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STRUCTURAL ANALYSIS STOMATAL PATTERNS AND CUTICULAR WAX DEPOSITION IN THE GLORY LILY (GLORIOSA SUPERBA L.)

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ABSTRACT

The Glory Lily (Gloriosa superba L.) is an intriguing flowering plant renowned for its distinctive beauty and medicinal properties. Research into the microscopic structure and function of plant leaves is known as foliar micromorphology. The stomatal type, shape, and orientation, as well as the cuticular wax deposition, were all uncovered by a structural investigation of the epidermal tissues and leaf architecture of G. superba. Maximum stomatal density was found on the abaxial epidermis. An organized stomatal pattern of anomocytic stomata was present in the epidermis. The stomatal density was 13.0 and the stomatal index was 28.

Keywords: Stomatal morphology Wax, Leaf, Foliar, Density

I. INTRODUCTION

It is said that the name Gloriosa was derived from the adjectives "glorious," which means lovely, and "superb," which implies astounding or majestic in nature. A beautiful perennial that may spread both by seed and by fleshy rhizome. It is a climber with modified leaves that finish in tentacles. The stem can reach heights of four meters, however it is hollow, weak, smooth, and has few branches. The stem is also green in color. The leaves are simple, alternate, opposite, sessile, ovate, and lance-shaped, and the tendrils can reach a length of twenty centimeters. They are not well-suited to be pollinated by small insects because they are heterosexual, solitary, large, very attractive, initially greenish, then yellow, passing through orange, and scarlet, to crimson in color, and have six perianth lobes bent backwards, the number of tepals, stamens, and anthers are all six, and the single style is bent almost 90° at the point of attachment to the ovary. There are many seeds inside the fruit capsule, which can grow to be 12 centimeters in length. The tuber crop is ready for commercial harvest in three to four years.

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Even though tubers are the primary vector for this disease's propagation, it moves at a glacial pace. Gloriosa superba L. prefers regions with a significant wet season and low humidity, and it will not thrive in the tropics. Although it is most common in savanna-forest, you may also spot this plant-climbing species in other types of vegetation, such as open woodland, thickets, grassland, bush-land, and hedges. It grows both at ground level and at altitudes up to 2,500 meters. It prefers slightly acidic to neutral soil that drains well and is not depleted of organic matter.

The Glory Lily has a rich historical and cultural significance across different regions where it is found. In various African countries, such as Zimbabwe and South Africa, it holds symbolic importance and is often associated with cultural festivities and traditional ceremonies. The vivid colors of its flowers have inspired artists, poets, and writers for generations, further accentuating its cultural importance.

In the Indian subcontinent, Gloriosa superba has been treasured for its medicinal properties for centuries. Ayurvedic, Siddha, and traditional Chinese medicine systems have used various parts of the plant to treat a wide range of ailments, including fever, inflammation, skin disorders, and menstrual problems. Its roots, leaves, and tubers are believed to possess potent therapeutic compounds, and their preparation and usage have been documented in ancient texts.

One of the most significant aspects of Gloriosa superba is its pharmacological potential. Various parts of the plant contain a group of alkaloids known as colchicines, including colchicine, gloriosine, and colchicoside. These alkaloids have attracted extensive scientific interest due to their diverse medicinal properties. Colchicine, in particular, has been the subject of intensive research in modern medicine due to its anti-inflammatory and anti-mitotic properties. It has found application in the treatment of gout, Behçet's disease, and familial Mediterranean fever, among other conditions. Additionally, colchicine's anti-tumor effects have led to investigations into its potential as an anticancer agent.

The roots and tubers of G. superba have been used in traditional medicine systems to treat various ailments, including fever, rheumatism, snakebites, and skin diseases. The local communities in regions where it grows have developed knowledge about the plant's preparation and administration, passing down this invaluable wisdom through generations. Beyond its cultural and medicinal significance, the Glory Lily has considerable economic importance. The plant's attractive flowers make it a popular choice for ornamental gardening and floral arrangements, contributing to the horticultural industry.

II. REVIEW OF LITERATURE

Mayakrishnan, Balachandar et al., (2022) The considerable therapeutic value of Gloriosa superba L. makes it an economically significant plant. However, most Gloriosa taxa have been synonymized as G. superba, therefore species delimitation has to be revisited. This study was

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thus initiated to examine the G. superba's vegetative anatomical characteristics. To document the anatomy of G. superba, freehand sections were cut and stained with different staining solutions from the leaf, scale leaf, tendril, stem, tuber, and roots. Each plant component's cellular dimensions were calculated. Anomocytic stomata on the abaxial surface, cuticle-covered uniseriate epidermis, undifferentiated mesophyll, and a bundle sheath enveloping vascular bundles were all found in this investigation of a leaf's anatomy. The scale leaf, in contrast to the leaf, has air chambers in the mesophyll and lacks a bundle sheath. Several layers of cells formed wall thickenings and collateral vascular bundles underneath the tendril's uniseriate cuticularized epidermis. The mature stem has a bi-layered epidermis, no stomata on its surface, and a chlorenchymatous hypodermis, all of which set it apart from the immature stem. The stem was found to have an air route with epidermis and a thin cuticle covering it. The ground tissue of tubers contains starch granules. The earliest record of velamen in G. superba root is here. The root metaxylem has a scalariform perforation end plate. Arbuscular mycorrhizal and dark septate endophytic fungi inhabit the roots of G. superba. Therefore, it's possible that these anatomical characteristics of G. superba will help in its identification.

Vaishnavi, B.A. et al., (2019) When it comes to medicinal plants, the glory lily is a crucial yet threatened species. Glory lily, or climbing lily as the locals say in southern India, is one of the common names for this flower. Colchine and colchicoside are two important alkaloids found in the plant's seeds and tubers, and they have been used for centuries in traditional medicine and pharmacology to treat a wide range of illnesses. The tuber is used to treat a wide variety of ailments, from cancer and impotence to haemorrhoids and nocturnal seminal emission. It is also used to induce labor and terminate pregnancies. In addition to its usage in treating wounds and skin conditions, fever, inflammation, piles, blood disorders, uterine contractions, general body toning, and poisoning, gloriosa superba is also used to treat these conditions. The placenta may be expelled and the roots are very toxic, acrid, anthelmintic, antipyretic, bitter, digestive, expectorant, and expectorant. Paralysis, rheumatism, snake bite, and bug bites are all well treated with the root paste. Therefore, the purpose of this paper is to compile as much data as possible about the pharmacological effects of glory lily.

N., Ashokkumar (2018) During 2016, researchers from the Department of Nematology at Tamil Nadu Agricultural University in Coimbatore tested a method for increasing the levels of both main and trace nutrients in Glory lily rind. According to the findings, incorporating farm yard manure into the rind of Gloriosa superba significantly enhanced the concentrations of both key nutrients like nitrogen and potassium and trace elements like calcium, magnesium, iron, copper, and manganese. In addition, the nutritious content of these foods has been found to significantly increase if the rind is degraded using Farm Yard Manure. The nutritional breakdown is as follows: (N 0.50%, P 0.14%, and K 0.98%; Ca 0.09%, Mg 0.03%, Fe 2.68 µg/g, Cu 21.3 µg g-1, Zn 35.6 µg g-1, Mn 459.7 µg g-1) The addition of farm yard manure to G. superba rind increased the concentration of several nutrients, including phosphorus, potassium, calcium, magnesium, iron, zinc, and manganese, all of which can be used as soil

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amendments for the prevention of plant parasitic nematodes. G.superba was given a boost to its economic worth as a result of the breakdown of its rind with farm yard manure.

Padmapriya, S. et al., (2016) The tubers of the herbaceous or semi-woody climber Gloriosa superba are fashioned like a v. The plant's alkaloids, colchicines, and colchicosides are highly prized for their therapeutic benefits, especially in the treatment of cancer-related disorders, arthritis, gout, rheumatism, and impotence. Colchicine inhibits mitotic cell division, hence it also functions as an anti-mitotic agent. Anti-inflammatory and analgesic thiocolchicoside (TCC) is a semi-synthetic derivative of natural colchicoside. The beautiful, vivid blooms and hercogamous character make cross pollination a natural occurrence. Catering to the demands of the phytopharmaceutical businesses requires the development of genotypes with increased seed output, alkaloid content, and field resistance to key pests and diseases. Glory lily is a climber, thus trellies or standards are necessary for it to thrive. The need for tubers from the wild has been alleviated thanks to the rapid proliferation of microtubers grown from the seed material. This article discusses the glory lily from a variety of perspectives, including its botany, therapeutic applications, cytogenetics, floral biology, breeding techniques, culture, post-harvest technologies, and phytochemistry.

Banu, H. & Nagarajan, N. (2012) The stunning tuberous climbing plant Gloriosa superba Linn. (Family: Liliaceae) is one of the endangered species of medicinal plants; it is found in forests across India and the Andaman Islands, and it features vivid wavy-edged yellow and red blooms. The purpose of this research was to analyze the phytoconstituents present in extracts of the leaves and tubers of the Gloriosa superba plant. All experiments conformed to accepted methods. Alkaloids, flavonoids, saponins, glycosides, steroids, phenols, and tannins were all found in the results. None of the extracts tested positive for the presence of resins. Phytochemical analysis revealed that the plant was abundant in a number of physiologically active chemicals, suggesting it may be mined for crude medications to supplement existing medical treatments. In order to isolate and characterize the many chemical active components, we suggest more study of this plant.

III. MATERIALS AND METHODS

Collection and identification plant material

Gloriosa superba plants that were free of disease when they were gathered were found along the coast of India between November 2019 and April 2020. The third to seventh leaves from the plant's base were randomly chosen to gather the necessary leaf samples using sterile scissors. Micromorphological and architectural investigations of leaves, both qualitative and quantitative, were conducted on fresh leaves.

Foliar micromorphological studies

Micromorphological characteristics of G. superba leaves were studied in their native habitat.

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Paradermal slices, taken manually using the conventional procedure, were analyzed to learn more about foliar micromorphological characteristics such stomatal orientation, type, shape, density, distribution, and stomatal index.

Statistical analyses

Data for many factors, including stomatal density, frequency, and stomatal index, were derived using Salisbury's (1932) approach. ANOVA was used in SPSS version 16 for the statistical analysis. The data were given as the mean SD from three separate studies, and statistical significance was determined using Duncan's multiple range tests at a significance level of $P < 0.05$.

IV. DATA ANALYSIS AND INTERPRETATION

The structure of the epidermis has been factored into analyses of species' evolutionary histories. Micromorphological features of a species' leaves are used as biomarkers and aid in the authentication of foliar medications in pharmacognosy. In this analysis, we used the Stomatal density and Stomatal index to measure the micromorphological and architectural features of the leaves. Stomatal characteristics of G. superba are listed quantitatively in Table 1.

Micromorphology of leaf surfaces is researched extensively in agriculture and horticulture to ascertain the dispersal and deposition of foliar spray. Micromorphological features of the leaves, such as cuticle (epicuticular wax), leaf position and angle, stomatal density, and trichome density, impact the uptake of herbicides and growth-promoting hormones in horticultural types.

Epidermal surface

The epidermal cells were massive, elongated, and tightly packed. The paradermal slice revealed deep cuticular striations and undulating anticlinal walls. The epidermis acts as a barrier between the plant's exterior and its interior tissues. Water loss is reduced, gas exchange is regulated, and metabolic chemicals are secreted from the epidermis in plants. Epidermal cells have unique structural characteristics between species. Folding and curling of epidermal cells provided the structural rigidity of monocot leaves.

Stomatal pattern and density

Abaxial epidermis has more stomata per unit area than adaxial epidermis. Several monocot grass species, including Setaria viridis, have similar documentation. The majority of G. superba's stomata were found to be anomocytic, with unclear subsidiary structures (Fig. 2B). There were distinct coastal and intercostal zones. All stomata were pointing in the same direction, but the distance between them varied (Fig. 2A). Stomata were more common in the lamina's intercoastal sections and less common in its coastal regions. When the stomata were close together, a single subsidiary served three to four of them. The length of the stomata, which are surrounded by epidermal cells, varies. G. superba had a stomatal density of 13.0 and a stomatal index of 28.0 (Table 1).

Table 1: Statistics on the density and index of stomata in G. superba

Field No.	Stomatal density (Mean±SD)	Stomatal Index (SI) (Mean±SD)
1	11.0 ± 0.13a	28.0 ± 0.31b
2	10.0 ± 0.24b	24.0 ± 0.15a
3	13.0 ± 0.13d	33.0 ± 0.18e
4	10.0 ± 0.30a	31.0 ± 0.20d
5	11.0 ± 0.15e	32.0 ± 0.09e
6	13.0 ± 0.09d	26.0 ± 0.16a
7	13.0 ± 0.27c	27.0 ± 0.21b
8	12.0 ± 0.22d	28.0 ± 0.10c
9	14.0 ± 0.08b	30.0 ± 0.20d
10	13.0 ± 0.16d	32.0 ± 0.21e
Mean	13.0 ± 0.18c	28.0 ± 0.12c

Note: The values in the columns labeled with the same letters are not statistically distinct from one another at the $P < 0.05$ level, as determined by a mean separation analysis performed in SPSS (version 16.0).

Type and number of stomata are intrinsic characteristics of a particular species at any geographic level, but due to environmental factors the shape and structure were modified. This parameter could be used to identify the growth and developmental stages of plants.

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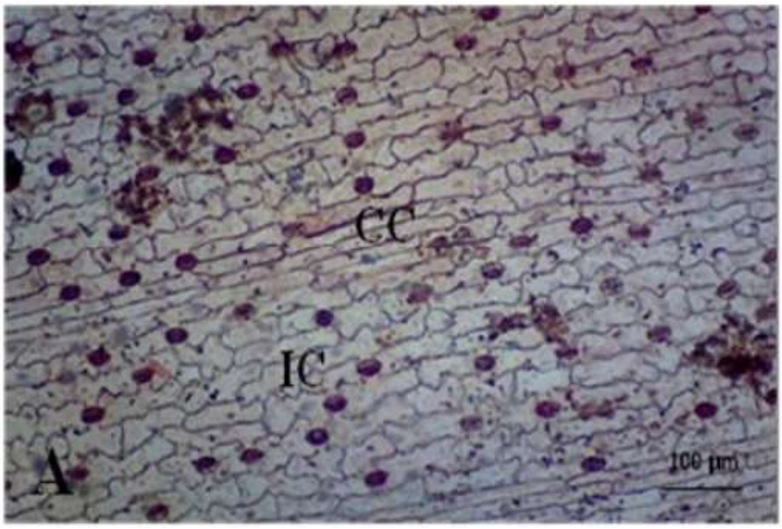

(A) Stomatal distribution and density in abaxial epidermis (CC – Costal cells, IC – Intercoastal Cells)

(B) Paradermal section of stomatal distribution – magnified view (AST – Anomocytic Stomata, EC – Epidermal Cells)

Figure 2 Pattern of stomata in Gloriosa superba

Monocotyledonous plants are distinguished by their alternating cell files of stomata and pavement cells. Because the abaxial side is less exposed to heating, it has been claimed that the density of stomata is highest there and lowest on the adaxial surface to prevent excessive water loss. Water loss may be reduced and the photosynthetically active palisade mesophyll cells located in close proximity to vascular bundles may be better protected if coastal cells lack stomata.

V. CONCLUSION

The Glory Lily (Gloriosa superba L.) stands as a testament to the intricate beauty and interconnectedness of the natural world. Its flamboyant flowers and medicinal properties continue to enchant and benefit humanity, underscoring the importance of preserving biodiversity and safeguarding the treasures that nature bestows upon us. By valuing and protecting G. superba, we not only honor its rich history but also embrace the opportunity to unlock new possibilities for both traditional and modern medicine while ensuring a brighter, sustainable future for this glorious gift of nature. Due to scarcity of this species, adulteration in leaf drug of G. superba in the market samples could be identified through these parameters.

REFERENCES: -

1. Mayakrishnan, Balachandar & Ravichandran, Koshila Ravi & Thangavelu, Muthukumar. (2022). Vegetative anatomy and endorrhizal fungal morphology of an endangered medicinal plant Gloriosa superba L. Microscopy Research and Technique. 85. 10.1002/jemt.24183.

2. Vaishnavi, B.A. & Khanm, Hajira & Hr, Bhoomika. (2019). Review on Pharmacological Properties of Glory Lily (Gloriosa superba Linn.): An Endangered Medicinal Plant. International Journal of Current Microbiology and Applied Sciences. 8. 1359-1364. 10.20546/ijcmas.2019.802.159.

3. Chaudhary, Sachin & El-Shorbagi, Abdel-Nasser & Shridhar, Bhawna & Gupta, Mandeep & Verma, Harish. (2019). A REVIEW ON PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE OF GLORIOSA SUPERBA LINN.. International Research Journal Of Pharmacy. 10. 1-5. 10.7897/2230-8407.1004113.

4. N., Ashokkumar. (2018). Studies on nutrient enhancement of Glory lily (Gloriosa superba L.), Rind.

5. Padmapriya, S. & Rajamani, K. & Sathiyamurthy, V.A.. (2016). Glory lily (Gloriosa superba L.) - A review. 7. 43-49.

6. Manokari, M. & Shekhawat, Mahipal. (2016). Foliar Micromorphological and Architectural Studies of Glory Lily (Gloriosa superba L.)-An Important Medicinal Plant.

7. Alemu, I.D., and T.M. Daba. 2016. Gloriosa, a Source of Colchicine: Review Article. In. J. Chem. Sci. 10 (4): 1888- 1893

8. Maroyi, A. 2012. “The genus Gloriosa (Colchicaceae): Ethnobotany, Phylogeny and Taxonomy.” PhD diss., Wageningen University, The Netherlands.

ISSN: 2320-3714
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Impact Factor: 10.1
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9. Banu, H. & Nagarajan, N.. (2012). Phytochemical screening for active compounds in gloriosa superba leaves and tubers. International Journal of Pharmacognosy and Phytochemical Research. 4. 17-20.

10. Hemaiswarya, Shanmugam & Raja, Rathinam & Anbazhagan, Chinnathambi & Venkatesan, Thiagarajan. (2009). Antimicrobial and mutagenic properties of the root tubers of Gloriosa superba Linn. (Kalihari). Pakistan Journal of Botany. 41. 293-299.

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