

Structure, History, Phytochemistry, Pharmacology, and Toxicology Asian Crinum Lily Plant

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ABSTRACT

Asian Crinum Lily (Crinum asiaticum) is a perennial herbaceous plant with a long history of traditional medicinal uses in various Asian cultures. This research paper provides an in-depth analysis of the plant, covering its structure, historical usage, phytochemical constituents, pharmacological properties, and potential toxicological aspects. Through a comprehensive review of available literature, this paper aims to enhance our understanding of Asian Crinum Lily and its potential applications in medicine.

Keywords: Asian Crinum Lily, Phytochemical, Pharmacological and Potential Toxicological

1. INTRODUCTION

Inflammation and arthritis are two common health issues that affect a significant portion of the global population. Inflammation is the body's natural response to injury or infection, characterized by pain, redness, swelling, and heat. Arthritis, on the other hand, refers to the inflammation of joints, leading to stiffness, pain, and reduced mobility. Both conditions can significantly impact the quality of life for individuals affected by them. In recent years, there has been increasing interest in natural plant-based remedies for managing inflammation and arthritis due to their potential efficacy and lower risk of side effects compared to conventional medications. One such plant that has gained attention for its potential anti-inflammatory and anti-arthritis properties is the Asian Crinum lily (*Crinum asiaticum*). *Crinum asiaticum*, also known as the Asian spider lily or poison bulb, is a perennial flowering plant native to Asia. It has been traditionally used in various Asian folk medicines for the treatment of inflammation-related ailments, including arthritis. The plant contains bioactive compounds such as alkaloids, flavonoids, saponins, and phenolic compounds, which are believed to contribute to its medicinal properties.

1.1 Description

Perennial *C. asiaticum* can attain a maximum height of 1.2 m (3.9 ft). This item is based on a leaf. It has a round pseudobulb. The bulb is cylindrical near its top. The diameter of the base, which is branching laterally, is between 6 and 15 cm. It has lanceolate leaves with an undulating edge and a sharp point at the tip. They can reach lengths of 1 metre, are dark green, and have 1 pointed end. They range in width from 7-12 cm and in quantity from 20-30. Umbel-shaped inflorescence with 10–24 fragrant blooms that each have six petaloid tepals. The stem of the flower stands straight and is as long as the leaf. The spathe is 6-10 cm in length, and it is lanceolate and membranous. The length of the bractlet lining is between 3 and 7 centimetres. The perianth tube is long and thin, measuring 7-10 cm in length and 1.5-2 mm in diameter; it is green and white. White, linear, revolute, attenuate, 4.5-9 cm long, and 6-9 mm wide, the corolla has the appearance of a spider. The corolla has six lobes. The length of the pedicel is roughly 0.5–2.5 cm. There are 6 crimson stamens in all. It's estimated that the length of the filaments is between four and five centimetres. The anthers are long and tapered, measuring at least 1.5 centimetres. The ovary is up to 2 cm in length and has a fusiform shape. Fruits are oblate capsules that range in size from 3 to 5 centimetres in length. The exotesta of these giant seeds is soft and spongy.

1.2 Objectives

1. To Examine the structure, historical usage, and phytochemical constituents of Asian Crinum Lily.
2. To Investigate the pharmacological properties of Asian Crinum Lily.
3. To Assess the potential toxicological aspects of Asian Crinum Lily.

2. STRUCTURE AND TAXONOMY

Poison bulb, huge crinum lily, grand crinum lily, and spider lily are all names for the same plant, *Crinum asiaticum*, which is frequently grown as an ornamental in many warmer regions. It's a bulbous perennial with a stunning flower umbel that's much sought after by amateur and professional gardeners alike. However, ingesting any component of the plant can

be fatal. There have been rumours that contact with the sap can be irritating to the skin. The Indian Ocean, East Asia, tropical Asia, Australia, and the Pacific Islands are all home to *C. asiaticum*. The Mexican government recognises it as a native species in Mexico, the West Indies, Florida, Suriname, Louisiana, and a number of Pacific islands.



Fig. 1: Asian Crinum Lily Plant

2.1 Taxonomic Classification

Kingdom : Plantae

Order: Asparagales

Species: *C. asiaticum*

Clade: Tracheophytes

Family: Amaryllidaceae

Binomial Name : *Crinum*

Clade: Angiosperms

Subfamily: Amaryllidoideae

asiaticum

Clade: Monocots

Genus: *Crinum*

2.2 Morphological Features

Bulbous Structure: Asian Crinum lily is characterized by a bulbous structure, which is an underground storage organ. The bulb stores nutrients and energy that support the plant's growth and development.

Leaves: The plant has long, strap-like leaves that arise from the bulb. The leaves are typically green in color and grow in a basal rosette pattern. They are relatively thick and fleshy, allowing them to store water.

Flowers: Asian Crinum lily produces large, showy flowers on long stalks. The flowers are usually white or pink, but there may be variations in color within the species. These flowers have a pleasing fragrance and attract pollinators like bees and butterflies.

While the morphological features of the Asian Crinum lily do not directly relate to its anti-inflammatory and anti-arthritis activities, it is the presence of specific bioactive compounds within the plant that contribute to these properties. Some of the key compounds found in *Crinum asiaticum* that have been associated with its therapeutic effects include:

Alkaloids: Asian Crinum lily contains various alkaloids, including crinamine, lycorine, and galanthamine. These alkaloids have been studied for their anti-inflammatory and analgesic properties.

Flavonoids: Flavonoids are a diverse group of plant compounds known for their antioxidant and anti-inflammatory activities. *Crinum asiaticum* contains flavonoids such as quercetin, kaempferol, and rutin, which may contribute to its potential anti-inflammatory effects.

Phenolic Acids: Phenolic acids, including ferulic acid and p-coumaric acid, are present in *Crinum asiaticum*. These compounds have been shown to possess anti-inflammatory properties and may help reduce pain and inflammation associated with arthritis.

Saponins: Saponins are another group of bioactive compounds found in Asian Crinum lily. These compounds have been investigated for their anti-inflammatory and immune-modulating effects.

3. HISTORICAL SIGNIFICANCE AND TRADITIONAL USES

3.1 Ethnobotanical Importance

Medicinal Uses: Various parts of the Asian Crinum Lily have been used in traditional medicine systems across Asia. The bulb, leaves, and roots contain bioactive compounds such as alkaloids, flavonoids, and saponins, which have demonstrated potential therapeutic properties. The plant has been used to treat ailments such as digestive disorders, skin conditions, respiratory problems, and reproductive issues.

Ornamental Plant: Asian Crinum Lily is widely cultivated as an ornamental plant due to its beautiful, large, and fragrant flowers. It is commonly used in gardens, landscapes, and as potted plants, adding aesthetic value to outdoor and indoor spaces.

Cultural and Religious Significance: In many Asian cultures, the Asian Crinum Lily holds symbolic and religious significance. It is often used in ceremonies, rituals, and decorations during religious festivals and events. The plant's association with purity, beauty, and spirituality has made it an integral part of cultural practices and traditions.

Fiber and Craft Uses: The long, strap-like leaves of the Asian Crinum Lily contain strong fibers that have been traditionally used for making ropes, baskets, mats, and other handicrafts. The leaves are harvested, dried, and woven into various functional and decorative items.

Insect Repellent: Some communities have used Asian Crinum Lily as a natural insect repellent. Crushed leaves or extracts from the plant are applied on the skin or placed in the vicinity to deter mosquitoes and other insects.

3.2 Traditional Medicinal Uses

Digestive Disorders: The bulb and roots of the Asian Crinum Lily have been used in traditional medicine to alleviate digestive issues such as indigestion, diarrhea, and constipation. Extracts from the plant have been administered orally or used as a component in herbal formulations to promote gastrointestinal health.

Respiratory Conditions: In traditional medicine systems, the Asian Crinum Lily has been employed to treat respiratory ailments. It has been used to alleviate symptoms of cough, asthma, bronchitis, and sore throat. The plant is believed to possess expectorant and anti-inflammatory properties that help soothe respiratory discomfort.

Skin Disorders: Various skin conditions have been treated using the Asian Crinum Lily. The bulb and leaves have been used topically to manage skin irritations, rashes, burns, and wounds. The plant is believed to have antimicrobial and anti-inflammatory properties that contribute to its potential effectiveness in treating such skin ailments.

Reproductive Health: The Asian Crinum Lily has been traditionally used to address reproductive health issues, particularly in women. It has been employed to regulate menstrual cycles, alleviate menstrual pain, and manage symptoms associated with menopause. Additionally, the plant has been used as a traditional remedy to promote fertility and enhance libido.

Anti-inflammatory and Analgesic Effects: The Asian Crinum Lily has been attributed with anti-inflammatory and analgesic properties. It has been used in traditional medicine to reduce pain and inflammation associated with conditions such as arthritis, rheumatism, and muscular injuries.

Antimicrobial Activity: Some traditional uses of the Asian Crinum Lily suggest its potential antimicrobial properties. Extracts from the plant have been applied topically to wounds and infections to prevent bacterial growth and promote healing.

4. PHYTOCHEMISTRY

4.1 Major Phytochemical Constituents

The Asian Crinum Lily contains various bioactive compounds that contribute to its medicinal properties. Some of the major phytochemical constituents include alkaloids, flavonoids, phenolic compounds, and other bioactive compounds.

4.2 Alkaloids

Alkaloids are nitrogenous compounds known for their diverse physiological effects. The Asian Crinum Lily contains alkaloids such as crinamine, crinidine, and crinine. These alkaloids have demonstrated a range of pharmacological activities, including anti-inflammatory, analgesic, antimicrobial, and anticancer properties. They may also exhibit effects on the nervous system, cardiovascular system, and respiratory system.

4.3 Flavonoids

Flavonoids are a class of polyphenolic compounds widely distributed in plants. The Asian Crinum Lily contains various flavonoids, including kaempferol, quercetin, and their glycosides. Flavonoids possess antioxidant properties, helping to neutralize harmful free radicals and protect cells from oxidative damage. They also exhibit anti-inflammatory, antimicrobial, and anticancer activities. Flavonoids have been associated with potential benefits for cardiovascular health, immune function, and neuroprotective effects.

4.4 Phenolic Compounds

Phenolic compounds are a diverse group of plant secondary metabolites with notable health benefits. The Asian Crinum Lily contains phenolic compounds such as ferulic acid, caffeic acid, and their derivatives. These compounds exhibit antioxidant, anti-inflammatory, and antimicrobial properties. They are also known for their potential to scavenge free radicals, reduce oxidative stress, and protect against chronic diseases such as cardiovascular disorders and certain cancers.

4.5 Other Bioactive Compounds

In addition to alkaloids, flavonoids, and phenolic compounds, the Asian Crinum Lily contains other bioactive compounds that contribute to its medicinal properties. These include saponins, tannins, terpenoids, and sterols. Saponins have been associated with various biological activities, such as anti-inflammatory, antimicrobial, and anticancer effects. Tannins possess astringent properties and have been used traditionally for their antidiarrheal and wound healing properties. Terpenoids and sterols have demonstrated antioxidant, anti-inflammatory, and antimicrobial activities.

5. PHARMACOLOGICAL PROPERTIES

5.1 Anticancer Activity

The Asian Crinum Lily has been investigated for its potential anticancer properties. Studies have shown that the plant contains bioactive compounds such as alkaloids and flavonoids, which exhibit cytotoxic effects against various cancer cell lines. These compounds have demonstrated the ability to inhibit cancer cell proliferation, induce apoptosis (programmed cell death), and inhibit tumor growth in animal models. The anticancer activity of the Asian Crinum Lily is attributed to its ability to interfere with cancer cell signaling pathways, inhibit angiogenesis (formation of new blood vessels to support tumor growth), and induce cell cycle arrest.

5.2 Antimicrobial Activity

The Asian Crinum Lily possesses antimicrobial properties against a range of microorganisms. The plant extracts have demonstrated inhibitory effects against bacteria, including both Gram-positive and Gram-negative strains. They have also shown activity against fungi, including pathogenic species. These antimicrobial effects are attributed to the presence of bioactive compounds such as alkaloids, flavonoids, and phenolic compounds, which can disrupt microbial cell membranes, inhibit microbial growth, and exhibit synergistic effects with conventional antimicrobial agents.

5.3 Anti-Inflammatory and Analgesic Effects

The Asian Crinum Lily exhibits anti-inflammatory and analgesic properties. Studies have shown that plant extracts can reduce inflammation by inhibiting the release of pro-inflammatory mediators and enzymes. These anti-inflammatory effects are attributed to the presence of bioactive compounds like alkaloids, flavonoids, and phenolic compounds, which can modulate inflammatory pathways. Additionally, the plant extracts have demonstrated analgesic effects, providing relief from pain, which may be attributed to their ability to inhibit pain receptors or modulate pain signaling pathways.

5.4 Antioxidant Activity

The Asian Crinum Lily possesses significant antioxidant activity due to the presence of flavonoids, phenolic compounds, and other bioactive compounds. These antioxidants help neutralize harmful free radicals and reduce oxidative stress, which can contribute to the development of chronic diseases. The plant's antioxidant activity has been demonstrated in various studies, and it plays a vital role in protecting cells and tissues from oxidative damage, supporting overall health and potentially reducing the risk of diseases such as cardiovascular disorders, neurodegenerative conditions, and certain cancers.

5.5 Antidiabetic Potential

Studies have indicated that the Asian Crinum Lily exhibits potential antidiabetic properties. The plant extracts have been shown to have hypoglycemic effects by reducing blood glucose levels. These effects may be attributed to the presence of bioactive compounds like alkaloids and flavonoids, which can enhance insulin secretion, improve insulin sensitivity, and inhibit

key enzymes involved in carbohydrate metabolism. The plant's antidiabetic potential suggests its possible use as a complementary approach in the management of diabetes.

5.6 Antihypertensive Activity

The Asian Crinum Lily has demonstrated potential antihypertensive activity. Research suggests that plant extracts can lower blood pressure by promoting vasodilation (widening of blood vessels), inhibiting angiotensin-converting enzyme (ACE) activity, and reducing oxidative stress. These effects may be attributed to the presence of bioactive compounds such as alkaloids, flavonoids, and phenolic compounds. The plant's antihypertensive properties make it a subject of interest for potential use in the management of hypertension.

5.7 Immunomodulatory Effects

The Asian Crinum Lily exhibits immunomodulatory effects, meaning it can modulate the immune system. Studies have shown that plant extracts can stimulate immune cells, such as macrophages and lymphocytes, and enhance the production of immune-modulating cytokines. These effects may contribute to improved immune responses and increased resistance to infections and diseases. The plant's immunomodulatory properties hold promise for potential applications in immune-related disorders and as an adjunct to conventional therapies.

5.8 Neuroprotective Properties

The Asian Crinum Lily has shown potential neuroprotective properties. The plant extracts have been found to protect neuronal cells against oxidative stress, reduce neuroinflammation, and exhibit neurotrophic effects. These effects may be attributed to the presence of bioactive compounds with antioxidant and anti-inflammatory properties. The plant's neuroprotective properties suggest its potential in the prevention and management of neurodegenerative diseases, such as Alzheimer's and Parkinson's diseases.

5.9 Other Pharmacological Activities

In addition to the aforementioned properties, the Asian Crinum Lily exhibits other pharmacological activities. These include hepatoprotective (protecting the liver), nephroprotective (protecting the kidneys), cardioprotective (protecting the heart), and wound healing properties. The plant extracts have demonstrated potential in protecting liver and kidney tissues, reducing cardiovascular risk factors, and promoting wound healing through various mechanisms. These additional activities highlight the plant's potential therapeutic versatility.

6. TOXICOLOGICAL CONSIDERATIONS

6.1 Acute and Chronic Toxicity Studies:

Acute and chronic toxicity studies are conducted to assess the potential adverse effects of a substance when administered in single or repeated doses over a short or long period. In the context of the Asian Crinum Lily (*Crinum asiaticum*), these studies involve administering different doses of the plant extract or its constituents to laboratory animals and observing their responses.

Acute toxicity studies typically involve administering a single high dose of the plant extract to animals and monitoring them for any signs of toxicity or adverse effects. The objective is to determine the highest dose at which no mortality or severe toxicity occurs. The results help establish the safety margin and identify potential hazards associated with the plant's use.

Chronic toxicity studies are carried out by administering lower doses of the plant extract or its constituents to animals over an extended period, typically several weeks to several months. These studies are essential to evaluate the effects of long-term exposure. They provide valuable information on the potential cumulative toxicity, organ-specific effects, and any adverse effects that might not be immediately apparent in acute toxicity studies.

6.2 Genotoxicity and Mutagenicity Assessments

Genotoxicity and mutagenicity assessments are conducted to evaluate whether the plant extract or its constituents have the potential to damage DNA and cause genetic mutations, which can lead to the development of cancer or other genetic disorders. These studies are crucial in determining the safety of the plant for human consumption or medicinal use. Various *in vitro* and *in vivo* tests are used to assess genotoxicity and mutagenicity. *In vitro*

tests involve exposing isolated cells to the plant extract or its constituents and examining for DNA damage or mutation. In vivo tests are conducted in laboratory animals, where they are exposed to the plant extract orally or through other routes, and their genetic material is assessed for any changes. Positive results in genotoxicity or mutagenicity tests raise concerns about the safety of the plant, and further investigation is required to determine the potential risks and appropriate safety precautions.

6.3 Safety Considerations

While the Asian Crinum Lily has demonstrated promising pharmacological properties, safety considerations are paramount when considering its use for medicinal purposes. Here are some important safety considerations:

Dosage: Like any herbal remedy, the dosage of the Asian Crinum Lily should be carefully considered. Higher-than-recommended doses may lead to adverse effects, even with a relatively safe plant.

Allergic Reactions: Some individuals may be allergic to specific compounds present in the plant. Allergic reactions can range from mild skin irritation to severe allergic responses, such as anaphylaxis. It's essential to be cautious if you have known allergies to plants in the Amaryllidaceae family.

Drug Interactions: The Asian Crinum Lily may interact with certain medications, potentially altering their efficacy or causing adverse effects. If you are taking other medications, it's essential to consult a healthcare professional before using the plant for medicinal purposes.

Purity and Contamination: The safety of the Asian Crinum Lily product also depends on its purity and potential contamination with pesticides, heavy metals, or other harmful substances. Proper sourcing and quality control are crucial to ensure product safety.

Special Populations: Pregnant or nursing women, children, and individuals with underlying health conditions should exercise extra caution and seek professional advice before using the Asian Crinum Lily for medicinal purposes.

Traditional Use: If the Asian Crinum Lily has a history of traditional use in specific cultures, it can provide valuable insights into its safety profile. However, caution should be exercised since traditional practices might not always align with modern scientific knowledge.

7. FUTURE PERSPECTIVES

7.1 Therapeutic Potential and Drug Development Prospects

The Asian Crinum Lily exhibits a wide range of pharmacological properties, as discussed earlier. Its bioactive compounds, including alkaloids, flavonoids, and phenolic compounds, have shown promising effects in various preclinical studies. These properties and compounds provide a basis for considering the plant's therapeutic potential and its potential as a source for drug development. *Some key areas of interest include:*

Anticancer Therapy: The Asian Crinum Lily's anticancer activity, particularly its ability to inhibit cancer cell proliferation and induce apoptosis, holds promise for developing novel anticancer drugs or complementary therapies.

Anti-Inflammatory and Immunomodulatory Agents: The plant's anti-inflammatory and immunomodulatory effects indicate potential for developing drugs that can target inflammatory disorders and modulate immune responses.

Neuroprotective Agents: The Asian Crinum Lily's neuroprotective properties make it a candidate for the development of drugs that can potentially treat or prevent neurodegenerative diseases. **Antidiabetic and Antihypertensive Agents:** The plant's potential in managing diabetes and hypertension suggests its future prospects for developing drugs that can assist in controlling these conditions.

7.2 Challenges and Research Gaps

While the Asian Crinum Lily shows promise, several challenges and research gaps need to be addressed for its future development:

Standardization and Quality Control: Ensuring consistent quality and standardization of the plant extracts and their bioactive compounds is crucial. This involves developing standardized extraction methods, identifying biomarkers, and implementing quality control measures to ensure reproducible and reliable products.

Bioavailability and Pharmacokinetics: Understanding the bioavailability, absorption, distribution, metabolism, and excretion of the plant's bioactive compounds is essential for optimizing therapeutic efficacy and dosage regimens. Further research is needed to explore these aspects and enhance the plant's pharmacokinetic profile.

Drug-Drug Interactions and Safety Profiles: As with any potential therapeutic agent, it is important to assess potential drug-drug interactions and thoroughly evaluate the safety profiles of the plant's bioactive compounds. These considerations will help ensure the safe use of the Asian Crinum Lily and prevent adverse interactions with other medications.

Sustainability and Conservation: With the growing interest in medicinal plants, ensuring sustainable sourcing and conservation of the Asian Crinum Lily is essential. Proper cultivation methods, protection of natural habitats, and adherence to ethical and sustainable practices will be critical in maintaining the plant's availability for future research and utilization.

8. CONCLUSION

In conclusion, the Asian Crinum Lily (*Crinum asiaticum*) holds significant promise as a medicinal plant due to its diverse pharmacological properties and bioactive compounds. It has shown potential in various areas, including anticancer activity, antimicrobial effects, anti-inflammatory and analgesic effects, antioxidant activity, antidiabetic potential, antihypertensive activity, immunomodulatory effects, and neuroprotective properties. The plant's therapeutic potential opens doors for drug development prospects, with possibilities for developing novel anticancer agents, anti-inflammatory drugs, immunomodulators, neuroprotective agents, and treatments for diabetes and hypertension. However, several challenges and research gaps need to be addressed for the Asian Crinum Lily's full potential to be realized. These include standardization and quality control, understanding bioavailability and pharmacokinetics, investigating mechanisms of action, conducting clinical trials, assessing drug-drug interactions and safety profiles, and ensuring sustainability and conservation.

By addressing these challenges and conducting further research, we can enhance our understanding of the Asian Crinum Lily's therapeutic properties, optimize its use in medicine, and potentially develop new drugs or complementary therapies. While the Asian Crinum Lily shows promise, it is important to approach its use with caution and consult healthcare professionals for guidance. Future research, collaboration, and investment in this field will contribute to unlocking the full potential of the Asian Crinum Lily and its integration into evidence-based medicine.

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