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# STUDY ON QUANTITATIVE ANLAYSIS OF TWO IMPORTANT MEDICINAL PLANTS GLORIOSA SUPERBA L. AND CELASTRUS PANDICULATES WILDLIFE

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## ABSTRACT

Gloriosa superba L., a perennial herb from the Colchicaceae family, and Celastrus paniculatus Wild, an evergreen climbing shrub, are two plants of significant medicinal value. Both are integral to traditional Indian medicinal systems like Ayurveda, Unani, and Siddha. The research paper aims to highlight the nootropic activity of C. paniculatus while exploring its phytochemistry, traditional uses, and other pharmacological activities. Both Gloriosa superba L. and Celastrus paniculatus Wild exemplify the importance of traditional medicinal plants, not just in historical practices, but also in modern pharmacology. The rich phytochemical profiles and broad therapeutic potential of these plants call for continued research and exploration. This study underscore the need for the further integration of these natural resources into modern medicinal practices.

**Keywords:** Gloriosa superba L., Celastrus paniculatus Wild., therapeutic, modern pharmacology

## 1. INTRODUCTION

Natural products, also known as phytochemicals, continue to be one of the most vital sources of bioactive compounds. Even in our highly technological era, more than half of the world's population depends on plants as a primary source of remedies, using them to address a broad spectrum of ailments. It is estimated that around 40-80% of new drugs that are approved and

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under commercialization are derived from natural products. These statistics highlight the immense significance of natural products in healthcare and pharmaceutical industries.

The four primary classes of secondary metabolites derived from these natural products are Terpenoids, Phenols, Glycosides, and Alkaloids. Phytochemical techniques are primarily applied to derive quality medicines from various chemical components such as alkaloids, flavonoids, saponins, phenolics, terpenoids, tannins, and more. With their diverse biological activity, phytochemicals from medicinal plants are garnering increased attention in medical science.

In developing countries, over-the-counter remedies and "Ethical Phytomedicines," which are standardized crude drugs defined both clinically and toxicologically, are viewed as promising low-cost alternatives in primary healthcare. The field has gained momentum in recent years through the interaction of traditional ethnobotanical knowledge study and the application of modern phytochemical analysis and biological activity studies to medicinal plants.

One of the key areas of focus in this context is the qualitative and quantitative analysis of Gloriosa superba L., an important medicinal plant from the Colchicaceae family. This semi-woody, herbaceous branched climber, reaching approximately 5 meters in height, is adorned with brilliant, wavy-edged yellow and red flowers. G. superba is among the endangered species of medicinal plants but has a wide range of applications in traditional medicine practices in tropical Africa and Asia.

The tuber of G. superba is traditionally used to treat a plethora of conditions including bruises, sprains, colic, chronic ulcers, haemorrhoids, cancer, impotence, and even to induce labour pains and abortion. Haroon et al., 2011, highlighted that the tuberous root of G. superba, when boiled with sesamum oil and applied twice a day on joints affected by arthritis, reduces pain. It has also shown efficacy in treating wounds, skin-related problems, fever, piles, inflammation, uterine contractions, blood disorders, and poisoning. Researchers have reported various pharmacological properties of G. superba, with studies indicating that its tuber extract shows antibacterial, antifungal, and mutagenic activities, and antihaemolytic activities when extracted with alcohol.

Another plant of interest is Celastrus paniculatus Wild., known in Ayurveda as the 'Tree of

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Research paper  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

life.' This plant, belonging to the family Celastraceae, has been used since ancient times to treat brain-related disorders and enhance learning and memory. The Jyotishmati oil extracted from the seeds of C. paniculatus is known to have effects on the Central Nervous System. Although native to the Indian subcontinent, it grows wildly in Australia, China, Taiwan, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Nepal, Thailand, Vietnam, and many Pacific islands.

C. paniculatus is a large, deciduous, climbing unarmed shrub that reaches a height of 10 meters, with long slender elongating branches that are reddish-brown. The stem is covered with elongate lenticles and can be up to 23 cm in diameter. The leaves are simple, alternate, ovate or obovate, and shortly acuminate. The inflorescence is paniculate, with yellowish or greenish-white un isexual flowers in terminal pyramidal panicles. The calyx of the flowers is pubescent on the outside, with semi-orbicular, ciliate lobes, and oblong petals. Male flowers exhibit stamens inserted on the margin of the disc with short filaments and oblong anthers.

In the grand scheme of ethnopharmacology and phytochemistry, plants like Gloriosa superba L. and Celastrus paniculatus Wild. present a wealth of potential. They offer not only a rich source of natural compounds but also a strong foundation of traditional knowledge based on centuries of use. However, despite the recognized importance and potential of these plants, there is still much to learn about their properties and potential applications.

For instance, G. superba, with its colorful flowers and wide range of traditional uses, is a compelling candidate for further study. Its applications in treating various conditions, from arthritis to cancer, suggest a rich source of bioactive compounds waiting to be discovered and harnessed. Similarly, C. paniculatus, with its long history of use in Ayurvedic medicine for brain-related disorders, is a promising source of compounds that could potentially contribute to the treatment of neurodegenerative diseases, an area of great need in modern medicine.

The study of these plants also raises important ethical and conservation considerations. As with any natural resource, it's essential to balance the need for exploration and use with the need to protect and preserve. As G. superba is an endangered species, any use or study of this plant must be done sustainably, with a focus on conservation.

Overall, the role of natural products in medicine is more relevant now than ever before. With the advancements in phytochemical analysis techniques and the ever-growing need for new

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and effective medications, the potential of plants as a source of bioactive compounds is vast. The qualitative and quantitative analysis of plants like G. superba and C. paniculatus is not just a study of their individual potential but is also a testament to the power of nature and its untapped resources.

## 2. Aim And Objectives

- To underscore the significance of natural products or phytochemicals as a vital resource for bioactive compounds, forming the basis for numerous medications in use today.
- To perform a qualitative and quantitative analysis of Gloriosa superba L., highlighting its importance as a medicinal plant and discussing its various traditional uses.
- To provide a detailed account of Celastrus paniculatus Wild., its traditional medicinal uses, especially in treating brain-related disorders and enhancing learning and memory, and its geographical spread.
- Promote Sustainable Use and Conservation: To promote the sustainable use of these plants for their medicinal properties and emphasize the importance of conservation, particularly for endangered species like G. superba.
- Reiterate the Role of Natural Products in Modern Medicine: To reiterate the role of natural products in modern medicine, the potential of plants as a source of bioactive compounds, and the importance of further studies to unlock their full potential.

## 3. RESEARCH METHODOLOGY

The research methodology detailed above entails the collection, preparation, and detailed analysis of plant parts from Gloriosa superba L., a plant native to India. It covers the processes involved in the study from the initial collection of plant parts, through to the preparation of plant extracts and the ensuing qualitative and quantitative phytochemical analysis of the plant.

The first phase of the methodology involves the collection of the plant parts. The researchers harvested Gloriosa superba L. from the Babasaheb Ambedkar Mathwada university campus in Aurangabad, Maharashtra, India. The plant parts collected were the tuber and leaves, which were subsequently cleaned of soil dust with tap water. These parts were then dried under shade and ground into a fine powder which was stored in an airtight bottle for subsequent use. The plant materials were identified by referencing standard floras.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

The next phase is the preparation of plant part extracts. The researchers utilized the Soxhlet extraction method to create extracts from the plant parts. The powdered plant parts were placed in the Soxhlet apparatus with a solvent at a temperature of 55°C for 72 hours. The extracts were then filtered and the solvent evaporated, leaving behind the plant extract in powder form. This extract was then dissolved in DMSO at a 10% concentration for subsequent analyses.

The third stage of the methodology is the qualitative analysis of the plant parts. The researchers conducted screening tests to determine the presence of various secondary metabolites including alkaloids, glycosides, terpenoids, tannins, flavonoids, saponins, steroids, and phenols. The tests involved heating the extract with various reagents and observing for color changes or precipitate formation, which would suggest the presence of these metabolites. The researchers used various detection methods such as the Mayer's reagent test for alkaloids, ferric chloride test for glycosides, and the ferric chloride test for phenols.

The final stage of the methodology is the quantitative analysis of the plant parts. The researchers prepared the plant extracts for quantitative determination of alkaloids by stirring the powdered plant material in n-butanol and centrifuging the mixture. The supernatant was then used for the estimation of total alkaloids using a titrimetric method. The alkaloid content was calculated based on the volume of HCL neutralized.

The researchers also estimated the total phenolic content by using a modified Dewanto method. The phenolic content was expressed as milligrams of gallic acid equivalents per gram of dry weight. Furthermore, the total flavonoid content in the plant extract was analyzed using the aluminum chloride colorimetric system. The concentration of flavonoids was calculated and expressed as the equivalent of quercetin per gram of sample. All these tests were conducted in triplicate to ensure the validity of the results.

## 4. RESULTS AND DISCUSSION

The qualitative phytochemical studies were carried out in the solvents viz. Methanol, Chloroform and n-Butanol. The Methanol, Chloroform and n-Butanol tuber and leaves extract of *Gloriosa superba* L. shows the presence of alkaloid, glycosides, terpenoids, tannin, flavonoids, saponins, steroid and phenols but in tuber of *Gloriosa superba* L. high intensity of phytochemicals than that of leaves showed in table no.1 by twice and tannin absence in

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Research paper  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

methanolic and n-butanol extract of leaves. Also, the quantitative studies were carried out in the same solvent mentioned above, Alkaloid content in tuber of *Gloriosa superba* L. that was 2.921, 2.546 and 3.045 µg/ml respectively, and total flavonoids in tuber, 0.845, 0.641 and 0.978 µg/ml respectively and also followed by total content of phenols that was 1.284, 0.652 and 1.361 µg/ml. Total content of Alkaloid, flavonoids and phenols in the Methanol, 1.926, 0.434 and 1.641 µg/ml. respectively, in the Chloroform 1.554**,** 0.391 and 0.856 µg/ml. and followed by in the n-Butanol leaves extract of *Gloriosa superba* L. that was 2.045, 0.423 and 0.426 µg/ml.

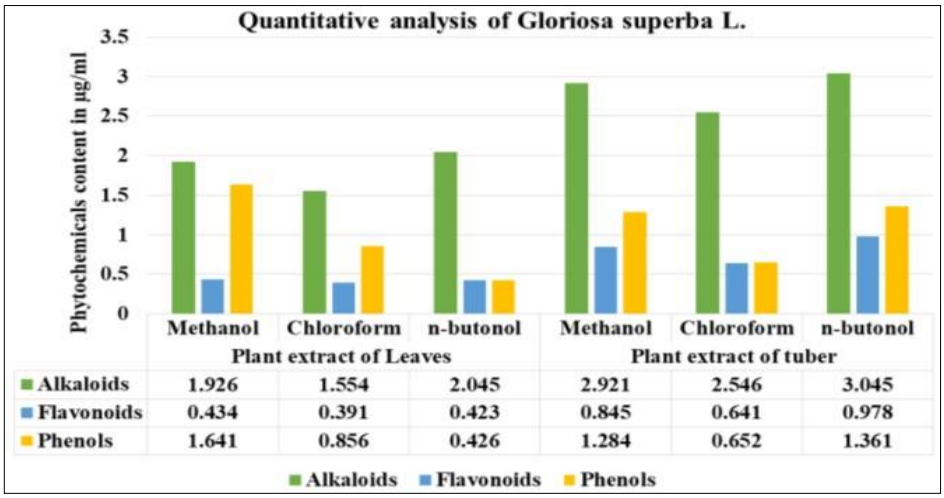


**Fig 2:** Quantitative analysis of *Gloriosa superba* L. plant parts, (leaves and tuber µg/ml)

Learning and memory are intricate phenomena affected by numerous factors. These can either facilitate learning by improving performance or inhibit the process, leading to impairment. Celastrus paniculatus, an essential medicinal plant utilized in the traditional Indian system of medicine, plays a critical role in managing various neurological disorders. This versatile plant, used alone or in combination with other drugs, is scientifically proven to enhance memory and cognition, primarily by increasing the acetylcholine level in the brain. This increase in acetylcholine is instrumental in improving memory and learning processes.

Moreover, C. paniculatus significantly reduces the content of norepinephrine, dopamine, and serotonin, neurotransmitters critical for learning and memory. In experimental models, the oil derived from the plant's seeds reversed scopolamine-induced impairment in maze performance

ISSN PRINT 2319 1775 Online 2320 7876

Research paper  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

and selectively countered spatial memory impairment due to the synergistic effect of active compounds. This was observed in the sodium nitrite-induced amnesic rodent model, where the plant's aqueous seed extract showed dose-dependent cholinergic activity, enhancing memory performance.

In the shuttle-box and passive avoidance paradigm, the aqueous seed extract improved learning and memory by reducing lipid peroxidation (LPO) and enhancing endogenous antioxidant enzymes in the brain. In the radial arm maze (RAM) model, a significant decrease in the activity of acetylcholinesterase (AChE) from the hypothalamus, frontal cortex, and hippocampus of the rat brain was noted when treated with the seed oil.

Additionally, C. paniculatus oil alleviates the symptoms of Attention Deficit Hyperactivity Disorder (ADHD) in rats, owing to its antioxidant potential. The seed oil increases Superoxide Dismutase (SOD), reduces glutathione (GSH), Catalase (CAT), and Malondialdehyde (MDA) levels. It also restores the altered levels of bioamines, dopamine, noradrenaline, and serotonin, involved in the pathophysiology of ADHD and essential for learning and memory processes.

The seed oil also prevents learning and memory impairments in kainic acid-induced neurodegeneration in rats, potentially due to its antioxidant and anti-inflammatory activity. A significant increase in serum uric acid level in rats, which is a protective factor against Alzheimer's disease via its antioxidant properties, was observed. Uric acid significantly increased SOD, CAT, GSH levels, and decreased MDA level in substantia nigra regions of MPTP-treated rodents. Furthermore, uric acid inhibited the hippocampal expression of pro-inflammatory cytokines such as IL-1β and reduced serum and hippocampus levels of IL-1β, IL-6, and TNF-α.

Pre-treatment with ethanolic and aqueous extracts of C. paniculatus showed significant improvement in the 3-Nitropropionic acid (3-NP) induced cognitive dysfunctions due to its potent antioxidant effect. Both extracts also exhibited a neuroprotective effect against glutamate and hydrogen peroxide-induced neurotoxicity by inhibiting NMDA receptors. Pre-treatment of fetal bovine nasal cells (FBNC) with the aqueous extract significantly attenuated neuronal death against glutamate-induced injury by modulating glutamate receptor function. A significant decrease in serum cortisol and cholinesterase also resulted in rats treated with C.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

paniculatus oil, a sign of neuroprotection.

Oxidative stress involves free radicals, and free radical scavenging is a primary mechanism of neuroprotection. The aqueous extract of seeds significantly decreased MDA levels and increased GSH and CAT levels in rat brains, showing potent antioxidant properties. The plant's chloroform extract exhibited the most potent antioxidant property in DPPH, TEAC, FR AP, and LOX inhibition assays, potentially due to high total phenolic content. In carrageenan-induced pedal edema in rats, the methanolic extract of the flowers exhibited effective anti-inflammatory activity. This anti-inflammatory property of C. Paniculatus may be due to the presence of a large number of terpenoids and sterols, compounds known to possess robust anti-inflammatory potential.

## 5. CONCLUSION

Gloriosa superba L. is a plant that serves as a rich source of various phytochemicals such as alkaloids, glycosides, terpenoids, tannins, flavonoids, saponins, steroids, and phenols. Studies have shown that extraction in n-butanol solvent yields the highest intensity and content of these phytochemicals, followed by methanolic extract of the tuber of Gloriosa superba L. These extracts have been found to possess antimicrobial properties.

Research by Sagbo et al., 2005, and Jothi, 2019, highlights that polyphenols and phenols present in plants are secondary metabolites that are considered natural antioxidants. Further, Trease et al., 1983, and Jothi, 2019, have documented that Gloriosa superba is an alkaloid plant. It contains alkaloid components such as colchicine and gloriosine, which are widely used in pharmaceutical formulations.

Flavonoids, another category of ketonic compounds found in Gloriosa superba, have been reported by Noroozi et al., 1998, and Al-Humaid et al., 2010, to induce anti-inflammatory activity. They inhibit oxygen compounds and enzyme cyclooxygenase-dependent pro-inflammatory activity. Furthermore, flavonoids have potent anti-inflammatory activity as they inhibit prostaglandin synthesis. Flavonoids in higher plants are linked with cardiovascular diseases and have antioxidant potentials that can be used to treat cancer. This was supported by Pietta, 2000, and T. Sivakumar, 2017, who noted that flavonoids and antioxidants are the origin of vitamins A, C, E, and plant-based diets.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

In light of these findings, Gloriosa superba L. presents a rich spectrum of phytochemical compounds that are valuable for future studies focused on purification, identification, and characterization of active compounds.

Similarly, C. paniculatus, another medicinal plant, has been deemed the 'Elixir of life.' It is used as a major component in numerous pharmaceutical medications, which makes it highly sought after in the pharmaceutical industry. The current market price of C. paniculatus seeds (as of 2010-2011) in Mumbai was Rs. 2000/kg in the wholesale market and approximately Rs.4000 to 5000/kg in local Ayurvedic shops. This reflects the significant economic and pharmaceutical value of these seeds.

However, the future of C. paniculatus is threatened due to indiscriminate overexploitation from natural sources to meet growing demand by the pharmaceutical industry. Issues such as low seed viability, lack of vegetative propagation methods, and inadequate attempts for replenishment of wild stock have contributed to its vulnerable and endangered status (Warrier et al., 2001). Therefore, there is an urgent need for special attention and scientific efforts towards the conservation and propagation of this plant. These efforts will help ensure the survival of this species and the continued availability of its valuable medicinal properties for future generations.

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