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Review Article

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TOXICOLOGICAL AND THERAPEUTIC APPLICATIONS OF MEDICINALLY IMPORTANT PLANT *LANGALI (GLORIOSA SUPERBA LINN.)*- A REVIEW

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ABSTRACT

Agadtantra is one among the *Ashtanga* of *Ayurveda*, which deals with all cases of poisoning. In *Ayurveda*, the concept of poison is vast and etiologically varied, if a poisonous plant is used accurately, it can become an excellent drug as there can be important source of chemical substances with great therapeutic effects. In *Ayurvedic* ancient literature, *Gloriosa superba Linn.* a plant from Liliaceae family, comes under the *Upavisha* category. Despite being a poisonous plant, roots, leaves and seeds of *Langali* are used in folklore medicine and nowadays it is grown for its high colchicine content to be used in gout. It is also used for the treatment of bruises and sprains, chronic ulcers, hemorrhoids, impotence, cancer, leprosy, inducing abortion etc. In this review an endeavor has been made to explore the poisonous effects and therapeutic utilities of *langali* according to modern as well as ayurvedic perspective from different available literature, where *langali* is described for its poisonous actions and also as a traditional drug. This comparative analysis will strengthen the ayurvedic knowledge and its use in the present scenario. This comprehensive review of *Gloriosa superba* includes information on phytochemistry, clinical effects of poisoning, therapeutic applications, ethnomedicinal uses and pharmacological activities.

KEYWORDS: *Langali*, *Gloriosa superba*, Ethnomedicinal uses, *Upavisha*, *Ayurveda*, Colchicine etc.

INTRODUCTION

In Indian Medicine, *Gloriosa superba Linn.* is considered as one of the seven *upavishas* which cure many illnesses but may prove fatal on misuse, so the art of use of plant medicine is **herbalism**.[1] Since 2000 B.C., despite of the poisonous actions, *Gloriosa superba* is being used as a traditional medicine by the tribes. Also in *Ayurveda*, the entire plant has been used due to its important medicinal properties.[2] *Gloriosa superba Linn*., is a plant belonging to the family Liliaceae, and is one of the endangered species among the medicinal plants. It is a semi-woody branched climber reaching approximately to a height of 5 meters, with brilliant wavy edged red and yellow flowers that appears from November to march every year.[1] *Gloriosa* derives its name from the word '***gloriosus***', means **handsome** and ***superba*** from the word '**superb**' means splendid. By the virtue of its floral beauty, it is also being placed as a pot plant in gardens.[3] It is known as 'glory lily' in English, *'Agnimukhi'* in Sanskrit '*Kalihari*' in Hindi.[4] This spectacular lily is extensively scattered in the tropical and sub-tropical parts of the India, including the foothills of Himalayas and is the state flower of Tamil Nadu.[5] In South India, Glory lily is an industrial medicinal crop grown for its high colchicine content, also collected from wild but due to its over-exploitation in wild as well as problems faced during field cultivation, it was on the verge of extinction.[6-8] There are wide variety of uses of different parts of G*loriosa superba* especially in traditional system of medicine. The tuber is used for the treatment of bruises and sprains, chronic ulcers, hemorrhoids, colic, impotence, cancer, leprosy, nocturnal seminal emission, and also for inducing labor pains and abortions. [9]. It is also used in skin related problems, fever, wounds, inflammation, blood disorders, uterine contractions, poisoning and general body toner.[10-11]

Morphological description[12]

Gloriosa superba, is tall glabrous branching climber which is a rainy season plant, that sprouts well in warm, humid, and tropical conditions.

Tubers- Finger-like, V or L-shaped, which are white in color when young and becomes brown with age.

Leaves- glossy, pointed, each equipped with a tendril which helps the plant to climb for support.

Occur in whorls of 3 to 4, opposite or alternate, simple, sessile, blade ovate to lanceolate ranging from 6 to 20 cm in length and 1.5 to 4 cm wide.

Flowers -Beautiful and attractive flowers borne on long stalks, having six widely separated reflexed tepals, six long outward spreading stamens and a prominent trifurcate style, ranging in color from bright yellow to bicolored, red and yellow or purple and yellow.

Fruits- Having capsules that split open to release several smooth red seeds.

Pharmacological and therapeutic properties of *Langali*[4,13,14]

RASA	*Katu, Tikta, Kashaya*
GUNA	*Tikshna, laghu, shara*
VIRYA	*Ushna*
VIPAKA	*Katu*
DOSH KARMA	*Kaphavata-shamaka, pittala*
ROGAGHNATA	*Kushtha, shopha, arsha, vrana, dushtavrana, shula, krumi, Visha, bastishula, kandu, shosha*
PRABHAVA	*Garbhapatana*

लाङ्गली कटुका चोष्णा कफवातहरा सरा ।
अपरापातनी चैव सद्यः प्रसवकारिका ॥
शोथापहा विशेषेण मता व्रण निवारिणी ।
कुष्ठकृमिप्रशमनी विशेषात्परिकीर्तिता ॥ (रस तरंगिणी/ 24 तरंग)

Chemical constituents of *Gloriosa superb*a *Linn*

All the parts of *Gloriosa superba* are highly toxic especially the tubers, because of the presence of a highly active alkaloid, **Colchicine**. It also contains another toxic alkaloid, known as Gloriosine. Other compounds isolated from the plants are lumicolchicine, 3-demethyl colchicine, 3-demethyl-Ndeformyl-N-deacetylcolchicine, N-formyldeacetyl- colchicine.[15] The tubers contain salicylic acid and benzoic acid, sterols, colchicine, 3-demethyl colchicine, 1, 2- didemethyl colchicine, 2, 3-didemethyl colchicine, N-deacetylcolchicine, N-formyl-colchicocide, superbine and tannins.[16] Luteolin, colchicine, N-formyldeacetyl-colchicine and glucosides of 3-demethylcolchicine have been isolated from flowers. High level of colchicine is present in seeds.[17]

Metabolism of colchicine[18]

- Colchicine is rapidly absorbed from the intestine and undergoes first-pass hepatic metabolism.
- It inhibits the polymerization of microtubules and formation of mitotic spindle in cell division causing severe affect to the rapidly dividing cells of the intestinal mucosa.
- Colchicine excretion accounts for about 10-20% from renal system.
- Excretion is through feces.

Table 1: Stages of Colchicine toxicity.[19-20]

Time period	Symptoms
0-24 h	Nausea, vomiting, abdominal pain, diarrhea, anorexia, electrolyte imbalance hypovolemia, peripheral leukocytosis.
2-7 days	Profound leucopenia, thrombocytopenia, bone marrow hypoplasia. Cardiac arrythmias, cardiovascular collapse. Respiratory distress, hypoxia pulmonary oedema. Oliguric renal failure. Rhabdomyolysis. Peripheral neuropathy, ascending paralysis. Metabolic acidosis. Mental state changes. Seizures. Peripheral neuropathy and ascending paralysis.
7th day onwards	Rebound leukocytosis. Transient alopecia.

Table 2: Side effects of Colchicine.[21]

Affected body parts	Side effects
G.I.T	Nausea, vomiting, abdominal pain, abdominal distension, diarrhea, cholera-like gastroenteritis, malabsorption syndrome, secondary lactose intolerance
Heart	Arrhythmia
Muscles	Myopathy, proximal muscular weakness, rhabdomyolysis, elevation in serum creatine, kinase concentration
Peripheral nerves	Axonal neuropathy, hyporeflexia, ascending polyneuritis
Blood	Bone marrow depression, thrombocytopenia, leukopenia, aplastic anemia
Skin	Alopecia, skin
Gonads	Reversible azoospermia

Poisoning symptoms according to *Ayurveda*

There is nausea, vomiting, diarrhea, pain in abdomen, hypotension, weak pulse rate, convulsions, etc.[22]

Treatment for *Langali* poisoning according to *Ayurveda*

1. Intake of *ardraka* alone cures *visha* of *langali.*
2. Consumption of *chanampayar* (Lens culinaris), *bhumyamalaki*, and *ardraka* in equal quantity.
3. Consumption of *kwatha* of *bibhitaka twak.*
4. Consumption of *shigrumoolatwak swarasa* and *dadhi* in equal quantity.
5. By external application and intake of *neelimoola* and *maricha.*
6. Intake of *haritaki kwatha*.
7. Consumption of *shigrutwak* with *madhu.*
8. Consumption of *shunthi kalka* with *ushna jala* or *lepa* in whole body.[23]
9. Boiling *shunthi* in water and then consuming it.[24]

Shodhana* of *Ashuddha Langali

Shodhana is the process, which involves the conversion of any poisonous drug into non-poisonous one and at the same time beneficial for the body. It is combination of processes which removes unwanted material from the drug & controls its toxic effect thus enhancing the properties of drug.

Brihatrayee does not report the *shodhana* of *Langali*, it is only considered *mulajavisha* by *Charaka*. Other classical texts of *Ayurveda*, categories it under *upavisa varga* and has given certain *shodhana* procedures, before its internal administration.[25] Different methods are as follows-

1. Soaking *langali* in *gomutra* for 1 day.[26]
2. By mixing pieces of *langali* with *saidhav lavana*.[27]
3. By making a solution of *takra* and *saindhava Lavana* then immersing pieces of *langali* in it for 3 days. The pieces should be immersed during night time then dried during day time in sunlight. After completion of 3 days, wash the pieces of *langali* with warm water and dry it in sunlight.[27]
4. Soaking *langalikanda* in *gomutra* for 1 day, then in the kwath of *guduchi* and *tanduleeyaka moola* for 30 *nazika* (30×24 minutes). Then in *godugda* for 1 day.[25]

Pharmacological/Therapeutical applications of *Langali* (*Gloriosa superba Linn.)* [Ayurvedic aspects proved through Researches]

❖ **Analgesic and Anti-inflammatory activity**

Ayurvedic aspect

- Root powder is given to treat rheumatic fever.[28]
- Seeds are used for relieving rheumatic pain and muscular pain.[29]

Ethnomedicinal uses

- The tuberous root stocks of *Gloriosa superba* is boiled with *sesamum* oil and applied twice a day on the joints, affected with arthritis to reduces pain.[30]
- Seeds and tubers are used to cure gout and rheumatism.[31-32]
- The plant rhizome is used as poultices to relieve neuralgia, used in topical applications to treat arthritic conditions, sprains, dislocations and swellings of the joints.[33]

Research work

John et al. tested for analgesic, anti-inflammatory and toxic studies on Wistar rat model weighing 150–200 g. It was reported that hydroalcoholic extract of aerial part of *Gloriosa superba* possesses a moderate anti-inflammatory effect and is safe up to 2000 mg/kg body weight. It was evidenced by significant reduction in paw edema and cotton pellet induced granuloma methods suggesting its activity in the proliferative phase of inflammation. They attributed its analgesic, anti-inflammatory and wound healing action to phytoconstituents present in the plant.[34]

❖ **Gynecological disorders**

Ayurvedic aspect

- In case of painful labor *langali churn* is given to ease childbirth.[35]
- For fetus expulsion root of *langali* is placed in the vagina.[35]
- The paste of the rhizome is applied to the palm, sole, and lower part of belly for easing childbirth.[35]

Ethnomedicinal uses

- 20 gm root paste, 7 black pepper with goat milk is given to induce abortion.[36-37]
- Roots of *Langali* and seeds of *piper nigrum* are grounded together then 2 spoonful of this paste is

mixed with a pinch of ghee, taken early in the morning to abort pregnancy up to 3 months.[38]
- Soup made from leaf or tuber sap after due processing are administered to women suffering from delayed puberty, sterility, delayed childbirth and menstrual problems.[39]
- For inducing labor pain and normal delivery rhizome extract is applied over the navel and vagina.[40]

Research work

A study was conducted in which, ether, chloroform, and ethyl alcohol extracts of roots of *Gloriosa superba Linn*. was evaluated for the antifertility activity in female wistar albino rats. The result shows a significant reduction in number of implants and number of pups born in all groups of different extracts compared to the control. Thus, showing statistically significant abortifacient activity.[41]

❖ Animal poisoning

Ayurvedic aspect

- Roots are given internally as an antidote for snake poison.[28]
- In cases of snake bite, *langali root* and *maricha* in equal quantity is given with water.[42]
- *Langali* and *shireesha pushpa moola* is used for external application in bite of *Raga mandali sarp* (viper variety).[43]
- *Saarvakarmika agad* is used in bite of *Vyantaradashta sarp.*[44]
- *Langalikanda, ashwagandha, madhuka, draksha, karam, nimbatwak, chitraka, hingu, shunthi, haridra, chandana, mayakku, devadaru churna* is triturated in *jambeera swarasa* then *gutikas* are made and used for external application to prevent spread of poison.[45]
- In case of *mooshika visha karnika patana, langali, trivrut, alabumoola, neelimoola, snuhi, apamarga* is made into *kalka* with *tila* then used as external application.[46]
- Boiling *Langali, musali, bakula, shireesha, nimbapatra* in *tandulodaka,* is used for *swedana* in poison inflicted person.[47]
- In case of confused state due to poison, *gutika* are made with *langalimoola* and *maricha* then taken with water.[48]

Ethnomedicinal uses

1. Root paste is effective against paralysis, insect bites and snake bite.[49]
2. Root paste is applied on bitten spot of Scorpion.[50]
3. Tuber paste is taken orally as an antivenom for snakebite.[51-52]

Research work

- Kumarapppan et al. evaluated the antivenom properties displayed by the alcoholic extracts of *Andrographis paniculata*, *Crateva magna*, *Gloriosa superba* and *Hydrocotyle javanica*. Extracts of *H. javanica* and *G. superba* gave 80 % and 90 % protection to mice treated with minimum lethal dose of venom (LD99). These two plants showed significant neutralization effect against the venoms of *Naja nigricollis* venom. *H. javanica* and *Gloriosa superba* (25-100 mg/mL) produced significant changes of membrane stabilization of human red blood cells (HRBC) exposed to hyposaline-induced hemolysis.[53]

Samy et al. traditional approach was evaluated scientifically with some selected plant extracts (7.2 mg/kg bw) and partially purified fractions (2.4 mg/kg bw) were orally administered to mice experimentally envenomed with rattlesnake venom S.C. injection (2.5–15µg/kg bw). The purified fractions (2.4mg/kg bw) produced significant protection against venom induced changes in serum SOD and LPx levels. The isolated fractions effectively inhibited the toxic effect of snake venoms in vitro than in vivo. The above observations confirmed the protective activity of plants- *Aristolochia indica, Hemidesmus indicus, Gloriosa superba, Strychnos nux-vomica, Eclipta prostrata,* and *Andrographis paniculata* against the lethal action of snake venom.[54]

❖ Skin diseases

Ayurvedic aspect

- *Langali* is used in the treatment of *kushta.*[22]
- In skin diseases paste of *langali mool* is applied over the affected areas.[35]

Ethnomedicinal uses

- Roots and leaves are used in parasitical skin infections.[55]
- Tuber paste is applied on the affected parts once every two days till it cures.[56]
- Rhizome paste is rubbed on the body externally for 3 days in Leprosy.[57]
- Seed paste is applied externally in dermatitis.[58]
- The sap from the leaf tip is used as smoothening agent for pimples and skin eruptions.[59]

Research work

- Excellent antifungal sensitivity by *Gloriosa superba* have been expressed by the n-butanol fraction against *Candida albicans* and *C. glabrata* (up to 90%) and against *Trichophyton longifusus* (78%) followed by the chloroform fraction against *Microsporum canis* (80%) (Khan et al., 2008). These findings justify the use of *Gloriosa superba* in the treatment of various fungal skin diseases.[60]

❖ Anthelmintic, Ectoparasitic, Nematocidal activity

Ayurvedic aspect

- *Langali* is used to kill *krimi.*[22]
- *Patra swaras* is used to kill head lice.[35]

Ethnomedicinal uses

- The tuber, pods and leaves were used to treat infections of guinea-worms, schistosomes roundworm, liver fluke, tapeworm and filaria.[61]
- Leaves are used **t**o remove intestinal worm.[62]
- To kill lice, leaf extract is applied to hair.[63]

Research work

- Zahir et al., Flower methanol extract of *Gloriosa superba* was found to be toxic against larvae of cattle tick *Rhipicephalus microplus* (LC50 = 153.73 ppm; LC90 = 1794.25 ppm). Flower acetone extract of *Gloriosa superba* was found to be toxic against the adult sheep internal parasite *Paramphistomum cervi* (LC50 = 157.61 ppm; LC90 = 747.02 ppm). These findings suggest that the flower methanol and acetate extract of *Gloriosa superba* could be used in the control of *R. microplus*, *P.cervi.* [64]
- Bunyapraphatsara and van Valkenburg et al., The extracts of the shoots and of the tubers of *Gloriosa superba* are known to have strong nematocidal activity which can be attributed mainly to colchicine. These findings suggest that crude form of *Gloriosa superba* can be used to control nematodes and other related organisms. [65]

❖ **Wound**

Ayurvedic aspect

- Paste of tuber is applied on the *vrana.*[35]
- Tuberous roots are useful in during ulcers, scrofula.[28]

Ethnomedicinal uses

- Rhizome paste is applied over the wound.[66]

Research

- Shanmugam et al., In a study, it was exhibited that the aqueous, methanol and petroleum extract of root tubers of *Gloriosa superba* were active against Gram-negative bacteria *E. coli, Proteus vulgaris* and *Salmonella typhi* at 500 µg/ml and also against Gram positive bacteria *Bacillus subtilis*, and *Staphylococcus aureus* at 1000 µg/ml. Therefore, the presence of phytoconstituents makes it a potent antibacterial agent.[67]

❖ **Male fertility-suppressing activity**

Ethnomedicinal uses

- Used as herbal contraceptive.[68]

Research work

- A study was undertaken to establish the role of Gloriosa superba extract in regulation of male reproductive capacity. Oral administration of ethanolic Gloriosa superba tuber extract in male rat was found to alter the normal male reproductive physiology, causing significant reduction in, ductal sperm motility, cauda epididymal sperm count and blood testosterone levels. Parallel analysis of hepatic and renal toxicity was done which shows no abnormal alterations, which may be an indication of Gloriosa superba as a source of safe and effective oral contraceptive for males.[69]

❖ **Tumors**

Ethnomedicinal uses

- Warm poultice of root tuber is applied over the tumor.[70]
- Seeds are used to cure cancer related diseases.[71]

Research work

- A in vivo study was done, where animals were divided into five groups (n = 6) experimented for 14 days. The tumor was induced by intraperitoneal transplantation of Ehrlich ascites carcinoma cells in Balb/c mice. After 24 hours of Ehrlich's Ascites Carcinoma transplantation, treatment was started by injecting Cyclophosphamide (50 mg/kg) intraperitoneal whereas Gloriosa superba Linn extract (5 mg/kg & 10 mg/kg) was administrated orally. On the 15th day, mice were sacrificed to estimate hematology, biochemical estimation and histopathology. The extract showed a significant decrease ($P < 0.001$) in body weight in the treatment group compare to the control group further there was amelioration in hematology, biochemical estimation, and histopathology. From the result, it was concluded that the extract has a potent antitumor activity.[72]
- The *Gloriosa superba* methanolic extracts by In vitro Assay for Cytotoxicity Activity (MTT Assay) reveals the presence of different types of phytoconstituents which has the capacity of anti-oxidant and cytotoxicity effect on Hep-G2 cells. Thus, *Gloriosa superba* has the potentiality to inhibit the human carcinoma cell line growth.[73]

CONCLUSION

Medicinal plants have been used in healthcare system since many decades, because of the presence of various bioactive compounds present in them. This plant *Gloriosa superba* has showed a number of pharmacologically important phytochemicals such as colchicine and gloriosine which are toxic but after proper *shodhana*, it becomes a potent therapeutic agent to treat various ailments. *Gloriosa superba* has been claimed for potent activity confirming its various traditional and ayurvedic uses. It is believed that the medicinal properties and biological activities mentioned in this review will help researchers to explore this plant to a further extent. Thus, randomized trials should be done to explore the mentioned traditional and ayurvedic uses of the plant.

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