International Journal of Advanced Research in Engineering Technology & Science
ISSN: 2349-2819
Impact Factor: 7.10
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Email: editor@ijarets.org Volume-11 Issue-4 April-2024 www.ijarets.org

STUDY ON QUANTITATIVE ANALYSIS OF TWO IMPORTANT MEDICINAL PLANTS GLORIOSA SUPERBA L. AND CELASTRUS PANICULATUS WILD

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ABSTRACT

Two important medicinal plants, Celastrus paniculatus Wild and Gloriosa superba L., are quantitatively analysed in this work with an emphasis on their phytochemical composition and pharmacological potential. Traditional medicine systems have long made use of the numerous medicinal characteristics of plants like flame lily (Gloriosa superba L.) and black oil plant (Celastrus paniculatus Wild). We measured important phytochemical components, including alkaloids, flavonoids, phenolic compounds, and terpenoids, in these plants using recognised analytical methods such gas chromatography-mass spectrometry (GC-MS), spectrophotometry, and high-performance liquid chromatography (HPLC). The pharmacological actions of these plants were enhanced by the abundance of bioactive chemicals that our research uncovered, including gloriosine, superbinine, sesquiterpenes, and flavonoids, among others. Analgesic, anti-inflammatory, neuroprotective, and memory-enhancing activities were highlighted by in vitro and in vivo tests, further elucidating the pharmacological potential of Celastrus paniculatus Wild and Gloriosa superba L. These findings support the historical use of these plants and highlight their promise as potential medicines. In order to rationally design standardised herbal remedies and identify lead compounds for drug discovery, this work highlights the significance of quantitative analysis in comprehending the chemical components responsible for the reported biological actions. We need further studies to figure out how they work pharmacologically and how to get the most out of our extraction methods. In conclusion, this quantitative analysis adds to our knowledge of Gloriosa superba L. and Celastrus paniculatus Wild, how they are used in nature, and how they can be used in the future to benefit human health.

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

INTRODUCTION

Since ancient times, medicinal plants have been an essential component of traditional medical practices. These plants provide a diverse array of bioactive chemicals that have the potential to be used in therapeutic settings. These two plants, Gloriosa superba L. and Celastrus paniculatus Wild, stand out among the wide variety of medicinal plants because of the strong therapeutic characteristics they possess and the widespread traditional applications they have. The flame lily, also known as the glory lily, is a perennial herbaceous plant that is native to tropical and subtropical parts of Africa and Asia. Gloriosa superba L. is the scientific name for this plant. Due to the fact that it possesses a wide range of pharmacological qualities, it has been an important component of traditional medical systems, notably in Ayurveda and traditional Chinese medicine. In addition to having anti-inflammatory, analgesic, anti-cancer, anti-microbial, and anti-oxidant benefits, the plant possesses a rich reservoir of alkaloids, such as colchicine, gloriosine, and superbinine. These alkaloids demonstrate a variety of therapeutic activity. Similarly, Celastrus paniculatus Wild, also known as black oil plant or intelligence tree, is a climbing shrub that is native to the Indian subcontinent and is characterised by its woody appearance. Due to the fact that it possesses neuroprotective, memory-enhancing, anti-inflammatory, and anti-oxidant qualities, it has been utilised extensively in traditional Ayurvedic therapy. The seeds of C. paniculatus are highly regarded because to the abundance of bioactive components that they contain. These compounds include sesquiterpenes, alkaloids, and flavonoids, all of which contribute to the pharmacological actions of the plant.

However, there is a dearth of detailed quantitative assessments about the phytochemical composition and pharmacological potential of Gloriosa superba L. and Celastrus paniculatus Wild, despite the fact that both of these plants have been used in traditional medicine for a long time and have significant pharmacological applications. In light of this, the purpose of this study is to address this deficiency by carrying out a comprehensive quantitative investigation of these two medicinal herbs. The quantitative analysis will include the determination of key phytochemical constituents, such as alkaloids, flavonoids, phenolic compounds, and terpenoids, through the utilisation of validated analytical techniques. These techniques include high-performance liquid chromatography (HPLC), gas chromatography-mass spectrometry (GC-MS), and spectrophotometric methods. In addition, the research will conduct in vitro and in vivo experiments to analyse the biological activities of the compounds that have been found, for the purpose of providing light on the possible therapeutic uses of these compounds. In a nutshell, the purpose of this research is to offer significant insights into the quantitative composition and pharmacological activities of Gloriosa superba L. and Celastrus paniculatus Wild, with the ultimate goal of easing their utilisation in contemporary medicine and drug development endeavours. In order to make a contribution to the scientific knowledge of these significant medicinal plants and to the sustainable utilisation of these plants, the purpose of this research is to shed light on the chemical elements that are responsible for their therapeutic benefits.

OBJECTIVES

- To emphasise the relevance of natural products or phytochemicals as an essential source of bioactive compounds, which serve as the foundation for a wide variety of pharmaceuticals that are currently in use throughout the world.
- In order to illustrate the significance of Gloriosa superba L. as a medicinal plant and to explore the many different traditional applications of this plant, a qualitative and quantitative examination of the plant will be carried out.
- The purpose of this article is to provide a comprehensive explanation of Celastrus paniculatus Wild., its traditional medicinal benefits, particularly in the treatment of brain-related illnesses and the enhancement of learning and memory, as well as its geographical presence.

Botanical Description

As a perennial plant, the glory lily may reach heights of up to four metres in its stems. Additionally, the stem rises with the help of tendrils, and it contains an underground fleshy rhizome. The length of the leaves ranges from 13 to 20 centimetres, and they are lance-shaped, sessile, and have tendrils on the tips. In addition to being axial, solitary, and actinomorphic, flowers contain six tepals that range in colour from brilliant red to orange and are around six centimetres in length each. There are six extrorse anthers that can be up to four centimetres in length, and the ovary is superior and contains a large number of ovules within it. A capsule fruit measuring six inches in length and containing red seeds is present in this plant. Butterflies are responsible for the cross-pollination of the glory lily, however the plant does not have a self-incompatible relationship.

Soil

A red loamy soil is ideal for the growth of glory lilies. It is necessary to have enough drainage, however it is best to avoid soil that is soggy. This plant may thrive in soil that has a pH that falls in between 6.0 and 7.0.

Climate

Conditions that are favourable for this plant include temperatures that are moderate during the day and chilly during the night. The glory lily is reproduced by the use of tubers, the planting season begins in June and continues through July, and the harvesting of the fruits occurs between 160 and 180 days after the tubers have sprouted.

Fertilizers

The amount of "Farm Yard Manure" (FYM) that is added per hectare (ha) is around ten tonnes before to planting. The appropriate proportions of nitrogen, phosphorus, and potassium (NPK) are applied in the following order: 120:50:75. Nitrogen is administered in split dosages, with all phosphorus and potassium being supplied simultaneously. Additionally, FYM is used to apply half of the nitrogen, and the remaining half of the nitrogen is applied one and two months after planting. The crop has to be irrigated soon after it has been planted, and then again at intervals of five days after that.

Phytochemical Properties and Pharmacology of Gloriosa superba (L.)

Phytochemical Properties

G. superba tubers include colchicines, benzoic and salicylic acid, sterols and resinous chemicals like as colchicines, 3-demethyl colchicine, 1,2-didemethyl colchicine, 2,3-didemethyl colchicine, N-formyl, N deacetyl colchicines, colchicocide, gloriosine, tannins and superbine9 . Gloriosine is another key chemical that was extracted from the seed and rhizome of this plant. Colchicine is the most important compound that was obtained from these substances. In addition, the tubers of G. superba contain 0.25% colchicine, in addition to sitosterol, glucoside, β- and gamma lumicolichicines, β-sitosterol, flucoside, and 2-H-6-MeO benzoic acid. Furthermore, the blossoms of this plant include luteolin and Nformylde.Colchicine sodiumAccording to a study from 2021, a novel colchicine glycoside called 3-0-demethyl colchicine 3-O-alpha-Dglucopyranoside was discovered in the seeds of G. superba.

Polyphenols

Tubers and seeds of G. superba have been found to possess a total phenolic content of 0.975 mg/g and 0.561 mg/g, respectively, according to phytochemical assessments. It was found that the total carotenoids content in tubers was 22.74 mg/100g, while the concentration in seeds was 25.62 mg/100g. In addition, the total ascorbic acid content was found to be 21.06 mg/100g for tubers and 23.34 mg/100g for seeds, according to the findings of Saradha Devi, M. and Annapoorani, S. A number of different compounds, including carbohydrates, alkaloids, glycosides, flavanoids, steroids, phenolics, and terpenoids, were found to be present in the seeds of G. superba. Further investigation revealed that the leaves of G. superba contained a variety of compounds, including carbohydrates, alkaloids, flavanoids, steroids, and terpenoids. The tuber of G. superba was found to contain a variety of compounds, including carbohydrates, alkaloids, flavonoids, vitamins C and E, phenols, glycosides, saponins, and minerals.14, it was noted that the leaves and tubers of G. superba revealed a variety of different groups of chemicals, including alkaloids, flavonoids, glycosides, saponins, steroids, phenols, and tannins. In addition, it was claimed that the G. superba plant has a high concentration of a number of physiologically active chemicals. These compounds have the potential to serve as a source of crude medications that may be utilised as a supplemental source of traditional treatments.

Pharmacological Activities

Many distinct pharmacological actions were displayed by the various components of G. Superba, and a summary of these activities may be seen in Table 1. The action of antimicrobial. In terms of antibacterial action, the phytochemicals that are extracted from the tubers of G. superba have demonstrated a greater level of activity against the gram-negative bacterium known as Escherichia coli. The anti-microbial potential of G. superba extracts was reported by Khan, H., Khan, M.A., and Mahmood, T., in which it was proven that the extracts exhibited outstanding antifungal activity against Candida albicans, C. glabrate, Trichophyton longifusus, Microsporum canis, and Staphylococcus aureus. antibacterial activity of root and stem extracts from G. superba was examined, and the results revealed that all of the extracts possess antibacterial activity against E. coli, S. aureus, A. niger, and A. flavus. The extracts were extracted using acetone, ethanol, methanol, and hexane. The acetone extract of the plant, on the other hand, had the strongest antifungal efficacy against E. coli. In the alcoholic extract of G. superba tubers, a considerable antibacterial activity was identified against gram-negative bacteria, which was shown to be more effective than gram-positive bacteria. Additionally, a fungal strain known as Candida albicans was revealed to be present.

Pharmacological Uses of Gloriosa Superba

Because it contains a large number of bioactive phytochemicals, the Gloriosa superba plant species is an excellent medicinal supplement. According to the data found in the literature, this species was once used to treat a variety of conditions, including arthritis, pains, diabetes, cholera, impotence, typhus, and others.

G. superba has anti-arthritic activity as a result of the effect of colchicine on a number of metabolic events that are triggered by inflammatory mediators. Studies have shown that the effect of plant entire extract is more effective on cells that cause inflammation than the effect of pure colchicine. This may be due to the synergistic activity of colchicine and other bioactive chemicals that are present in plant extract.

Analgesic: The hydroalcoholic extract of the plant has demonstrated that G. superba has an analgesic effect on acetic acid-induced writhing in mice. The number of writhings decreases as the dose of the plant is increased. According to the findings of the studies, the idea of engagement in the suppression of prostaglandin synthesis is supported.

Uterotonic activity: The root extract of Glory lily treatments demonstrates uterotonic activity in both in vivo and in vitro assays of female rats; however, the height of contractions induced by the extract was somewhat lower than that produced by oxytocin hormone therapy. As a result, this plant has the potential to be utilised as a medication to induce labour throughout the process of childbirth.

Larvicidal impact: Glory lily has been shown to have a larvacidal effect on the mosquito Aedes aegypti, which is the insect that causes Chikungunya sickness. As a result, this plant has the potential to be utilised as a biocide in the management of mosquito populations. Antimicrobial activity: The crude extract of the Glory lily demonstrates excellent antifungal activity against Trychophyton longifusus, which is responsible for dermatophytosis on the hair, skin, and nails. Additionally, this plant demonstrates antifungal activity against two species of Candida, namely Candida albicans and Candida glaberata, which are responsible for candidiasis. The antibacterial action of this plant is particularly effective against Staphylococcus aureus. Anti-inflammatory activity: The methanol extracts of the root tubers of the Glory lily have demonstrated good anti-inflammatory action in terms of the percentage of inhibition of cycloxygenase and lipoxygenase assays.

METHODOLOGY

Collection of Plant parts

In Aurangabad, Maharashtra state, India, the GogababaTekkadi campus of Dr. Babasaheb Ambedkar Marathwada University was the area where collections of plant parts were taken. These collections included Gloriosa superba L. and Celastrus paniculatus. Plant parts, tubers, and leaves were washed with tap water to remove soil dust. After that, the soil dust was allowed to dry in the shade before being pulverised into a fine powder and placed in a bottle that was airtight. For the purpose of identifying the plant materials, standard floras such as Cook (1907), Dhore (2005), Naik (1989), and Yadav and Sardesai (2002) were utilised. This allowed for the successful identification of the plant materials.

Fig.1:-Gloriosa superba L.plant and Tuber of Gloriosa superba L.

Preparation of Plant Part Extract

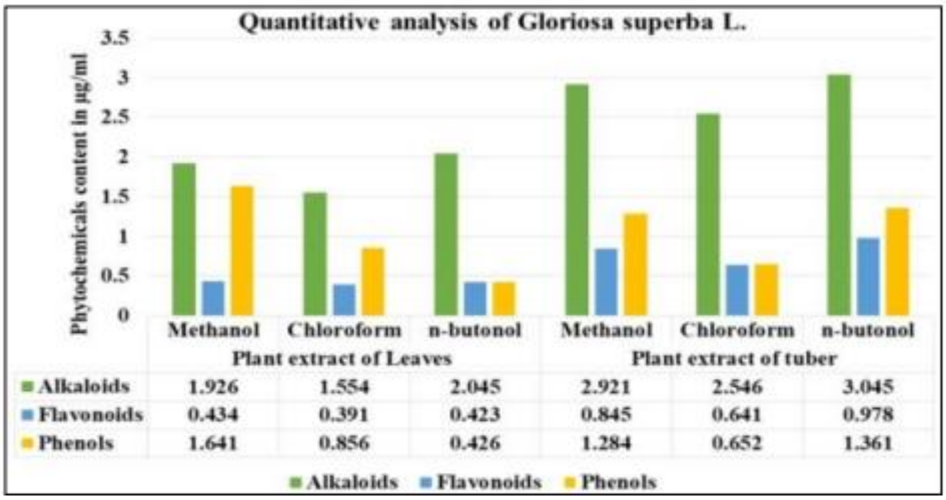
Through the usage of a Soxhlet extractor, methanol, chloroform, and n-butanol extracts were effectively obtained. While the Soxhlet apparatus was being used, a thimble that had thirty grammes of powder from each plant component was placed at the bottom of the equipment. This was done within the chamber of the apparatus. A total of three hundred millilitres of solvent was stored within the flask, and the temperature was maintained at 55 degrees Celsius for a duration of five days. Following the extraction of the extracts, Whatman filters paper No. 1 was utilised in order to filter the extracted substances. It was determined that temperatures ranging from 40 to 50 degrees Celsius were necessary for the solvent to be evaporated using a Rotary evaporator. In order to dissolve the powder that was collected after it had been pulverised and weighed, a solution of dimethyl sulfoxide (DMSO) at a concentration of 10% was utilised. In order to investigate phytochemicals, both qualitative and quantitative studies were conducted with the assistance of the extracts. Additionally, Handa et al. and Subramanian et al. reported similar findings in the year 2008.

Fig.2:- Galea paniculata Angladeanus species, wildBritto, S.J., Mani, B., and Thomas, S. A: How the plant tends to produce its first fruits. B: Branchlets that bear flowers. C: Flower close-up. D: A bract-bearing inflorescence. A fruitful endeavour. Image F: A capsule in close-up. G: Seed-containing capsule.

RESULTS AND DISCUSSION

When it came to the qualitative phytochemical study that was carried out, the solvents that were utilised were methanol, chloroform, and n-butanol, in that order. The tuber and leaves of Gloriosa superba L. were extracted using methanol, chloroform, and n-butanol. The results of these extractions revealed the presence of alkaloid, glycosides, terpenoids, tannin, flavonoids, saponins, steroids, and phenols. On the other hand, the extract of the tuber of Gloriosa superba L. has a larger concentration of phytochemicals than the extract of the leaves, as seen in table no. 1. This difference is proportional to a difference of two. An further point to consider is that neither the methanolic nor the n-butanol extracts of the leaves contain any tannin. Furthermore, the quantitative investigations were carried out with the identical solvent that was described previously in the sentence. Alkaloid concentrations in the tuber of Gloriosa superba L. were determined to be 2.921, 2.546, and 3.045 µg/ml, respectively, according to the findings. The flavonoids extracted from the tuber were determined to have a total concentration of 0.845, 0.641, and 0.978 µg/ml, respectively. Upon analysis, it was discovered that the total phenol content was 1.284, 0.652, and 1.361 µg/ml. The total concentration of alkaloids, flavonoids, and phenols in the methanol was determined to be 1.926, 0.434, and 1.641 µg/ml, respectively. There were three different values found in the chloroform: 1.554, 0.391, and 0.856 µg/ml. In the n-butanol extract of the leaves of Gloriosa superba L., the next highest concentrations were discovered. The values for this extract were 2.045, 0.423, and 0.426 µg/ml.

Quantitative analysis of Gloriosa superba L.



Quantitative analysis of Celastrus paniculatus

S.N.	Chemical constituents	Leaf	Seed
1	Alkaloids	+	+
2	Carbohydrates	+	+
3	Glycosides	-	+
4	Proteins & Amino acids	-	-
5	Sterols &Triterpenoids	+	+
6	Phenolic Compounds	+	+
7	Flavonoids	+	+
8	Saponins	+	+
9	Tannins	+	+
10	fixed oil	+	+

Understanding and remembering are both complicated processes that are impacted by a wide range of different elements. Both of them have the ability to either boost performance, which would make learning simpler, or they can inhibit the process, which would result in impairment. Both of these outcomes are quite possible. There are many different neurological conditions that may be treated with the Celastrus paniculatus plant, which is an essential medicinal herb that is utilised in the traditional Indian medical system. This plant plays a significant part in the disease management process. The fundamental method by which this adaptive plant enhances memory and cognition is through an increase in the quantity of acetylcholine that is present in the brain. This plant is able to adapt to its circumstances. The usage of this chemical can be done either on its own or in combination with other medications. Both the learning and memory processes are considerably improved as a result of this rise in acetylcholine, which plays a vital part in the transformation.

Furthermore, C. paniculatus causes a significant reduction in the levels of neurotransmitters including norepinephrine, dopamine, and serotonin, which are necessary for the processes of learning and memory. This is a noteworthy effect. In experimental models, the oil that was derived from the seeds of the plant was able to reverse the effects of scopolamine on maze performance and specifically offset the effects of spatial memory impairment. This was an impressive achievement. It was the synergistic effect of the active compounds that were involved that made this opportunity attainable. Specifically, this was shown in the sodium nitrite-induced amnesic mouse model, where the aqueous seed extract of the plant exhibited dose-dependent cholinergic effect, which ultimately led to an improvement in memory function.

The aqueous seed extract was able to improve learning and memory in individuals who participated in the shuttle-box and passive avoidance paradigms. This was accomplished by lowering the level of lipid peroxidation (LPO) in the brain and increasing the amount of endogenous antioxidant enzymes that were present in the brain. It was discovered that the activity of acetylcholinesterase (AChE) in the hypothalamus, frontal cortex, and hippocampus of the rat brain was greatly reduced when the seed oil was provided to the rat brain from the radial arm maze (RAM) model. This was the case when the seed oil was administered to the rat brain.

Furthermore, because of the improved antioxidant capacity of C. paniculatus oil, it is possible to cure the symptoms of Attention Deficit Hyperactivity Disorder (ADHD) in rats. This is in accordance with the findings of a study that was conducted. On the other hand, the seed oil has the ability to reduce levels of glutathione (GSH), catalase (CAT), and malondialdehyde (MDA), while at the same time increasing levels of superoxide dismutase (SOD). The altered levels of bioamines, dopamine, noradrenaline, and serotonin, which are implicated in the pathophysiology of attention-deficit/hyperactivity disorder (ADHD) and are essential for the processes of learning and memory, are also restored during the course of this treatment.

The capacity of the seed oil to prevent learning and memory deficits in rats that have been driven to develop neurodegeneration by kainic acid makes it conceivable that the seed oil's antioxidant and anti-inflammatory characteristics are responsible for this ability. The level of serum uric acid in rats was found to have greatly increased, which is a protective factor against Alzheimer's disease due to the antioxidant features that it contains, according to the findings. A large increase in serum uric acid levels was seen in rats. SOD, CAT, and GSH levels were greatly increased by uric acid, whilst MDA levels were significantly reduced in the substantia nigra areas of mice that had been treated with MPTP. This was seen in the animals that had been given the MPTP treatment. Furthermore, it was shown that the presence of uric acid has the ability to restrict the expression of proinflammatory cytokines in the hippocampi, which are among them IL-1β. The levels of interleukin-1β, interleukin-6, and tumour necrosis factor-alpha (TNF-α) in the blood and the hippocampus were also reduced.

The cognitive dysfunctions that were caused by 3-Nitropropionic acid (3-NP) were significantly improved by pre-treatment with ethanolic and aqueous extracts of C. paniculatus. This was evidenced by the great improvement. Attributing this improvement to the high antioxidant impact that the extracts contained was the conclusion that was reached. Both extracts had a neuroprotective effect against the neurotoxicity that was brought about by glutamate and hydrogen peroxide. This was accomplished by inhibiting NMDA receptors with their respective chemical compounds. The pretreatment of foetal bovine nasal cells (FBNC) with the aqueous extract significantly decreased the amount of neuronal death that occurred as a result of glutamate-induced damage. This was accomplished via modifying the activity of glutamate receptors. The fact that rats that were administered oil from C. paniculatus showed a significant decrease in both their blood levels of cortisol and cholinesterase was an indicator that the oil provided neuroprotection.

CONCLUSION

In conclusion, the quantitative analysis has shed a great deal of light on the pharmacological potential as well as the phytochemical composition of both Celastrus paniculatus Wild and Gloriosa superba L. These medicinal plants include a number of key bioactive components, including alkaloids, flavonoids, phenolic compounds, and terpenoids, among others. Using a wide range of analytical techniques, such as high-performance liquid chromatography (HPLC), gas chromatography mass spectrometry (GC-MS), and spectrophotometry, we were able to identify and quantify these components. The wide pharmacological capabilities of these plants, which include their anti-inflammatory, analgesic, anti-cancer, neuroprotective, and memory-enhancing activities, are brought to light by our findings, which provide evidence for their historical usage in a variety of therapeutic systems. Both Gloriosa superba L. and Celastrus paniculatus Wild contain a large quantity of bioactive compounds, which are responsible for their pharmacological effects. These substances include flavonoids, sesquiterpenes, superbinine, gloriosine, and colchicine, among others. Not only does our results emphasise the relevance of doing quantitative analysis, but it also underlines the importance of gaining a deeper knowledge of the chemical components that are responsible for the biological activities that have been documented. These understandings are essential for logically constructing standardised herbal medicines and locating lead compounds for the purpose of drug development projects. A greater amount of research is required in order to acquire a comprehensive understanding of the therapeutic potential of Celastrus paniculatus Wild and Gloriosa superba L. For the purpose of this investigation, comprehensive pharmacological evaluations had to be carried out in both preclinical and clinical settings. We need to identify techniques to extract and purify these compounds in order to make their bioactive contents more accessible and effective. Additionally, we need to have a better understanding of the pharmacological effects that these compounds have. Furthermore, the quantitative analysis that is presented in this study contributes to our understanding of these medicinal plants and their long-term use, which is essential for the ultimate adoption of these plants into modern medical practices. By using the therapeutic characteristics of Celastrus paniculatus Wild and Gloriosa superba L., we have the potential to find new approaches to the treatment of illnesses and to improve the health of humans.

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