

Tissue Culture on Medicinal Plants –Stages

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ABSTRACT

Natural resources are not unlimited. Some indigenous plants in different regions have already become extinct. *G. superba* linn. is a commercially imperative medicinal plant which has diverse medicinal applications and eventually due to over-exploitation this plant is facing local extinction. A perusal of the literature shows that *G. superba* linn. has been widely used for diseases. A number of pharmacologically important phytochemicals such as gloriosine and colchicines have been isolated from this plant. On the behalf of previous reports based on this plant we can say how this plant and their contents are important. So the conservation of this plant very important. Cultivation may not be solution to save and at the same time utilize sustainably the endangered medicinal plant. The plant will conserved by tissue culture technique. By this technique not only we cultivate the good quality of plant but also enhance the valuable component of plant and reduce the over harvesting of plant. Plant biotechnology which has the potential to help build a sustainable economy based on primary plant production can also be applied to assist indigenous endangered plants. In particular, plant tissue culture technology including micropropagation has much potential in facilitating experimental studies to gain a better understanding of the biology of endangered plants. This will be of benefit to the development of appropriate management strategies to safeguard the sustainability of endangered plants.

KEYWORDS: *G. superba* linn., Endangered Medicinal Plant, Conservation, Medicinal Uses and Economic Uses

INTRODUCTION

Medicinal plants are largely used by all divisions of the population either directly as folk medications or indirectly in the preparation of recent pharmaceuticals. Indian subcontinent is praised with most varied and diverse soil and climate conditions suitable for the growth of veracious plant species. The native people are acquainted with the properties and use of plants of their surroundings. People depend on the forest resources for several purposes like for timber, wood, non-timber forest products, medications, food etc (Pushpangadan, 1995). Plants have been used as medicines for thousands of years and are used today in their natural as well as processed from several medicinal plants which have been forgotten by current man as a conclusion of his dependence on the quick results of allopathic medicines and are being rediscovered because of growing awareness of unwanted side effects and other attitudes of the later (Alagesaboopathi 2009, 2011). Herbal

renaissance" is happing all over the globe as herbal products are the symbol of safety as compare to synthetic medicine, which could be regarded unsafe to human and environment (Samanta et al., 2005).

Traditional systems of plant-based medicine have served the people of south central Asian region since time immemorial. Ancient texts among the Indian literary records such as rigveda and atharvaveda (2000-1000BC) portray extensive references on the description and use of several plants as source of medicine. Later during 1000-600 BC compilation exclusively dedicated to medicinal plants and their use written by Charaka and Susrutha included Charaka Samhita and Susrutha Samhita. From time immemorial, man has been dependent on nature for survival. This dependency

led the aboriginal people living in harmony with nature to evolve a unique system of knowledge about plant wealth by trial and error methods. Traditionally, this treasure of knowledge has been passed on orally from generation to generation without any written document (Samy et al. 2008).

Medicinal plants have been an integral part of life in various regional communities for food and drug both. The ethnobotanists are trying to ascertain new medicines from the forests by the help of tribal people. In India, the population of tribal people is around fifty three million along with 555 tribal groups or communities, which are reside in forest and surrounding.

These people have enormous indigenous knowledge which is a possible tool to explore for novel cost-effective plants for food as well as medicine (Lal et al., 2011). The popularity of traditional medicines has grown enormously during the recent years. The domestic demand for traditional medicines in India has increased. The market of traditional systems of medicine in India is estimated to be about Indian rupees 4000 corers per year¹²⁻¹⁴ (Wadankar et al., 2011). *G. superba* linn. is one of the endangered species among the medicinal plants, which is a striking tuberous climbing plant With brilliant wavy edged yellow and red flowers that appears from November to March every

year (Kavina et al., 2011).

This review is aimed at compiling an up-to-date medicinal and economical properties or all related information's of *G. superba* over its distributional range, current status and role of biotechnology for the conservation of this important plant.

Plant Profile and Classification

G. superba Linn. belongs to the family Liliaceae, commonly known as glory lily, superb lily, tiger lily or tiger claws, is an important medicinal plant of the Tropics (Ridley, 1924). *G. superba* Linn. is a perennial herbaceous vine growing 3.5 to 6.0 meters in length show in figure 1. *G. superba* is a tuberous plant with V or L-shaped, finger-like tubers that are pure white when young, becoming brown with age. It is a climbing herb, sometimes erect up to 6 m long, bearing pointed, dark green, glossy leaves, each equipped with a tendril by means of which it clings onto other plants.

Leaves occur in whorls of 3 to 4, opposite or alternate, simple, sessile, ovate to lanceolate ranging from 6 to 20 cm in length and 1.5 to 4 cm wide. The attractive flowers are borne on long stalks and have six erect petals ranging in colour from bright yellow to bicoloured, red and yellow or purple and yellow. The fruits are capsules that split open to release several smooth red seeds with a spongy test (Maroyi et al., 2011).



**Figure 1: *Gloriosa superba* Linn.
Scientific Classification**

Kingdom : plantae

Subkingdom –Tracheobionta

Division- Spermatophyta

Class- Liliopsida

Subclass- Liliidae

Order- Liliales

Family- Liliaceae

Genus- *Gloriosa*

Species- *Gloriosa superba* Linn.

Habitat of *G. superba* linn.

Gloriosa is a native of tropical Asia and Africa. The genus derives its name from the Latin word gloriosus, referring to the flowers. It is found growing throughout tropical India, from the North -West Himalayas to Assam and the Deccan peninsula, extending up to an elevation of 2120 M. In Karnataka, it is commonly found growing all along the Western Ghats; it is also found growing in Madagascar, Srilanka, Indo-China and on the adjacent island (Faroogi and Sreeramu, 2001). The plant grows in sandy-loam soil in the mixed deciduous forests in sunny positions. It is very tolerant of nutrient-poor soils. It occurs in thickets, forest edges and boundaries of cultivated areas in warm countries up to a height of 2530 m. It is also widely grown as an ornamental plant in cool temperate countries under glass or in conservatories (Acharya, 2006).

Chemical Constitutes of *G. superba* linn.

Studies reveal that all parts of the plant, especially the tubers are extremely toxic due to the presence of a highly active alkaloid, Colchicine. The species also contains another toxic alkaloid, Gloriosine.

Other compounds such as lumicolchicine, 3-demethyl-N-deformyl-N-deacetylcolchicine, 3-demethylcolchicine, N-formyldeacetylcolchicine have been isolated from the plant (Chulabhorn *et al.*, 1998).The tubers or dried roots contain colchicines, benzoic and salicylic acid, sterols and resinous substances-colchicines, 3-demethyl colchicine, 1,2-didemethyl colchicine, 2,3- didemethyl colchicine, N-formyl, N-deacetyl colchicines, colchicocide, gloriosine, tannins and superbine (Jain and Suryavanshi, 2010). Colchicine and its derivative from tubers. Silosterol, its Glucoside and beta and Gamma Lumicolichicines. Beta silosterol, its Flucoside and 2-H-6-MeO benzoic acid. Flower's contain Luteolin, its Glucoside, N-Formyl-de-Me-colchicine, its Glucoside and 2-de-Me-colchicine Content of Colchicine 0.25%.

Pharmacological Value

Gloriosine and colchicine are two commonly used phytochemicals that is present in whole part of plant. Due to the presence of these alkaloids *G. superba* show many pharmacological properties like anti inflammatory [Jomy *et al.*, 2009], Antimicrobial

(Hemaiswarya, 2009), Antithrombotic/Anticoagulant potential (Kee et al., 2008), Anticancer activity (Reuter, 2010), Snake bite potential [Haroon, 2008], Hapatoprotective activity (Mohandass, 2011), Antioxidant activity (Amudha and Shanthi, 2011) and Anthelmintic Activity (Pawar, 2010) etc .

Traditional Uses of *G. superba* linn.

The root tuber is mixed with babchi seeds (*Psoralea corylifolia*), black cumin (*Nigella sativa*) and purple fleebane (*Vernonia anthelmintica*) and is made to a paste and is applied externally for various skin diseases (Gopi Radha). Traditionally, the rural women prefer *G. superba* plant for gynecological disorders like abortion, menstrual trouble, conception disorders, sterility, delivery problems, etc rather than modern medicines. The Gond tribe of Madhya Pradesh in case of induced abortion they grind rhizome/tuber of the plant kalihari (*G. superba*) mixed with ghee and used orally (Tiwari et al., 2003). The tribes of Deogarh district used *G. superba* against piles. It is ethnomedicinally very important to the tribal's. The people of this region derive immense benefit by using herbal medicines for their primary health care (Sahu, 2010). The roots and rhizomes are used in traditional system of medicine. Rhizome is anticancerous, oxytocic, antimalarial, stomachic, purgative, cholagogue, anthelmintic, alterative, febrifuge and antileprotic. Leaf is antiasthmatic and antiinflammatory. Root shows antigonorrhoeic and antibiotic activity.

Economic Importance

G. superba linn. is also known as the national flower of Zimbabwe Except miscellaneous pharmaceutical product and other therapeutic preparations, it is also a popular plant for providing color in greenhouses and conservatories even immature flowers are beautiful to behold All parts of the plant, especially the tubers, are extremely poisonous. The

tubers may be mistakenly eaten in place of Sweet Potatoes (*Ipomoea batata*) since the tubers resemble those of sweet potatoes. The juice of the leaves is used as an ingredient in arrow poisons. The flowers are used in religious ceremonies. *G. superba* is believed as most important herb that is exported, and collection of seeds and roots for the foreign market is causing a shortage of raw material for local drug industries in India. If endangered plants like *G. superba* are allowed to become damaged through excessive collection, a whole series of traditional medicines and plants which have been in use for thousands of years will be threatened (kirti et al., 2007).

Current Status

G. superba Linn. is an important medicinal plant of Asia and Africa. It is used in diseases, like cancer, gout, scrofula and act as antipyretic, antihelmintic, purgative and antiabortive. It is a source of colchicines and colchicocides, which are very costly, being highly demanded by pharma industries. Due to excessive use of the plant for diverse medicinal purposes the species is on the verge of extinction and included in Red Data Book. The strenuous efforts of botanists, biotechnologists, policy makers and conservationists are required. It is a matter of great concern to conserve this plant otherwise we will be losing it by 2020 (Ade, 2009).

Reason of Extinction

Medicinal plants are basic resource for human health. Interest in and demand for traditional remedies and other plant based health products are increasing worldwide. *G. superba* linn. is an important medicinal plant, which contain many valuable secondary metabolites. Due to heavy market demand of different useful parts of plant, the availability is continuously decreasing in wilderness. Due to over harvesting from the natural forest during the last decade, this commercially traded plant is going to be vanished in the

near future due to unique medicinal properties, demand in Indian as well as international market. This increasing demand has created exploitation pressure on natural forests (FRLTH, 2003). Some other factors are also responsible for extinction of *G. superba* linn. in which habitat destruction is a major external factor affecting plant population under wild conditions. Loss of habitat is also a threat to this plant species growing in the natural forest. Uncontrolled cattle's grazing is highly detrimental to the species. Trampling and grazing by livestock kills most of the young seedlings. The frequent forest fires affect most of the forest area and destroy many

important plants in forest. Tubers, fruits and seeds of *G. superba* dispersed on ground get burnt due to these forest fires (Mishra 2009).

Role of Biotechnology Tools for their Conservation

G. superba L. is a medicinal climber, its seeds and tubers contain valuable alkaloids viz., colchicine and colchicoside as the major constituents, which are used to treat many diseases (Chitra, 2010). *G. superba* usually multiply by corm and seeds but due to low germination capability it restricts for the regeneration. *G. superba* is a commercially imperative medicinal plant which has diverse medicinal applications and eventually due to over-exploitation this plant is facing local extinction. Some time plant tissue culture techniques play a key for conservation of this plant. At present Plant tissue culture offers a valuable to overcome the problem regarding conventional propagation, and obtain disease free healthy plants (Neha Bhagat, 2011). Its seeds have poor germination and low availability, while propagation by corm also a limiting factor, making micropropagation an essential proposition in order to meet the demand for quite a huge amount for raw material by pharmaceutical industries (chaturvedi 2007). Plants have been regenerated from somatic embryogenesis, caulogenesis, direct plantlet formation and regeneration of shoot buds

from root (chaturvedi 1968). One of the main problems for any credible experimental studies with endangered or threatened plants is that there are so few of them in the natural populations.

Plant tissue culture, particularly micropropagation techniques can be applied to clone a large number of an endangered plant with minimal damage to the natural populations (Carson and Leung, 1994; Faisai et al., 2007; Chaudhuri et al., 2008; Mohammadi-Dehcheshmeh et al., 2008). Although the large number of plants regenerated in the tissue culture laboratory can be introduced back to the natural environments, there might be some unforeseen potential risks associated with monoculture practice. Clearly this is not desirable. Therefore, the main utility of the clonal plants is for experimental studies as there would be little or greatly reduced variability due to plant materials. They can be deployed to gain clearer insights into all aspects of the biology of the endangered plants. These are pre-requisites to development of strategies to manage them in relation to the whole spectrum of potential threats including climate change. Plants regenerated following this in vitro selection scheme might be genetically improved plants with an expanded capacity to cope with or even thrive in drier conditions that are projected to result from climate change. Therefore using this non-controversial, non-genetic engineering approach could be an option to ensure the sustainability of the endangered plant (Gopal et al., 2008). People's participation in conservation of rare and endangered medicinal plants like *G. superba* will also be very useful. There is a pressing need to conserve the plant by *in situ* and *ex situ* multiplication in general and micropropagation in particular so as to meet the ever increasing demand from the industries (Kapai et al., 2010).

CONCLUSIONS

G. superba is a commercially imperative medicinal plant which has diverse medicinal

applications and eventually due to over-exploitation this plant is facing local extinction. A perusal of the literature shows that *G. superba* has been widely used for diseases. A number of pharmacologically important phytochemicals such as gloriosine and colchicines have been isolated from this plant.

On the behalf of previous report based on this plant we can say how this plant and their contents are important. So the conservation of this plant very important. Cultivation may not be solution to save and at the same time utilize sustainably the endangered medicinal plants. Plant biotechnology, particularly plant tissue culture technology including micropropagation techniques, which have already been applied to the primary production systems could also be applied to assist advancing our knowledge concerning all aspects of their biology. This is needed for informed management strategies to minimize the projected extinction fate for many of them. The plant will conserved by tissue culture technique. By this technique not only we cultivate the good quality of plant but also enhance the valuable component of plant and reduce the over harvesting of plant.

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