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REVIEW ARTICLE

Phytochemistry and Pharmacological Potential of *Crinum asiaticum*: A Review of Health Benefits

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Abstract

Background: *Crinum asiaticum*, a member of the *Amaryllidaceae* family, has long been recognized in traditional medicine systems across Asia, particularly in *Ayurveda* and folk healing practices. Known for its striking appearance and therapeutic versatility, the plant has been used to treat a variety of ailments ranging from inflammation and infections to chronic conditions. Its widespread use in ethnomedicine has prompted scientific interest in exploring its phytochemical makeup and pharmacological potential. **Aim:** This review aims to consolidate current knowledge on the phytochemical constituents and pharmacological activities of *C. asiaticum* and evaluate its potential therapeutic applications, and identify gaps for future research. **Methods:** A thorough literature review was conducted using databases such as PubMed, Web of Science, and Science Direct, covering studies from 2007-2024 to the present. The review focused on experimental, clinical, and ethnobotanical studies based on *C. asiaticum.* **Results:** The plant is rich in bioactive compounds including alkaloids (*e.g.*, lycorine, quinine), flavonoids, glycosides, and phenolics. These constituents contribute to a wide range of pharmacological effects such as antimicrobial, antioxidant, anti-inflammatory, analgesic, anticancer, and hepatoprotective activities. Mechanistic studies suggest that these effects are mediated through pathways involving apoptosis induction, free radical scavenging, and enzyme modulation. Additional benefits include wound healing, neuroprotection, and metabolic regulation. However, data on toxicity and clinical efficacy remain sparse. **Conclusion:** *C. asiaticum* exhibits significant therapeutic promise, supported by both traditional use and emerging scientific evidence. Nonetheless, further research-particularly clinical trials and toxicological assessments-is essential to fully validate its safety and efficacy for modern medical applications.

Major Finding: *Crinum asiaticum's* contains a variety of phytochemicals and encouraging pharmacological properties have attracted a lot of interest in therapeutic applications.

Keywords: *Amaryllidaceae, C. asiaticum,* Pharmacological Activities, Phytoconstituents, Traditional Use

1. Introduction

Nature boasts a plethora of plants that have been revered for their healing properties over the ages. One such plant is the tropical perennial herb *C. asiaticum* (commonly called poison bulb, Crinum lily, or Spider lily), which is notable both for its medicinal and ornamental significance. Traditionally, this plant has been used in emergencies when someone has ingested a harmful substance. If a person gets poisoned, this poison bulb has been reported to induce vomiting, helping to remove the poison from the body quickly. It works because it causes the stomach to empty its contents before the poison can do serious damage. However, such traditional use requires extreme caution, as the plant itself is toxic and unsafe if not used properly. Modern medical care should always be sought immediately in cases of poisoning, with the traditional role of this plant viewed only as a cultural practice. Regional variations include "*bakong*" in Malaysia, "*morabau*" in Papua New Guinea, and "*naagadami*" in *Ayurveda,* underscoring its wide cultural presence[1].

Crinum asiaticum grows naturally in many warm places around the world, including Australia, East Asia, Tropical

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Asia, and the Islands in the Pacific and Western Indian Ocean. Photochemical investigations have identified bioactive compounds, including a flavine-inhibitor adduct formed from the interaction of mitochondrial amine oxidase's flavine with 3-dimethylamino-1-propyne. This specialized dihydroflavine, modified at N-5, has a well-elucidated structure, an important discovery for pharmacological and agricultural research. Such knowledge highlights the potential of *C. asiaticum* in future drug discovery and plant improvement strategies. Usually, this perennial plant reaches a height of up to 1.2 meters, or about 3.9 feet[2]. It exhibits a unique shape with a round pseudobulb, 6 to 15 cm wide, which bears side branches and supports long, strap-like dark green leaves up to a meter long, generally with wavy edges. There can be about 20 to 30 leaves, each measuring 7 to 12cm wide. When flowering, the plant produces a fragrant umbel consisting of 10 to 24 showy white blossoms. *C. asiaticum*, a member of the kingdom *Plantae,* order *Asparagales*, and family *Amaryllidaceae* (subfamily *Amaryllidoideae*), is distinguished by its lush foliage and spectacular flowers. Taxonomically, although older classifications sometimes used the synonym *Bulbinea siaticum*, its correct binomial is *Crinum asiaticum*[3].

Members of the genus *Crinum* are robust perennials adapted to thrive in tropical and subtropical habitats, often in marshy or coastal areas. In addition to its aesthetic value, this plant holds significance in traditional medicine. Ethnobotanical practices employ the bulb and leaves in poultices and decoctions to treat skin disorders, pain, inflammation, and swelling, reflecting its perceived detoxifying and therapeutic qualities. The combined hardiness, medicinal potential, cultural role, and striking ornamental beauty make *C. asiaticum* an important plant of both scientific and societal interest[4]. Table 1 describing the classification of *C. asiaticum* (Figure 1).

Table 1. Taxonomic classification and synonymous binomial names of *C. asiaticum*. scientific classification of *C. asiaticum*

Kingdom	*Plantae*
Clade	*Tracheophytes*
Order	*Asparagales*
Family	*Amaryllidaceae*
Sub-Family	*Amaryllidoideae*
Genus	*Crinum*
Species	*C. asiaticum*
Binomial name	*Crinum asiaticum*
Synonyms	*Bulbinea siaticum*

2. Materials and Methods

This review looks at scientific studies from 2007 to 2024 about the plant known by names like *Crinum asiaticum*, poison bulb, grand crinum lily, spider lily, and nagdaman. Authors searched through databases like PubMed, Google Scholar, ScienceDirect, Scopus, Web of Science, and ResearchGate. They used search techniques with different keywords and phrases, such as 'traditional medicine', 'health benefit', 'toxicity', and other related terms along with *C. asiaticum*. By combining these keywords with Boolean operators like AND, OR, and NOT, they found many relevant studies.

3. Traditional Use

Crinum asiaticum L. holds significant value in traditional medicine across various countries globally. It is primarily utilized for pain relief, while its secondary applications include wound treatment. Its medicinal properties are notably documented in regions such as India, Bangladesh, Malaysia, Indonesia, Micronesia, Thailand, and Vanuatu. *C. asiaticum*, commonly known for its medicinal uses, is a plant that has a long history in traditional herbal medicine. People have used its boiled and crushed leaves to make ointments for conditions like piles, hemorrhoids, and painful joints. In the Chittagong hill regions of Bangladesh, local tribes prepare remedies from this plant to help with many health issues, such as ear and throat infections, arthritis, and even symptoms like coughing and fever. A mixture of its juice with honey is often used on wounds and abscesses[5,6]. Research shows that both the alcohol and water extracts from the bulb of *C. asiaticum* can fight harmful bacteria, suggesting that this plant might be a valuable source of new medicines to combat infections. Overall, *C. asiaticum* shows great promise as a natural remedy for a variety of health problems[7].

4. Phytoconstituents

Certain groups of chemicals are known for their powerful effects on health, playing important roles



Figure 1. *C. asiaticum* plant.

Table 2. List of phytoconstituents present in *C. asiaticum*

Country	Disease	Parts Used	Phytoconstituents	References
Bangladesh (Chakma community)	Furuncle is a painful, pus infection.	Roots	Lycorine glucoside	[12]
Bangladesh	Menstrual discomfort	Tubers, the roots of Ocimum sanctum together	-	[12]
Bangladesh	Emetic and antidotes	Bulbs	Crijaponine A and B, lycorine, acetylated derivatives, quinine, 11-hydroxyvitamin, humane, epibuphanisine	[12]
India (Tripura state,Tipuri tribe)	Tonsillitis	Bulb juice	Kalbretorine, pseudolycorine	[12]
Bangladesh	Edema, pain,	The whole plant employed	Seco-isopowellaminone, crinamine N-oxide	[13]
India	Arthritis	Bulb	-	[13]
Indonesia	Postular skin eruptions	Latex	-	[13]
South Africa	Aching joints, backache	Bulbs /Roasted	Noraugustamine, 4aN-dedihydronoraugustamine,3-O-acetylsanguinine, 1,2-diacetyllycorine	[13]
Thailand (Kutchum district)	Fever	Leaves	Phenanthridone derivatives	[13]
Bangladesh (Bede community of savar)	Rheumatic pain	Leaves	Crinine, lycorine, ambelline derivatives	[14]
India (Haryana Mahendergarh district)	Laxative and urinary problems	Bulbs	Hippadine, pratorimine, pratorinine	[14]
India (Rajasthan)	Earache and wounds	Leaves and tubers	2-Alkylquinolin derivatives	[14]
Micronesia	Withdrawal of the testes	Leaves	6-Hydroxycrinamine, lycorine, crinamine	[14]
Bangladesh	Gastric acidity	Leaf juice and fruit	Crijaponine A and B, lycorine, acetylated derivatives, quinine, 11-hydroxyvitamin, humane, epibuphanisine	[15]

in avoiding illnesses such as cancer and infections, reducing inflammation, and fighting damage from free radicals. A study found that the crucial oil from the leaves of *C. asiaticum* is made up of a variety of compounds, with these compounds accounting for about 93.14% of the total oil. This suggests that the oil could be a valuable source of natural substances that may help in treating various health issues[8]. The findings highlight the potential benefits of using plants like *C. asiaticum* in developing new health remedies. *C. asiaticum* contains a variety of important compounds, including 3-methylbutanal, hexanal, and benzaldehyde, among others. Among these, the highest amounts found were 1-hexadecanol, oleic acid, and methyl octadecenoate[9]. Scientists tested essential oil and extracts from this plant to see how well they can fight off fungi, using a method called GC-MS analysis to identify 27 different components in the essential oil[10]. Many of these compounds are known for their potential health benefits, making them interesting for further study. The research highlights the valuable properties of *C, asiaticum,* suggesting it could be useful in products aimed at improving health and wellness[11]. Table 2 describing the phytoconstituents present in *C. asiaticum* along with the part and pharmacological action in various diseases.

5. Pharmacological Activities of *C. asiaticum*

5.1 Anti-inflammatory Activity

The model of paw edema caused by carrageenan is a popular way to test how well natural substances can reduce swelling and inflammation in the body. In this model, a substance called carrageenan is used to create inflammation in the paw of a test animal, usually a rat or a mouse. Researchers then give the animal different natural compounds to see if they can help reduce the swelling during the early stages of inflammation. This method is effective because it helps scientists identify which oral anti-inflammatory agents might work best in treating problems like pain and swelling in humans. By using this simple yet powerful model, researchers can find new treatments that could help people feel better when they are suffering from inflammation[16]. This model evaluatedthe anti-inflammatory properties of *C. asiaticum* leaf extract. Edema formation in the rat paw post-carrageenan injection occurs in two distinct phases[17]. Within the 1st hour, the initial phase is driven byhistamine and serotonin, which are released. In contrast, the second phase involves the release of prostaglandins, proteases, and lysosomes, causing arterioles and venules dilation and elevated permeability of the blood vessels[18]. Administration of *C. asiaticum* leaf extract at a dose of 2 g/kg resulted in anti-inflammatory effects of 51.6%, 32.2%, 29.8%, and 40.8% at 1, 2, 3 and 4 hours post-carrageenan injection, respectively. At a lower dose of 1 g/kg, the extract achieved effects of 3.9%, 11.43%, 17.83%, and 8.76% at 1,2,3, and 4 hours post-injection[19]. The findings indicate that the ethanol extract of *C. asiaticum* leaves exhibits substantial anti-edematogenic effects in carrageenan-induced paw edema, validating its efficacy in reducing inflammation. As this model is considered a reliable predictor for anti-inflammatory activity, the study highlights the potential of *C. asiaticum* leaf extract as a potent anti-inflammatory agent[20]. Pharmacological activities of *C. asiaticum* given in (Figure 2).

5.2 Antimicrobial Properties

Studies have highlighted that *C. asiaticum* demonstrates wide-ranging research has shown that the essential oil from the leaves of *C. asiaticum* has strong antimicrobial properties, making it effective against various harmful germs[21]. This oil can target both Fungal pathogens and both Gram-positive and Gram-negative bacteria, like *Candida albicans* and *Rhizopus* species. Notably, the oil has shown impressive results, using 1.25 mg/ml Minimum Inhibitory Concentration (MIC) values for Shigella boydii and just 0.078 mg/ml for both *Candida albicans* and Rhizopus species. These results imply that *C. asiaticum* would be a useful natural remedy in fighting infections caused by these pathogens, highlighting its potential role in healthcare[22]. Furthermore, Recent studies show that the extracts and essential oil from *C. asiaticum* have strong antifungal properties, making them effective against 5 different fungal pathogens. The essential oil stands out with its impressive ability to fight these fungi, requiring less than 1.0 mg/ml to be effective, which is a much lower amount compared to the extracts[23]. This suggests that the essential oil is not only more powerful but also more efficient in its action against these harmful fungi. These findings could lead to new ways of using *C. asiaticum* in

medicine and natural treatments, offering a promising alternative to traditional antifungal drugs. Overall, the use of *C. asiaticum* could greatly benefit those looking for natural solutions to fungal infections[24]. Among the fungi tested, *Rhizoctonia solani* Kuhn appeared the most susceptible, with an EC50 value of 0.11 mg/ml. additionally, the root extract of *C. asiaticum var. japonicum* in methanol demonstrated notable anti-HIV-1 activity, with an Effective Dose (ED50) of 12.5 µg/ml, as reported, explored the antibacterial effects of both aqueous and ethanol-based leaf extracts, revealing that the ethanolic extract displayed significant activity, with Minimum Bactericidal Concentration (MBC) values between 13 ± 0.45 and 18 ± 0.21 mm, and MIC values ranging from 0.187 to 0.375 mg/ml[25,26]. Phytol, a compound with various applications in the fragrance and flavour industries, was noted as well. This analysis not only highlights the variety of beneficial compounds present but also opens doors for further research on their potential uses[27].

5.3 Antioxidant Effect

Numerous studies have demonstrated the antioxidant properties of *C. asiaticum*. For instance, research. highlighted the protective effects of the plant's ethanolic extract and lycorine (compound 9) on human erythrocytes[28]. The study shows that both the leaf extract and lycorine can help fight oxidative damage caused by 2-amidinopropane. They work by neutralizing harmful free radicals, specifically 1,1-Diphenyl-2-Picrylhydrazyl (DPPH) radicals. The leaf extract is found to be more effective than lycorine in this process. As the amount of leaf extract increases, its ability to fight these radicals grows stronger. This means that using the leaf extract can be a good way to shield cells from oxidative stress-related harm, which is important for maintaining overall health[29]. Similarly, found that the methanolic extract of *C. asiaticum* bulbs demonstrated outstanding scavenging of free radicals capabilities, with an IC50 value of 5.62 µg/ml, closely rivalling the IC50 value of ascorbic acid[30]. In another study, the antioxidant potential of the ethanolic leaf extract of *C. asiaticum* in diabetic rats induced with alloxan. Their findings showed that the extract protected hepatocytes by mitigating markers of oxidative stress related to hyperglycemia and enhancing antioxidant activity in liver tissues[31]. The rats experienced significant improvements in blood sugar, cholesterol, triglycerides, and low-density lipoprotein levels, along with an increase in high-density lipoprotein levels[32]. In recent studies, researchers found that certain enzymes such as lactate dehydrogenase, alkaline phosphatase, acid phosphatase, aspartate transaminase, and alanine transaminase, showed lower levels. This is important because these enzymes play key roles in various body processes, including the breakdown of proteins and energy production. Researchers studied the antioxidant properties of twelve different types of *Crinum* plants, and they observed that the methanolic extract from *C. asiaticum* stood out because it had the strongest antioxidant activity[33]. To understand how well these extracts could fight against free radicals-harmful substances that can damage. cells-they used several tests. One of these tests, called the DPPH radical scavenging assay, showed how effectively the extracts could reduce harmful radicals. Additionally, they measured the overall antioxidant activity and the ferric reducing antioxidant power to get a complete picture of each plant's ability to protect calls from damage. Overall, these findings highlight the possible health advantages of *C. asiaticum* and suggest it could be a valuable source of natural antioxidants[34].

5.4 Anti-tumor Effect

The study focused on how CAL-n affects cancer cells by using a test called the MTT assay. First, the scientists placed the cancer cells in small wells and let them sit for 72 hours. Then, they took out the fluid from each well and added a special MTT solution, which helps to see how alive the cells are. After adding the solution, they kept the wells in a dark place for 4 more hours to let the reaction happen. Once that time was up, they mixed in another solution called dimethyl sulfoxide to help measure the results. Finally, they used a machine called an ELISA plate reader to see how much colour had developed in each well, which showed how well CAL-n worked against the tumour cells. The measurements were taken at two specific wavelengths to ensure accuracy in the results[35].

5.5 Anti-cancer Property and Cytotoxicity Effect

Lethality test for brine shrimp is a useful test that helps scientists discover whether certain substances can

be harmful to living things. For example, researchers found that a methanolic extract from *C. asiaticum* leaves showed strong toxic effects on brine shrimp, with a lethal concentration value of 257,1 µg/ml. This means that a small amount of the extract can kill a significant number of these tiny shrimp. In another study, a different part of the same plant, the methanolic bulb extract, also proved to be deadly to brine shrimp, with a slightly lower lethal concentration of 94.06 µg/ml[36]. Furthermore, hot water extracts of *C. asiaticum* were found to protect mouse cancer cells from a type of damage caused by calprotectin, with an important compound called lycorine showing that it might help in reducing this harm. These studies suggest that *C. asiaticum* could have important properties that can be further explored for health benefits[37]. Furthermore, several alkaloids such as Crinumaquine, (-)-lyconne, ungeremine, 11-O-methylinamine, 3-0-acetylhamayne and crimamine are all natural compounds found in certain plants, particularly from the *Amaryllidaceae* family. These substances are known for their potential health benefits, including helping with pain relief and fighting infections[38]. Scientists study these compounds to understand how they work in the body and how they might be used in medicines. For example, some of these compounds have been linked to effects that could help treat diseases like cancer. Because they come from plants, they also make researchers excited about new, natural ways to create medicines. Understanding these compounds better might not only give us insights into their healing properties but also inspire new treatments in the future[39]. isolated from *C. asiaticum* bulbs, were found to exhibit notable inhibitory effects on various tumour cell lines, including A549, LOVO, HL-60, and 6T-CEM. Additionally identified - Criasiaticidine A, lycorine, 4′-hydroxy-7-methoxyflavan, and pratorimine are the four alkaloids- were extracted from the alkaline ethyl acetate-soluble fractions and ethyl acetate of *C. asiaticum* bulbs, showing Lewis lung carcinoma cells and cytotoxicity. Among them, lycorine demonstrated the highest efficacy, with ED50 values[40]. The Malaysian leaf extract in methanol, *C. asiaticum* shows strong anti-angiogenic properties, meaning it can help stopthe development of new blood vessels, which is important in fighting cancer. in tests done on rat aortic rings, the extract effectively blocked new vessel growth[41]. It also demonstrated cytotoxic effects, killing cancer cells at a low concentration of 2.18 µg/ml. Additionally, the extract reduced cell movement and lowered the release of a cancer-promoting substance called VEGF in specific cell types. One active compound found in this extract, identified through analysis, is lycorine. Beyond its leaf extract, recent studies have shown that the essential oil from *C. asiaticum* leaves can kill breast cancer cells when tested in a controlled setting. Furthermore, a newly discovered polysaccharide, named CAL-n, also slowed down the growth of liver cancer cells. Overall, these results imply that *C. asiaticum* could be a promising source for developing new cancer treatments[42].

5.6 Anthelmintic Activity

In this study, we tested the anthelmintic activity using a method that was slightly adjusted from an existing protocol. We chose adult earthworms, specifically *Pheretima posthuma*, because they are similar in body structure and function to the roundworms that infect humans. This similarity makes earthworms a useful model for our tests, as they can help us understand how potential treatments might work against human intestinal worms[43]. By observing how these treatments affect the earthworms, we can gain valuable insights into their effectiveness before moving on to more complex studies. Overall, this approach allows us to explore new ways to fight worm infections in people. Earthworms are commonly employed for preliminary *in vitro* assessments of anthelmintic activity because they are readily available and simple to handle[44]. To start the experiment, every worm was carefully washed with regular saline to remove any leftover dirt and feces. After cleaning, the worms were measured out and mixed with 10 ml of purified water to create different strengths of the solution, specifically mg/mL of 10, 20, 30, 40, and 50. The worms were then divided into 7 groups and put in petri plates with 5 worms each. Next, extracts from the leaves of *C. latifolium* were added to the dishes, and the researchers watched how long it took for the worms to become paralysed or die[45]. A worm was considered paralysed if it did not move unless it was shaken hard. Death was determined when a worm no longer moved at all, even if it was shaken or put in warm water at 50° C, and this was also accompanied by a noticeable change in color[46].

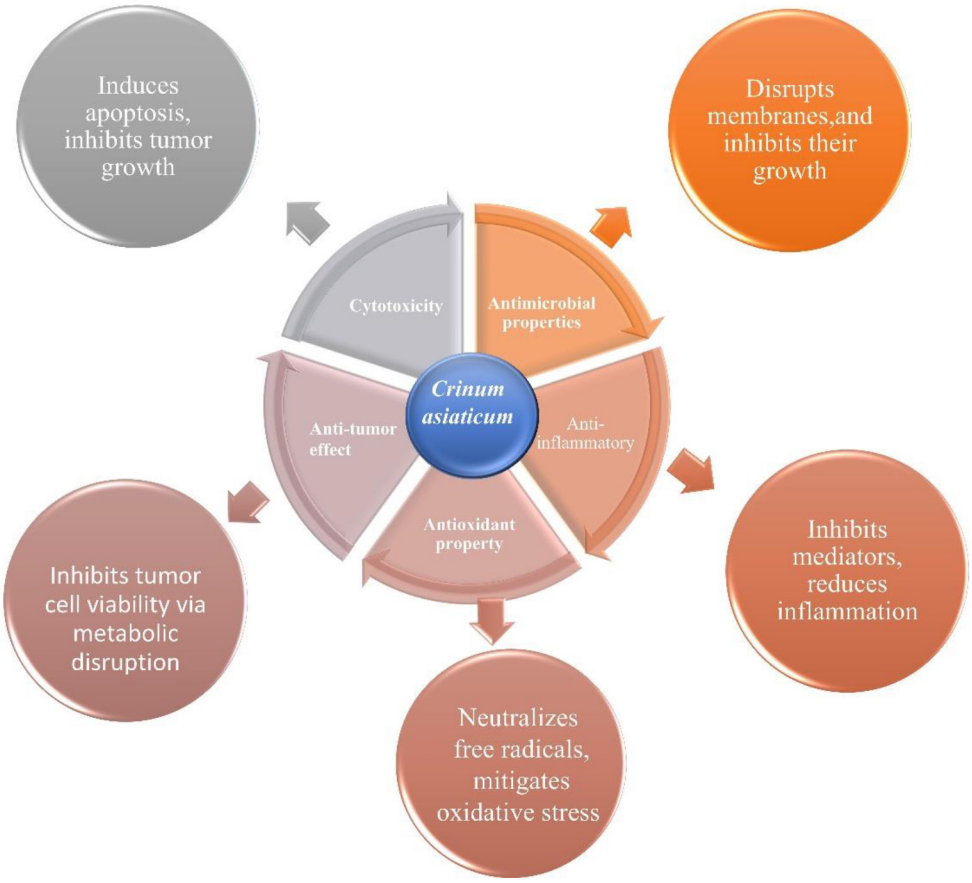


Figure 2. Pharmacological activities of *C. asiaticum* showing its cytotoxic, antimicrobial, anti-inflammatory, antioxidant, and anti-tumor effects.

5.7 Anti Diabetic Activity

Crinum asiaticum, commonly known as poison bulb, has shown promising antidiabetic properties in scientific studies[47]. Previous research indicates that leaf extracts of this plant, prepared using cold maceration techniques, contain bioactive substances such as tannins, phenolics, alkaloids, and flavonoids[48]. These compounds contribute to its glucose-lowering potential[49]. In experiments involving alloxan-induced diabetic rats, both aqueous and ethanolic extracts of *C. asiaticum* leaves demonstrated significant antidiabetic activity[50]. Thus, *C. asiaticum* exhibits a broad spectrum of pharmacological activities *viz.* antioxidant, anti-inflammatory, antimicrobial, anticancer, and neuroprotective effects. A summary of these reported activities is demonstrated in Figure 2.

6. Discussion

Crinum asiaticum is a botanically and pharmacologically important plant with extensive therapeutic potential. Its traditional use in medicinal practices, such as *Ayurvedic*, *Unani*, and folk systems across Asia, has been increasingly validated by modern research into its pharmacological and phytochemical characteristics[51,52]. Numerous alkaloids, including as lycorine, crinine, crinamine, and haemanthamine, are found in the plant, which are key to its medicinal properties[53]. These compounds have shown significant bioactivities in *in vitro* and *in vivo* investigations, demonstrating anti-inflammatory, antimicrobial, antioxidant, anticancer, hepatoprotective, analgesic, and wound-healing effects[54,55]. Notably, lycorine and crinine have exhibited cytotoxic and antiproliferative properties against several cancer cell lines, including those associated with breast, colon, and lung cancers, positioning them as potential candidates in oncology research[56-58]. The anti-inflammatory properties of *C. asiaticum* are particularly noteworthy, with studies revealing its ability to suppress pro-inflammatory markers like TNF-α and IL-6 in animal models[59].

Aqueous and ethanolic extracts of its leaves and bulbs have also demonstrated robust free radical scavenging activity in the ABTS and DPPH tests, highlighting their antioxidant potential[60]. This capability might have a crucial role in managing chronic diseases linked to oxidative stress, including heart disease and neurodegenerative disorders[61,62]. Additionally, the plant's antimicrobial efficacy against various bacterial and fungal strains suggests its potential role in combating antibiotic resistance[63]. Its wound-healing effects have also been substantiated, with applications of its extracts promoting faster re-epithelialization and enhanced collagen deposition in wound models[64,65]. Despite these promising results, significant gaps remain in the scientific literature[66]. Most pharmacological studies are restricted to preliminary experimental models, with limited clinical trials conducted to establish the plant's safety and effectiveness in humans[67]. Furthermore, a lack of standardized extraction protocols and dose-response evaluations poses challenges for reproducibility and large-scale pharmaceutical use[68]. Mechanistic studies, including genomic and proteomic analyses, are also required to elucidate the biochemical pathways influenced by the plant's active compounds[69]. Toxicological assessments have revealed that certain parts of the plant could be toxic at high doses, with alkaloids like lycorine associated with emetic effects[70,71]. Consequently, establishing a well-defined therapeutic window through detailed toxicological studies is essential[72,73]. In summary, *C. asiaticum* is a valuable medicinal plant with substantial potential for drug discovery and therapeutic application[74]. Its traditional medicinal uses are increasingly supported by modern pharmacological findings, particularly in areas such as inflammation, infection, cancer, and oxidative stress[75]. However, advancing its application in healthcare requires an interdisciplinary approach involving phytochemical isolation, molecular biology, pharmacological testing, and clinical validation[76,77]. Future research efforts should focus on isolating pure compounds, exploring their synergistic effects, studying pharmacokinetics, and conducting extensive clinical trials[78,79]. If utilized effectively, *C. asiaticum* could significantly contribute to the development of novel plant-based therapeutics, especially in response to rising drug resistance and the growing demand for alternative medicine[80].

7. Conclusion

A well-known member of the *Amaryllidaceae* family, *C. asiaticum* has attracted a lot of scientific attention because of its wide range of pharmacological actions and varied phytochemical profile. Its abundance of bioactive components, including alkaloids, flavonoids, saponins, glycosides, and phenolics, is highlighted in this thorough analysis. These compounds play a major role in its anti-inflammatory, anti-cancer, antibacterial, hepatoprotective, and neuroprotective qualities. *C. asiaticum* has long been prized for its therapeutic properties in traditional medical systems, and current scientific research supports and broadens these assertions. There is an urgent need for carefully planned clinical trials to assess the effectiveness, safety, pharmacokinetics, and dose characteristics of formulations based on *C. asiaticum* in people, notwithstanding the encouraging *in vitro* and *in vivo* results. Furthermore, it is still unclear exactly what molecular pathways underlie many of its therapeutic effects. To optimize bioavailability and therapeutic results, future studies should also concentrate on standardizing plant extracts, identifying lead chemicals, and creating innovative formulations.

To sum up, *C. asiaticum* has a great deal of promise as a natural medicine source. It might greatly aid in the creation of new medications for a range of infectious and chronic illnesses with further multidisciplinary research, meeting the demand for safer, more effective, and plant-based substitutes for synthetic medications worldwide.

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9. Author Contribution

C.G: Writing- original draft; A.M: Review, editing, and conceptualization; P.B: Review, editing, and validation. All authors have read and approved the final version of the manuscript.

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