

Shankhapushpi (*Convolvulus pluricaulis* Choisy): Validation of the Ayurvedic therapeutic claims through contemporary studies

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Shankhapushpi (*Convolvulus pluricaulis* Choisy, CP) is an extremely versatile plant, commonly prescribed as nootropic (*medhya*), rejuvenator, nervine tonic in epilepsy, insanity and possesses wide range of therapeutic attributes. Since it is an essential ingredient of myriad popular Ayurvedic monoherbal or polyherbal preparations, it is commercially quite exploitable. Although CP exhibits a wide range of therapeutic attributes, only scattered information exploring the curative potential of CP is available, and there is a need to assemble it. Therefore, to revalidate the Ayurvedic therapeutic claims of *Shankhapushpi* in light of contemporary experimental and clinical studies, this study was carried out. Information was extracted from various Ayurvedic literature viz. *Brihatrayi* (*Charaka Samhita*, *Sushruta Samhita* and *Ashtanga Hridaya*) and *Nighantu* (lexicon). Online studies available on *Convolvulus pluricaulis* Choisy published in Pubmed, Scopemed, Pubmed Central Databases, Dhara online database and other allied databases were also rationally reviewed and documented in the present review. The current work appears to be the first of its kind and can be considered a reference standard for future studies.

Key words: Ayurveda, *Convolvulus pluricaulis*, *shankhapushpi*

INTRODUCTION

Herbal medicine is making a spectacular comeback since the side effects of synthetic medicine are daunting, and therapeutic approach is drifting towards alternative medicine. In both organised (Ayurveda, Unani) and unorganised (folk, tribal, native) forms, plants are utilised as therapeutic agents. *Shankhapushpi* (*Convolvulus pluricaulis* Choisy, CP) is one such effective herb and has been used since ancient times by physicians and laymen to combat diabetes. Various dosage forms and a wide array of derived products (active, natural principles and crude extracts) have been used in the traditional system of medicine and have reported therapeutic activity experimentally and clinically in numerous scientific journals. *Shankhapushpi*, with flowers shaped like a *Shankha* (conch), is one of Lord Shiva's sacred instruments often used in ritual worship. It is considered *Medhya Rasayana* (memory enhancer) in *Ayurvedic* texts,^[1] and has been used as rejuvenator, anti-ageing,

mental stimulant and tranquiliser.^[2] All parts of CP (*Convolvulaceae*) syn *Convolvulus microphyllus* Sieb. ex Spreng are approved for medicinal use as per the Ayurvedic Pharmacopoeia of India.^[3] Some other plants are also acknowledged under the name *Shankhapushpi*; these include *Evolvulus alsinoides* Linn, *Clitorea ternatea* Linn (*C. ternatea*) and *Canscora decussata* Schult. Many physicians believe *C. ternatea* to be *Shankhapushpi*.^[4,5] The Indian Council of Medical Research has given quality standards for CP drug in publication.^[6]

In spite of several researches being already carried out during the past decades, only scattered information exploring medicinal virtues of CP is accessible and there is need to re-collect it. Therefore, an attempt is made in the present review to scrutinise ancient Ayurvedic literature that have portrayed its medicinal values and validating it in light of available modern experimental and clinical studies.

MATERIALS AND METHODS

Search Criteria

Information extracted from various *Nighantu*, *Brihatrayi* (*Charaka Samhita*, *Sushruta Samhita* and *Ashtanga Hridaya*) and published articles, of which few review articles and cross-references thereof were collected. Published materials on recent research developments on CP including original articles in

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Pubmed, Scopemed, Pubmed Central Databases, Dhara online database and other allied databases were studied for the review. The search criteria were restricted to the Ayurvedic and modern concept of the drug, its ethno-medicinal use, pharmacological and clinical outcomes in various ailments.

Inclusion Criteria

All reports of experiments on different model types (*in vitro* and *in vivo*) varying from animal and human model systems were considered. Reported data was scrutinised and represented in the form of figures and tables for the current review. The figures of the compounds were obtained as reported in different journal sources.

Ayurvedic Pharmacodynamics

Ayurvedic pharmacodynamic properties of CP are given in Table 1.

Shankhapushpi in Brihatrayi

Triads of Brihatrayi i.e. *Caraka*, *Sushruta* and *Vagbhata* have mentioned *Shankhapushpi* as a vital ingredient in various memory enhancer formulations along with other

therapeutic attributes. Moreover, *Caraka* has expounded the *Medhya Guna* (nootropic property) of *Shankhapushpi* as '*Medhya Visheshena cha Shankhapushpi*'. While describing *Divya Aushadhi* (divine herb), *Sushruta* has considered *Vegavati* herb similar to *Shankhapushpi*.^[7] Commentators of *Vagbhata*, *Arunadatta* and *Hemadri* have not commented regarding *Shankhapushpi* but *Indu* has attributed the synonym *Supushpi* to it.^[8] *Chandra* has also named *Shankhapushpi* as *Shankhakusuma*.^[1] More details are summarised in Table 2.^[1,7,8]

Shankhapushpi in Nighantu

Ayurvedic *Nighantu* (lexicons) are also branded as Ayurvedic materia medica. *Dhanvantari Nighantu* describes

Table 1: Ayurvedic pharmacodynamics

Bio-energetic	Properties
<i>Rasa</i>	<i>Katu</i> (pungent), <i>Kashya</i> (astringent)
<i>Guna</i>	<i>Guru</i> (heavy), <i>Sara</i> (unstable), <i>Snigdha</i> (oily), <i>Pichchila</i> (sticky)
<i>Viryā</i>	<i>Ushna</i> (hot)
<i>Vipaka</i>	<i>Madhura</i> (sweet)
<i>Doshakarma</i>	<i>Tridosahara</i> (alleviate all three <i>Dosha</i>)
Part used	Whole plant and juice

Table 2: Description of Shankhapushpi in Brihatrayi

Reference	Preparations	Dosage forms	Use
C.Ci. 1-1/48 ^[1]	<i>Brahma Rasayana</i>	<i>Avaleha</i>	<i>Dirghayushya</i> (longevity), <i>tandra</i> (drowsiness), <i>klama</i> (mental exhaustion), <i>swasa</i> (dyspnoea), <i>medha</i> (intelligence), <i>smriti</i> (memory), <i>bala</i> (strength)
C.Ci. 1-1/58 ^[1]	<i>Dwitiya Brahma Rasayana</i>	<i>Avaleha</i>	<i>Dirghayushya</i> , <i>shrutagrahinya</i> (quick comprehension), <i>vishahara</i> (detoxification)
C.Ci. 1-3/24 ^[1]	<i>Endra Rasayana</i>	<i>Avaleha</i>	<i>Smriti</i> , <i>medha</i> , <i>swarya</i> (good voice), <i>varna</i> (glowing skin), <i>vishahara</i> , <i>switra</i> (leucoderma), <i>kushtha</i> (skin disorder), <i>udararoga</i> (abdominal diseases), <i>pliha</i> (spleen disorders), <i>vishamajwara</i> (intermittent fever)
C.Ci. 1-3/30-31 ^[1]	<i>Medhya Rasayana</i>	<i>Kalka</i> *	<i>Ayuprada</i> (longevity), <i>bala</i> , <i>deepana</i> (kindle up digestion), <i>swarya</i> , <i>medhya</i> , <i>rasayana</i> (rejuvenation)
C.Ci. 10/25 ^[1]	<i>Brahmyadi</i>	<i>Purana Ghrita</i>	<i>Vata kaphaja apasmara</i> (epilepsy)
C.Ci. 10/60 ^[1]	<i>Medhya Rasayana</i>	<i>Avaleha</i>	<i>Vijnana</i> (intelligence), <i>dhairya</i> (patience), <i>samadhi</i> (absoluteness)
C.Ci. 18/57 ^[1]	<i>Agastya Haritaki</i>	<i>Avaleha</i> ,	<i>Swasa</i> (breathlessness), <i>hikka</i> (hiccough), <i>arsha</i> (piles), <i>grahani</i> (dysentery), <i>hridroga</i> (heart disease), <i>aruchi</i> (anorexia), <i>pinasa</i> (chronic coryza), <i>vali</i> (wrinkles), <i>palit</i> (grey hair), <i>varna</i> , <i>bala</i> , <i>panchakasa</i> (five type of cough), <i>kshaya</i> (emaciation)
Su. Su. 42/11 ^[7]	<i>Tiktavarga</i>	NA	NA
Su.Sa. 10/68 ^[7]	<i>Suvarnamityadi Churna</i>	<i>Churna</i> **	<i>Medha</i> , <i>bala</i> , <i>buddhi</i> , immuno-enhancer
Su.U. 52/42 ^[7]	<i>Dwipanchamuladi Agastya Avaleha</i>	<i>Avaleha</i>	<i>Rajyakshma</i> (similar to tuberculosis), <i>grahani</i> , <i>shopha</i> (inflammation), <i>swarabheda</i> (hoarse sound), <i>kasa</i> , <i>pandu</i> (similar to anaemia), <i>swasa</i> , <i>shiroroga</i> (head related problems), <i>hridroga</i> , <i>hikka</i> , <i>vishamajwara</i> , <i>medha</i> , <i>bala</i>
A.H.Ci. 3/127 ^[8]	<i>Endra Rasayana</i>	<i>Avaleha</i>	<i>Swasa</i> , <i>hikka</i> , <i>vishamajwara</i> , <i>arsha</i> , <i>grahani</i> , <i>hridroga</i> , <i>pinasa</i> , <i>vali</i> , <i>palit</i> , <i>varna</i> , <i>bala</i> , <i>panchakasa</i> , <i>kshaya</i>
A.H.U.1/9 ^[8]	<i>Shankhapushpi Kalka</i>	<i>Kalka</i> **	<i>Jatakarma shirah sneha pichu</i> (putting oil smeared cotton on head after birth) and <i>prashana</i>
A.H.U.1/43 ^[8]	<i>Vachadi kshirapaka</i>	<i>Kalka</i>	<i>Vaka</i> , <i>medha</i> , <i>smriti</i> , <i>buddhi</i>
A.H.U.6/24 ^[8]	<i>Brahmi Ghrita</i>	<i>Kalka</i>	<i>Unmada</i> (mental disorder), <i>kushtha</i> , <i>apasmara</i> (epilepsy), <i>vandhya</i> (infertility), <i>vaka</i> , <i>swara</i> , <i>smriti</i> , <i>medha</i>
A.H.U.7/24 ^[8]	<i>Brahmyadi Purana Ghrita</i>	<i>Ghrita</i>	<i>Medhya</i> , <i>unmada</i> , <i>papma</i>
A.H.U.39/18 ^[8]	<i>Pathyadi Ghrita</i>	<i>Ghrita</i>	<i>Tandra</i> , <i>shrama</i> (lithargy), <i>klama</i> , <i>vali</i> , <i>palita</i> , <i>medha</i> , <i>smriti</i>
A.H.U.39/44-45 ^[8]	<i>Shankhapushpi Kalka</i>	<i>Kalka</i>	<i>Ayuprada</i> , <i>amayanashana</i> , <i>bala</i> , <i>agni</i> , <i>swara</i> , <i>medhya</i>
A.H.Ci 39/50 ^[8]	<i>Brahmi Ghrita</i>	<i>Ghrita</i>	<i>Jara</i> , <i>vyadhinashana</i> , <i>tandra</i> , <i>alasya</i> , <i>shrama</i> , <i>klama</i> , <i>kushtha</i> , <i>kilasa</i> , <i>gulma</i> , <i>visha</i> , <i>jwara</i> , <i>unmada</i> , <i>udararoga</i>

*Prepared of root and flower, **With *madhu* and *sarpi*, C.Ci. - *Caraka Samhita Chikitsasthana*, Su.Su. - *Sushruta Samhita Sutrasthana*, Su. Sa. - *Sushruta Samhita Sharirasthana*, Su. U. - *Sushruta Samhita Uttarasthana*, A.H.Ci. - *Ashtanga Hridaya Chikitsasthana*, A.H.U. - *Ashtanga Hridaya Uttarasthana*, NA - Not available

the *Guna* (property) of *Shankhapushpi* under the name of *Shankhini* (like a conch shell).^[9] In contrast, *Kaideva Nighantu* describes *Shankhapushpi* and *Shankhini* as two different plants and suggests they should always be used in fresh state rewrite. Two types of *Shankhapushpi* mentioned by this text are *Raktapushpa* and *Nilapushpika*.^[10] *Raja Nighantu* has mentioned *Vishnukranti* as a variety of *Shankhapushpi*, while this name is also used as a synonym of *Aparajita* (*C. ternatea*). As *Guna-Karma* of *Aparajita* is somewhat similar to *Shankhapushpi*, both are considered same and it is used as substitute for each other in various regions.^[11] Detailed available description in different *Nighantu* is given at Table 3.^[9,12-26] No description is found in other *Nighantu* viz. *Amarakosha*, *Chamatkara Nighantu*, *Dravyagunasamgraha*, *Madanadi Nighantu*, *Laghu Nighantu*, *Shabdachandrika*, *Saraswati Nighantu*, *Siddhasara* and *Shoushruta Nighantu*.

Taxonomical Hierarchy

CP is categorised taxonomically 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

Names of CP in different languages are listed as follows:

Hindi: *Shankhapushpi*, *Shyamakranta*, *Vishnukranta*, *Shannkhavalli*, *Shankhahuli*, etc., English: *English Speedwheel*, Urdu: *Sankhaholi*, Bengali: *Barabhutra*, Kannada: *Vishnukarandi*, *Vishnukranti*, etc., Malayalam: *Krishnakranti*, *Vishnukranthi* etc., Marathi: *Shankhavall*, *Shankhavalli*, *Shankvel* etc., Oriya: *Krishna-enkranti*, Tamil: *Vishnu Kanthi*, *Vishnukranti*, *Vishnukiranti* etc., Telugu: *Vishnukarandi*, *Erravishnukarantha*, *Vishnukranti* etc., Tibetan: *Khalsa pus syi (d)*, *Sa nkhapu spa* etc.

Habitat

CP is found in regions of Southern India, Sri Lanka, Tropical Africa and South-Eastern Asia.^[27,28] It is a horizontal-spreading, perennial wild herb commonly found on sandy or rocky land under xerophytic conditions and extensively grows on the wasteland in the plains of Punjab, Bihar and Chhota Nagpur in India.^[29] Flowering begins during September and October, and flowers vary from white to light pink in colour.^[30]

Morphology

CP is a perennial herb like morning glory and is a fulvous hairy herb. Its detailed morphology is as following: Branch: prostrate and can be more than 30 cm long, Stem: ascending or prostrate, 10-40 cm long, densely velvety with spreading hairs, Leaves: elliptic in shape (2 cm), linear to oblong, small and sub-sessile, nearly stalkless,

Table 3: Description of Shankhapushpi in Nighantu

Nighantu reference	Description
<i>Abhidhana Manjari</i> ^[12] <i>Madanadi Gana/Ekarth Varga</i>	NA
<i>Abhidhana Ratnamala</i> ^[13] <i>Katuskandha</i>	NA
<i>Ashtanga Nighantu</i> ^[14] <i>Kaiyadeva Nighantu</i> ^[15] <i>Shyamadi Gana, Aushadhi Varga, Misharaka Varga</i>	NA Rasa- <i>Katu tikta, guna- sara, virya-anushna</i> , Properties- <i>Swarya, rasayan, varnya, medhya, balya</i> etc. Indications- <i>Luta, kushtha, bhuta, visha, krimi</i>
<i>Dhanvantari Nighantu</i> ^[9] <i>Karaviradi Varga</i>	Rasa- <i>Katu, tikta, virya-ushna</i> Indications- <i>Kasa, visha, apasmara, medhya, rasayana</i>
<i>Nighantu sesha</i> ^[16] <i>Gulma Kanda</i> <i>Paryayaratnamala</i> ^[17]	NA Synonyms- <i>Santanika, mechaka, medhya, ashu</i> , etc.
<i>Bhavaprakasha Nighantu</i> ^[18] <i>Mishravarga/Guduchyadi Varga</i>	Rasa- <i>Kashaya, guna- sara, virya- ushna</i> Properties- <i>Medhya, vrishya, smriti, kanti, bala, agni</i> Indications- <i>Manasaroga, kushtha, krimi, visha</i>
<i>Madanapala Nighantu</i> ^[19] <i>Abhayadi Varga</i>	Rasa- <i>Kashaya, guna-sara</i> Properties- <i>Smriti, medhya, varnavilasini</i> Indications- <i>Chetasavikara, mohanashini</i>
<i>Madhavadravyaguna</i> ^[20] <i>Vividha Aushadhi Varga</i> <i>Raja Nighantu</i> ^[21] <i>Guduchyadivarga Dravya</i>	Properties- <i>Sara, tikta, medhya, krimivishapaha</i> Rasa- <i>Tikta, guna-hima</i> Properties- <i>Medhya, swarakaraini</i> Indications- <i>Grahahutadidoshagna, vashikarana</i>
<i>Rajavallabha Nighantu</i> ^[22] <i>Shankhapushpi Gana</i> <i>Shivakosha</i> ^[23] <i>Pancha-panchaksharam Yantah</i>	Properties- <i>Tikshna, ushna, medhya, krimivishapaha</i> Synonyms- <i>Yuthi, kambumalini</i>
<i>Siddhamantra</i> ^[24] <i>Doshaghna Varga/Tridosahara Dravya</i>	NA
<i>Hridaya Dipika</i> ^[25] <i>Davinam Varga</i>	NA
<i>Shodhala</i> ^[26] <i>Vishaya sangraha/ Karaviradi varga</i>	Properties- <i>Sara, medhya, unmada, chhardi, visha</i>

NA - No synonyms, properties or indications are mentioned; only name of plant is quoted

lance-shaped or inverted lance-shaped, 0.8-3 cm long, 1.5-6 mm broad, wedge-shaped at the base, pointed/blunt at tip, velvety/hairy are located at alternate positions with branches, Flowers: bluish like a *Shankh*, giving it the name *Shankhapushpi*. 1-3 flowered cymes carried on stalks up to 2-3 cm long but often much shorter or absent. Style - 2-4 mm long, stigma - 3-5 mm long, seeds are 2-4, approximately 2-2.5 mm long, dark brown; Fruit: Nut oblong, trigonous, stramineous and stiptate.^[31]

Phytochemistry

The extract of this botanical contains the alkaloids convolvine, convolamine, phyllabine, convolidine, confoline, convoline, subhirsine, convosine and convolidine along with scopoline and β -sitosterol as major phytoconstituents. Ethanol, extracted from CP, helps in reducing total serum cholesterol, phospholipids and some types of harmful fatty acids from body.^[32] The specific pharmacological action of convolvine has been found to block M2 and M4 cholinergic muscarinic receptors. It was also found that convolvine potentiates the effects of arecoline, a muscarinic memory enhancer that ameliorates cognitive deficits in Alzheimer's disease.^[33,34] Detailed phytochemistry is mentioned in Table 4.^[33,35-50] Chemical structures of anti-stress components isolated from CP^[33,34,40,51-53] are illustrated in Figure 1.

Therapeutic Applications

Pre-Clinical Studies

Available pharmacological studies of CP were compiled by collecting data from late sixties till date, in order to provide sufficient information to evaluate the action of CP with its potential properties. Therapeutic applications are described in Table 5.^[42,47,54-85]

Clinical Studies

Clinical works are reported only on polyherbal preparations containing CP as the major ingredient. Maharshi Kalash 4 and 5 (MAK-4 and MAK-5) are two polyherbal preparations which are a part of the natural healthcare system of India. MAK was found to have anti-inhibiting effects *in vitro* and *in vivo* when both

Table 4: Phytochemical features

Phytochemical	CP
Carbohydrates	D-glucose, maltose, rhamnose, sucrose, starch and other carbohydrates ^[35,36]
Proteins and amino acids	Proteins and amino acids ^[37,38]
Alkaloids	Only convolamine has been identified but other alkaloids (convoline, convolidine, convolvine, confoline, convosine, etc.) were found in other species of this family. The plant contains alkaloid shankhapushpine (C ₁₇ H ₂₅ NO ₂), melting point from 162°C to 164°C ^[36,39-44]
Fatty acids/volatile oil/Fixed oil	Volatile oil, fatty acids, fatty alcohols; hydrocarbons, myristic acid (30.9%), palmitic acid (66.8%) and linoleic acid (2.3%) and straight chain hydrocarbon, hextriacontane. ^[45,46]
Phenolics/Glycosides/ Triterpenoid/Steroids	Scopoletin, β -sitosterol and ceryl alcohol. ^[47] Chloroform fraction of this contains 20-oxodotriacontanol, tetratriacontanoic acid and 29-oxodotriacontanol, flavonoid-kampferol, steroids-phytosterols, β -sitosterol. ^[48] CP-1, a phytochemical marker has been isolated and characterised by HPTLC technique ^[47] Estimation of scopoletin by HPTLC in CP and its formulation ^[49,50] Estimation of scopoletin by spectrofluorimetry ^[33]

CP - *Convolvulus pluricaulis*; HPTLC - High Performance Thin Layer Chromatography

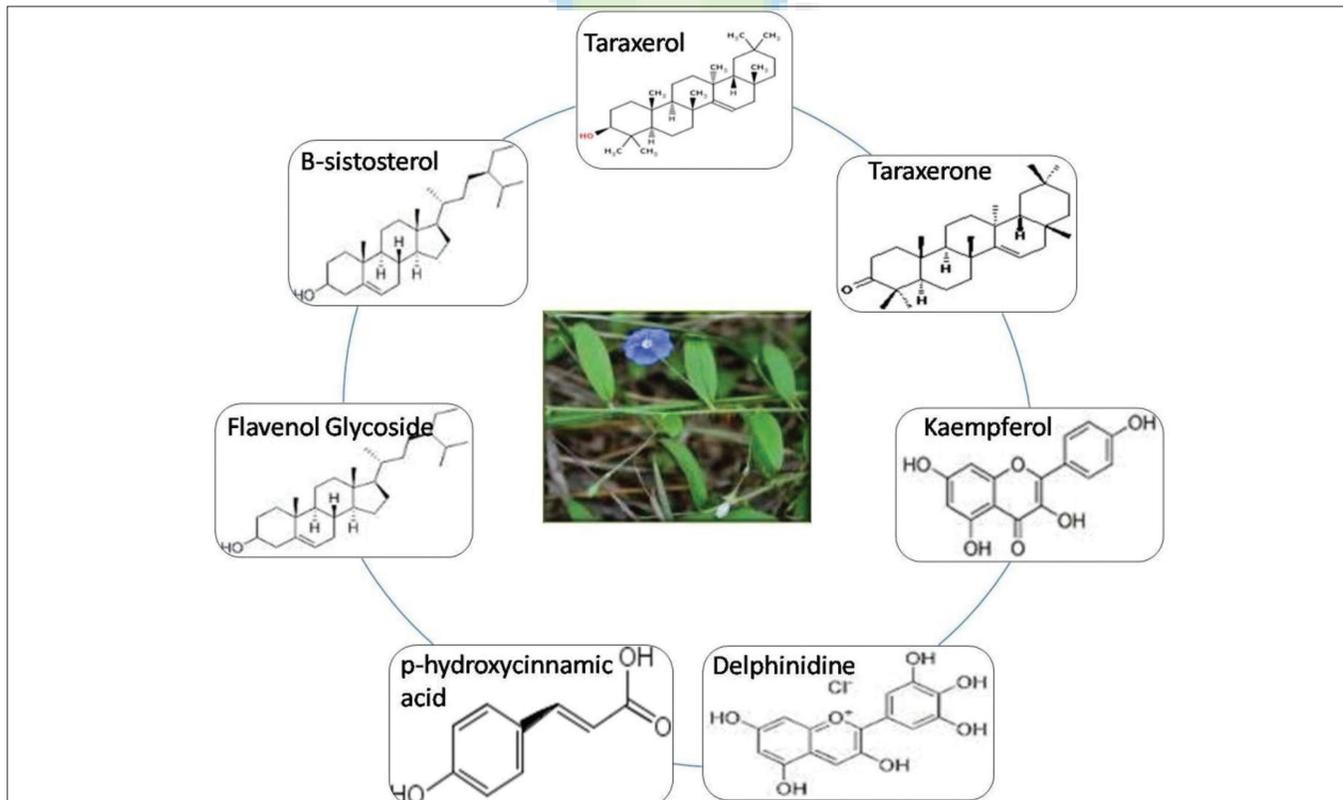


Figure 1: Chief phytoconstituents isolated from CP

Table 5: Pre-clinical Studies

Effect	Pre-clinical studies
Learning, memory and behaviour	Significant improvement was noted in paradigms and active avoidance tests in rats using different laboratory models to evaluate learning and memory assessment using ethanolic extract and ethyl acetate and aqueous fractions of CP. ^[42,47] Tablets made with three <i>bhavana</i> (levigation) of <i>Shankhapushpi</i> juice in its powder affected the potency of tablet to improve memory. ^[54] Highly significant improvement was observed in long-term memory of healthy volunteers of 16-25 years age-group with CP tablets made with three <i>bhavana</i> of its juice. ^[55]
Anxiolytic	An antagonist effect against amphetamines and tremorine, a potentiation of the acetylcholine effect of pentobarbitone-induced hypnosis and morphine analgesia, without having its own sedative properties was found by using alcoholic extract of CP. A protective action on muscle against electroshocks has been demonstrated. ^[56-58] 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 was found by using ethyl acetate and aqueous fractions of the ethanolic extract. ^[59] The leaves and flowers have hypotensive properties used for treating anxiety neurosis. It is recommended as a brain tonic to promote intellect and memory, eliminate nervous disorders and treat hypertension ^[60]
Muscle relaxant	The neuromuscular co-ordination indicative of the muscle relaxant activity at a higher dose of 200 mg/kg p.o. was significantly reduced by using ethyl acetate fraction ^[61]
Antidepressant	On interaction with adrenergic, dopaminergic and serotonergic system by using chloroform fraction of total ethanolic extract, significant effect of antidepressant was observed. ^[60,62]
Antistress	Reduction in exploratory behavioural pattern and suppression of aggressive behaviour, reduction in spontaneous motor activity, hypothermia, alterations in the general behaviour pattern and potentiation of pentobarbitone sleeping time was observed by methanolic extract of the whole plant ^[63]
Effect on glands	Effect on various glands through neurohumours, particularly acetylcholine, by nitrogen-containing active principle of the drug, which produced marked reduction in I-131 uptake, protein-bound iodine and acetylcholine. ^[64]
Anxiolytic, Neurodegenerative and Antistress	Barbiturate potentiation effect in albino rats was observed in dose of 100 mg/100 g body weight, and this effect was weaker than that of diazepam but stronger than that of <i>Centella asiatica</i> Linn and urban <i>Hydrocotyle asiatica</i> Linn. This plant has also been reviewed and reported for its potent anxiolytic, neurodegenerative and antistress activity by various researchers ^[42,65-68]
Brain nourishment	Increasing acquisition which increases brain protein content and enhances neuropeptide synthesis of the brain was observed by using ethanolic extract of the plant when administered to rats through gastric intubation at different time intervals. ^[69] Therapeutic role of Ayurvedic herbs in mental disorders classified CP as a brain tonic. ^[70] CP is a common plant in southern India where the whole plant is used in various formulae as a nervine tonic for improvement of memory and intellect ^[71]
Anticonvulsant activity	Animals with tonic convulsion induced by transcorneal electroshock, treated with the methanolic extracts of stem callus, leaf callus and whole plant (200 mg/kg orally) showed significant protection against tonic convulsion comparable with that of the standard drug Phenytoin. ^[72] A potent anticonvulsant activity was shown by CP. ^[73] The water-soluble portion of an alcoholic extract eliminated spontaneous motor activity and fighting response but did not affect the escape response; electrically induced convulsive seizures and tremorine-induced tremors were antagonised by the extract ^[74]
Hypolipidemic	Significantly reduced serum cholesterol, LDL cholesterol, triglycerides and phospholipids found in cholesterol-fed gerbils by using ethanolic extract of the whole plant for 3 months ^[75]
Antioxidant activity	An ethanolic extract of CP possesses significant antioxidant activity when tested <i>in vitro</i> . ^[76]
Antimicrobial, insecticidal, antifungal, antibacterial and anthelmintic activity	A new compound, 29-oxodotriacontanol, isolated from the chloroform fraction of the plant extract was shown to be a potent antifeedant constituent under laboratory evaluations whereas another compound, tetratriacontanoic acid, was found for the first time in this plant. The whole plant was bio-assayed by the leaf disc method by feeding deterrence using <i>Spilosoma obliqua</i> Walker as a test insect. The azadirachtin and crude neem extracts were considered as standard. A new compound (29-oxodotriacontanol) produced 85.74% inhibition at 8000 ppm concentration. ^[55] The alcoholic extract of CP possessed potent antifungal activity ^[77]
Effect on thyroid gland	Root extract-induced inhibition in thyroid function is primarily mediated through T4-T3 conversion. ^[60] Potent effect was observed in the management of thyrotoxicosis ^[78]
Analgesic	The extract caused reduction in fighting behaviour in mice but was devoid of analgesic activity although it potentiated morphine analgesia ^[79]
Cardiovascular	Marked and prolonged hypotension in dogs and inhibited the frog myocardium was found by total water soluble fraction of the plant. ^[80] Negative inotropic action on amphibian and mammalian myocardium exerted spasmolytic activity on smooth muscles was observed by using the ethanolic extract of the entire plant ^[81]
Antidiabetic	It is an effective remedy for treatment of diabetes ^[55]
Reproductive system	Fine paste made by grinding the plant is helpful for the cure of abscesses, and juice of the whole plant prevents excessive menstruation. ^[82] In sexual and seminal debility, it is recommended ^[55]
Antiulcer and anticatonic	The antiulcerogenic effect was observed because of the augmentation of mucosal defensive factors such as mucin secretion, lifespan of mucosal cells and glycoprotein rather than of the offensive factors such as acid pepsin ^[83]

CP - *Convolvulus pluricaulis*; LDL - low-density lipoproteins

used in combinations.^[86] Significant increase in serum triiodothyronine (T3) and thyroxine (T4) concentration and decrease in serum cholesterol concentration confirmed the

thyroid-stimulating property of CP in 50 patients of simple diffuse goiter at 1 tds dose of Thyrocap, a preparation containing solid extract of *Bauhinia variegata*, *Commiphora*

mukul, *Glycyrrhiza glabra* and CP (100 mg of each extract/capsule) for 3 months.^[87]

Traditional and Folklore Uses

CP is used as anthelmintic, effective in dysentery, brain and hair tonic, cure for skin ailments and for reducing high blood pressure by tribals in Chindwara, Madhya Pradesh, India.^[88] In Gonda, Uttar Pradesh, India, CP leaves are recommended for depression and mental disturbance.^[89] It has been widely used in Ayurvedic medicine to treat nervous disorders, similar to the use of kava kava (*Piper methysticum*) and valerian (*Valeriana officinalis*) as prescribed by American herbalists.^[90] It is also available in American stores for medicinal use such as to calm the nerves by regulating the body's production of the stress hormones, adrenaline and cortisol.^[91] *C. arvensis* var. *obtusifolium* Choisy is generally the only variety recognised in North America.^[92]

Toxicological Profile

No conspicuous information on toxicity of CP is available so far. The sedative effect of CP in mice was observed at doses greater than 200 mg/kg, and moderate to marked decrease in locomotor activity was observed for approximately 12 hours by lethal dose (LD₅₀) of the whole extract of CP.^[93]

Cp-Drug Interaction

Concurrent administration of CP with phenytoin in epilepsy in multiple-dose regimens showed beneficial pharmacokinetic as well as pharmacodynamic interaction leading to enhanced anti-epileptic activity and diminished untoward effect of the drug. The doses and frequency of oral synthetic drug requirement was also reduced by the herb.^[94]

Formulations of Cp

CP is used as a major ingredient in several of monoherbal and polyherbal preparations viz. BR-16A (Himalaya Drug Co. Ltd.), Shankhapushpi syrup (Unjha), Dimagheen (Dawakhana Tibiya College), Shankhavalu Churna (Narnaryan Pharmacy), etc.

DISCUSSION

Medicinal plants have provided leads to combat diseases since the dawn of civilization. From screening the classics of *Brihatrayi* and *Nighantu*, it becomes clear that *Shankhapushpi* has been used to treat a wide range of diseases. Since most of the pharmacological activities of CP were limited to animal model, clinical trials of individual as well as compound formulations should be conducted in order to establish their safety and effectiveness. CP is an astringent, hot aphrodisiac and a nervine tonic; it improves strength, digestive power, complexion, voice, and it also cures intestinal worms, animal poisoning, skin disease, cough, dyspnea, diabetes, dysuria and uterine disorder. It is also helpful in epilepsy, insomnia,

heart disease and haemetemesis.^[95,96] The extensive survey of literature revealed that CP is highly regarded as a universal panacea in herbal medicine with various pharmacological activities. In spite of extensive preliminary research, little is known regarding the mechanism of observed biological activities of CP. It contains many different chemicals that might affect the body. CP must be analyzed clinically in wake of thorough investigation of ethnomedicinal usage. This may prove to be a torch bearer in future therapeutics.

Since no negative CP-drug interaction is reported till date, more studies in this area remain yet to be accomplished. A consorted therapeutic approach by linking CP and synthetic drugs will be highly desirable. Though the herb is considered to be safe in the dosage mentioned, potent curative effects of the plant against particular human ailments need to be verified by more controlled and exhaustive clinical trials. To summarise the scattered knowledge in ancient and contemporary literature, it is needed to highlight the entities which are worthy of further investigation leading to the drug developments.

CONCLUSION

Shankhapushpi exhibits antioxidant and laxative activities and is also used as brain and nervine tonic. It is also indicated to be used in anxiety, neurosis, epilepsy, insomnia, burning sensation, oedema and urinary disorders. The drug possesses multiple-target actions and several therapeutic claims by virtue of its various active phytomolecules. Contemporary experimental and clinical studies confirm and establish the Ayurvedic therapeutic validation of the herb. Future experiments involving large sample size and in depth cause-effect evaluations would be more confirmatory.

REFERENCES

1. Acharya YT. Charaka Samhita. 7th ed. Varanasi: Chaukhamba Orientalia; 2002. p. 385-542.
2. Yoganarasimhan SN. Medicinal Plants of India. Vol. 2. Bangalore: Cyber Media; 2000. p. 100.
3. Anonymous. The Ayurvedic Pharmacopoeia of India. Vol. 2. Delhi: Ministry of Health and Family Welfare, Department of Indian Systems of Medicine and Homeopathy, Controller of Publications; 2001. p. 147-149.
4. Goyal PR, Singh KP. Shankhpuspi (*Evolvulus alsinoides* Linn) [J] a medicinal herb. *Int J Mendel* 2005;22:124-125.
5. Unnikrishnan E. Materia medica of the local health traditions of Payyannur [J]. Thiruvananthapuram: Kerala Research Programme on Local Level Development, Center for Development Studies; 2004. p. 334.
6. Gupta AK, Tandon N, Sharma M. Quality standards of Indian medicinal plants. New Delhi: Indian Council of Medical Research; 2005. p. 126.
7. Acharya YT. Sushruta Samhita. 7th ed. Varanasi: Chaukhamba Orientalia; 2002. p. 506, 186, 395, 770.

8. Paradakara HS. Astanga Hridaya. 4th ed. Varanasi: Chaukhamba Sanskrita Sansthana; 2010. p. 597- 927.
9. Tripathi H. Dhanwantari Nighantu. 1st ed. Varanasi: Chowkhamba Bharti Academy; 2008. p. 16.
10. Sharma PV. Kaideva Nighantu. 2nd ed. Varanasi: Chowkhamba Orientalia; 2006. p. 622.
11. Tripathi I. Raja Nighantu. 4th ed. Varanasi: Chowkhamba Krishnadas Academy; 2006. p. 58.
12. Available from: <http://localhost:4001/eNighantu/abhidhanamanjari/?mod=search&searchText=sha~NkhaPushpI>. [Last accessed on 2013 Jun 20].
13. Available from: <http://localhost:4001/e-Nighantu/abhidhanaratnamala/?mod=search>. [Last accessed on 2013 Jun 20].
14. Available from: <http://localhost:4001/e-Nighantu/ashtanganighantu/?mod=search>. [Last accessed on 2013 Jun 20].
15. Sharma PV. Kaideva Nighantu. 2nd ed. Varanasi: Chowkhamba Orientalia; 2006. p. 622.
16. Available from: <http://localhost:4001/eNighantu/nighantushesha/?mod=search&searchText=sha~NkhapuShpI>. [Last accessed on 2013 Jun 20].
17. Available from: <http://localhost:4001/eNighantu/paryayaratnamala/?mod=search&searchText=sha~NkhaPushpI>. [Last accessed on 2013 Jun 20].
18. Available from: <http://localhost:4001/eNighantu/bhavaprakashanighantu/?mod=search&searchText=sha~NkhaPushpI>. [Last accessed on 2013 Jun 20].
19. Tripathi S. Madanpala Nighantu. 1st ed. Varanasi: Chowkhamba Krishnadas Academy; 2009. p. 58.
20. Available from: <http://localhost:4001/eNighantu/madhavadavyaguna/?mod=search&searchText=sha~NkhaPushpI>. [Last accessed on 2013 Jun 20].
21. Available from: <http://localhost:4001/eNighantu/rajanighantu/?mod=search&searchText=sha~NkhaPushpI>. [Last accessed on 2013 Jun 20].
22. Tripathi I. Rajavallabha Nighantu. 4th ed. Varanasi: Chowkhamba Krishnadas Academy; 2006. p. 58.
23. Available from: <http://localhost:4001/eNighantu/shivakosha/?mod=search&searchText=sha~NkhaPushpI>. [Last accessed on 2013 Jun 20].
24. Available from: <http://localhost:4001/eNighantu/siddhamantra/?mod=search&searchText=sha~NkhaPushpI>. [Last accessed on 2013 Jun 20].
25. Available from: <http://localhost:4001/eNighantu/hrududayadipakanighantu/?mod=search&searchText=sha~NkhaPushpI>. [Last accessed on 2013 Jun 20].
26. Available from: <http://localhost:4001/eNighantu/shodhalanighantu/?mod=search&searchText=sha~NkhaPushpI>. [Last accessed on 2013 Jun 20].
27. Austuin DF. *Evolvulus alsinoides* (Convolvulaceae): An American herb in the Old World. *J Ethnopharmacol* 2008;117:185-98.
28. Cramer LH. *Gentianaceae*. In: Dassenayake MD, Fosberg FR, editors. *A revised Handbook to the Flora of Ceylon*. New Delhi: Amarind Publishing Co; 1981. p. 55-78.
29. Sa'ad F. The *Convolvulus* species of the Canary Islands, the Mediterranean Region and the near and Middle East. *Mededeelingen van het Botanisch Museum en Herbarium van de Rijks Universiteit te Utrecht* 1967;1:281-288.
30. Dandiya PC, Chopra YM. CNS-active drugs from plants indigenous to India. *Indian J Pharma* 1970;2:67-90.
31. Available from: <http://www.flowersofindia.net/catalog/slides/Shankh%20Pushpi.html>. [Last accessed on 2013 Aug 24].
32. Dandekar. Analysis of a clinically important interaction between phenytoin and Shankhapushpi, an Ayurvedic preparation. *J Ethnopharmacol* 1992; 35 (3):285-288.
33. Kapadia NS, Acharya NS, Acharya SA, Shah MB. Use of HPTLC to establish a distinct chemical profile for Shankhapushpi and for quantification of scopoletin in *Convolvulus pluricaulis choisy* and in commercial formulations of Shankhapushpi. *J Planar Chromatogr* 2006;19:195-9.
34. Zafar R, Ahmad S, Mujeeb M. Estimation of scopoletin in leaf and leaf callus of *Convolvulus microphyllus* Sieb. *Indian J Pharm Sci* 2005;67:600-3.
35. Asthana S, Greig NH, Holloway HW, Raffaele KC, Berardi A, Schapiro MB, *et al.* Clinical pharmacokinetics of arecoline in subjects with Alzheimer's disease. *Clin Pharmacol Ther* 1996;60:276-82.
36. Mirzaev YR, Aripova SF. Neuro and psychopharmacological investigation of the alkaloids convolvine and atropine. *Chem Nat Comp* 1998;34:56-8.
37. Shah SC, Quadry SJ. *A textbook of pharmacognosy*. 7th ed. New Delhi: CBS Publishers; 1990. p. 388-389.
38. Deshpande SM, Srivastava DN. Chemical studies of *Convolvulus pluricaulis choisy*. *J Indian Chem Soc* 1969;46:759-60.
39. Bisht NP, Singh R. Chemical studies of *Convolvulus microphyllus* Sieb. *Planta Med* 1978;34:222-3.
40. Basu NK, Dandiya PC. Chemical investigation of *Convolvulus pluricaulis*. *J Am Pharm Assoc* 1948;37:27.
41. Lounasmaa M. The tropane alkaloids. In: Brossi A. *The alkaloids: Chemistry and pharmacology*. New York: Academic Press; 1988. p. 72-74.
42. Prasad GC, Gupta RC, Srivastava DN, Tandon AK, Wahi RS, Udupa KN. Effect of Shankhapushpi on experimental stress. *J Res Indian Med* 1974;9:19-27.
43. Singh GK, Bhandari A. *Text book of pharmacognosy*. New Delhi: CBS Publishers; 2000. p. 193-194.
44. Razzakov NA, Aripova SF. Confolidine, a new alkaloid from the aerial part of *Convolvulus subhirsutus*. *Chem Nat Comp* 2004;40:54-5.
45. Gapparov AM, Razzakov NA, Aripova SF. Alkaloids of *Convolvulus subhirsutus* from Uzbekistan. *Chem Nat Comp* 2007;43:291-2.
46. Gapparov AM, Aripova SF, Razzakov NA, Khuzhaev VU. Conpropine, a new alkaloid from the aerial part of *Convolvulus subhirsutus* from Uzbekistan. *Chem Nat Comp* 2008;44:743-4.
47. Deshpande SM, Srivastava DN. Chemical examination of the fatty acids of *Convolvulus pluricaulis*. *Indian Oil Soap J* 1969;34:217-8.
48. Srivastava DN, Deshpande SM. Gas chromatographic identification of fatty acids, fatty alcohols, and hydrocarbons of *Convolvulus pluricaulis* (Choisy). *J Am Oil Chem Soc* 1975;52:318-9.
49. Singh GK, Bhandari A. *Text Book of Pharmacognosy*. New Delhi: CBS Publishers; 2000. p. 193-194.
50. Patil UK, Dixit VK. Densitometric standardization of herbal medical products containing *Evolvulus alsinoides* by quantification of a marker compound. *J Planar Chromatogr* 2005;18:234-9.
51. Nahata A, Dixit VK. Spectrofluorimetric estimation of scopoletin in *Evolvulus alsinoides* Linn. and *Convolvulus pluricaulis* Choisy. *Indian J Pharm Sci* 2008;70:834-7.
52. Lounasmaa M. Tropane Alkaloids, *The Alkaloids, Chemistry and Pharmacology*. In: Brossi A, editor. New York: Academic Press; 1988. p. 68.
53. Lounasmaa M. The tropane alkaloids. In: Brossi A. *The alkaloids: Chemistry and pharmacology*. New York: Academic Press; 1998. p. 19.
54. Nahata A, Patil UK, Dixit VK. Effect of *Convolvulus pluricaulis* Choisy. on learning behavior and memory enhancement activity in rodents. *Nat Prod Res* 2008;22:1472-82.
55. Sharma VN, Barar FS, Khanna NK, Mahawar MM. Some pharmacological actions of *Convolvulus pluricaulis*: An Indian indigenous herb. *Indian J Med Res* 1965;53:871-6.

56. Amin H, Vyas HA, Vyas MK, Harisha CR. A comparative pharmacognostical and phytochemical study of Shankhapushpi (*Convolvulus pluricaulis*) tablet with bhavana and without bhavana. *Inter J Res Ayu Pharm* 2011;2:1457-60.
57. Amin H, Vyas HA, Vyas MK. Philosophical and applied Ayurvedic aspects of Mana w.s.r. to Smriti. M.D. dissertation. I.P.G.T and R.A. Jamnagar; 2012.
58. Barar FS, Sharma VN. Preliminary pharmacological studies on *Convolvulus pluricaulis* chois-A Indian indigenous herb. *Indian J Physiol Pharmacol* 1965;9:99-102.
59. Mudgal V. Studies on medicinal properties of *Convolvulus pluricaulis* and *Boerhaavia diffusa*. *Planta Med* 1975;28:62-8.
60. Nahata A, Patil UK, Dixit VK. Anxiolytic activity of *Evolvulus alsinoides* and *Convolvulus pluricaulis* in rodents. *Pharm Biol* 2009;47:444-51.
61. Manyam MD. Dementia in Ayurveda. *J Altern Complement Med* 1999;5:81-8.
62. Dhingra D, Valecha R. Evaluation of the antidepressant like activity of *Convolvulus pluricaulis* in the mouse forced swim and tail suspension tests. *Med Sci Monit* 2007;13:155-61.
63. Dhingra D, Valecha R. Screening for antidepressant-like activity of *Convolvulus pluricaulis* Choisy in mice. *Pharmacol Online* 2007;1:262-78.
64. Pawar SA, Dhuley JN, Naik SR. Neuropharmacology of an extract derived from *Convolvulus microphyllus*. *Pharm Biol* 2001;39:4.
65. Singh RH, Mehta AK. Studies on the psychotropic effect of the Medhya Rasayana drug 'Shankhapushpi' (*Convolvulus pluricaulis*) part 1 (Clinical Studies). *J Res Ind Med Yog Homeo* 1977;12:18.
66. Shukla SP. Anti-anxiety agents of plant origin. *Probe* 1981a; 20:201.
67. Shukla SP. A comparative study on the barbiturate hypnosis potentiation effect of medhya rasayana drugs shankhapushpi (*Convolvulus pluricaulis*). *BMEBR* 1981b;1:554.
68. Sinha SN, Dixit VP, Madnawat AV, Sharma OP. The possible potentiation of cognitive processing on administration of *Convolvulus microphyllus* in rats. *Indian Med* 1989;1:1-6.
69. Dandiya PC. The pharmacological basis of herbal drugs acting on CNS. *Eastern Pharm* 1990;33:39-47.
70. Dubey GP, Pathak SR, Gupta BS. Combined effect of Brahmi (*Bacopa monniera*) and Shankhapushpi (*Convolvulus pluricaulis*) on cognitive functions. *Pharmacopsychocol* 1994;7:249-51.
71. Sharma K, Arora V, Rana AC, Bhatnagar M. Anxiolytic effect of *Convolvulus pluricaulis* petals on elevated plus maze model of anxiety in mice. *J Herb Med Toxicol* 2009;3:41-6.
72. Sinha. The possible potentiation of cognitive processing on administration of *Convolvulus microphyllus* in rats. *Indian Med* 1989;1.
73. Upadhyay VP. Therapeutic role of Ayurvedic herb in mental disorders. *Vedic Path* 1986;69:24-9.
74. Adams M, Gmunder F, Hamburger M. Plants traditionally used in age related brain disorders-a survey of ethnobotanical literature. *J Ethnopharmacol* 2007;113:363-81.
75. Ahmad S, Zafar RU, Sahid M. Anticonvulsant potential of callus cultures of *Convolvulus microphyllus* Sieb. *OPEM* 2007;7:46-50.
76. Shukla SP. Anti-anxiety agents of plant origin. *Probe* 1981a; 20:201.
77. Chaturvedi M, Mali PC, Dixit VP. Hypolipidaemic effect of *Convolvulus microphyllus* on cholesterol fed gerbils. *J Phytological Res* 1997;8:153-5.
78. Bhakuni RS, Tripathi AK, Shukla YN, Singh SC. Insect antifeedant constituent from *Convolvulus microphyllus* (L) Sieb. *Phytother Res* 1996;10:170-1.
79. Gupta RC, Mudgal V. Anti-fungal effect of *Convolvulus pluricaulis* (Shankhapushpi). *J Res Indian Med* 1974;9:67.
80. Panda S, Kar A. Inhibition of T3 production in levothyroxine-treated female mice by the root extract of *Convolvulus pluricaulis*. *Horm Metab Res* 2001;33:16-8.
81. Gupta RC, Singh PM, Prasad GC, Udupa KN. Probable mode of action of shankhapushpi in the management of thyrotoxicosis. *Anc Sci Life* 1981;1:49-53.
82. Rakhit S, Basu NK. *Convolvulus pluricaulis*. *Indian Y Pharm* 1958;20:357-9.
83. Alam MM, Siddiqui MB, Hussain W. Treatment of diabetes through herbal drugs in rural India. *Fitoterapia* 1990;61:240-2.
84. Singh MP, Panda H. Medicinal herbs with their formulations. 1st ed. Delhi: Daya Publishing; 2005. p. 234.
85. Sairam K, Rao CV, Goel RK. Effect of *Convolvulus pluricaulis* Choisy on gastric ulceration and secretion in rats. *Indian J Exp Biol* 2001;39:350-4.
86. Penza M, Montani C, Jeremic M, Mazzoleni G, Wendy Hsiao WL, Marra M, *et al.* MAK-4 and -5 supplemented diets inhibit liver carcinogenesis in mice. *BMC Complement Altern Med* 2007;7:19.
87. Pandit RK, Prasad GC. Role of thyrocap in the treatment of simple diffuse goitre: A case report. *J Res Edu Ind Med* 1992;11:21-4.
88. Rai MK. Ethnomedicinal Studies of Patalkot and Tamiya (distt. Chhindwara): m. P.- plants used as tonic. *Anc Sci Life* 1987;7:119-21.
89. Singh VK, Ali ZA, Zaidi ST, Siddiqui MK. Ethnomedicinal uses of plants of Gonda district forests of Uttar Pradesh, India. *Fitoterapia* 1996;67:129-39.
90. Husain GM, Mishra D, Singh PN, Rao CV, Kumar V. Ethnopharmacological review of native traditional medicinal plants for brain disorders. *Phcog Rev* 2007;1:20-9.
91. Kumar V. Potential medicinal plants for CNS Disorders: An overview. *Phytother Res* 2006;20:1023-35.
92. Robinson BL, Fernald ML. *Gray's New Manual of Botany*. 7th ed. New York: American Book Co.; 1908. p. 543.
93. Pawar SA, Dhuley JN, Naik SR. Neuropharmacology of an extract derived from *Convolvulus microphyllus*. *Pharmaceut Biol* 2001;39:253-8.
94. Dandekar UP, Chandra RS, Dalvi SS, Joshi MV, Gokhale PC, Sharma AV. Analysis of a clinically important interaction between phenytoin and Shankhapushpi, an Ayurvedic preparation. *J Ethnopharmacol* 1992;35:285-8.
95. Chuneekar KC. *Bhavaprakasanighantu*, Reprint. Varanasi: Chowkhamba Krishnadas Academy; 1982. p. 455.
96. Sharma PV. *Dravyaguna vijñana*, Reprint. Varanasi: Chowkhamba Krishnadas Academy; 1983. p. 10-11.

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