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A Comprehensive Review of Shankhpushpi: Exploring its Pharmacological Properties and Therapeutic Potential

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Abstract:
Shankhpushpi (Convolvulus pluricaulis Choisy) is a well-regarded Ayurvedic herb used for enhancing cognitive functions, reducing anxiety, and supporting mental health. Known for its neuroprotective, anti-inflammatory, and antioxidant properties, Shankhpushpi is often recommended as a brain tonic and for treating conditions such as anxiety, depression, epilepsy, and dementia. This herb contains numerous bioactive compounds like flavonoids, coumarins, and alkaloids, which contribute to its therapeutic efficacy. Traditionally, Shankhpushpi has been used to improve memory, treat respiratory and skin conditions, and promote hair growth. Studies have shown its potential in neuropharmacology with notable effects on anxiety, memory, and stress management. Shankhpushpi also displays cardioprotective and lipid-lowering properties, supporting overall cardiovascular health. Commonly Shankhpushpi known in Ayurveda, *C. pluricaulis* (CP) has been used to treat various ailments, particularly those affecting the central nervous system, such as anxiety, depression, epilepsy, and dementia. Pharmacological research suggests its ability to reduce oxidative stress, promote relaxation, and balance hormonal responses, which are beneficial in stress-related conditions. These properties highlight Shankhpushpi's significant role in Ayurveda for mental health support, cognitive enhancement, and overall well-being.

Keywords: Shankhpushpi, Convolvulus Pluricaulis, Oxidative stress, Alzheimer's disease

I. Introduction:

Shankhpushpi (*Convolvulus prostrates*) is a native and significant herb known for its ability to enhance nervous system functions[1]. It is widely used in traditional Ayurvedic practice, both as a single herb and in formulations, due to its potent bioactive components. Many Ayurvedic physicians still prescribe it as a natural tonic for the mental development of children. In Ayurveda, the therapeutic properties of plants are explained through concepts such as rasa (taste), guna (qualities), virya (potency), vipaka (post-digestive effect), and karma (action). Shankhpushpi is described as having a katu (pungent) and kasya (astringent) taste, with guru (heavy), snigdha (unctuous), sara (fluid), and pischila (sticky) qualities. It is ushana (hot) in potency, madhura (sweet) in post-digestive effect, and is known for its actions such as promoting intellect (medhakrita), improving voice (swarakara), and alleviating mental disorders (grahabhutadidoshhara)(reference).Although four plants like Canscora decussata Schult., Clitoria ternatea Linn., Convolvulus pluricaulis Choisy, and Evolvulus alsinoides Linn. are considered Shankhpushpi by Indian Ayurvedic practitioners, Convolvulus pluricaulis is specifically identified as Shankhpushpi in the Ayurvedic Pharmacopoeia of India. Shankhpushpi is a Sanskrit term meaning "the plant with flowers shaped like a conch." The word is a combination of "shankh" (meaning conch, a sacred instrument of Lord Shiva used in rituals) and "pushpa" (meaning flower), referring to the flower's resemblance to a conch shell. The botanical name of Shankhpushpi is *Convolvulus pluricaulis* Choisy, and it belongs to the family Convolvulaceae. This small, hairy, perennial herb, often associated with morning glory, is found in many regions. It has prostrate branches, small elliptic to oblong lanceolate leaves, and typically produces white to light blue flowers that are usually solitary in the upper axils, sometimes appearing in pairs. The flowers have two distinct styles that branch into four near the base. The plant yields a pale yellow oil with a greenish tint and a distinctive aroma through steam distillation. Shankhpushpi thrives in wastelands under xerophytic conditions in northern India during September and October. Its range extends to the Sahara and Sind deserts, a region known as the Saharo-Sindian distribution. The herb is renowned as a brain tonic, improving memory and cognitive function. Traditionally, its leaves have been used to treat chronic bronchitis and asthma, while its roots have been used to relieve childhood fever. The oil extracted from the plant is believed to stimulate hair growth. Shankhpushpi is also valued as a beauty-enhancing herb, nourishing all layers of the skin[2]. Neurodegenerative diseases (NDD) like Alzheimer's (AD) and Parkinson's (PD) account for 60–80% of all dementia cases. Medicinal herbs, with their diverse phytochemical compositions, are often used in traditional therapies as natural, multi-drug formulations with little to no side effects. *Convolvulus pluricaulis* Choisy (synonym *Convolvulus prostratus* Forssk.), belonging to the

Convolvulaceae family, is a perennial herb native to the Indian subcontinent. Commonly known as Shankhpushpi in Ayurveda, *C. pluricaulis* (CP) has been used to treat various ailments, particularly those affecting the central nervous system, such as anxiety, depression, epilepsy, and dementia. CP's pharmacological benefits include anti-inflammatory, antioxidant, and immunomodulatory properties. It contains several bioactive compounds, including flavonoids (kaempferol and quercetin), coumarins (scopoletin and ayapanin), phenolic acids (hydroxycinnamic acid), and phytosterols (β-sitosterol), which contribute to its therapeutic effects[3]. The Convolvulaceae family, commonly known as the morning glory family, includes over 1,880 species across 57 genera. This plant family is widely distributed in the southern regions of India, as well as in Sri Lanka and Myanmar. It is primarily cultivated at elevations above 1,300 meters[4].

II. Taxonomical Classification:

Kingdom: Plantae, Sub **Kingdom:** Tracheobionta **, Division:** Magnoliophyte, **Class :** Magnoliopsida, **order:** Solanales , **Family:** Convolvulaceae, **Genus:** Convolvulus, **Species:** Pluricaulis

III. Common Names of Shankhpushpi:

Table1. Common Name

English	Speedwheel
Hindi	Shankhpushpi, Aparajit
Sanskrit	Sankhapuspi
Urdu	Sankhali
Gujarati	Shankhavali
Kannada	Bilikanthisoppu
Malayalam	Krsnakranti
Marathi	Shankhabela
Tibetan	Shankhapushpi
Telugu	Shankhapushpi
Tamil	Sanghupushpam

Figure1: ShankhPushpi

Botanical Description:

The stem of Shankhpushpi is light green, slender, and cylindrical, with a thickness of about 0.1 cm or less. It has noticeable hairy nodes and internodes. Under a microscope, the stem shows a single-layered epidermis covered by a thick cuticle, with occasional unicellular hairs. The cortex is differentiated into two zones: 2-3 layers of upper collenchymatous cells and 1-2 layers of lower parenchymatous cells, both of which are round to oval and elongated.

The midrib of the leaves appears convex on the upper side and concave on the lower side, with vascular bundles surrounded by 4-5 layers of parenchymatous cells and typical elements of phloem and xylem. The lamina reveals unicellular hairs on both surfaces, a two-layered palisade, and a few bicollateral vascular bundles within the spongy parenchyma. The vein islet count is 20-25 per square millimeter[5].

Morphological Description of Shankhpushpi: The root is typically branched, cylindrical, and ribbed, with rough stem nodules and small secondary roots. It measures 1-5 cm in length and 0.1-0.4 cm in thickness, with a color ranging from yellowish-brown to light brown.

Stem: Slender, cylindrical, and about 0.1 cm or less in thickness, with distinct hairy nodes and internodes; light green in color.

Leaf: Short-stalked, linear-lanceolate, and pointed, with hairs on both surfaces; 0.5-2 cm long and 0.1-0.5 cm wide; light green.

Flower: White or pinkish, either solitary or in pairs, sessile or nearly sessile in the leaf axils. Sepals are narrow, linear-lanceolate, and sparsely hairy. The corolla is short and disc-shaped. There are five free, epipetalous stamens, alternating with the petals and deeply inserted into the corolla tube. The ovary is superior and bicarpellary.

Fruit: Capsule-shaped, oblong to globose, with a leathery, pale brown outer layer (pericarp).

Seed: Brown, with fine, minute hairs (minutely puberulous) [6].

IV. Geographical Distribution of Convolvulus of Pluricaulis:

The C. pluricaulis samples were collected from the Aravali foothills (Delhi and Kurukshetra, Haryana), the Gangetic Plains (Lucknow, Uttar Pradesh), the Arid zone (Jodhpur, Jaipur, Udaipur, Rajasthan), and the Vindhyachal region (Bhopal, Madhya Pradesh)[7].

Phytochemical Constituents:

Preliminary phytochemical screening of the ethanolic extracts from C. pluricaulis leaves showed the presence of various compounds, including alkaloids, glycosides, flavonoids, carbohydrates,

proteins, sterols, gums, and mucilages. The alkaloids, flavonoids, glycosides, and steroids found in C. pluricaulis are believed to be key contributors to its traditional therapeutic effects, due to their diverse pharmacological properties and unique structures. Other compounds like proteins, gums, and mucilages have also been identified in C. pluricaulis[8]. The chemical constituents of Shankhpushpi include carbohydrates such as D-glucose, rhamnose, maltose, sucrose, and starch. It also contains proteins, amino acids, and alkaloids like convolvine, convolamine, confoline, phyllabine, convolidine, convoline, convosine, subhirsine, and convolvidine, as well as fatty acids[9]. Several other hydrocarbons are also present in the extract of the CP plant, including 1-pentyl-2-tridecanyl cyclopentyl cyclohexane carboxylate, 1,2-benzenedicarboxylic acid, 10-bromodecanoic acid, 1-octadecanesulphonyl chloride, 2-butanone, 2-pentanol, 7-hydroxyheptadecanyl-1,7,17-tricarboxylic acid, ascorbic acid, cyclononasiloxane, cyclooctadecanyl methanol, decanoic acid, dicyclohexyl cyclo-octyl acetic acid, eicosane, heneicosane, hydroxy cinnamic acid, octatriacontyl pentafluoropropionate, pentadecyl 2-propyl ester, pentanoic acid, pentyl hexacosanoate, phthalic acid, silane, squalene, tetracyclohexanyl caproate, and tridecane[10].The CP plant contains a variety of compounds, including:Carbohydrates: D-glucose, maltose, rhamnose, sucrose, starch, and other carbohydrates.Fatty acids/volatile oils/fatty oils: Fatty alcohols and hydrocarbons, myristic acid (30.9%), palmitic acid (66.8%), linoleic acid (2.3%), and estriacontane.Proteins and amino acids: Proteins and amino acids have also been isolated from the plant.Phenols/glycosides/triterpenoids/steroids: A chemical analysis by Deshpande et al. identified scopoletin, β-sitosterol, and ceryl alcohol in C. pluricaulis. The chloroform fraction contains 20-oxodotriacontanol, tetratriacontaenoic acid, 29-oxodotriacontanol, the flavonoid campferol, and phytochemical steroids. CP-1 is a phytochemical marker that has also been isolated and characterized[11].

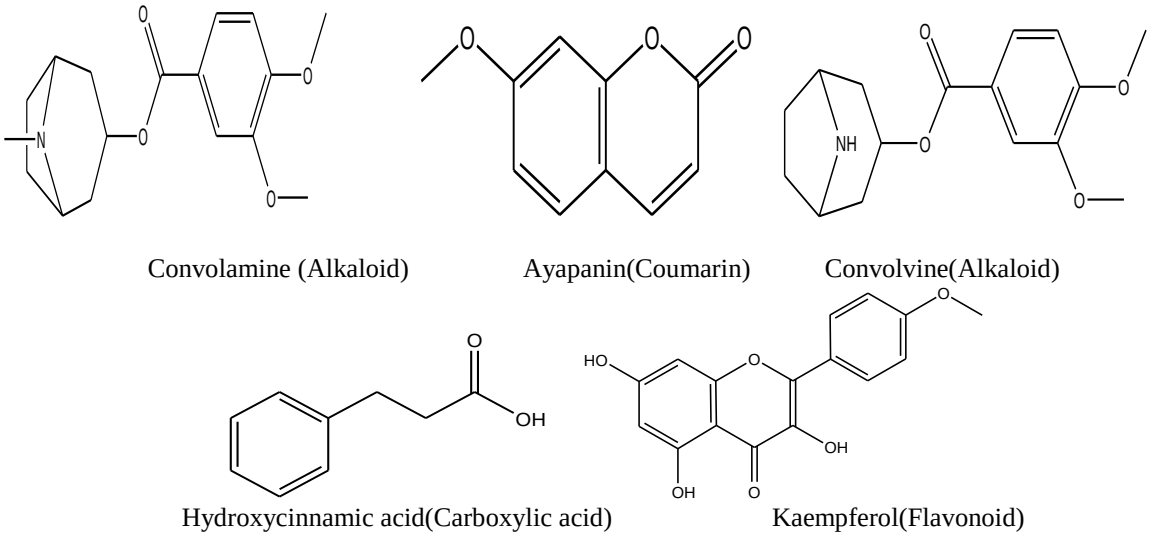

Figure2: Chemical structures of constituents of Shankhpushpi[12]

V. Traditional Uses of Shankhpushpi:

Shankhapushpi (Convolvulus pluricaulis Chois) has been used in India for centuries to treat various conditions such as anxiety, insomnia, and to promote longevity by enhancing strength and immunity. It improves digestion, strength, complexion, and vocal quality, while also treating intestinal worms, dysuria, animal poisoning, dyspnea, cough, diabetes, and uterine disorders. Additionally, it is beneficial for epilepsy, insomnia, heart disease, and hematemesis.

The leaves and flowers of Shankhapushpi have hypotensive properties, making them useful in the treatment of anxiety neurosis. In tribal communities in Chhindwara, Madhya Pradesh, it is regarded as an anthelmintic, effective for dysentery, skin conditions, and high blood pressure. In Gonda, Uttar Pradesh, the leaves are recommended for mental disturbances and depression.

Shankhapushpi is non-toxic and has no known side effects. In fact, it promotes overall health and weight gain. According to Ayurveda, Rasayana therapy, which includes the use of Shankhapushpi, has both physical and psychological benefits, preventing aging, enhancing intelligence, and increasing resistance to diseases. As a Medhya Rasayana herb, it helps balance the body's Kapha, Vata, and Pitta doshas. Herbalists believe Shankhapushpi soothes the nervous system by regulating the production of stress hormones like cortisol and adrenaline[13].Pharmacological studies on Shankhapushpi (Convolvulus pluricaulis) have demonstrated its varying degrees of hypotensive and tranquilizing effects. Clinical research has shown

clear benefits of the herb in treating patients with anxiety neurosis. It promotes feelings of calm and peace, improves sleep quality, and provides relief from anxiety, stress, and mental fatigue, significantly reducing stress-induced neuroticism.The herb is believed to exert its effects by modulating the brain's neurochemistry. Additionally, it helps restore balance in the body's Kapha, Vata, and Pitta doshas, and is known for its astringent and bitter properties[14]. The entire herb is used medicinally as a decoction with cumin and milk to treat fever, nervous weakness, and memory loss. Convolvulus pluricaulis serves as a brain tonic and is an excellent remedy for bowel disorders, particularly dysentery[15]. Shankhpushpi leaves have traditionally been used to treat chronic bronchitis and asthma, while its root is used for childhood fevers, and its oil helps stimulate hair growth. As an astringent, hot aphrodisiac, and nervine tonic, Shankhpushpi (Convolvulus pluricaulis) is commonly found in southern India. The whole plant is often used in formulations to boost memory and intellect (Adams, 2007). Its leaves and flowers also have hypotensive effects, making them beneficial for treating anxiety neurosis[16].

VI. Pharmacological Activities of Shankhpushpi:

Convolvulus pluricaulis (CP) has been thoroughly researched for its pharmacological benefits. It is recognized for its neuropharmacological effects, such as nootropic, antistress, anxiolytic, antidepressant, anticonvulsant, tranquilizing, and sedative actions, which support its use in Ayurvedic medicine for treating CNS disorders. CP also has antimicrobial, antipyretic, anti-inflammatory, analgesic, diuretic, antidiabetic, and insecticidal properties[16].

6.1 Anticonvulsant Activity: The water-soluble portion of an alcoholic extract of CP suppressed spontaneous motor activity and the fighting response, but had no effect on the escape response. The extract also countered electrically induced convulsions and tremorine-induced tremors. Animals treated with methanolic extracts from CP stem callus, leaf callus, and the whole plant (200 mg/kg orally) showed significant protection against tonic convulsions caused by transcorneal electroshock, comparable to the standard drug phenytoin. Additionally, CP has demonstrated strong anticonvulsant activity[16].

6.2Anxiolytic activity: Anxiolytic activity was assessed using the elevated plus maze (EPM) model (Pellow & File, 1986). The EPM had two open arms (16×5 cm) and two closed arms (16×5×12 cm) with an open roof, with opposing arms facing each other. The maze was raised 50 cm above the ground. The animal was placed in the center of the maze, facing an open arm. Over the next 5 minutes, its behavior was recorded, including the number of entries and time spent in the open arms. An entry was counted only when the animal fully crossed into an arm with all four paws[17].

6.3 Nootropic Activity: The ethanolic extract of *Convolvulus pluricaulis* and its ethyl acetate and aqueous fractions have demonstrated nootropic activity. Two doses—100 mg/kg and 200 mg/kg administered orally—were given to rats in separate groups. Both doses significantly improved memory and learning, as assessed through passive and active avoidance paradigms using Cook and Weidley's pole climbing apparatus and the elevated plus-maze model. Another study further examined the nootropic properties of *Shankhpushpi*. Three plants, namely *Convolvulus pluricaulis*, *Clitoria ternatea*, and *Evolvulus alsinoides*, were evaluated for nootropic activity using the rotating rod, Porsolt's swim despair, and actophotometer models. The findings indicated that all three plants possess nootropic effects[18].

6.4 Cardiovascular activity: A completely water-soluble extract from the plant produced a notable and lasting drop in blood pressure in dogs and inhibited heart muscle activity in frogs. Additionally, an ethanolic extract from the whole plant showed a negative ionotropic effect on heart muscle in both amphibians and mammals and demonstrated spasmolytic effects on smooth muscles[19].

6.5 Thyroid Activity: The experiment was conducted on colony-bred Swiss albino female mice, approximately 3 months old, weighing 28 ± 2 grams and maintained at a constant temperature. After a 7-day acclimation period, the mice were divided into four groups of seven, and each one's initial body weight was recorded.Group I served as the control, receiving 0.1 ml of a suspending agent (Tween 80 and water). Group II was injected intraperitoneally (i.p.) with 50 mg/100 g body weight of L-thyroxine daily. Group III was given both L-thyroxine and a plant extract (0.4 mg/kg body weight, i.p.), while Group IV received only the plant extract at the same dose as Group III. The treatment was administered daily between 10–11 a.m. to minimize circadian variation and was continued for 30 days.

On the final day, the mice's body weights were recorded, and blood samples were collected after sacrifice. Serum samples were stored at -20°C for later analysis of T3 and T4 concentrations. The results showed a significant increase in serum T3 and T4 levels ($P < 0.001$) and 5′-DI activity ($P < 0.01$) in the thyroxine-treated group . In contrast, combined treatment with thyroxine and the plant extract led to a significant decrease in T3

concentration ($P < 0.001$) and 5′-DI activity ($P < 0.01$). Mice treated only with the plant extract showed a significant reduction in serum T3 concentration and 5′-DI activity ($P < 0.001$ and < 0.05, respectively). Additionally, G-6-Pase activity significantly increased in thyroxine-treated mice ($P < 0.01$) but decreased following treatment with the plant extract ($P < 0.05$, compared to control values)[20].

(6.6) Antidepressant Activity: Mice were individually placed in a glass jar ($25 \times 12 \times 25$ cm^3) filled with fresh water to a height of 15 cm, maintained at 25°C. After an initial 2-minute period of intense activity, each mouse adopted a characteristic immobile posture. A mouse was considered immobile when it floated without struggling, making only minimal limb movements to keep its head above water. The total immobility time was recorded over the next 4 minutes of a 6-minute test. Changes in immobility time were then observed in separate groups of mice after administering drugs. Fluoxetine (20 mg/kg, orally) and imipramine (15 mg/kg, orally) given for 10 consecutive days significantly reduced the immobility time compared to the saline-treated control in both the Forced Swim Test (FST) and Tail Suspension Test (TST)[21].

6.7 Hypolipidemic activity: C. pluricaulis may be effective in reducing serum cholesterol, LDL cholesterol, triglycerides, and phospholipids, thereby inhibiting atherogenesis. The diet consumed averaged 20-25 grams per gerbil every 24 hours (equivalent to 60-100 grams per kilogram of body weight). For 90 days, 1 ml of coconut oil containing cholesterol was administered daily via gavage. This cholesterol feeding over 90 days led to hypercholesterolemia. Treatment with C. microphyllus extract resulted in reduced serum cholesterol and LDL cholesterol levels[22].

6.8 Antimicrobial activity: Microbial infections pose a significant global threat due to their high rates of morbidity and mortality. While antibiotics have greatly helped to control these infections, the rise of dangerous antibiotic-resistant pathogens remains a major concern, highlighting the urgent need for new antibiotics. Natural products, with their unparalleled chemical and structural diversity, continue to be the most promising sources for drug discovery. Plant-derived compounds, in particular, have a long history of clinical use and are generally well-tolerated and accepted by patients, making them credible antimicrobial sources. Despite the extensive history of using medicinal plants to treat diseases like microbial infections, only about 100,000 plant species, including Convolvulus plant[23].

6.9 Antioxidant activity: Free radicals are highly reactive molecules that can initiate oxidative chain reactions. Antioxidants act as part of the body's defense system by safely interacting with free radicals to halt these chain reactions, thereby preventing cellular damage that can lead to various diseases. Convolvulus plants have demonstrated antioxidant activity both in vitro and in vivo, which may vary depending on the species, plant part (such as the whole plant, aerial parts, flowers, or leaves), extraction solvent, and concentration used[23].

6.10 Anti-Inflammatory Activity: In studies with ethanolic and aqueous leaf extracts of *C. pluricaulis*, the ethanolic extract proved more effective, showing a significant reduction in paw volume. In the control group, paw volume increased rapidly after carrageenan injection. However, rats pre-treated with the ethanolic extract showed a significant inhibition of paw edema compared to the standard drug[24].

6.11 Analgesic Activity: The analgesic activity of ethanolic and aqueous leaf extracts of *C. pluricaulis* was evaluated, revealing that the ethanolic extract had a higher percentage inhibition index, making it a better analgesic than the aqueous extract when compared to the standard drug, morphine sulfate. At a dose of 750 mg/kg, the ethanolic extract of *C. pluricaulis* showed statistically significant analgesic effects compared to the control, standard, and doses of 250 mg/kg and 500 mg/kg. The analgesic effects of the extract were comparable to the standard drug, demonstrating significant efficacy[24].

VII. Conclusion:

Shankhpushpi (*Convolvulus pluricaulis*), a well-regarded herb in Ayurvedic medicine, exhibits a wide range of therapeutic benefits, particularly for nervous system health. Known for enhancing cognitive function, memory, and mental well-being, *Shankhpushpi* is commonly used to address anxiety, stress, depression, and neurodegenerative conditions like Alzheimer's and Parkinson's disease. The plant's potent bioactive compounds, including flavonoids, alkaloids, and antioxidants, contribute to its effectiveness in traditional treatments. Studies support its use as a nootropic, anxiolytic, anti-inflammatory, and antimicrobial agent, providing both physical and psychological benefits without significant side effects. Additionally, *Shankhpushpi* shows promise in managing cholesterol levels and providing pain relief. Its safety, wide-ranging medicinal properties, and versatility make *Shankhpushpi* a valuable natural remedy in holistic health care.

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