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A DESCRIPTIVE STUDY ON *HYMENOCALLIS LITTORALLIS* PLANT

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ABSTRACT

Hymenocallis littoralis (Jacq) Salisb, commonly known as Spider Lily, is an important medicinal and ornamental plant belonging to the family Amaryllidaceae. Native to tropical and subtropical regions, it is widely cultivated for its attractive flowers and various therapeutic applications. Traditionally, different parts of the plant, including bulbs, leaves, flowers, and roots, have been utilized in folk medicine for their emetic, anti-inflammatory, wound healing, and antimicrobial properties. The bulbs are known for their astringent and expectorant effects, while leaf extracts have shown anti-bacterial and hair growth-stimulating properties. The plant is commercially significant in India, particularly in Gujarat and Maharashtra, where it holds a premium place in the floriculture market due to its year-round flowering and aesthetic appeal. Phytochemical studies on *Hymenocallis littoralis* have revealed the presence of several bioactive compounds, predominantly alkaloids such as lycorine, pancratistatin, haemanthamine and hippeastrine. These compounds exhibit a wide range of pharmacological activities including anticancer, antiviral, antioxidant and cytotoxic effects. Ethno-pharmacological investigations have also highlighted its potential in treating conditions like arthritis, fungal infections, and biofilm-associated infections. In addition to its medicinal significance, the plant's propagation through bulbs and tissue culture, along with its adaptability to different soils and climates, makes it an economically viable crop. This review aims to consolidate the current knowledge on the botanical characteristics, traditional uses, cultivation practices, phytochemistry and pharmacological potential of *Hymenocallis littoralis*, emphasizing its role as a promising candidate for the development of novel therapeutic agents.

KEYWORDS

Hymenocallis littoralis, Amaryllidaceae, Ismene Salisb, Leptochiton, Pancratium and Twin-scaling.

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INTRODUCTION

The traditional uses of medicinal plants in healthcare practices are providing clues to new areas of research and hence its importance is now well recognized[1]. *Hymenocallis littoralis* (Jacq) Salisb commonly known as 'Spider Lily' is a bulbous, herbaceous plant from the family of Amaryllidaceae [2]. The plant is distributed by the sea

and in swamps in tropical, sub-tropical, and temperate regions throughout the world[3]. Throughout the history of *Hymenocallis littorallis*, many alkaloids have been identified from its bulb[4-6].

Plants of the family Amaryllidaceae included more than 1000 species in about 85 genera. More than 30 species in 11 genera were used in the treatment of human cancer. Chemical investigations of Amaryllidaceae were carried out for about 200 years[4]. Toxic constituents are Amaryllidaceae alkaloids such as lycorine and tazettine and other toxic plant alkaloids.

Several additional alkaloids have cholinergic, analgesic, hypotensive and cytotoxic actions among which lycorine is the main alkaloid having centrally emetic action, which is responsible for clinical symptoms[7]. In pets, chewing on or ingesting leaves generally causes mild gastrointestinal upset and ingestion of parts of the bulb may lead to more severe signs. *Hymenocallis* alkaloids are the main biological activity constituents in this family[8]. *Hymenocallis littorallis* (Botanical name) which contains poisonous parts such as bulbs, leaves and flowers Amaryllidaceae is a widely spread family all over the world containing about 90 genera and 1310 species. The plant *Hymenocallis littorallis*, which is the main commercial species in Western India, it is around 60-7cm tall with light green foliage. The sword-shaped leaves are broad in size (4-5cm) and the plant flowers throughout the year. It is used mainly as an ornamental plant; flowers used in perfumes.

Herbal medicine is becoming more popular since it offers significant benefits without having a negative impact on health or productivity. Herbal remedies have a solid traditional or conceptual foundation and the potential to be effective pharmaceuticals for treating a variety of diseases due to their safety and efficacy[9].

This genus has its origin in South America and Africa. The name *Hymenocallis*, which refers to the membranous beauty of its delicate flowers, is derived from two Greek words hymen, which means membrane, and kallos, which means beauty. *Hymenocallis* bears tender bulbs.

The *Hymenocallis* members were formerly thought to be the American representatives of the Old-World genus Pancratium L. However, Salisbury (1812) established *Hymenocallis* as a distinct genus, based on distinct differences in seed characteristics *Pancratium* produces black, dry, compressed seeds with a phytomelan layer. While *Hymenocallis* has nearly ovoid, green, fleshy and often viviparous seeds. Along with the genera *Ismene* Salisb and *Leptochiton* Sealy, *Hymenocallis* forms the tribe Hymenocallideae[10].

Hymenocallis is native to warmer regions of the New World, i.e. Southern part of North America[11], Southern United States, (Florida, Georgia, Indiana, Louisiana, New Carolina, Texas and Mexico) to the Andes in South America[12], Bahamas, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Cuba, Equador, Guatemala, Haiti, Peru, Surinam, Venezuela, West Indies, etc.) and one species (*H. senegambica*) to West Africa. There are over 40 species in the genus, but *Hymenocallis littoralis* is the most economically significant and is widely grown in western India, specifically in Gujarat and Maharashtra and it takes up a premium position in the flower market of Mumbai. There is production of around 2000 lakh bundles (50 flower buds per bundle) of spider lily per annum from Gujarat alone. This genus is widely distributed in Mexico[13]. Holland being the major producing country.

TAXONOMICAL CLASSIFICATION[14]

Kingdom: Plantae
Clade: Angiosperms
Clade: Monocots
Order: Asparagales
Family: Amaryllidaceae
Subfamily: Amaryllidoideae
Genus: Hymenocallis
Species: H. littorali

Common names[15]

Alligator lily (*H. palmeri, syn. H. humilis*), Basket flower/Basket lily (*H. narcissiflora, syn. Ismene*

calathina, Pancratium calathinum, P. narcissiflorum), Caribbean lily (*H. caribbaea*), Cayman islands spider lily /Crysolite lily (*H. latifolia*), Crown beauty, Green pine lily (*H. henryae*), Ismene of Peruvian daffodil (*H. speciosa*), Ismene lily/Peruvian daffodil (*H. calathina, H. narcissifolia*), Sea daffodil, Spider flower, Spider lily (*H. calathina*), Summer daffodil.

Local names

Marathi: Nagdavana (नागदवणा)[16]

Hindi name: Sudharshan Spider Lily (सुदर्शन स्पाइडर लिली)[17]

English: Beach spider lily[18]

Malayalam: Kadal thali

Tamil: Kadarkarai Ilangonrai[19]

MORPHOLOGY OF PLANT

Bulb

The bulb is astringent, diuretic, emetic and expectorant. It is used to induce vomiting and to treat swellings. The grated bulb is used to extract larvae of skin parasites by applying pulp to the respiratory orifice of the larva in order to smother it[20].

Leaves

It is one of important medicinal plant. The part of the plant such as leave has anti-inflammatory and antibacterial properties. Also the leaves are stripped and used to stimulate hair growth[21].

Flowers

Approximately 12 centimetres long, the fragrant flowers have a perianth tube that is greenish below and whitish above and linear, white and spreading lobes. That are 10 centimetres long and 5 to 7 millimetres wide[15].

Root

The roots of *Hymenocallis littoralis*, also known as the Beach Spider Lily, are traditionally used as a folk medicine for wound healing, and the plant as a whole is used as an emetic and to treat swellings, sores and varicose veins[22].

TRADITIONAL USES

Hymenocallis littoralis is a horticultural and medicinal plant that is used as an emetic to cure swellings, ulcers and varicose veins. As well as a folk remedy for wound healing[22].

In the Philippines, the bulb is the only portion of the plant utilised for wound healing.

In Lao, testicles that are too low due to excessive running are treated with boiled roots in water.

The juice from the squeezed leaves is administered to cuts and wounds.

While a Mixture of oil and crushed bulbs is applied to the face to treat freckles and blemishes[23].

PROPAGATION

Vegetative propagation like offsets, division of clumps, bulbs, twin-scaling, etc. is followed in *Hymenocallis littoralis*. Spider lily is commercially propagated by bulbs of around 5-8cm size. Spider lily can also be grown from fresh seeds and offsets. There are some reports on tissue Culture of *Hymenocallis littorallis*[24]. Explants of *Hymenocallis speciosa* have been cultured on solid White's medium, supplemented with NAA and BA at 2.0 C in the dark. The Regeneration of bulblets by scales is markedly increased by NAA at 0.01mg/l and BA at 5Mg/l. Regeneration capacity has been found higher in *H. speciosa* were bulblets were found Formed on scale base explants[25].

CULTIVATION

Though spider lily grows in a variety of soils but fertile loamy or medium black soil which is light in texture is most suitable for its cultivation. It can also be grown in heavy black soil and many species even in muddy soils.

The soil pH should be normal, i.e, 6.5-7.5. However, it can tolerate salinity/alkalinity also to some extent. The field should be dug up by 40-60cm depth, tilled and furrowed.

Hymenocallis littorallis which grows commercially in India, and even other species thrive well in tropical climate, i.e, hot and humid conditions which are highly favourable for its growth and flowering. However, it can be grown in dry climates and hilly tracts also. Though it shows profuse flowering in bright sunlight conditions but have been observed to flower even in partial shade.

Hymenocallis littorallis grows well in open and full sunlight conditions, however, in hilly areas it prefers greenhouse conditions. Soil should be weed-free and thoroughly ploughed. Hoeing should also be followed when soil matures after watering. Furrows should be made for bulb planting at 90 x 20cm spacing, i.e., 90cm distance between two rows and 20cm between plants in a row. Thus plant density is around 45,000 bulbs per hectare of land. Double row system is also followed in which 60cm distance is maintained between two rows. Spider lily plants are perennial and exhibit year round flowering. Hence, once planted it thrives well for about 5-6 years. Planting is done in the month of October-November. Although it can be planted in any season[26].

FEEDING AND WATERING

It needs good amount of watering for proper growth and flowering. Light irrigation should be given at the time of planting. Gradually irrigation should be increased with sprouting of the bulbs and normal frequency of once in 5-7 days should be maintained. During hot summer months, frequency of irrigation should be increased at 3-4 days intervals and during winter months at 8-9 days interval[27]. Normally around 25 irrigations per year is required though the frequency largely depends upon prevailing weather conditions[28].

Spider lily being a perennial crop needs good amount of feeding. During land preparation and each year thereafter, 30 tonnes/ha of farmyard manure (compost) should be incorporated in the soil before planting. Koladiya reported maximum plant height, number of leaves, width of leaves and bulb multiplication with application of 400kg N/ha[29]. In a study conducted on the nutrition requirement for N and P of spider lily in Maharashtra, the optimum growth and high number of flower yield were obtained with application of 300kg N + 250kg P2O5/ha[30].

According to Patel, every year the crop need for chemical fertilizers is 300kg N, 225kg P and 200kg K per hectare. Phosphorus and potash should be given as basal dose. Nitrogen should be given in four split doses, i.e. June, September, December and March.

POST HARVEST

Hymenocallis Littorallis plants thrive well continuously for 5-6 years and there is no need of bulb lifting every year as observed in Gujarat and Maharashtra. After 5-6 years, a group or cluster of 7-8 bulbs is developed, hence the old crop should be uprooted. The bulbs should be separated, dried and after treatment with a fungicide, viz. Carbendazim should be planted independently. This crop does not require to be stored at low temperature for dormancy breaking like other bulbous crops. De Hertogh and Le Nard advocate lifting of the bulbs before the first frost and storing them immediately at a well-ventilated place at 25^{o}C temperature for drying and then storing at 20^{o}C after grading[31]. Flower harvesting in spider lily is done in the early morning between 6 and 9 hours. Stage of harvesting in spider lily is a mature bud when buds have started turning white just to open the next day. Grading of the buds is done as per the bud size (length) in two grades and bundles of 50 buds each is made. The bundles are tied with rubber bands and packed in gunny bags or plastic bags. The spider lily bags are immediately transported to the markets.

Production of spider lily is around 5-6 lakh bundles per annum per ha. The vase life of spider lily is noticeably short, it is just one day. There is a great fluctuation in the market rate of spider lily, ranging from Rs.10 - Rs.80 per thousand buds, which varies day-to-day. There is need to work out optimum post-harvest handling techniques for spider lily. The buds of spider lily can be stored in cold storage for a duration of one week with Pre-storage pulsing with 250ppm 8-HQC and 2% sucrose for 45 minutes and tissue paper packaging at 2ºC temperature. Further, there is need to work out pulsing and preservative solutions to enhance the vase life of spider lily flowers[32].

PHYTOCHEMICAL CONSTITUENTS

Several phytochemical constituents, including flavonoids, phenols, alkaloids[33] and other secondary metabolites[4], were identified from this plant but, as Sundarasekar and companions' observation, there aren't many research specifically examining these phytochemical compounds[34]. Several alkaloids, including lycorine, littoraline, hippeastrine, lycorenine, tazettine, pretazettine, macronine, homolycorine, lycoramine, vittatine and haemanthamine have been obtained from *Hymenocallis littoralis*[35]. The compounds were reported to possess various pharmacological effects such as antiviral, antiparasitic, anticancer, antibacterial, antioxidant and wound healing[36,37]. Lycorine, a pyrrolophenanthridine alkaloid, is one the major alkaloids found in *Hymenocallis littoralis*. It exhibits potent antiviral properties against the measles, poliovirus, and herpes simplex type 1 viruses[38].

ETHNOPHARMACOLOGY

Antioxidant Activity

The study derived 7, 4-dihydroxy-8-methylflavan from the P. littorale stem extract and evaluated its radical scavenging potential[39].

Cytotoxicity Activity

A 1993 study isolated pancratistatin (PST) from *Hymenocallis littoralis* which displayed potent cytotoxicity against a human tumor cell line. According to a recent study, PST spares healthy cells while selectively targeting cancer cells.

The anti-cancer efficacy and specificity of AMD4 and AMD5, two natural chemicals related to PST, were examined in this study. Natural Amaryllidaceae alkaloids might incorporate a phenanthridone structure that contributes to their selectivity against cancer cells[40].

Anti-tumor Activity

Excellent *in vitro* and *in vivo* cytotoxicity against numerous tumour cell lines and strong selectivity for cancer cells versus normal cells were demonstrated by the biological actions of isocarbostyril alkaloids[41].

Lycorine Alkaloids / Littoraline / HI Reverse Transcriptase Inhibition / Cytotoxicity Activity

Lycorine and haemanthamine demonstrated strong *in vitro* cytotoxicity, while littoraline exhibited HIV reverse transcriptase inhibitory action[14].

Narcistatin/Antineoplastic Activity

The horticultural production or reduction of narciclasine 1a-4 from the same source resulted in the extraction of human cancer cell line inhibitory isocarbostyril precursors from *Hymenocallis littoralis* bulbs[43].

Pancratistatin / Anticancer Activity

The species serves as an effective source of pancratistatin, a powerful anticancer agent. The bulbs produce the majority of pancratistatin, with the roots producing a lesser amount. The report describes a method for large-scale production.

Narciclasine was employed as precursor for synthetic conversion to natural (+) pancratistatin[14].

Anti-Fungal Activity

The study assessed how effectively a methanol extract of different plant parts inhibited Candia albicans. The flower and anther were effect at 6.25mg/ml[44].

Antimicrobial Activity

Study evaluated an aqueous extract against three organisms: *E. coli*, *S. aureus*, and *Candida albicans*. Varied concentrations showed inhibitory activity against all the tested organisms[14].

Antibacterial Activity

Leaves, flowers, and stem bark extracts in ethyl acetate and methanol exhibited antibacterial activity against *B. subtilis*[45].

Wound healing Activity

For the first time, cell-based technologies were used to evaluate the wound-healing potential of an extract from *Hymenocallis littorallis* (Amaryllidaceae). Significant medicinal properties. Including anti-Candida, antioxidant, cytotoxic, and wound-healing characteristics, are demonstrated by the ornamental plant *Hymenocallis littorallis*[4].

Anti-Arthritic Activity

The study evaluated the anti-arthritic potential of a crude extract of flowers using inhibition of protein denaturation method. Results revealed potent dose-

dependent anti-arthritic efficacy by inhibition of protein denaturation mechanism[46].

Biofilm Inhibition / Antibiofilm Activity

Study evaluated anti-biofilm potentials of *H.littorallis* against pathogenic microorganisms using experiment and computational biology methods. Antimicrobial and antibiofilm properties have been found to be promising against S.aureus NCIM 2654 and C. albicans NCIM 3466. Due to the presence of flavonoids and phenols, leaf extract demonstrated strong antioxidant activity. Potential for developing novel lead compounds for combating pathogenic microbes that produce biofilms is indicated by the in vitro and in silico studies[47].

Anti-Inflammatory Activity

The inhibition of protein denaturation technique was used in the study to assess the anti-inflammatory properties of the crude flowers extract. The HRBC membrane stabilisation approach has demonstrated strong anti-inflammatory action in successive ethanol extracts, with 83.46% and 84.72% for 100 and 500µg/ml, respectively[48].

Figure No.1: *Hymenocallis Littoralis* plant

Figure No.2: Bulb of *Hymenocallis Littoralis*

Figure No.3: Leaves of *Hymenocallis Littoralis*

Figure No.4: Flowers of *Hymenocallis Littoralis*

Figure No.5: Roots of *Hymenocallis Littorallis*

SUMMARY AND CONCLUSION

Hymenocallis Littorallis is (Spider Lily) is a medicinally and economically significant plant with wide ornamental, therapeutic, and pharmacological applications. Rich in Amaryllidaceae alkaloids like lycorine and pancratistatin, it exhibits potent antiviral, anticancer, antimicrobial, anti-inflammatory and wound-healing properties. Its ease of cultivation and propagation, along with its diverse traditional uses, underscores its potential as a valuable source for drug discovery and development in modern herbal medicine.

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CONFLICT OF INTEREST

I declare that I have no conflict of interest.

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