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CONVOLVULUS PLURICAULIS A NOOTROPIC HERB WITH NEUROPHARMACOLOGICAL ACTIVITY: A REVIEW

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Abstract: *Convolvulus pluricaulis Choisy a rasayana drug which is mainly advocated for use in mental stimulation and rejuvenation therapy. It is known as Shankhpushpi by Ayurvedic practitioners in ancient systems of Indian medicine as it was a prominent memory improving drug, a psychostimulant and tranquiliser in traditional Indian medicine. The plant contains several alkaloids, flavanoids and coumarins as active chemicals that bring about its biological effects. Convolvulus pluricaulis Choisy is a prostrate spreading perennial wild herb commonly found on sandy or rocky ground under xerophytic conditions in northern India. Convolvulus is known from the margins and within the Sahara and Sind deserts, a distribution that called Saharo Sindian [1]. The most widespread application of Shankhpushpi is for mental problems, but they have been considered for an array of other human maladies.*

Introduction: *Convolvulus pluricaulis* (Shankhapushpi) is a prostrate, spreading perennial wild herb found on sandy or rocky ground under xerophytic conditions in northern India belonging to family Convolvulaceae. In Ayurvedic system of ancient Indian medicine, it is mentioned as under Medhya Rasayana means "rejuvenating to intellect or brain". It has been used clinically for its memory enhancer, anxiolytic and tranquilizing properties. In addition, it also possesses diuretic, antioxidant, antimicrobial, antidiabetic, antiulcer, hypolipidemic, antipyretic, analgesic, anti-inflammatory, hypotensive and insecticidal properties. It occurs as an ingredient in Brahmarasayana, Aindrarasayana, Agastyaharitaki, Medhyarasayana, and Manasamitram and in a number of other composite drugs. The names Sankhanamni, Sankhaphuli, Kiriti, Kambu Malini, Kambu Puspi Smritihita, Medhya and Vana Vilasini are synonymous with the name Shankapushpi. In Ayurvedic texts it is described under the bitter group of drugs, i.e. drugs of *Vyadhignadi* and *Guducyadi* group. Shankhpushpi of the Ayurvedic Pharmacopeia of India consists of the whole plant of *Convulvulus pluricaulis* Choisy (Convulvulaceae) syn *Convulvulus microphyllus* Sieb ex Spreng [2]. Plants other than *Convuluvulus pluricaulis* use the name Shankhpushpi in different parts of the country. These include *Evolvulus alsinoides* Linn, *Clitorea ternatea* Linn and *Canscora decussata* Schult. The Indian Council of Medical Research has given quality standards for *C. pluricaulis* drug in its publication [3]. *C. pluricaulis* has been found to augment both cognitive function and memory enhancing effects in many behavioral studies [4]. Studies have also showed that the ethanolic plant extract of *C. pluricaulis* reduced the increased levels of malondialdehyde (MDA) and protein carbonyl. Studies have shown beneficial effect of extract on decreased glutathione peroxidase (GPx) and reduced glutathione (GSH) in hippocampus [5].

Scientific classification: The scientific classification of C. *pluricaulis* is as follows:

Kingdom:	**Plantae**
Sub-kingdom:	Tracheobionta
Super-division:	Spermatophyta
Division:	Magnoliophyta
Class:	Magnoliopsida
Sub-class:	Asteridae
Order:	Solanales
Family:	Convolvulaceae
Genus:	Convolvulus
Species:	*Pluricaulis*

Vernacular Names: The vernacular names of C. *pluricaulis* are described as follows:

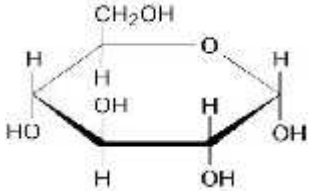
Region/ Language	Vernacular names
Sanskrit	Sankhapuspa
Bengal	Sankhapuspi
Gujarati	Shankhavali
Hindi	Shankhapushpi, Aparajit
Kannada	Bilikanthisoppu
Marathi	Shankhavela
Punjabi	Shankhapuspi
Tamil	Sanghupushpam, kakkurattai
Telugu	Shankhapushpi

Morphology: Convolvulus pluricaulis herb is commonly found especially in the state of Bihar in India. Convolvulus pluricaulis flowers are sky blue in color and about 5 mm in size the leaves are located at alternate positions with branches or flowers they are elliptic in shape and about 2 mm in size. Convolvulus pluricaulis branches are spread around the ground and can be more than 30 cm long. The herb produces flowers during the months of September and October which are white to light pink in color [6]. The shape of the flower is like a "Shankh" (a marine shell) giving it the name is Shankhpushpi.

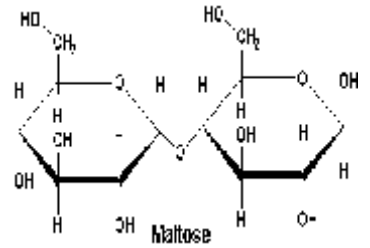
Chemical constituents of C. pluricaulis: Various chemical compositions, such as glucose, sucrose, glycosides, alkaloids and various acids etc, are found in the plant. Convolvulus pluricaulis is a twining perennial herb considered as the most wonderful gift of nature to the mankind. In Ayurveda (an ancient system of Indian medicine), it is mentioned as a rasayana which is commonly used as brain stimulator and memory enhancer.

Carbohydrates	**D-glucose, maltose, rhamnose, sucrose, starch**
Proteins and amino acids	Proteins and amino acids
Alkaloids	Shankhapushpine, convolamine, convoline, convolidine, convolvine, confoline, convosine
Fatty acids/volatile acids/fixed oil	Volatile oils, fatty acids, fatty alcohols, hydrocarbons, myristic acids, palmitic acids and linoleic acids
Phenolic/glycosides/triterpenoids/steroids	Scopoletin, β-sitosterol, ceryl alcohols, 20-oxodotriacontanol, tetratriacontanoic acids, flavonoid-kampferol, steroids-phytosterols

Phytochemical Structures Present in C. pluricaulis

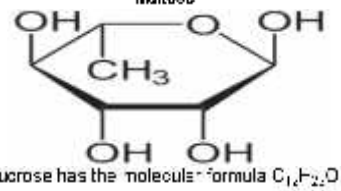
Chemical name	Structure	Remarks
D- glucose		D-glucose is also known as dextrose or grape sugar. It is a simple monosaccharide found in the plants.

Maltose



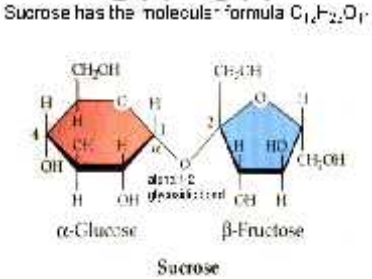
Maltose is also known as maltobiose or malt sugar, a disaccharide formed from two units of glucose joined with α bond.

Rhamnose



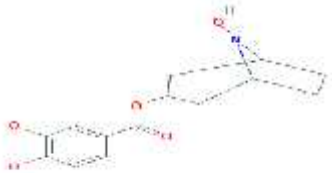
Rhamnose is a naturally occurring deoxy sugar.

Sucrose



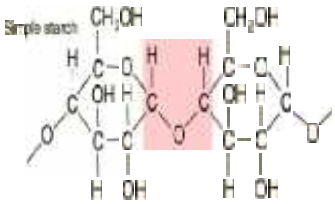
Sucrose is the organic compound commonly known as table sugar and sometimes called saccharose.

Convoline



Convolvine is an alkaloid, present in the leaves and stem of this species.

Starch

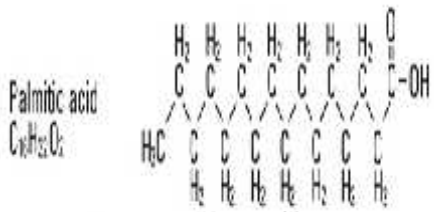


Starch or amylum is a carbohydrate consisting of a large number of glucose units joined by glycosidic bonds.

Myristic acid

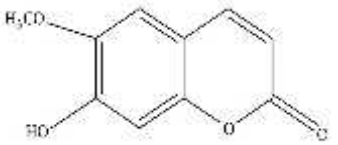
Myristic acid also called tetradecanoic acid is common saturated fatty acids.

Palmitic acid



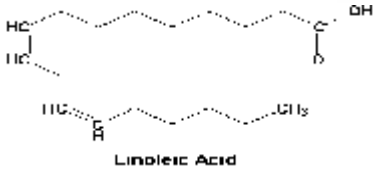
Palmitic acid also called hexadecanoic acid, is the most common fatty acid found in animals, plant and microorganism

Scopoletin

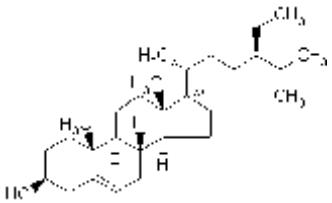
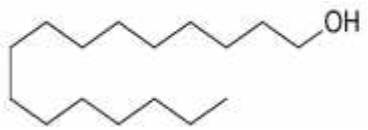


Scopoletin is a coumarin found in root of plants in the genus scopolia

Linoleic acid



Linoleic acid belongs to one of the two families of essential fatty acids; it is an unsaturated n-6 fatty acid

Kampferol	 Kaemferol	Kampferol is a natural flavonol, a type of flavonoid; kampferol have a wide range of pharmacological activities, including antioxidant, anti-inflammatory, antimicrobial, anticancer, cardio protective, neuroprotective, antidiabetic, antiosteoporotic, estrogenic/antiestrogenic, anxiolytic, analgesic and antiallergic activities
β-sitosterol		β-sitosterol is one of several phytosterols (plant sterols) with chemical structures similar to that of cholesterol. It is used in treating hypercholesterolemia
Cetyl alcohol		Cetyl alcohol, also known as 1-hexadecanol and palmityl alcohol, is a fatty alcohol

Pharmacology: *Convolvulus pluricaulis* (CP) has been widely screened for its various pharmacological activities. It has relatively well documented neuropharmacological actions such as nootropic, antistress, anxiolytic, antidepressant, anticonvulsant, tranquilizing and sedative activities which justify its use in CNS diseases in the Ayurvedic system of medicine. It has antimicrobial, antipyretic, anti-inflammatory, analgesic, diuretic, antidiabetic and insecticidal properties.

Anticonvulsant Activity: The water soluble portion of an alcoholic extract abolished spontaneous motor activity and the fighting response, but did not affect the escape response; electrically induced convulsive seizures and tremorine induced tremors were antagonised by the extract [7]. It was observed that the animals treated with the methanolic extracts of stem callus, leaf callus and whole plant (200 mg/ kg oral) of CP showed significant protection against tonic convulsion induced by transcorneal electroshock, which was also comparable with that of the standard drug phenytoin. CP has also been shown to possess a potent anticonvulsant activity [8].

Neurodegenerative & Antiamnesic Activity: Alcoholic extract of CP was found to cause an antagonist effect against amphetamines and tremorine, a potentiation of the acetylcholine effect of pentobarbitone induced hypnosis and morphine analgesia, without having own sedative properties. A protective action on muscle against electroshocks has been shown [7, 9, 10]. The chloroform fraction of the total ethanolic extract of *Convolvulus pluricaulis* elicited a significant antidepressant like effect in mice by interaction with the adrenergic, dopaminergic, and serotonergic systems[11]. A methanolic extract of the whole plant produced alterations in the general behavior pattern, reduction in spontaneous motor activity, hypothermia, potentiation of pentobarbitone sleeping time, reduction in exploratory behavioural pattern and suppression of aggressive behavior [12]. Ethyl acetate and aqueous fractions of the ethanolic extract showed an anxiolytic effect as evidenced by an increase in the time spent in open arms and the number of open arm entries compared with the control group. The ethyl acetate fractions at doses of 200 mg/kg p.o. significantly reduced the neuromuscular coordination indicative of the muscle relaxant activity at a higher dose [13].

Memory Enhancement Activity: Convolvulus pluricaulis is one of the best and prominent natural medicines for improving memory due to its chemical composition, including phytonutrients like Scopoline ß- Sitosterol, Convolvidine, Subhirsine, Convolvine, Convoline and Confoline. Convolvulus pluricaulis is mainly used as a brain tonic and brain stimulator. Daily consumption of Convolvulus pluricaulis prevents memory loss. The ethanolic extract of CP and its ethyl acetate and aqueous fractions were evaluated for their memory enhancing properties. Two doses (100 and 200 mg/kg/p.o.) of ethyl acetate and aqueous fractions of the ethanolic extract were administered in separate groups of animals. Both the doses of all the extracts of CP significantly improved learning and memory in rats [15].

Antiulcer Activity: The antiulcerogenic effect of CP was found to be due to augmentation of mucosal defensive factors such as mucin secretion, lifespan of mucosal cells and glycoprotein rather than on the offensive factors such as acid pepsin [16].

Antioxidant Activity: Ethanolic extract of *Convulvulus pluricaulis* possesses significant antioxidant activity when tested *in vitro* [13]. The assay was based on the capacity of the samples to inhibit blue formazan formation by scavenging the superoxide radicals generated in riboflavin-light-NBT system [16]. The reaction mixture contained 50 mM phosphate buffer (pH- 7.6), 20 µg riboflavin, 12 mM EDTA,0.1 mg/3mL NBT, added in the sequence. The reaction was started by illuminating the reaction mixture with different concentration of samples. Immediately after illumination, the absorbance was measured at 590 nm and EC_{50} (effective concentration, required to inhibit NBT reduction by 50%) values were calculated from the dose inhibition curves by graphical method [17].Ascorbic acid was used as positive control [18].

Analgesic Activity: The extract caused a reduction in the fighting behavior in mice but was devoid of analgesic activity it potentiated morphine analgesia [7].

Cardiovascular Activity: Total water soluble fraction of the plant caused a marked and prolonged hypotension in dogs and Inhibited the frog myocardium [19, 20].Ethanolic extract of the entire plant exerted a negative ionotropic action on amphibian and mammalian myocardium. It also exerted spasmolytic activity on smooth muscles[7].

Conclusion: Modern lifestyles have resulted in stress-related disorders, and various approaches, for example-yoga, meditation and anti-stress drugs are used to counteract aversive stress effects. Plant drugs have come to the rescue to mankind in many ailments and may offer satisfactory solutions to stress-induced perturbations. This plant has been shown to have scientific potential for CNS depression for its anxiolytic, tranquillizing, antidepressant, antistress, neurodegenerative, antiamnesic, antioxidant, hypolipidemic, immunomodulatory, analgesic, antifungal, antibacterial, antidiabetic, antiulcer, anticatatonic and cardiovascular activity. It is reported to contain several types of alkaloids, flavanoids and coumarins as active chemicals that bring about its biological effects.

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