdom:** Plantae
- **Subkingdom:** Viridaeplantae
- **Phylum:** Trahceophyta
- **Subphylum:** Euphyllphytina
- **Infra phylum:** Radiotopses
- **Class:** Liliopsida
- **Sub class:** Commelinidae
- **Order:** Zingiberanae
- **Family:** Costaceae
- **Sub family:** Asteroideae
- **Tribe:** Coreopsideae
- **Genus:** *Chamaecostus**Chamaecostuse*
- **Specific epithet:** *Igneus*.

Morphology :

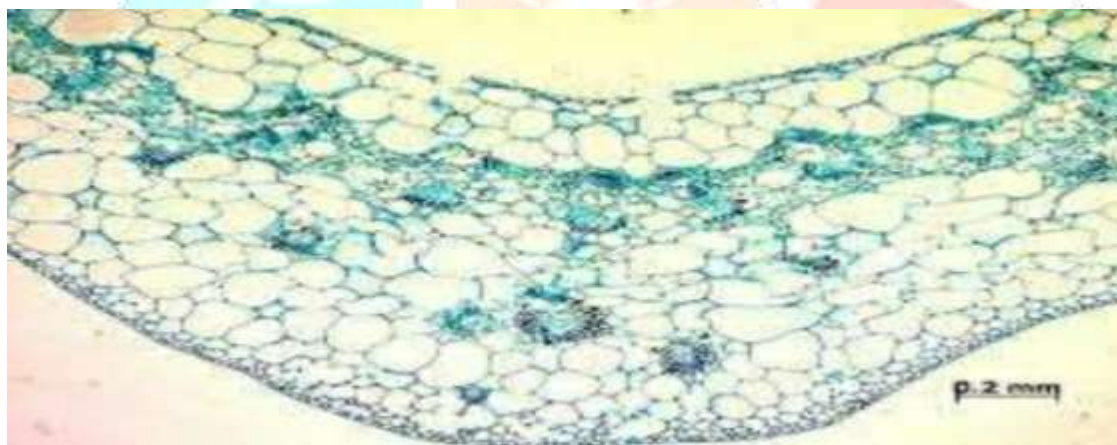
- It is a perennial, upright, spreading plant reaching about two feet tall, with the tallest stems falling over and lying on the ground.
- Leaves are simple, alternate, entire, oblong, evergreen, 4-8 inches in length with parallel venation.
- The large, smooth, dark green leaves of this tropical evergreen 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 [4].

Cultivation and propagation :

- In Siddha medicine, it is known as kostum. It is being cultivated in Kashmir and the Himalayan regions for its root. It is related to the gingers and was originally part of the family Zingiberaceae. But now the Costus species and their kin have been reclassified into their own family, Costaceae.[1]
- The species reproduces vegetative by rhizome and birds disperse seeds when they feed on the fruits.
- Costus products are sometimes called Costus comosus and are edible in nature. The flower petals are quite sweet and nutritious.
- It's a lower grower and makes a great ground cover. The long red flower spikes of Costus pulverulentus are unique to the family and they are sure to create interest in the garden. The plant grows very quickly. And the propagation is by stem cutting. It needs sunshine but it also grows in slightly shady areas [6].
- It is cultivated in India for its use in traditional medicine and elsewhere as an ornamental.

Microscopic Character :

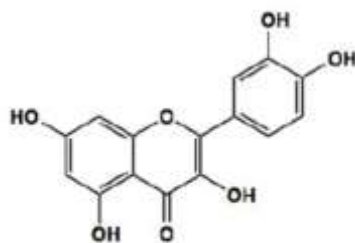
Microscopic characters of leaf include



- Epidermis with anomocytic stomata
- Mesophyll cell with calcium oxalate crystals
- Fibers associated with parenchyma cells

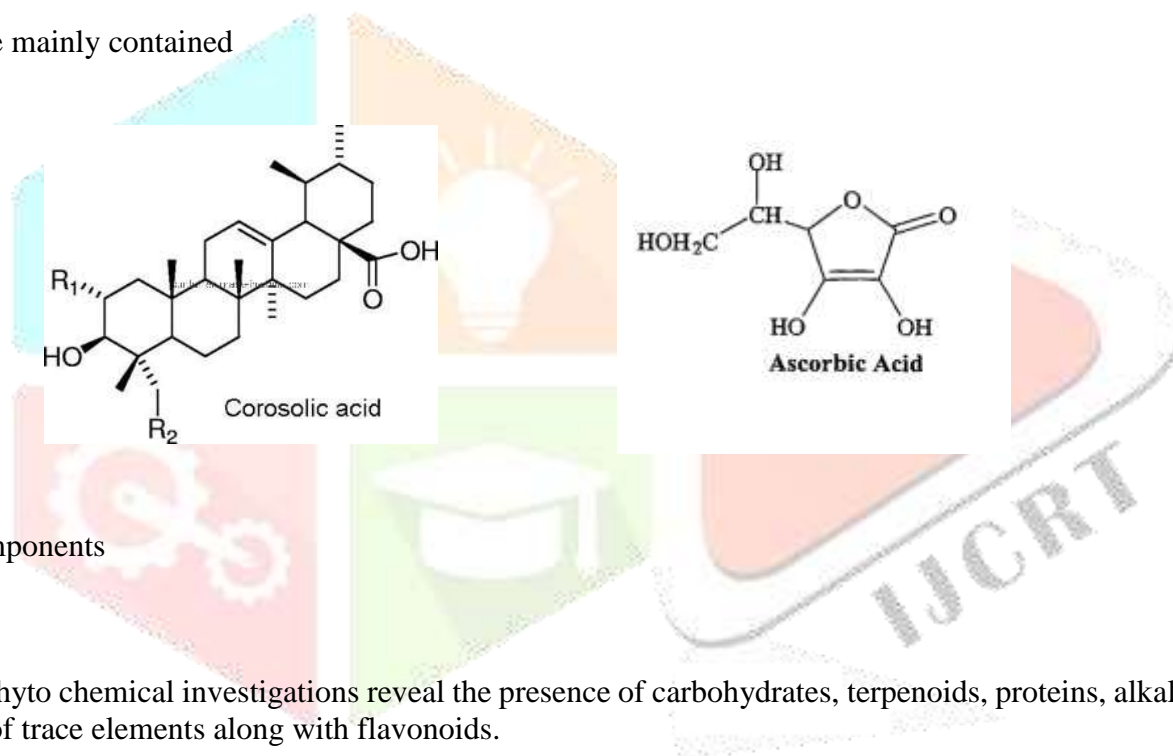
Phyto Chemical Constituents :

- The phytochemical constituent of this plant is quercetin. It is a flavonoid. It was isolated as active principle from methanol extract of chamaecostus cuspidatus.



Quercetin

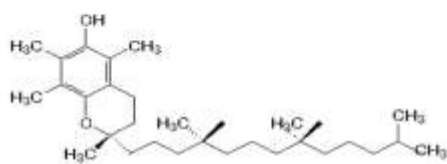
- The leave mainly contained



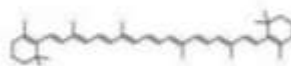
Corosolic acid

Ascorbic Acid

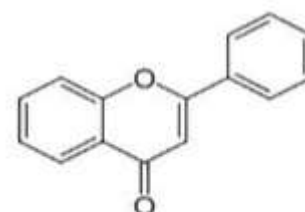
- Other components
- Various phyto chemical investigations reveal the presence of carbohydrates, terpenoids, proteins, alkaloids, tannins and amounts of trace elements along with flavonoids.
- Leaves are rich in protein, iron, ad antioxidant components such as ascorbic acid,a-tocopherol, β -carotene, terpenoids, steroids, and flavonoids.



Vitamin E (α -tocopherol)



β -carotene



Flavonoids

- Ethanol extract of leaves yielded tannins, phlobatannins, saponin, flavonoids, terpenoids, and cardiac glycosides.[18]
- Study for essential oil yielded the following major constituents in % :

Rhizome Constituents	Percentage
Hexadecanoic acid	25.26%
12-octadecadienoic acid	7.74%
Dodecanoic acid	16.56%
Tetradecanoic acid	10.20%
Linalool	8.48%
a-terpinol	4.44%

Stem Constituents	Percentage
Hexadecanoic acid	28.3%
12-octadecadienoic acid	18.33%
Dodecanoic acid	5.62%
Linalyl propanoate	6.03%
Tetradecanoic acid	4.82%
A-eudesmol	3.55%
Y-eudesmost	3.21%
4-ethoxy phenol	3.06%

Leaf Constituents	Percentage
Hexadecanoic acid	24.51%
2.pentanol	22.41%
Didecanoic acid	3.96%
β -ionone	8.69%
Farnesyl acetone	7.04%
a-ionone	8.01%





Fig-4. Costus igneus stem



Fig-5. Costus igneus Leaf



Fig-6. Costus igneus Rhizomes

Pharmacological Activities :

This plant has been proven to possess various Pharmacological activities on Antimicrobial, anti cancerous, Anti-diabetic and antioxidant.

Antimicrobial Effect :

- Methanolic extract of *C. igneus* showed maximum anti-bacterial activity against gram-positive *Bacillus cerus*, *Bacillus megaterium*, *Micrococcus leuteus*, *Staphylococcus aureus*, *Streptococcus lactis*, and gram-negative strains *Pseudomonas aeruginosa*, *Escherichia coli*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, and *Salmonella typhimurium*. [7][5]
- Among the extracts of various parts of *C. Pictus*, methanolic extracts of stem and flower exhibited maximum inhibitory activity on the growth of tested microbes, viz., *Shigella flexneri*, *Klebsiella pneumonia*, *Bacillus subtilis*, *Escherichia coli* at the concentration of 150 µg/ml. [8][5]
- The isolated compound from the ethanolic extract of *Costus igneus* showed moderate anti-bacterial and anti-fungal activity against *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. [9][17]

Anti cancerous Effect :

- The ethanolic extract of leaves of *C. Pictus* was found to have anti-proliferative and anti-cancer potential in in-vitro mammalian fibrosarcoma (HT-1080) cells. [10] All the extracts of bark had potent anti-cancer properties against HT 29 and A549 cells. [11]
- Study evaluated the cytotoxicity activities of crude ethanolic extracts from *Chaemaecostus subsessilis* and *C. cuspidatus* and six fractions against a panel of six human cancer cell lineages (HL60, Jurkat, MDA-MB231, MCF-7, HCT, THP-1). Cytotoxic effects in the HL60, Jurkat and THP-1 lineages were mediated via an apoptotic mechanism. [20] [30]

Anti-Diabetic Effects :

- *Costus igneus* is a traditionally used medicinal plant and a common member of ornamental plants in south Indian Gardens. Leaves are the important part which produces significant antidiabetic activity. [24, 25]
- It reduces fasting as well as postprandial blood glucose levels. But the exact mechanism of action behind the antidiabetic activity is not known yet. [29]
- Along with the antidiabetic activity, insulin plant also reduces the diabetic associated complications; bring renal, hepatic parameters to a controlled level, decreases the amount of glycosylated haemoglobin, corrects the lipid profile, increases body weight as well as insulin level and shows marked improvement in the histopathological examination. [26, 27, 28]

Antioxidant :

- The antioxidant activities of leaves and rhizomes in methanol, aqueous, ethanol, and ethyl acetate extracts were assessed using different models like DPPH, β-carotene, Deoxyribose, superoxide anion, reducing power, and metal chelating assay at different concentrations. [12][30]
- Leaves and rhizomes of *C. Pictus* showed good antioxidant activity of about 89.5% and 90.0% when compared with standard BHT (Butylated Hydroxy Toulene) (85%) at a concentration of 400 µg/ml. Results obtained revealed that methanolic extracts of both leaves and rhizomes of *C. Pictus* possess higher antioxidant activity when compared with other extracts. [12][19]
- Methanolic extracts of flower and stem of *C. pictus* possess *in vitro* antioxidant activity against oxidative protein damage. [8]
- It was evident from the study that the polyphenols and antioxidants not only scavenge off the free radicals but also inhibits the generation of the free radical. [13][17]

Toxicity study :

- Acute toxicity studies revealed that the administration of aqueous extract 1 g/kg b.w/day for 30 days produced no effect on the general behavior and all the animals survived the test period.[14]
- However, in a study carried out on the methanolic extract of *C. igneus*, findings indicated toxicity at 250 mg/kg body weight.[15]
- Further, in another investigation, palmitic acid was found to be the major component in the stem, leaf, and rhizome oils of *C. Pictus*. Palmitic acid is found to induce degeneration of myofibrils in healthy adult rat cardiomyocytes, enhance LDL to HDL cholesterol ratio, and it was found to be the important precursor for the development of coronary heart diseases. So, the constant use of *C. Pictus* leaves for diabetic treatment may cause serious cardiac diseases, and it is not recommended for the treatment.[15][17]

Medicinal Uses [6] :

- In Siddha medicine, used for diabetes; leaves chewed twice daily, or dried powder of leaves taken 1/2 to 1 gram twice daily.
- Used by tribal people of Kolli hills of Tamilnadu for diabetes.
- Leaves consumed as fresh, dried and powder leaf forms.
- In Mexico, infusion of aerial parts used for treatment of renal disorders.

Geographical Source[31] :

- *Costus igneus* is native to Southeast Asia , especially on the greater sunda Islands in Indonesia.
- It is also found in India including west bangal
- In Southren India the plant already are used as a directly supplement for the treatment of diabetes.



Marketed Products :



Concussion :

The treatment of diabetes using the *Chamaecostus cuspidatus* plant have no side effects. The anti-diabetic effect of its leaves is currently been tested in diabetic patients. Studies reveal its role in various diseases, which opens up new clinical research areas.[17] Investigations are needed to analyze the mechanism of action of the compounds and standardization of herbal drugs using models and this in turn would be useful to provide many links to develop various kinds of ant diabetic drugs in low costs. So medicinal plant is better to use in the treatment than conventional medicine.

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