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Evaluation of Antidiabetic and Antioxidant Activities of Ethanolic Leaf Extract of Tecoma Stans (L.) Juss.

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ABSTRACT

The ethanolic leaf extract of *Tecoma stans* (L.) Juss. demonstrates potent therapeutic potential as both an antidiabetic and antioxidant agent, validated through various chemical and biological assays. Phytochemical analysis reveals a rich composition of bioactive compounds, specifically alkaloids like tecomine and various phenolic flavonoids, which drive its medicinal efficacy. Its antidiabetic action is characterized by the significant inhibition of carbohydrate-digesting enzymes, such as -amylase and-glucosidase, alongside an insulin-mimetic effect that effectively lowers blood glucose levels in streptozotocin-induced diabetic models. Simultaneously, the extract exhibits robust antioxidant properties by scavenging free radicals and reducing lipid peroxidation, thereby protecting cellular structures from the oxidative stress typically exacerbated by chronic hyperglycemia. These dual actions suggest that *Tecoma stans* not only helps manage glucose homeostasis but also mitigates the systemic secondary complications associated with diabetes.

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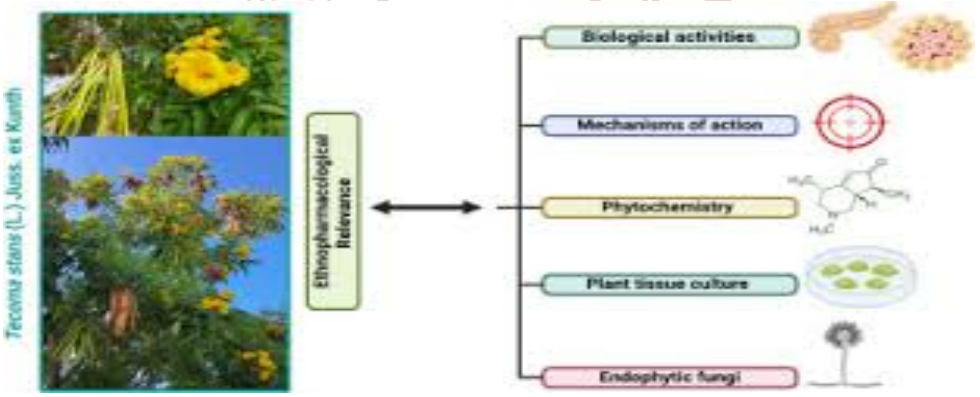

Fig-1 Compound Chart

INTRODUCTION

The study of the ethanolic leaf extract of *Tecoma stans* (L.) Juss. is significant due to its long-standing history in traditional Mexican and Ayurvedic medicine as a primary treatment for "sweet urine" or diabetes. While modern medicine relies heavily on synthetic drugs like glibenclamide and metformin, these often come with side effects and provide only symptomatic relief, creating a critical need for safer, plant-based alternatives. *Tecoma stans* is particularly noteworthy because it contains a unique profile of over 120 bioactive compounds, including the potent hypoglycemic alkaloids tecomine and tecostanine, which work synergistically with antioxidant flavonoids to target multiple pathways of the disease. Beyond simply lowering blood glucose, the extract's ability to inhibit carbohydrate-digesting enzymes and neutralize oxidative stress offers a comprehensive approach to preventing long-term diabetic complications like nephropathy and cardiovascular

damage. Consequently, scientifically validating this extract bridges the gap between ancient ethnobotanical knowledge and evidence-based pharmacology, potentially leading to more accessible and holistic therapeutic options for chronic metabolic disorders.

Structure and Botanical classification of plant Profile

Botanical Classification

The botanical classification of Tecoma stans (L.) Juss. follows the taxonomic hierarchy below:

Comparative Antidiabetic Potency

Studies comparing Tecoma stans (TSE) with other medicinal plants highlight its unique strengths:

- *Teucrium cubense (TCE): In comparative tests on adipose cells, Tecoma, TSE stimulated glucose uptake by 193% in murine cells and 115% in human cells, whereas T. cubense only achieved 112% and 54% respectively.*
- *Pterocarpus marsupium: When tested individually, both T. stans and P. marsupium significantly reduced fasting blood glucose. However, their combination showed synergistic effects that were more potent than either plant alone, reaching an efficacy comparable to the standard drug metformin.*
- *Acarbose (Standard Reference): While highly effective, T. stans flower extract has a higher*

for enzyme inhibition than pure acarbose. For -amylase, the extract's is compared to acarbose's

Comparative Antioxidant Profile

Tecoma stans is often ranked alongside top antioxidant plants due to its rich phenolic content:

- *Azadirachta indica (Neem) &*

Catharanthus roseus: Like these plants, T. stans is highly effective at scavenging DPPH and ABTS radicals.

- *L-ascorbic acid: Methanolic and ethanolic extracts of T. stans have demonstrated superior antioxidant potential at higher concentrations compared to standard L-ascorbic acid (Vitamin C), particularly at concentrations of*

Efficacy Summary Table

Feature	*Tecoma stans*	*Teucrium cubense*	*Momordica charantia (Bitter Melon)*
Primary Mechanism	*Intestinal enzyme inhibition & glucose uptake*	*Glucose uptake stimulation*	*Insulin sensitivity &- cell repair*
Glucose Uptake	*Very High (up to 193%)*	*Moderate (up to 112%)*	*High*
Lipid Effects	*Reduces Cholesterol/Triglycerides*	*Minimal reported*	*Reduces Triglycerides*
Common Use	*Mexico & Central America*	*North America/Mexico*	*Asia & Africa*

Future Scope and Recommendations

The **Future Scope and Recommendations** for research on the ethanolic leaf extract of *Tecoma stans* (L.) Juss. focus on transitioning from laboratory-based evidence to standardized clinical applications.

Future Scope

- **Molecular Mechanism Mapping**: Future studies should utilize **molecular**
- **Docking** and gene expression analysis (RT-PCR) to determine how the extract affects **GLUT-4 translocation**, insulin receptor signaling, and PPAR activation.
- **Isolation of Novel Compounds**: While tecomine is well-known, further bioassay-guided fractionation is needed to identify other minor alkaloids or glycosides that may contribute to its **synergistic effect**.
- **Chronic Toxicity Profiles**: Most current data covers acute toxicity (up to 14 days). Long-term safety studies (90 days or more) are required to evaluate its impact on **renal and hepatic functions** during chronic administration.
- **Formulation Development**: Research can move toward developing standardized **nano-formulations** or controlled-release capsules to improve the bioavailability and stability of the extract's volatile phytochemicals.
- **Drug Interaction Studies**: Investigating how the extract interacts with common synthetic drugs like **Metformin** or **Vildagliptin** could pave the way for successful poly-therapy (herb-drug combinations).

Recommendations

- **Clinical Trials**: It is recommended to initiate **Phase I and II clinical trials** to validate the safety and efficacy observed in animal models within human subjects.
- **Standardization Markers**: Researchers should establish a **fingerprint profile** (using HPTLC or HPLC) for the ethanolic extract to ensure batch-

to-batch consistency in commercial herbal products.

- **Sustainable Cultivation**: Given its medicinal value, standardized agricultural practices (GAP) should be recommended to ensure high yields of secondary metabolites, avoiding heavy metal contamination from wild harvesting.
- **In-depth Antioxidant Analysis**: Future work should explore the extract's role in preventing **oxidative DNA damage** and its potential as a protective agent against diabetic retinopathy and nephropathy.

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