

Argyrea speciosa (Linn. f.) sweet: A comprehensive review

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ABSTRACT

Argyrea speciosa (Linn. f.) Sweet is a popular Indian medicinal plant, which has long been used in traditional Ayurvedic Indian medicine for various diseases. This plant is pharmacologically studied for nootropic, aphrodisiac, immunomodulatory, hepatoprotective, antioxidant, antiinflammatory, antihyperglycemic, antidiarrheal, antimicrobial, antiviral, nematicidal, antiulcer, anticonvulsant, analgesic and central nervous depressant activities. A wide range of phytochemical constituents have been isolated from this plant. A comprehensive account of the morphology, phytochemical constituents and pharmacological activities reported are included in view of the many recent findings of importance on this plant.

Key words: Anticonvulsant activity, antioxidant activity, *Argyrea speciosa*, central nervous depressant activity, immunomodulatory activity

INTRODUCTION

The term herb refers to a plant used for medicinal purpose. Medicinal herbs and plant extracts are now generally considered as effective medicines to be respected, appreciated and they play a major role in modern pharmacy. World Health Organization estimated that about 80% of the world's population relies on herbs for their primary healthcare needs. There has been an explosion of scientific information concerning plants, crude plant extracts and various substances from plants as medical agents during the last 20 to 30 years. Although herbal medicine has existed since the dawn of time, our knowledge of how plants actually affect human physiology remains largely unexplored. Numbers of plants are claiming various medicinal uses and many researches are going on in this view. One such plant, *Argyrea speciosa* (L. f.) Sweet, which have various medicinal properties is widely used in Ayurveda, the ancient traditional medicinal system in India. In this review a comprehensive account of the morphology, phytochemical constituents and pharmacological activities are included in view of the many recent findings of importance on this plant.

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TAXONOMY OF ARGYREIA SPECIOSA (LINN. F.) SWEET^[1]

Kingdom: *Plantae*
Subkingdom: *Tracheobionta*
Super-division: *Spermatophyta*
Division: *Magnoliophyta*
Class: *Magnoliopsida*
Subclass: *Asteridae*
Order: *Solanales*
Family: *Convolvulaceae*
Genus: *Argyrea* Lour.

Synonyms

Argyrea speciosa (L. f.) Sweet, *Argyrea nervosa* (Burm.f.) Bojer

Argyrea speciosa (Linn. f.) Sweet

Vridhdadara is considered as a rejuvenator and useful in edema, deranged *vata*, rheumatoid arthritis, cough, dyspnea and fever; invigorating and *picchila*.^[2]

Vernacular name^[1,3]

Gujarati: Samundrasosh, Vardharo
Hindi: Samandar-ka-pat, Samundarsokha, Ghav-patta
Bengal: Bichtarak, Guguli
Malayalam: Samudrapachcha, Samudrapala, Samudrastokam
Marathi: Samandarshokh, Samudrasoka
Sanskrit: Antakotarapushpi, Chhagalanghri, Vryddhadaraka, Samundrasosha

Tamil: Ambagar, Peymunnai, Sadarbalai, Samuttrappalai
 Telugu: Chandrapoda, Kokkiti, Palasamudra, Samudrapachcha, Samudrappala
 Kannada: Chandrapada
 Urdu: Samandarsotha
 English: Elephant creeper, Woolly Morning-Glory

Occurrence and distribution^[3]

It is woody climber found throughout India, up to an altitude of 300 m. Common in Assam, West Bengal, Bihar, Orissa and South India.

Flowers and fruits

August-December

Parts used

Roots, leaves, flowers and seeds

Ayurvedic preparations

Speman, Geriforte, Tentex forte

MORPHOLOGY^[4-8]

Root

The roots of *Argyreia speciosa* are varying in size as well as in thickness. The thin roots are usually 2-4 mm in diameter and show somewhat smooth brownish exterior. When cut transversely they show a thin periderm and cambium, appearing as a dark line almost midway between the centre and the outer circumference separating the outer phloem from the inner central wood. The thicker roots are 5-25 mm in diameter or even more have a rough exterior due to the presence of large number of lenticels. A transversely cut surface of such root shows colorless tertiary phloem and a pink-colored crescent-shaped tertiary xylem [Figure 1].

Stem

The stem is white and tomentose in young stages. The older stem (25 mm) is so thick that it shows vertical ridges and numerous lenticels, which are mostly transversely elongated [Figures 2 and 3].



Figure 1: Roots

Leaf

The lower surface of the leaf is entirely covered with hair, which gives the leaf a silvery soft wooly appearance. The upper surface of the leaf is green, glabrous and shows the markings of nerves by slight depressions. The mature leaf is dorsiventral, uncostate with a strong midnerve and several faint lateral nerves, alternate, petiolate, acute at the apex and cordate at the base. The margin is entire but slightly wavy near the base. Lateral nerves 14-20 pairs arise alternatively on the midrib; the single nerves bifurcate before reaching the edge; the anterior branch unites with the posterior one of the neighboring nerve; an arched nervule connecting the two branches reach the margin. Petioles stout and cylindric, a little shorter than the length of the blade are completely covered with wooly tomentum [Figure 3].

Seeds

The seeds are more or less triangular, 0.5 to 0.75 cm long up to 5 mm broad having two flat or slightly concave sides, the third side is convex. The hilum is distinct, brown colored, rounded situated in the spherical depression at the broader end. The outer surface is glabrous or at places with whitish patches of pulp. The texture is hard and not easily breakable. The seeds are exalbuminous. The embryo of seed is large having two-folded cotyledons and distinct plumule of whitish black to blackish brown color. The odor is not characteristic while it tastes slightly astringent [Figure 4].

MICROSCOPY^[4-8]

Root

The young root shows an epidermis composed of small cubical parenchymal cells, followed by a wide cortex consisting of mostly isodiametric or in some cases, slightly oval cells. The primary vascular structure is tetrarch to pentarch. The mature root possesses a narrow periderm of 6-8 layers of cork cells, a single layer of phellogen and 10-12 layers of phelloderm cells. The phelloderm cells close to the phellogen are somewhat tangentially elongated and thin walled but become gradually polyhedral. Some of them possess rosette crystals of calcium oxalate. The secondary phloem is a wide zone, consisting of sieve tube elements with companion cells and phloem

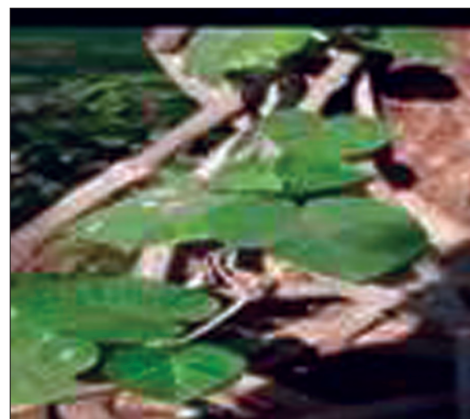


Figure 2: Stem

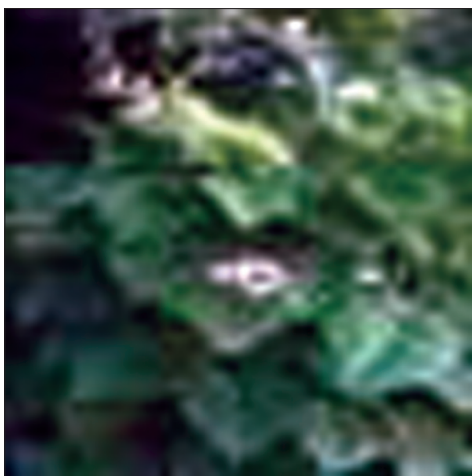


Figure 3: Whole plant

parenchyma. Resin canals, small strands of tertiary xylem and tertiary phloem are found scattered throughout the region. The secondary xylem is composed of large xylem vessels, tracheids, fiber tracheids and fibers. The vessels are drum-shaped, having bordered pits on the walls. The tracheids are cylindrical and possess bordered pits on the walls. The wood fibers are long and tapering with pointed ends.

Stem

The young stem shows nonglandular hairs, which are uniseriate, multicellular and usually three-celled. Resin canals are distributed throughout the cortex. An amphiphloic siphonostele is present following the cortex. The mature stem shows the cork composed of 10-15 layers of cells, which are stratified due to alternate arrangement of 3-4 layers of large cells, followed by almost equal number of shorter cells. The secondary phloem is wide and occupies the greater portion. A tertiary cambium arises in the secondary phloem and gives rise to tertiary phloem and tertiary xylem strands. The xylem vessels are drum-shaped with well-marked perforation rims. A few vessels are long and cylindrical. They also have bordered pits on the walls and there are no end-wall openings. The xylem fibers are long with pointed tapering ends and short lumen. They are however, shorter and narrower as compared to the pericyclic fibres which have pointed, truncated ends and show in some cases peg-like outgrowths towards the tapering ends.

Leaf

The transverse section of the leaf near the apex shows a prominent-ridged midrib on the lower surface and a small groove on the upper surface, while a section through the basal region presents a small ridge on the upper side as well. The ventral cuticle is stratified while the dorsal is thin and simple. The epidermal cells of the upper side have synclinous walls with rubiaceous type of sunken stomata. The openings of the latex canals are bound by 5-6 cells. The epidermal cells of the underside differ from those of the upper in possessing smaller cells and about twice the number of stomata and openings of latex canals. The cells of the epidermis along the veins on both sides of the leaf are roughly rectangular, straight-walled and completely devoid of appendages. The spongy tissue is composed of rounded cells enclosing air spaces and a few latex canals. The palisade cells

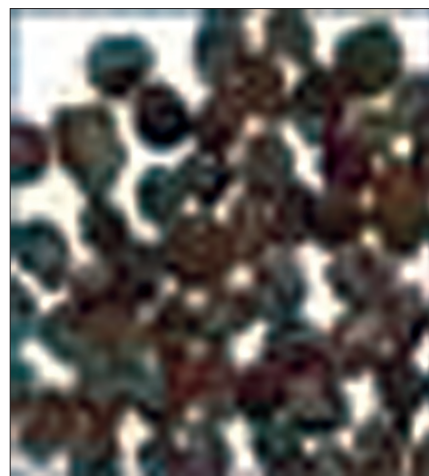


Figure 4: Seeds

are nearly rectangular, roughly four times longer than broad and are seen in the section usually in a single row only and rarely in two rows. A few latex canals are sometimes present in this zone as well. The vascular bundles are hexagonal in transverse section and occur in characteristic, continuous single row chains.

The transverse section of the petiole at the base is grooved along the ventral side while the groove becomes rather negligible at the apex. Arrangement of the tissues in the petiole is as in the stem. The vascular bundles are open, bi-collateral and arranged in a ring. The vasculature is represented by a shallow abaxial arc and a pair of adaxial traces. Conjunctive parenchyma separates the xylem and the phloem tissues distinctly. There are broad patches of phloem parenchyma. Xylary tissues of the leaf and the petiole are identical. Fresh vascular bundles are produced in the pith. The epidermal cells are barrel-shaped and most of them bear trichomes. Hypodermis or any mechanical tissues are completely lacking. Hexagonal cortical cells are smaller towards the periphery and the stele but are larger in the central region. The cortical cells merge gradually with the phloem parenchyma. The endodermis and pericycle are not made out even in a very young petiole. The latex canals associated with xylary tissues are recognized. The trichomes are silvery giving a wooly cover to the dorsal surface of the leaf and the entire petiole. Each trichome has a barrel-shaped basal cells and filamentous apical cell, base of which is invariably swollen. Sometimes the basal cell may be divided into two.

The midrib is seen as a semicircular projection on the abaxial face, and on the adaxial face it is in the form of small hump. A single crescent-shaped bi-collateral vascular trace traverses in the center. The rest of the area is occupied by parenchyma. The tissue details of the vasculature and ground is similar to that of the components in the petiole. Two functional and morphological types of trichomes occur, the short glandular nine-celled peltate and the long aglandular and two-celled. The structure depicted by Singh (1957) as the pore of the latex canal are in fact the peltate glandular trichomes.^[7] The microscopic constants viz., the palisade ratio, vein islet number, stomatal number and stomatal index have also been determined.^[8]

PHYTOCHEMISTRY

Seeds

The seeds of *Argyrea speciosa* yielded fatty oil, which was found to contain the glycosides of palmitic, oleic, stearic, behenic, linoleic and linolenic acid.^[9,10] Gas layer chromatography (GLC) of the seed oil revealed the presence of myristoleic, myristic, palmitic, linoleic, linolenic, oleic, stearic, nonadecanoic, eicosenoic, heneicosanoic and behenic acids identified as their corresponding methyl esters. Presence of branched fatty acids 12-methylmyristic acid and 15-methylstearic acid was also reported.^[11] The ethanolic extract of the seeds revealed a mixture of three alkaloids, out of which only one was characterized as ergometrine. The other constituents isolated were caffeic acid and ethyl caffeate.^[12] The presence of ergoline alkaloids was also reported by Nair *et al.*^[13] The ergolines were reported to be of clavine type. The free amino acids reported in the seeds were glutamic acid, glycine, isoleucine, leucine, lysine, phenylalanine, tyrosine, praline and α -aminobutyric acid.^[14] The total crude protein found in the seeds was 30.6% while the albumin, globulin and glutelin contents were 10.4, 8.8 and 10.6% respectively. These findings suggested the use of seeds for edible purpose.^[15]

Fruits

The fruits of *Argyrea speciosa* were reported to contain n-triacontanol, β -sitosterol, p-hydroxycinnamoyl octadecanolate and caffeic acid.^[16]

Leaves

The petroleum ether extract of the leaves of *Argyrea speciosa* yielded 1-triacontanol, epifriedelinol acetate, epifriedelinol and β -sitosterol.^[17] The leaves were found to contain flavonoids, quercetin, kaempferol and kaempferol 3-O-L-rhamnopyranoside.^[18,19] Two flavone glycosides characterized as 7,8,3',4',5'-pentahydroxyflavone, 5-O- α -L-rhamnopyranoside and 7,8,3',4',5'-pentahydroxyflavone 5-O- β -D-glucopyranoside were reported from leaves.^[20] A triterpene reported from leaves was friedelanol, 5-O- β -D-glucopyranoside.^[21]

Roots

The hexane extract of the roots of *Argyrea speciosa* yielded tetradecanyl palmitate, 5,8-oxidotetracosan-10-one.^[22] Two aryl esters characterized as stigmasteryl p-hydroxycinnamate and hexadecanyl p-hydroxycinnamate along with coumarin scopoletin were isolated from the root.^[23] A coumarin glycoside named L-ester coumarin, 6-methoxy-7- α -D-glu was also isolated from root.^[24]

TRADITIONAL USES

Roots

The root part of *A. speciosa* is bitter, aphrodisiac, diuretic, alterative, tonic and useful in gleet, gonorrhoea, strangury, chronic ulcers, rheumatism and diseases of the nervous system. Powdered roots are given with milk in synovitis and syphilis. A paste of roots along with *Asparagus racemosus*, *Grewia hirsute* and *Hemidesmus indicus* is used for chronic cough, cold and in consequent fever. As an alterative and nervine tonic, powdered root is soaked seven times during seven days in the juice of the tubers of *Asparagus racemosus* and

dried. The resulting powder is given in doses of a quarter to half a tola with clarified butter for about a month. It improves intellect, strengthens body and prevents effects of age. Root of this plant forms an ingredient of a compound powder known as *Ajmodadi Churna*, which is useful in rheumatic affections and hemiplegia.^[1,25] Root is used in dysentery.^[26]

Leaves

The leaves of *A. speciosa* are emollient and vesicant and externally used in the treatment of ringworm, eczema, itch and other skin diseases. The leaves are also used internally to cure boils and swellings. These are also used as a local stimulant and rubefacient. Mixed with vinegar, the sap is rubbed over the body to reduce obesity. In Assam and Bihar, the leaves are eaten as vegetable.^[1,3]

Seeds

The seeds are eaten in some parts of Bihar. The seeds mixed with those of *Hygrophila auriculata* syn. *H. spinosa* are used as a tonic.^[3]

BIOLOGICAL ACTIVITIES

General pharmacology

The 50% ethanolic extract of the seeds in a preliminary biological screening showed effect on cardiovascular system in dog/cat. The extract also exhibited antispasmodic activity on the isolated guinea pig ileum. The seed extract was devoid of antibacterial, antifungal, antiprotozoal, antiviral and anticancer activities. The seed extract was also devoid of the effects on respiration, preganglionically stimulated nictitating membrane and central nervous system in experimental animals. The LD₅₀ of the extract was 500 mg/kg i.p. in mice.^[27] The 50% ethanolic extract of the plant was devoid of antibacterial, antifungal, antiprotozoal, antiviral and diuretic activities. Effects of the extract on isolated guinea pig ileum, rat uterus, respiration, preganglionically stimulated nictitating membrane, CVS and CNS experimental animals were also studied. The LD₅₀ of the extract was 825 mg/kg i.p. in mice.^[28]

Nootropic activity

Aqueous extract of roots of *A. speciosa* (100 and 200 mg/kg) was reported for nootropic and anticholinesterase activity.^[29] Nootropic was evaluated using elevated plus maze test and passive shock avoidance paradigm. Aqueous extract of roots of *A. speciosa* decreased transfer latencies and increased stepdown latencies in both young and aged mice. It successfully reversed amnesia induced by diazepam, scopolamine and natural aging. Effect of hydroalcoholic extract of *A. speciosa* root (200 mg and 400 mg/kg) on learning and memory were also studied in mice using radial arm maze and Morris water maze test.^[30] Treatment showed a decrease in number of days required to make the mice learned, time taken to find food by the learned mice in radial arm maze. In Morris water maze, treated mice showed a significant reduction in the number of days required to make the mice learned, escape latency of learned mice and number of circles completed before it escapes on to the platform.

Aphrodisiac activity

The root, flower and to some extent leaf of the plant showed

aphrodisiac activity as evidenced by an increase in mounting behavior of mice. The plant is valuable in development of effective medicine for stimulating male sexual activity with an influence on sex ratio favoring males.^[31] A product containing a mixture of *Orchis mascula*, *Hygrophila spinosa*, *Lactuca scariola*, *Macuna pruriens*, *Parmelia parvata*, *Argyrea speciosa*, *Tribulus terrestris* and *Leptadenia reticulata* (known as Speman) was reported to improve prostatic function as assessed by the activity of maltase and by the citric acid content, with increase in the activity of amylase and maltase and a decrease in post-treatment levels of glycogen in seminal fluid. It also promotes fertility as increased sperm count, sperm motility, follicle-stimulating hormone release and synthesis.^[32] A preparation 'Fortege' made from *Withania somnifera*, *Mucuna pruriens*, *Argyrea speciosa*, *Leptadenia reticulata* and *Anacyclus pyrethrum* is used for curing common male sexual disorders.^[33] A product containing dried roots of *Argyrea speciosa* is effective to treat male impotence and sterility as evidenced by increase in testosterone level in alcohol-exposed rats.^[34]

Immunomodulatory activity

A 95% ethanolic extract of dried root of *A. speciosa* was reported to stimulate both cellular and humoral immunity.^[35] Oral administration of the ethanolic extract of *A. speciosa* root (50, 100 and 200 mg/kg) in mice, dose dependently potentiated the delayed-type hypersensitivity reaction induced by both, sheep red blood cells and oxazolone. It significantly enhanced the production of circulating antibody titer in mice in response to sheep red blood cells. Chronic administration also significantly ameliorated the total white blood cell count and restored the myelosuppressive effects induced by cyclophosphamide.

Hepatoprotective and antioxidant activity

Ethanol extract and ethyl acetate extract (200 mg and 400 mg/kg) of *A. speciosa* root showed hepatoprotective activity against carbon tetrachloride induced hepatotoxicity in rats. They also showed *in vivo* antioxidant activity against oxidative stress in rats.^[36]

Analgesic and antiinflammatory activity

The alcoholic extract of the roots (50, 100 and 200 mg/kg) exhibited statistically significant anti-inflammatory activity against granuloma formation technique in the albino rats. The extract did not show much activity against formalin-induced arthritis in rats.^[37] A 95% ethanolic extract of root (50-200 mg/kg p.o.) was effective against carrageenan-induced paw edema and adjuvant induced arthritis.^[38] The methanolic extract of the *A. speciosa* root (30, 100 and 300 mg/kg p.o.) showed significant inhibition of carrageenan-induced hind paw edema in rats.^[39] In pain models for evaluation of analgesic activity, the methanolic extract of *A. speciosa* root (30, 100 and 300 mg/kg p.o.) showed significant decrease in acetic acid induced writhing, whereas methanolic extract of *A. speciosa* at the dose of (100, 300 mg/kg p.o.) showed significant increase in latency to tail flick in tail immersion method and elevated mean basal reaction time in hot plate method.^[39]

Hypoglycemic activity

The alcoholic extract of *A. speciosa* (250, 500 and 750 mg/kg, p.o.) showed significant dose-dependent percentage blood glucose

reduction in normal and in alloxan-induced diabetic rats at 8 h.^[40] The dried seeds of *A. speciosa* also possess hypoglycemic activity.^[41]

Antidiarrheal activity

The 50% ethanolic extract of flowers of *A. speciosa* (50, 100 and 150 mg/kg, p.o.) have significant antidiarrheal activity.^[42]

Antimicrobial activity

The alcoholic extract of the leaves revealed antibacterial activity against *Staphylococcus aureus* but was inactive against *Escherichia coli*. The aqueous extract was inactive against both the bacteria.^[43] The seed oil was found to possess *in vitro* antibacterial activity against *Klebsiella* species, *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus anthracis*, *Salmonella typhi*, *Salmonella paratyphi*, *Shigella boydii*, *Shigella flexneri*, *Streptococcus β-haemolyticus* and *Bacillus subtilis*.^[11,44] The oil was inactive against *S. aureus*.^[44] The seed oil also showed antifungal activity against *Aspergillus flavus*, *Colletotrichum capsici*, *Cryptococcus neoformans*, *Alternaria solani*, *Helminthosporium* sp., *Colletotrichum dematium*, *Aspergillus niger*, *A. sydowi* and *Fusarium oxysporum*. *Penicillium* sp. was found to be resistant to the oil.^[44] Hexadecanyl p-hydroxycinnamate and scopoletin isolated from the root were tested for antifungal activity against *Fusarium fusiformis*, *F. semitectum* and *Alternaria alternata*. At a concentration of 1000 ppm, both the compounds produced 100% inhibition against *Alternaria alternata*. The compounds also revealed phytotoxicity in terms of root growth inhibition of germinating wheat seeds.^[45]

Antiviral activity

The extract of the plant and fruits had interferon-like antiviral activity against vaccinia virus in CAM (chorioallantoic membranes) cultures, but was devoid of any activity against Ranikhet disease virus.^[46]

Nematicidal

The effect of the aqueous and alcoholic extracts of the leaves of *A. speciosa* on the spontaneous movements of both the adult worm and a nerve/muscle preparation of *Setaria cervi*, a filarial worm of cattle and on the survival of microfilariae *in vitro* was studied. The aqueous extract in a dose of 150 µg/ml caused a decrease in tone and amplitude of spontaneous movements of the worm. A similar response was produced by the alcoholic extract but at a much lower concentration of 75 µg/ml. The aqueous extract produced complete paralysis of the nerve/muscle preparation in a dose of 25 µg/ml whereas with alcoholic extract only 50 ng/ml was required.^[47]

Antiulcer activity

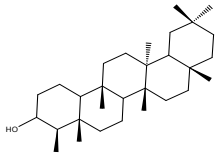
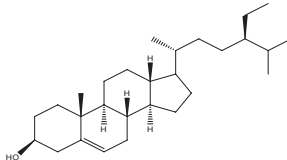
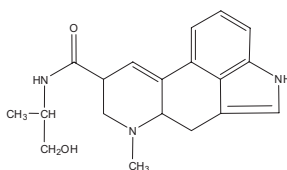
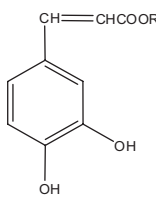
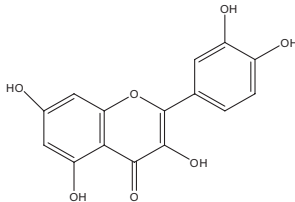
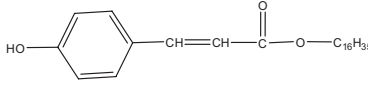
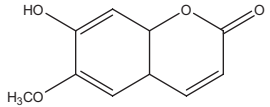
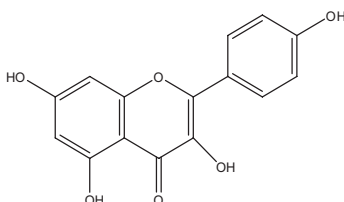
A 50% ethanolic extract of the flower of *A. speciosa* (100-200 mg/kg, p.o.) showed ulcer protective effect in ethanol, aspirin, stress and fourth pylorus ligation induced gastric ulceration in rats.^[48]

Anticonvulsant activity

The hydroalcoholic extract of *A. speciosa* roots (200 and 400 mg/kg, p.o.) significantly delayed the latency to the onset of first clonus as well as onset of death in unprotected mice and exhibited protection of pentylenetetrazole (80 mg/kg, s.c.) treated mice. Whereas in case of maximal electroshock seizures, hydroalcoholic extract of *Argyrea*

APPENDIX

Some of the chemical constituents isolated from different parts of *A speciosa* (Linn. f.) Sweet

Name of chemical constituent	Structure of chemical constituent
Epifriedelinol	
β -Sitosterol	
Ergometrine	
Caffeic acid R= H Ethyl caffeiate R= C2H5	
Quercetin	
Hexadecanyl p-hydroxycinnamate	
Scopoletin	
Kaempferol	

speciosa roots (200 and 400 mg/kg, p.o.) significantly reduced the duration of hind limb extension in mice and both the doses were statistically found to be equipotent.^[49]

Central nervous depressant activity

Central nervous system depressant activity was observed with n-hexane, chloroform, ethyl acetate and the remaining water fractions of hydroalcoholic extract of *A. speciosa* roots (100, 200 and 500 mg/kg, p.o.) as indicated by the results in which they reduced spontaneous motor activity and potentiated pentobarbital induced hypnosis in mice.^[50]

CONCLUSION

Argyrea speciosa (Linn. f.) Sweet is widely distributed throughout India. The plant appears to have a broad spectrum of activity on several ailments. Various parts of the plant have been explored for central nervous depressant activity, nootropic activity, aphrodisiac activity, anticonvulsant activity, immunomodulatory activity, antioxidant activity, analgesic activity, antiinflammatory activity, hypoglycemic activity, hepatoprotective activity, antibacterial activity, antifungal activity and many other activities. It is reported to contain flavonoids, sterol glycoside, flavonoids and essential oil. The pharmacological studies reported in the present review confirm the therapeutic value of *A. speciosa* (Linn. f.) Sweet. Many polyherbal formulations containing this plant parts are available in the market. However, less information is available regarding the clinical study, toxicity study, phyto-analytical studies of this plant. Several phyto-chemical studies have reported but still it needs to be progressed. With the availability of primary information, further studies can be carried out such as clinical evaluation, phyto-analytical studies, toxicity evaluation. The plant is pre-clinically evaluated to some extent; if these claims are scientifically and clinically evaluated then it can provide good remedies and help mankind in various ailments.

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