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Review Article

A Review on Costus Igneus Plant

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ABSTRACT

Costus igneus Nak and Costus pictus D. Don, commonly referred to as the Spiral flag, belong to the family Costaceae and are relatively recent introductions to India from South and Central America. These plants are perennial in nature, growing upright with a spreading habit, and typically reach a height of about two feet. They are characterized by spirally arranged leaves and visually appealing flowers. In southern regions of India, the plant is widely cultivated as an ornamental species, and its leaves are traditionally consumed as a dietary supplement for managing diabetes. In recent years, several scientific studies have investigated its antidiabetic activity. In addition to this, the plant has demonstrated multiple pharmacological properties such as lipid-lowering, diuretic, antioxidant, antimicrobial, and anticancer effects. Phytochemical investigations have identified the presence of carbohydrates, proteins, triterpenoids, alkaloids, tannins, saponins, flavonoids, steroids, and trace elements. The present work aims to review and summarize the available literature on the phytochemical composition and pharmacological activities reported for this plant to date.

INTRODUCTION

Costus igneus Nak, commonly referred to as fiery costus, spiral flag or the insulin plant. It is indigenous to regions of South and Central America. It has been introduced into India in recent years as a medicinal plant used in the management of diabetes, which is why it is popularly known as the “insulin plant”^[1]. In southern India, the plant is frequently cultivated as an ornamental species and has also naturalized in several areas^[2]. In traditional practice, it is used to

help regulate blood glucose levels and individuals with diabetes are known to consume one leaf daily for this purpose^[3]. Among the tribal communities of the Kolli Hills in the Namakkal district of Tamil Nadu. The leaves of *C. igneus* are recognized as an effective remedy for diabetes^[4]. The plant is a member of the family *Costaceae*. Nakai elevated *Costaceae* to family status based on distinctive features such as spirally arranged leaves and rhizomes lacking aromatic essential oils. Prior to this classification, ENGLER and PRANTL had

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placed the group as a subfamily of *Costoideae* within the *Zingiberaceae*. Its distinct taxonomic position is supported by several morphological and anatomical characteristics including a well-developed aerial shoot system with firm and often branched stems.^[5] The leaves are arranged in a low spiral pattern with specific divergence angles. The family *Costaceae* comprises four genera and nearly 200 species. With the genus *Costus* being the most extensive containing around 150 species predominantly found in tropical regions.

Taxonomical Classification of *Costus igneus* Plant :

Table.No.1. Taxonomical classification table for *Costus igneus* plant

Botanical Name	Costus Igneus N.E.Br.
Domain	Eukaryota
Kingdom	Plantae
Subkingdom	Viridaeplantae
Phylum	Tracheophyta
Subphylum	Euphyllaphytina
Infraphylum	Radiatopses
Class	Liliopsida
Subclass	Commelinidae
Order	Zingiberales
Superorder	Zingiberaceae
Family	Costaceae
Subfamily	Asteroidae
Tribe	Coreopsidae
Genus	Costus
Specific epithet	Igneus

PLANT PROFILE :



Figure.No.1. Costus Igneus Plant

1. **Synonym** : - Insulin plant, Honi, Pushkarmula
2. **Biological Source** : - It consists of fresh as well as dried leaves of plant *Costus igneus* belonging to the family *Costaceae*.
3. **Active Chemical Constituents** : - It contains Carbohydrates, Proteins, Triterpenoids, A-Tocopherol, Alkaloids, Flavonoids, Steroids, Saponins, Tannins, Ascorbic Acid, other traces amount of Potassium and Calcium.
4. **Uses** : - It is mainly used as anti-diabetic, anti-inflammatory, anti-oxidant and anti-cancer agent.

Morphology : The plant is a perennial herb with an upright and spreading growth habit, typically reaching a height of about two feet. It has tall stems tend to bend and trail along the ground as they mature. The leaves are simple, alternately arranged with smooth margins and an oblong shape remaining green throughout the year. They usually measure between 4 and 8 inches in length and display prominent venation. This tropical evergreen is characterized by large, glossy, dark green leaves with paler undersides, arranged spirally around the stem to form attractive, arching clusters that emerge from underground rhizomes. During warmer seasons, the plant produces showy orange flowers measuring approximately 1.5 inches in diameter, borne on cone-shaped inflorescences at the ends of branches^[6]. The fruits are small, inconspicuous, less than 0.5 inch in size and exhibit a green to multi-coloured appearance.

Major Constituents of Essential Oil :

Table.No.2.Table for Stem oil, Leaf oil and Rhizome oil.

Stem oil (%)	Leaf oil (%)	Rhizome oil (%)
Hexadecanoic acid (28.3)	Hexadecanoic acid (24.51)	Hexadecanoic acid (25.26)
9,12-Octadecanoic acid (18.33)	2-pentalol (22.48)	9,12-Octadecanoic acid (7.74)
Dodecanoic acid (5.62)	Dodecanoic acid (3.96)	Dodecanoic acid (16.56)
Linalyl propanoate (6.03)	β -ionone (8.69)	Tetradecanoic acid (10.20)
Tetradecanoic acid (4.82)	Farnesyl acetone (7.04)	Linalool (8.48)
A-eudesmol (3.55)	A-ionone (8.01)	α -terpineol (4.44)
γ -eudesmol (3.21)		
4-ethoxy phenol (3.06)		

Treatment of Diabetes Mellitus :

The Diabetes Mellitus can be treated by using the various synthetic medications as follows :

1. Metformin
2. Dapagliflozin
3. Sitagliptine
4. Vildagliptine
5. Glipizide

But due to continuous administration of these medications or drugs, some adverse effects may harm the human body and health. Some common adverse effects can be occurs in human body as follows :

1. Liver toxicity
2. Kidney failure
3. Hepato-renal Dysfunction
4. Gastrointestinal issues
5. Weight changes

Therefore, to overcome the side effects which induced due to the synthetic medications, the herbal plant named *Costus igneus* plays a major role in treating or managing the diabetes mellitus. The plant has less adverse effects than any other drugs or medications.

Management of Diabetes Mellitus :

Costus igneus, illustrated in Figure 1, belongs to the family *Costaceae* and is commonly referred to

as the spiral or helical flag. The species is native to eastern regions of Brazil, particularly the states of Bahia and Espírito Santo, as well as other parts of South America^[7]. It has been introduced into India more recently and is widely cultivated as an ornamental plant in Kerala^[8]. The plant grows well under tropical climatic conditions. It bears simple, alternately arranged, smooth-edged, oblong leaves that remain evergreen and typically measure between 4 and 8 inches in length with parallel venation. The leaves are large, glossy, dark green and arranged in a spiral manner around the stem. The plant usually grows up to about 60 cm in height with longer stems often reclining on the ground. During the summer season, attractive orange flowers ranging from 2.5 to 12.5 cm in diameter are produced. Propagation is commonly achieved through stem cuttings. The leaves are traditionally consumed as a health supplement. The individuals must take two to three leaves daily for the management of diabetes, which has led to the plant being popularly known as the “insulin plant”^[9].

Therapeutic Molecular Targets For Diabetes Mellitus :

1. Insulin receptor : Insulin facilitates glycogen biosynthesis and glucose transport in cadaverous muscle while limiting protein catabolism. Insulin enhances lipogenesis and glucose uptake while confining lipolysis in adipose towel. It boosts lipogenesis and



glycogen conflation and inhibits adipose acid oxidation and glycogen conflation in the liver, affecting metabolism laterally in addition to its direct physiological conduct.^[10,11]

2. Dipeptidyl peptidase-IV : DPP-IV is vital for glucose homeostasis. It's needed for incretin (Glucagon- suchlike peptide- 1 (GLP- 1) and Gastric inhibitory polypeptide (GIP)) breakdown as incretins allow the body to produce further insulin when it asked and minimize the position of glucose the liver produces and its impediments act by boosting incretin situations, which elevate insulin stashing, stymie glucagon release, lower blood sugar situations, and slow stomach evacuating.^[11,12]

3. Peroxisome proliferator-activated receptor- γ : When the agonist is bound, PPARs construct heterodimers involving retinoid X receptors and engage with cofactors to accelerate the rate of gene recap. PPARs play a crucial metabolic part as controllers of lipid metabolism and lipid detectors. Thyroid and steroid receptors are members of the PPAR superfamily of nuclear receptors. PPAR- γ is set up in a variety of apkins (e.g. fat, cadaverous muscle, and liver). Its stimulation increases the recap of genes garbling glucose and lipid metabolism, adipocyte development, and insulin signalling.^[12,13]

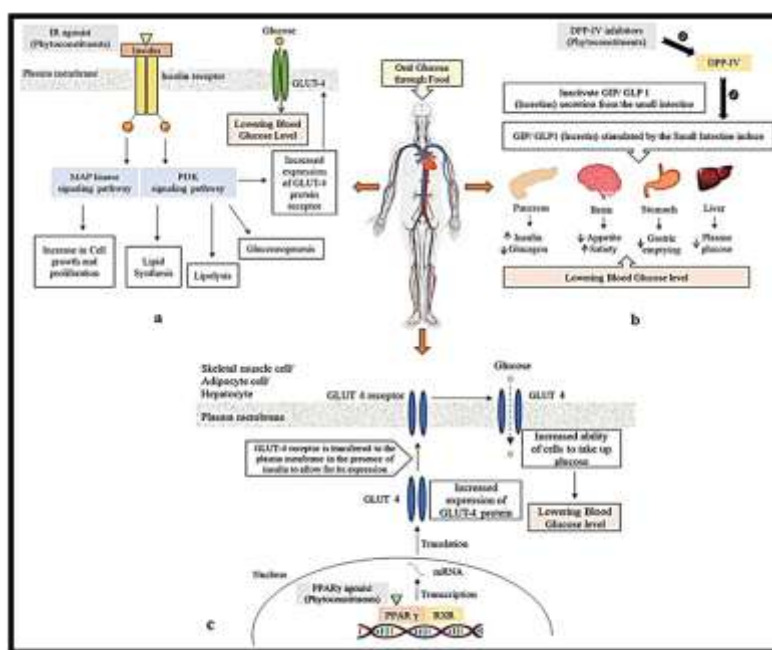


Figure.No.2. Therapeutic targets for diabetes mellitus and their underlying mechanisms: (a) IR, (b) DPP-IV, and (c) PPAR- γ .

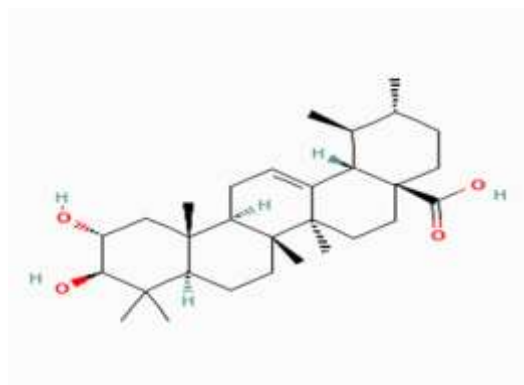
Bioinformatics attributes cost-effective and expedited work involved in designing trials, executing them and enforcing laboratory trials. Physiochemical principles and intricate scientific calculation ways are combined in a new way via molecular docking. Grounded on the typical commerce between the receptor and ligand and

medicine patch, docking aids in drug development. It aids the assiduity in concentrating on substances having the topmost eventuality against a specific target^[14]. In this investigative work, Manasi Yadav et al. had reported that the phytoconstituents of *Costus igneus* and for this an activator of Insulin receptor (IR), Dipeptidyl Peptidase- IV (DPPIV)

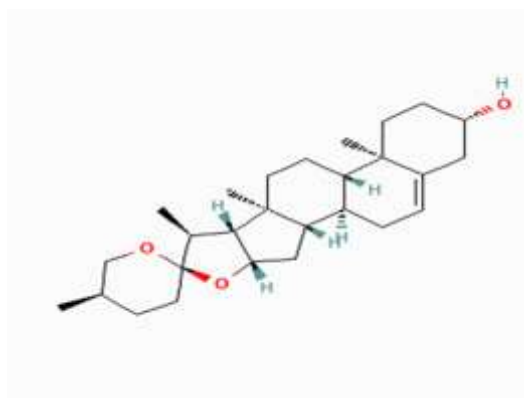
asset, and an agonist of Peroxisome proliferator actuated receptor- gamma (PPAR- γ) were chosen as remedial molecular targets for diabetes mellitus.

Phytochemical Constituents of *Costus igneus* Plant :

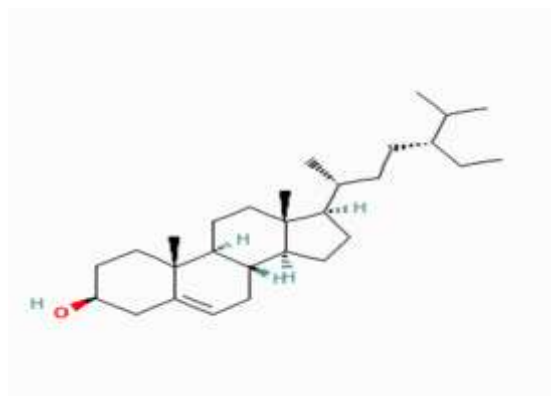
1. Corsolic acid (C₃₀H₄₈O₄)



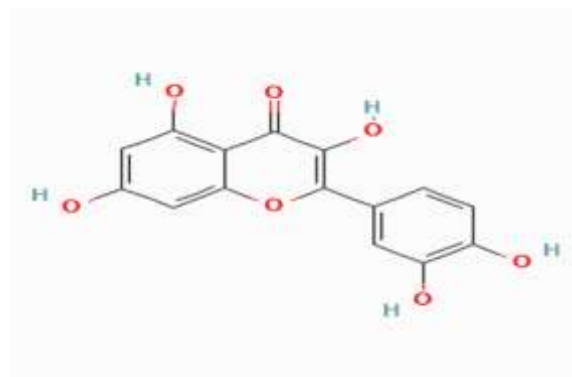
2. Diosgenin (C₂₇H₄₂O₃)



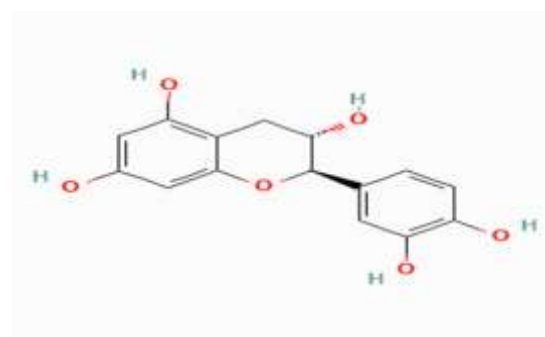
3. β -sitosterol (C₂₉H₅₀O)



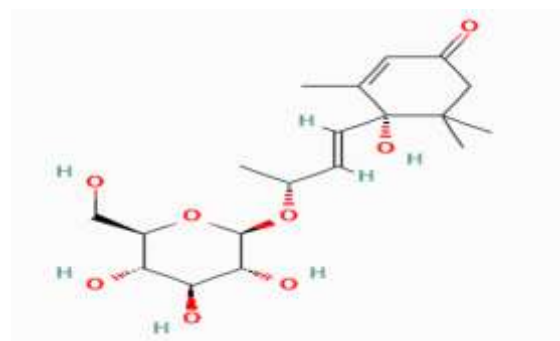
4. Quercetin (C₁₅H₁₀O₇)



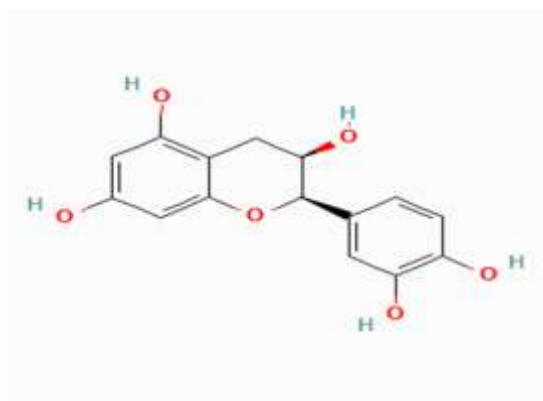
5. Catechin (C₁₅H₁₄O₆)



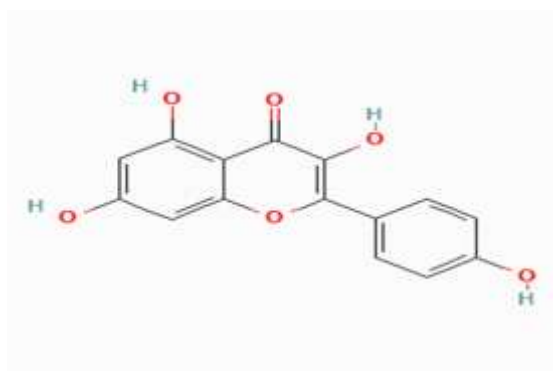
6. Roseoside (C₁₉H₃₀O₈)



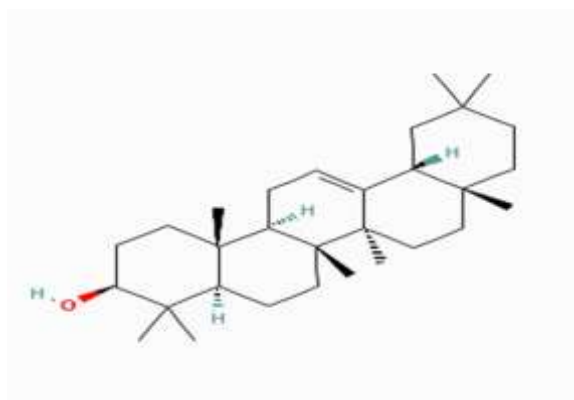
7. Epicatechin (C₁₅H₁₄O₆)



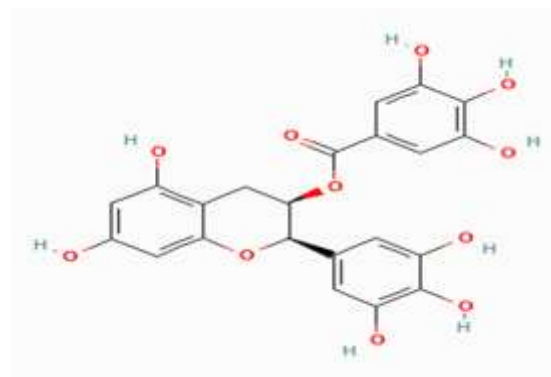
8. Kaempferol (C₁₅H₁₀O₆)



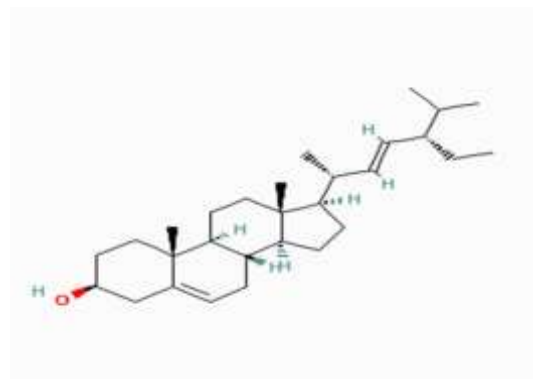
9. β -amyrin (C₃₀H₅₀O)



11. Epigallocatechin gallate (C₂₂H₁₈O₁₁)

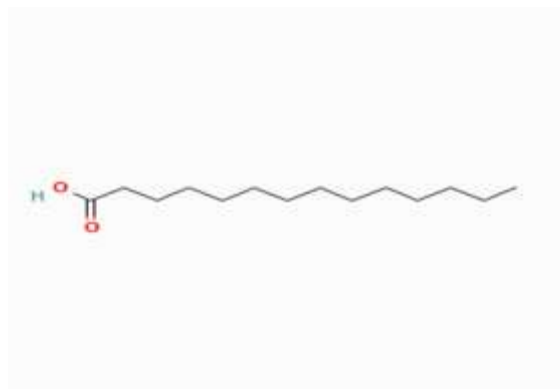


12. Stigmasterol (C₂₉H₄₈O)

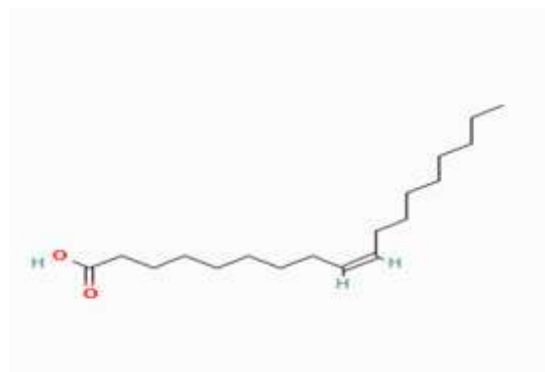


13. Tetradecanoic acid (C₁₄H₂₈O₂)

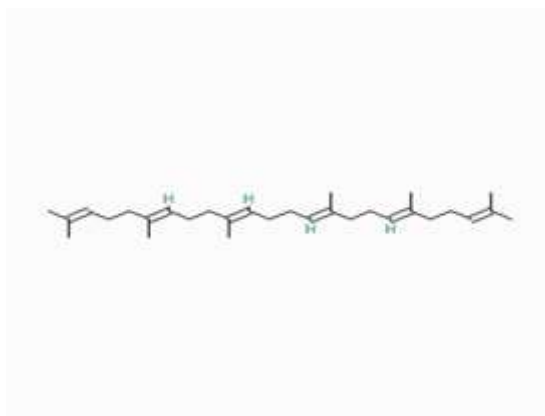
10. Hexadecanoic acid (C₁₆H₃₂O₂)



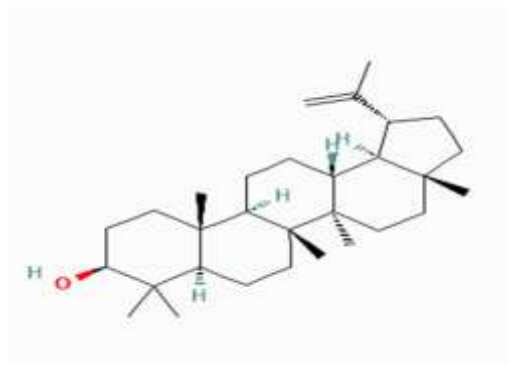
14. Oleic acid (C₁₈H₃₄O₂)



15. Squalene (C₃₀H₅₀)



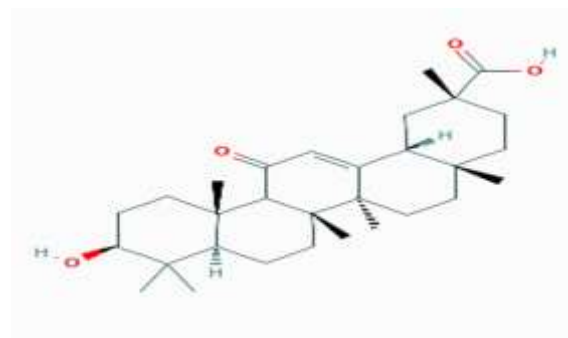
16. Lupeol (C₃₀H₅₀O)



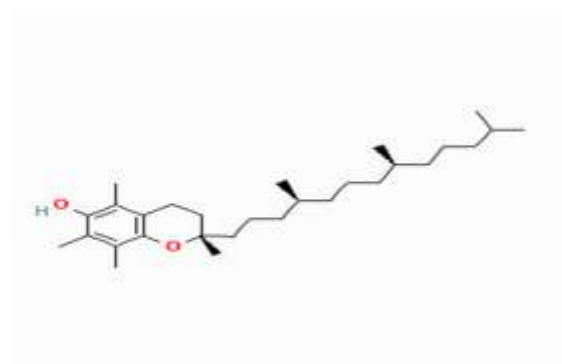
17. β -carotene (C₄₀H₅₆)



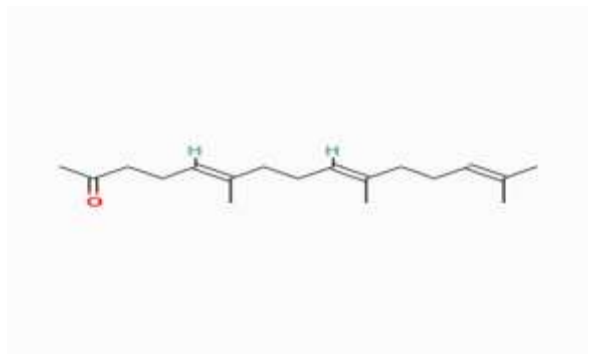
18. Glycyrrhetic acid (C₃₀H₄₆O₄)



19. α -tocopherol (C₂₉H₅₀O₂)



20. Farnesyl acetone (C₁₈H₃₀O)



CONCLUSION :

This review supports the therapeutic potential of the leaves in diabetes. The anti-diabetic effect of its leaves is currently being tested in diabetic patients. Studies reveal its role in various diseases, which opens up new clinical research areas. Medicinal plants provide safer and more inexpensive alternatives as follows :

1. Conventional medicines are expensive and often have negative side effects.
2. The anti-diabetic impact of their leaves is currently being investigated in diabetic patients.
3. Medicinal plants are more effective than traditional treatments.
4. Insulin plant leaves (*Costus igneus*) lowered fasting and postprandial blood sugar levels in rats with dexamethasone-induced hyperglycemia, returning them to normal levels.

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