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Review Article

Traditional uses and Phytopharmacological Aspects of *Argyreia nervosa*

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ABSTRACT

Recently there has been a shift from synthetic to herbal medicine, which can be said "Return to Nature". Medicinal plants have been known for millennia and are highly esteemed all over the world as a rich source of therapeutic agents for the prevention of diseases and other ailments. Nature has provided us a very rich botanical wealth and a large number of diverse types of plants grown wild in different parts of our country. In India, the use of different parts of various medicinal plants to cure specific ailments has been in vogue from ancient times. *Argyreia nervosa* belongs to family-convolvulaceae is an important herb used extensively in traditional systems of medicine. It is commonly known as Hawaiian Baby Woodrose, Elephant creeper or Wooly morning glow in English. It is a large climber growing throughout India and has been assigned various pharmacological properties in ayurvedic system of medicine. The pharmacological properties include antimicrobial, analgesic, anti-inflammatory, antiulcer, immunomodulatory, hypoglycemic, anticonvulsant etc. Basing upon this wide spectrum of activities this review article focused on traditional and phytopharmacological aspects of this important plant.

Key words: *Argyreia nervosa, Argyreia speciosa, Elephant creeper, Phytopharmacological.*

INTRODUCTION

Plants have anchored to the mother earth long before man has set his feet and it is said that god had endowed them with materials for survival of man and animal long before these creatures were made by him (Mazumdar and Mukhopadhyay, 2006). The world health organization (WHO) estimates that about 80% of the population still depends upon these herbal medicines for treatment of various diseases due to easy availability, economic and less side effects when compared to allopathic system of medicines. Nearly 2000 of natural drugs are mentioned in Indian Materia Medica that have reported various pharmacological activities, out of these 1600 are from plant origin (Mukherji, 2008). The importance of medicinal plants and traditional health care systems in solving the health care problems of the world is gaining proper attention. Because of this resurgence of interest, the research on plants of medicinal importance is growing phenomenally at the international level, often to the detriment of natural habitats and mother populations in the countries of origin. Most of the developing countries have adopted traditional medical practice as an integral part of their culture. Historically, all medicinal preparations are derived from plants, whether in the simple form of raw plant materials or in the refined form of crude extracts, mixtures, etc (Krishnaraju et al., 2005). Plants have been used in a number of systems of medicines in our country as well as in other countries. India is well known as the 'Emporium of Medicinal Plants'. The use of plants to treat various diseases in India dates back to the times of Rig-Veda (3500 to 1800 B.C.). Later, the monumental Ayurvedic works like

Charaksamhita and Sushrutasamhita followed by other Ayurveda and Siddha treatises have incorporated nearly 700 plant derived drugs entering into several medicinal preparations used in the health care system. India is one of the 12-mega biodiversity centers having about 10% of the world's biodiversity wealth, which is distributed across 16 agro-climatic zones (Shiva, 1996). In India around 20,000 medicinal plant species have been recorded recently (Dev, 1997), but more than 500 traditional communities use only about 800 plant species for curing different diseases (Kamboj, 2000). With a view to strengthen the medicinal plants sector all over the country as well as to conserve the wild stock, the NMPB (National Medicinal Plants Board) was set up by the Government of India in 2000. The prime objective of setting up the board was to establish an agency which would be responsible for coordination of all matters with respect to the medicinal plants sector, including drawing up policies and strategies for *in situ* conservation, cultivation, harvesting, marketing, processing, drug development, etc. (Kala and Sajwan, 2007). In India, several steps have been taken to improve the quality of Ayurvedic medicines. Good manufacturing practice (GMP) guidelines have been introduced so as to ensure quality control. Medicinal plant boards have been constituted at the state and central level to inspire people particularly the farmers for adopting cultivation of medicinal plants. Herbal gardens have been developed to make common man conversant with the rich heritage of Indian system of medicine. Various institutes like National Institute of Pharmaceutical Education and Research (NIPER), National Botanical Research Institute (NBRI), Central Institute of Medicinal and Aromatic Plants (CIMAP) and Central Research Drug Institute (CDRI) are playing pivotal role in laying down standards for Ayurvedic system of medicine (Singh, 2007). The main aim of this review is to give recent information along with the traditional uses of *Argyreia nervosa* that might be an important plant due to its invaluable pharmacological properties by which students and researchers will get the overall information about its published phytochemical and pharmacological properties for their further research.

Morphology:

Argyreia nervosa is a climbing shrub with woody tomentose stem belongs to family Convolvulaceae. It is commonly known as elephant creeper in English speaking countries and samundar-ka-pat among Hindi speaking people in India (Anonymous, 1995). It is widely distributed in tropical regions of the world. In India it is seen up to an altitude of 900 m (Gamble, 1956) often cultivated native in India from Assam and Bengal to Karnataka (Guhabakshi et al., 1999; Nadkarni, 1976). It is generally found growing in slightly moist localities like river banks, edges of lakes etc. and as undergrowth in semidecidous forests (Aiyer and Kolammal, 1964). It is a twining woody climber, reaching up to 10 m or more in height. Leaves are alternate, simple and 5-15 cm long. Flowers are large, showy, funnel shaped, tinted purple or pale to deep rose, regular, with short pedicels in axillary bracteates cymes borne on stout, whitish and tomentose peduncles, petioles 5-15 cm. long, characteristic odour and slightly bitter taste (Kirtikar and Basu, 1981). Fruits are yellowish brown, smooth globose, indehiscent and irregularly crumbling berries, 1.2-1.8 cm in diameter, containing 2 or 4 seeds embedded in a mealy pulp. 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 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 (Kirtikar and Basu, 1981). The roots of *Argyreia nervosa* 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 ever more have a rough exterior due to the presence of large number

of lenticels. The plant is propagated through stem cuttings and also by seeds (Sharma et al., 2001).

Phytochemical Constituents:

The seeds of *Argyreia nervosa* yielded fatty oil, which was found to contain the glycosides of palmitic, oleic, stearic, behenic, linoleic and linolenic acid (Biswas et al, 1947; Kelker et al., 1947). 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. Presence of branched fatty acids 12-methylmyristic acid and 15-methylstearic acid was also reported (Batra and Mehta, 1985). 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 (Agarwal and Rastogi, 1974). The presence of ergoline alkaloids was also reported by Nair et al., 1987. The ergoline alkaloids includes ergometrine, ergometrinine, lysergic acid-α-hydroxy ethyl amide (Chao et al., 1973; Miller et al., 1970), agroclavine, chanoclavine-I, chanoclavine-II, festuclavine, lysergene, lysergol, isolysergol, setoclavine, iso-setoclavine, ergine and isoergine (Rastogi and Mehrotra, 1990). The free amino acids reported in the seeds were glutamic acid, glycine, isoleucine, leucine, lysine, phenylalanine, tyrosine, praline and α-aminobutyric acid (Jaiswal et al., 1984). 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 (Jaiswal et al., 1984). An important glycoside, (24R)-ergost-5-en-11-oxo-3β-ol-α-D-glucopyranoside, designated as argyroside has isolated from the seeds (Rahman et al., 2003). Lysergamide is the basic psychoactive constituent present in the seeds for which the plant exhibited hallucinogenic effects (Gopel et al., 2003; Klinke et al., 2010). The fruits of *Argyreia speciosa* were reported to contain n-triacontanol, β-sitosterol, p-hydroxycinnamoyl octadecanolate and caffeic acid (Purushothaman et al., 1982). The petroleum ether extract of the leaves of *Argyreia speciosa* yielded 1-triacontanol, epifriedelinol acetate, epifriedelinol and β-sitosterol (Sahu and Chakravarti, 1971). The leaves were found to contain flavonoids, quercetin, kaempferol and kaempferol 3-O-L-rhamnopyranoside (Daniel, 1989; Khan et al., 1992). 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 (Ahmad et al., 1993). A triterpene reported from leaves was friedelanol, 5-O-β-D-glucopyranoside (Chandler and Hooper, 1979). The hexane extract of the roots of *Argyreia speciosa* yielded tetradecanyl palmitate, 5,8-oxidotetracosan-10-one (Rani and Shukla, 1997). Two aryl esters characterized as stigma steryl-p-hydroxy cinnamate and hexadecanyl-p-hydroxycinnamate along with coumarin scopoletin were isolated from the root (Shrivastava and Shukla, 1998). A coumarin glycoside named L-ester coumarin, 6-methoxy-7-o-alpha-D-glu was also isolated from root (Shukla et al., 2001).

Traditional uses:

Traditionally the plant is used in the treatment of gonorrhoea, strangury and chronic ulcers. A preparation "Fortege" made from this plant along with several other ingredients is used to cure sexual disorders in males. Another drug "Speman" consisting of several ingredients of plant material including this species, is reported to exhibit anabolic-cum androgen-like activity in mice (Anonymous, 1995), in stomach complaints, sores on foot, small pox, syphilis, dysentery and diarrhoea (Guhabakshi et al., 1999). Traditinally the leaves are used by Rajasthani tribes to prevent conception and antiphlogistic (Nandkarni 1995). The leaves are used externally in the treatment of ringworm, eczema, itch and other skin diseases (Malahotra, 1996). It is also used as a local stimulant and rubefacient (Guhabakshi 1999; Kirtikar and Basu, 1981). Seeds of *Argyreia nervosa* found to possess hypotension, spasmolytic (Agarwal and Rastogi, 1974) and anti-inflammatory activities (Gokhale et al., 2002). Roots of *Argyreia nervosa* proved the immunomodulatory activity against the myelosuppressive

effects induced by Cyclophosphamide (Gokhale et al., 2003). The root was also used in appetitiser, anaemia, aphrodisiac, anti-inflammatory, brain-tonic, cardiotonic, cerebral disorders, diabetes, expectorant, obesity, syphilius, tuberculosis, digestive, carminative, emollient, rubifacient, ulcers and wounds (Nandkarni, 1995; Krishnaveni and Santh, 2009; Das, 2003).

Pharmacological activities:

Antimicrobial activity:

The alcoholic extract of the leaves showed antibacterial activity against *Staphylococcus aureus* but was inactive against *Escherichia coli* where as aqueous extract was inactive against these two organisms (George and Pandalai, 1949). The seed oil of *Argyreia* was found to have antibacterial activity against both gram positive and gram negative bacteria. (Batra and Mehta, 1985; Mishra and Chaturvedi, 1978) but the oil was inactive against *S. aureus* (Mishra and Chaturvedi, 1978). The seed oil was found to have antifungal activity against a number of fungal species such as *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 (Mishra and Chaturvedi, 1978). The isolated compounds of the root such as hexadecanyl-*p*-hydroxycinnamate and scopoletin showed good antifungal activity against *F. fusiformis*, *F. semitectum* and *Alternaria alternate*. These two compounds also showed phytotoxicity in terms of root growth inhibition of germinating wheat seeds (Shukla et al., 1999). Flavonoid sulphates of the root inhibited the growth of *Mycobacterium tuberculosis* (Habbu et al., 2009). Ethanolic extracts of the leaves showed antibacterial activities against various bacterial strains such as *E.coli, Proteus vulgaris, Bacillus subtilis, Staphylococcus aureus* and antifungal activity against the fungal strains such as *Aspergillus niger, Aspergillus flavus and Candida albicans* (Ashish et al., 2010). Ethanolic fractions of the leaves was active against different fungal strains like *Aspergillus niger, Candida albicans, Aspergillus flavus, Trichoderma spp., Fusarium proliferatum, Microsporum spp.* and *Trichophyton spp*. Ethyl acetate fraction exhibited better activity compare to other fractions (Somashekhar et al., 2012). The antibacterial activity was done by both agar disc diffusion method and agar well diffusion method against four bacterial strains, viz., *Bacillus cereus, Staphylococcus aureus, Klebsiella pneumoniae, Escherichia coli* (Basha et al, 2011). The study revealed that methanol extracts was more potent than that of aqueous extracts.

Analgesic activity:

The methanolic extract of the roots of *A. speciosa* at the dose of 30-300 mg/kg showed significant decrease in the number of writhes in acetic acid induced writhing and at the dose of 100-300 mg/kg showed significant increase in latency to tail flick in tail immersion method and increase in the reaction time in hot plate method (Bachhav et al., 2009). Ethanloic extract of the root showed significant analgesic activity in writhing and tail flick method (Varsa et al., 2011). The analgesic activity of hydroalcoholic extract of root was studied by using tail flick test in rats and acetic acid induced writhing test in mice at the doses of 100, 200 and 500 mg/kg. The extract exhibited significant analgesic activity in dose dependent manner (Varsha et al., 2010). The ethyl acetate and methanolic extract of the whole aerial part of the plant was studied for its analgesic activity on healthy albino mice weighing about 30-40 g and healthy wistar strain albino rats weighing about 150-200 g, using acetic acid induced writhing and tail immersion method. Both the extracts produced significant analgesic activity (Jeet et al., 2012).

Anti-inflammatory activity:

The alcoholic extract of the roots exhibited significant anti-inflammatory activity against granuloma formation in the albino rats. The extract did not show any significant activity against formalin-induced arthritis in rats (Srivastava et al., 1972). 95% ethanolic extract of root was found to be significant in reduction of paw edema by carrageenan and Freud's adjuvant induced arthritis at the dose of 50-200 mg/kg (Gokhale etal., 2002). The methanolic extract of *A. speciosa* root showed significant inhibition of edema induced by carrageenan to the hind paw in rats (Bachhav et al., 2009). The anti-inflammatory effect of hydroalcoholic extract of *Argyreia*

speciosa root was evaluated by using acute inflammatory model, carrageenan induced paw oedema in rats at the dose of 100, 200 and 500 mg/kg. The extract significantly reduced rat paw edema induced by subplantar injection of carrageenan. This provides the scientific basis for the traditional medicinal uses of the plant for anti-inflammatory activity (Varsha et al., 2010). Ethyl acetate and methanol extract of the whole aerial part from *Argyreia nervosa* was studied for its anti-inflammatory activity on healthy wistar strain albino rats weighing about 140-250 g, using carrageenan induced paw edema. Both the extracts produced significant anti-inflammatory activity (Kamal et al., 2012).

Antipyretic activity:

Investigation of the antipyretic activity of methanol and ethyl acetate extract of whole aerial part of *Argyreia nervosa* was carried out by Kamal et al., 2012. The study was carried out on healthy wistar rats weighing about 150-200 g, using brewer's yeast-induced pyrexia for antipyretic study. Which showed that the plant have significant antipyretic activity. Hydroalcoholic extract and its acetone, chloroform and methanol fractions of the root of *A. speciosa* were studied for their antipyretic activity by Brewer's yeast-induced pyrexia in rats by Sandeep et al., in 2010. The result showed that the hydroalcoholic extract produced significant antipyretic activity, while acetone, chloroform and methanol fraction did not show any such activity.

Hypoglycemic activity:

The alcoholic extract of *A. speciosa* showed significant reduction of blood glucose in dose-dependent manner in normal and in alloxan-induced diabetic rats (Hema et al., 2008). The dried seeds of the plant also possess hypoglycemic activity (Akhtar, 1992). Hypoglycemic effect of alcoholic extract of *Argyreia nervosa* roots in normal, glucose loaded and streptozotocin (STZ) induced diabetic rats was carried out at the dose of 500 mg/kg. The extract produced decrease in blood glucose level in normoglycaemic rats, in oral glucose loaded rats and in STZ diabetic rats (Shiv et al., 2010).

Antiviral activity:

The extract of the plant and fruits showed antiviral activity against vaccinia virus but was inactive against Ranikhet disease virus (Babbar et al., 1982).

Anticonvulsant activity:

The extract of the root significantly delayed the latency to the onset of first clonus as well as onset of death in unprotected mice and exhibited protection of pentylenetetrazole treated mice. Whereas in case of maximal electroshock seizures, hydroalcoholic extract of the roots of the plant significantly reduced the duration of hind limb extension in mice (Vyawahare et al., 2009).

Nootropic activity:

Aqueous extract of roots of *A. speciosa* was reported for nootropic and anticholinesterase activity (Joshi et al., 2007). Nootropic activity was evaluated using elevated plus maze test and passive shock avoidance paradigm. Aqueous extract of roots of *A. speciosa* decreased transfer latencies and increased step-down 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 (Vyawahare et al., 2009).

Anthelmintic activity:

The aqueous and alcoholic extracts of the leaves of *A. speciosa* showed anthelmintic activity. The aqueous extract produced complete paralysis of the worm in a dose of 25 μg/ml whereas alcoholic extract requires only 50 ng/ml (Parveen et al., 1990).

Aphrodisiac activity:

The leaf, flower and root extracts showed aphrodisiac activity of mice. The plant also stimulates the male sexual activity (Subramoniam et al., 2007). The product "Speman" consisting of several ingredients of plant material including this species, is reported to exhibit

anabolic-cum androgen-like activity in mice (Anonymous 1995). It also promotes fertility, sperm motility, follicle-stimulating hormone release and synthesis (Jaytilak et al., 1976). A preparation 'Fortege' made from *Withania somnifera*, *Mucuna prutiens*, *Argyreia speciosa*, *Leptadenia reticulate* and *Anacyclus pyrethrum* is used for curing common male sexual disorders (Bhargava et al., 1978). A product containing dried roots of *Argyreia speciosa* is also used to treat male impotence and sterility by increasing the testosterone level in alcohol-exposed rats (Mitra et al., 1996).

Antidiarrheal activity:

The ethanolic extract of the flower of *A. speciosa* showed significant antidiarrheal activity (Rao et al., 2004).

Antiulcer activity:

The ethanolic extract of the flower of *A. speciosa* showed ulcer protective effect on rats (Rao et al., 2003). The antiulcer activity of Ethanolic root extract of *Argyreia speciosa* in rats was studied at the dose of 25, 50 and 100 mg/kg were evaluated in rats using ethanol, indomethacin and aspirin induced ulcer methods, which showed that the ethanolic root extract exhibited significant and dose dependent anti-ulcer activity in all ulcer models. Percentage ulcer inhibitions of extract at 100 mg/kg for ethanol, aspirin and indomethacin induced ulcers were 73.5, 60.5 and 87.5%, respectively (Khan et al., 2010).

Treatment of Skin Diseases:

Whole plant was used in the treatment of small pox and other skin diseases in the form of paste (Mohammed et al., 2009).

Wound healing activity:

The ethanolic extract of the leaves of *Argyreia nervosa* was studied for the wound healing property in normal and diabetic animals by oral and topical administration. The result showed that topical application of the extract showed promotion of healing more significantly as compared to oral administration in both normal rats and alloxan induced diabetic rats (Singhal et al., 2011; Sandhya et al., 2011).

Immunomodulatory activity:

Ethanolic extract of the dried root of *A. speciosa* stimulates both cellular and humoral immunity when administered orally to rats. (Gokhale et al., 2003).

Central nervous system depressant activity:

Central nervous system depressant activity was observed in different solvent extracts of root such as chloroform, n-hexane and ethyl acetate which showed the reduction of spontaneous motor activity and potentiated pentobarbital induced hypnosis in mice (Galani et al., 2009).

Hallucinogenic effect:

The ergot alkaloids present in the plant showed hallucinogenic effect (William et al., 2007).

Hepatoprotective and antioxidant activity:

Ethanol and ethyl acetate extracts of the root showed hepatoprotective activity against carbon tetrachloride induced hepatotoxicity in rats. They also showed *in vivo* antioxidant activity against oxidative stress in rats (Habbu et al., 2008). Aqueous extract of the roots of *Argyreia nervosa*, which is widely used in the indigenous system of medicine, was studied for its *in vitro* free radical scavenging activity by different methods viz. DPPH radical scavenging, ABTS radical scavenging, lipid peroxidation, iron chelating activity, superoxide scavenging, total antioxidant capacity, Nitric oxide scavenging and non-enzymatic Glycosylation of Haemoglobin assay which indicate that *Argyreia nervosa* has significant antioxidant activity (Shreedhara et al., 2009).

Action on obesity:

The ethanolic extract of *A. speciosa* root was evaluated for its effects on rats fed with cafeteria diet. The extract

significantly reduced the serum content of leptin, total cholesterol, low density lipoprotein and triglycerides thus the extract showed the reduction of obesity in experimental animals (Shiv et al., 2011).

Conclusion:

Herbal drugs and remedies have been the important part in the traditional system of medicines throughout the world and numbers of herbs have been used in one form or other for the treatment of various diseases and improvement of health. In this review, we have made an attempt to provide the morphology, traditional uses, phytochemistry and pharmacological properties of *A. nervosa* (syn: *A. speciosa*), a medicinal plant found in tropical and sub-tropical countries. This plant has diversified pharmacological potential and was used since ancient times. It has a strong future in the field of herbal medicine, thus the plant should be cultivated in a large scale particularly in unutilized and wasteland which will helpful the financial upliftment of the farmers along with the development of research in the field of herbal medicine. Furthermore, systemic and scientific research is required to explore the maximum pharmacological potential of the plant. This review will definitely help the researchers to explore the different properties of *Argyreia nervosa*.

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