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Argyreia nervosa's chemical constitutents & their pharmacological applications: An overview

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Abstract
Argyreia nervosa (Burm. f.) abstract Bojer, often called Woolly Morning Glory or Elephant Creeper, is a perennial climber that is a member of the *Convolvulaceae* family. As a Rasayana herb, it is widely used in traditional Ayurvedic treatment and is widely disseminated throughout the Indian subcontinent. The herb has long been used to treat a wide range of conditions, such as diabetes, rheumatism, skin conditions, neurological problems, and male sexual dysfunction. According to phytochemical studies, it contains a variety of bioactive components that contribute to its broad pharmacological profile, including triterpenoids, steroids, lipids, coumarin glycosides, alkaloids (ergine, ergonovine, isoergine), and flavonoids (quercetin, kaempferol, rutin). Numerous pharmacological actions, such as antipyretic, aphrodisiac, wound healing, antioxidant, immunomodulatory, antidiabetic, antiviral, anti-inflammatory, analgesic, and antibacterial effects, have been shown in experimental research. Its safety, effectiveness, and mode of action must be established by more thorough pharmacokinetic, toxicological, and clinical research before it can be developed into standardized herbal formulations.

Keywords: *Argyreia nervosa*, Convolvulaceae, Elephant creeper, Woolly morning Glory

Introduction
Plants are considered as a potential source of new drugs from centuries.[1] *Argyreia nervosa* is considered a Rasayana herb in Ayurveda and is traditionally used to treat various disorders related to the nervous system [2]. *Sweet Hawaiian Baby Woodrose* (*Argyreia nervosa*) is a perennial climbing shrub belonging to the *Convolvulaceae* family. It is widely recognized for its large, heart-shaped leaves and striking purple flowers. Native to the Indian subcontinent, it is commonly known by various names such as *Elephant Creeper*, *Woolly Morning Glory*, *Samudrasok* (in Hindi), and Brydhotareko (in Oriya and other regional dialects). The plant has cultural and medicinal significance in traditional systems and is often noted for its ornamental as well as psychoactive properties due to the presence of naturally occurring Alkaloids in its fruit [3].

Argyreia nervosa (Linn. f.), commonly known as sweet Argyreia, is a well-known Indian medicinal plant that has been extensively used in traditional Ayurvedic medicine. Pharmacological studies have demonstrated its wide-ranging biological activities, including nootropic ,immunomodulatory, hepatoprotective, antioxidant, anti-inflammatory, and wound healing properties. A diverse array of phytochemical constituents has been isolated from this plant, including quercetin, kaempferol , kaempferol 3-O-L-rhamnopyranoside, 3',4',5'-pentahydroxyflavone 5-O-α-L-rhamnopyranoside, and 7,8,3',4',5'-pentahydroxyflavone 5-O-β-D-glucopyranoside [4] . *Argyreia nervosa*, native to the Indian subcontinent, is primarily found in the Deccan region, Karnataka, and the eastern slopes of the Western Ghats at elevations around 900 metres [5]. Phytochemical analysis indicated the presence of triterpenoids, flavonoids, steroids, and lipid [6]. This plant develops into a compact bush during the first one to two years of growth. It will then elongate into vines once some of the leaves fall off. It has been reported that the vines can reach a maximum length of 31 feet (10 meters). These vines may become extinct and be replaced by new growth if regular water availability is not maintained. At this stage, the vine will dry down to the nearest node.

Hawaiian Baby Woodrose thrives in dry tropical climates with distinct wet and dry seasons, such as those found along rivers and streams. The wet tropics do not naturally contain it. The leaves of the plant are traditionally applied to treat skin diseases and wounds. Dried leaves have also been used in the management of diabetes. Among Rajasthani tribes, the leaves are traditionally used as a contraceptive to prevent conception .The roots are employed in the treatment of gonorrhea, rheumatism, and disorders of the nervous system. Additionally, they are used in the management of obesity, hoarseness, syphilis, anemia, tuberculosis, and general debility. The plant is also regarded as a general tonic [7]. Our research group has demonstrated that flavonoids isolated from *Argyreia nervosa*, including Vitexin, Myricetin, Isoquercetin, and Rutin, exhibit significant α-amylase inhibitory activity, indicating their potential as natural therapeutic agents for managing postprandial hyperglycemia in diabetic conditions [8].

Fig 1: *Argyreia nervosa*

Taxonomical Classification

Domain	Eukaryotic
Kingdom	Plantae
Subkingdom	Viridaeplantae
Phylum	Tracheophyta
Subphylum	Euphyllophytin
Infraphylum	Radiatopses
Class	Magnoliopsida
Subclass	Lamiidae
Superorder	Solananae
Order	Convolvulales
Family	Convolvulaceae
Subfamily	Asteroideae
Tribe	Ipomoeeae
Genus	Argyreia
Species	Nervosa - (Burm.f.) Bojer
Botanical name	*Argyreia nervosa*

Parts Used

The whole plant leaves, fruit, seeds and root are used for pharmacological applications.

Synonyms

Argyreia nervosa (L. F.) Sweet, Convolvulus nervosus Burm. F., Convolvulus speciosus L. F., Lettsomia Nervosa, Lettsomia nervosa (Burm. F.) Roxb., Rivea nervosa (Burm. F.)

Vernacular Name

- **Oriya:** Bryddhotareko
- **Sanskrit:** Vridha daraka
- **Hindi:** Samudra Shokha
- **Bengali:** Bijarka
- **Gujrathi:** Samudarsoka
- **Marathi:** Samudarsoka
- **Unani:** Samudar sokh
- **Tamil:** Kadarpalai, Samuddirapacchai
- **Telgu:** Chandrapada
- **Kannada:** Chandrapada
- **English:** Elephant creeper, Baby wood-rose, Elephant-climber,
- Elephant-creeper, Elephant-vine, Silver-morning-glory, Wood-rose, Woolly-morning-glory
- **Nepales:** Samudra phool
- **Sinhalese:** Vriddadaru
- **Spanis:** Hojas

Occurrence and Distribution:

This plant is a woody climber that occurs throughout India, particularly up to an altitude of about 300 m above sea level. It is commonly found in Assam, West Bengal, Bihar, Odisha, and the southern states of India.[9]

Ayurvedic Description

- **Rasa:** Katu, tikta, kasaya
- **Guna:** Laghu, snigdha
- **Veerya:** Ushna
- **Vipak:** Madhur [10].

Chemical constituents

Alkaloids, flavonoids, lipids, and other chemical components are all present in *A.nervosa*. A variety of fatty oils, including palmitic, stearic, oleic, linoleic, and linolenic acids, as well as palmitic glycosides, are mostly found in seeds. Additionally, they have free amino acids such as glutamic acid, α-aminobutyric acid, glycine, leucine, and phenylalanine. There have also been reports of compounds having serotonin (5-HT) agonist action, including LSD and its isomers, which give the plant its psychoactive qualities. These effects have led to the seeds being abused as "legal highs" or "biogenic drugs" in various Western countries. Tetradecanyl palmitate, stigmasteryl p-hydroxycinnamate, hexadecanyl p-hydroxycinnamate, quercetin, and caffeic acid are the main constituents of the roots. A coumarin glucoside, 6-methoxycoumarin-7-O-α-D-glucopyranoside, has also been discd more recently. Phytochemical investigations further revealed the presence of kaempferol and quercetin as major flavonoids [11].

The fatty acids palmitic acid (6.7%), oleic acid (33.2%), stearic acid (29.1%), behenic acid (6.6%), linoleic acid (18.2%), and linolenic acid (6.1%) are all present in the plant's seed oil, according to Kelkar *et al*. Triacontanol, a C30 straight-chain alcohol, has also been identified in its seeds. found roughly 20 components in the seed oil. Methyl myristoleate (2.5%), methyl myristate (0.1%), methyl palmitate (12.1%), methyl linolenate (6.8%), methyl linoleate (7.6%), methyl oleate (27.5%), methyl stearate (5.6%), methyl sterate (3.4%), methyl nonadecanoate (0.7%), methyl eicosenoate (1.2%), methyl eicosanoate (1.3%), and methyl behenate (0.3%) are the following compounds [12].

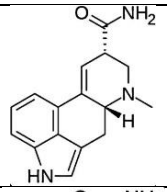
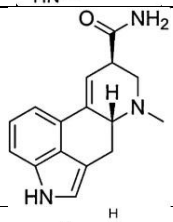
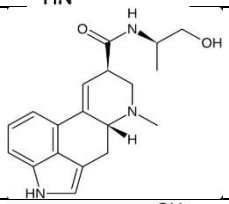
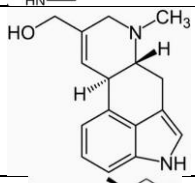
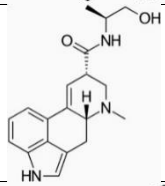
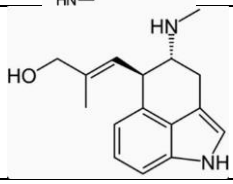
The roots were found to contain tetradecanyl palmitate and a disubstituted tetrahydrofuran 5, 8 oxidotetracosan-10-one [13]. Hexadecanyl p-hydroxy cinnamate, stigma steryl p-hydroxy cinnamate, and the coumarin scopoletin are also

present in the roots. Additionally, kaempferol 7-OMe-3-sulfate was found in the roots.[14]

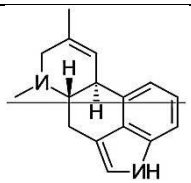
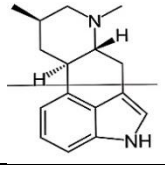
Ergolines

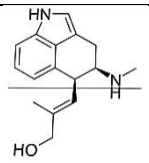
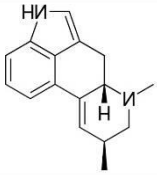
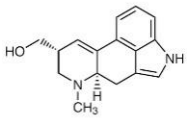
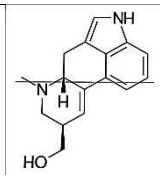
The tables below list the seveal ergolines and lysergamides found in *Argyreia nervosa*. Methylergometrine and methysergide, which were previously thought to be purely manufactured substances, have also been reported to be present.[15]

Ergolines Alkaloids of known percentage

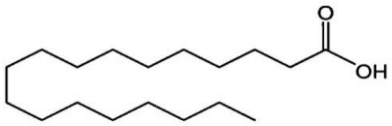
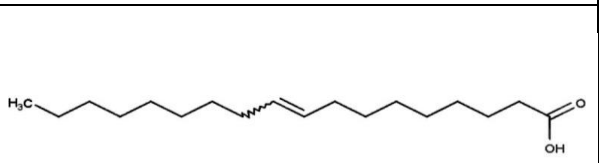
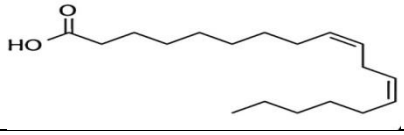
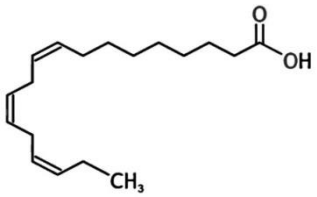
Compound Name	Chemical structure
Isoergine	
Ergine	
Ergometrine	
Elymoclavine	
Ergometrinine	
Chanoclavine	

Ergolines Alkaloids of unknown percentage

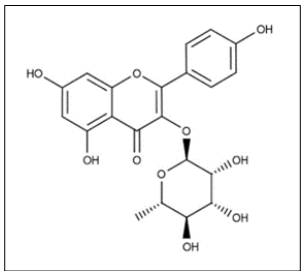
Compound name	Chemical structure
Agroclavine	
Festuclavin	

Chanoclavin	
Lysergene	
Lysergol	
Isolysergol	

Fatty acid

Compound name	Chemical structure
Estearic acid	
Oleic acid	
Linolenic acid	
Alpha - linolenic acid	

Glycoside



The steroidal glycoside argyroside (24R)-ergost-5-en-11-oxo-3β-ol-α-D glucopyranoside is specific to *Argyreia nerveosa*.[16]

Plant Part and it's major chemical constituents :

Leave

Leaves Contain bioactive compounds such as 1-triacontanol, epifriedelinol acetate, epifriedelinol, β-sitosterol, and various flavonoids including quercetin, kaempferol, and flavanone glycosides.[17]

Roots
Roots Comprise phytochemicals like tetradecanyl palmitate, 5,8-oxidotetracosan-10-one, and different aryl esters contributing to therapeutic activity.[18]

Fruits
Fruits are Rich in compounds such as n-triacontanol, β-sitosterol, p-hydroxy cinnamoyl octadecanolate, and caffeic acid with potential antioxidant properties.[19]

Seeds
Seed Contain alkaloids like chanoclavine, ergine, ergonovine, and isoergine, along with fatty oils (comprising myristoleic, myristic, palmitic, linoleic, linolenic, oleic, stearic, nonadecanoic, eicosenoic, eicosanoic, heneicosanoic, and behenic acids). Other notable constituents include argyroside and lysergamide.[20]

Morphology
Root
Size & Shape: Roots are cylindrical, tortuous, and varying in thickness. The thinner roots are usually 2-4 mm in diameter, while the thicker roots may reach several centimeters.
Surface: The outer surface is brownish to dark brown, somewhat smooth in young roots but rough and fissured in older ones. Fine longitudinal wrinkles and transverse cracks may be present.
Internal Appearance: On transverse section, the bark is comparatively thick, cork is well-developed, and the wood is yellowish-brown with distinct xylem vessels arranged radially.
Odor: Slight, characteristic.
Taste: Mucilaginous and slightly bitter.[21]
It is useful in the management of anorexia, loss of appetite, dyspepsia, flatulence, colic, chronic ulcers, ascites, haemorrhoids, hemiplegia, nervous weakness, neuralgic pain, cerebral disorders, synovitis, and general debility.

Fig 2: *Argyreia nervosa* root

Fruit
The fruit of *Argyreia nervosa* is a glabrous, globose to ovoid berry, usually small in size. Each berry contains one to four seeds embedded within a fleshy pericarp. The pericarp is smooth and varies in colour across the genus, appearing red, yellow, or brown when mature. . Seeds are hard, ovoid, and dark brown in appearance [22]. The seeds consist a fatty oil that contained glycerides composed of alminate, stearic, linoleic, linolenic, and oleic acids [23].

Fig 3: *Argyreia nervosa* fruit

Leaves
The rich covering of hair gives the lower surface of the leaf a smooth, silvery (argentine) appearance. The green, rough top surface is speckled with tiny indentations that represent veins. The adult leaf is dorsiventral, unicostate, alternating, petiolate, acute at the apex, and cordate at the base. It also has a conspicuous midrib and many lateral veins. Near the base, the margin is slightly crenulate, or wavy. There are between 14 and 20 pairs of lateral veins [24].

Fig 4: *Argyreia nervosa* leaves

Stem
In the young stage, the stem is white and densely tomentose. As it matures, the older stem thickens up to about 25 mm in diameter and develops prominent vertical ridges.[9] The juvenile stems have a tomentose appearance due to their herbaceous (cylindrical) nature and abundant covering of small hairs. The stems gradually lose their pubescence as they mature and undergo lignification, turning from semi-woody to fully woody. On the surface, a large number of lenticels form to promote gaseous exchange. Although some species, including *Argyreia nervosa*, have been seen to exhibit variants such as triangular or "Y"-shaped cross-sections, mature stems are normally terete. [22]

Fig 5: *Argyreia nervosa* stem

Flower

The flowers are large, funnel-shaped, and exhibit violet to lavender pigmentation, arranged in compact sub-capitate inflorescences. Upon maturation, the dried floral pods enclose black-colored seeds [25].

Fig 6: *Argyreia nervosa* Flower

Traditional Uses

Argyreia nervosa has been extensively used in traditional medicine for the management of various ailments. Ethnomedicinal reports indicate its use in the treatment of gonorrhea, strangury, and chronic ulcers. Polyherbal formulations such as "Fortege", containing A. nervosa along with other medicinal ingredients, are traditionally prescribed for the management of male sexual disorders. Another formulation, "Speman", which also includes this species among its components, has been reported to exhibit anabolic and androgen-like effects in experimental mice.

Traditionally, the plant has also been employed in the management of gastrointestinal disturbances, including stomach complaints, dysentery, and diarrhea, as well as for treating sores, syphilis, and smallpox. Among the Rajasthani tribal communities, the leaves are reputedly used for contraceptive purposes and as an antiphlogistic agent. Topical application of leaf paste is practiced in the treatment of various dermatological conditions such as ringworm, eczema, pruritus, and other skin infections. Additionally, the leaves serve as a local stimulant and rubefacient, while the seeds are reported to exhibit hypotensive, spasmolytic, and anti-inflammatory activities.[26]

Formulations & Preparations

- Vrddhadaru Kusama curna
- Vrddhadaruka kalpa
- Nagaradi modaka
- Banovit Capsule
- Confido Tablet

Pharmacological studies

1. **Antipyretic:** The fever-reducing potential of the plant was assessed using yeast-induced pyrexia in rats. Extracts prepared from the aerial parts demonstrated marked antipyretic activity, which is believed to act by suppressing prostaglandin synthesis in the hypothalamus. Similarly, a study carried out with an aqueous leaf extract in Swiss albino rats confirmed its ability to reduce yeast-induced fever [27] *Argyreia nervosa* displayed substantial antipyretic efficacy, which is considered to occur from the regulation of prostaglandin manufacture in the hypothalamus thermoregulatory area, hence mediating a reduction in increased body temperature [28]
2. **Aphrodisiac activity:** The plant's roots, blooms, and leaves all have significant aphrodisiac qualities, as seen by improved mounting behavior in test mice. This implies the potential for creating successful treatments meant to boost male libido and sway the sex ratio in favor of men. Male sexual dysfunction is historically treated with Fortege, a polyherbal preparation that contains Withania somnifera, Mucuna pruriens, *Argyreia nervosa*, Leptadenia reticulata, and Anacyclus pyrethrum. Additionally, preparations using dried *Argyreia nervosa* roots have demonstrated effectiveness in treating male sterility and impotence, as seen by increased testosterone levels in rat models subjected to alcohol. The combination of these medicinal plants, which are known to increase spermatogenic activity, boost libido, and alter androgenic activities through hormonal and neuropharmacological pathways, is responsible for its pharmacological efficiency [29]
3. **Wound healing activity:** In both healthy and diabetic animal models, the ability of *Argyreia nervosa* leaf extract to heal wounds has been evaluated through topical and oral administration. The results demonstrated that topical use of the extract provided a significantly stronger boost in the healing process, even while oral treatment showed some effect [30] *Argyreia nervosa* young leaves have a considerable capacity for wound healing. For 14 days in a row, mice with excision wounds received topical formulations made from ethanol, hydroethanolic, and aqueous extracts of the leaves. The plant may help promote dermal repair and healing, as seen by the treated groups' greater tissue regeneration, increased epithelialization, and quicker wound contraction.[31]
4. **Central Nervous System Activity:** The effects on the central nervous system of the n-hexane (n-HF), chloroform (CF), ethyl acetate (EAF), and aqueous (WF) fractions of the hydroalcoholic root extract of *Argyreia nervosa* were examined. Pentobarbital-induced sleep in mice and spontaneous locomotor behavior were used to measure the neuropharmacological activity of doses of 100, 200, and 500 mg/kg (p.o.). Chlorpromazine was used as the default reference medication. All fractions showed depressive effects on the central nervous system, as seen by increased pentobarbital-induced hypnosis and decreased locomotor activity [32]
5. **Immunomodulatory Activity:** Oral administration of the ethanolic root extract of *Argyreia nervosa* at doses of 50, 100, and 200 mg/kg in mice showed a dose-dependent enhancement of the delayed-type hypersensitivity response triggered by sheep red blood cells (SRBC) and oxazolone. The extract also markedly increased antibody production in response to SRBC. However, it did not influence macrophage phagocytic activity. Prolonged treatment with the extract significantly elevated the total white blood cell count and counteracted the myelosuppressive effects caused by cyclophosphamide [33]
6. **Antidiabetic Activity:** Both normal and alloxan-induced diabetic rats were used to test the plant's ethanolic extract's antidiabetic potential. In diabetic rats, the therapy led to a significant increase in liver

glycogen content and a significant drop in blood glucose levels. Additionally, the extract decreased lactate dehydrogenase (LDH) levels while increasing glucose-6-phosphatase activity. In this investigation, glibenclamide was used as the standard reference medication. It has been noted that *Argyreia nervosa* dried seeds produce strong hypoglycemic effects.[34] After eight hours, both normal and alloxan-induced diabetic rats' blood glucose levels significantly decreased when the alcoholic extract of *Argyreia nervosa* was given orally at doses of 250, 500, and 750 mg/kg [35]

7. **Antiviral Activity:** In chorioallantoic membrane (CAM) culture assays, both the plant and fruit extracts exhibited antiviral activity resembling that of interferons, effectively suppressing the vaccinia virus. However, they showed no inhibitory effect against the microorganism responsible for Ranikhet disease.[36] The antiviral effectiveness of *Argyreia nervosa* fruit extract was assessed. Using chorioallantoic membrane culture models, the study evaluated its interferon-like activity against the vaccinia virus. The extract showed this action, however it had no protective effect against the Ranikhet sickness virus [37]
8. **Analgesic and Anti-inflammatory Activity:** *Argyreia nervosa* root methanolic extract was applied to models of inflammation and discomfort. Using the granuloma formation paradigm, albino rats treated with alcoholic extract of *Argyreia nervosa* roots at doses of 50, 100, and 200 mg/kg showed a statistically significant anti-inflammatory effect. On the other hand, the extract had no discernible effect on rats' formalin-induced arthritis. Similarly, carrageenan-induced paw edema and inflammation linked to experimental arthritis were successfully decreased by a 95% methanolic root extract (50-200 mg/kg, p.o.). Additionally, mice's acetic acid-induced writhing was significantly reduced by methanolic root extract at dosages of 30, 100, and 300 mg/kg (p.o.), suggesting strong analgesic action. higher dosages (p.o., 100 and 300 mg/kg).also significantly prolonged the latency period in the tail-flick test and increased the mean basal reaction time in the hot plate assay, confirming both central and peripheral analgesic effects [38].
9. **Antimicrobial Activity:** *Argyreia nervosa* has long been used in traditional medicine for treating various skin infections due to its notable antimicrobial potential [39]. While it was ineffective against Escherichia coli, the leaves' alcoholic extract demonstrated strong antibacterial action against Staphylococcus aureus. On the other hand, neither of these bacterial strains showed any inhibitory effects from the aqueous extract. Additionally, the seed oil shown notable antibacterial action *in vitro* against a variety of pathogenic pathogens, such as Streptococcus β-haemolyticus, Bacillus subtilis, Shigella flexneri, Shigella boydii, and Salmonella typhi and paratyphi [40].
10. **Treatment of Skin Diseases:** Smallpox and various skin infections are among the dermatological problems for which the entire plant has historically been used. To encourage healing and reduce skin lesions, a paste made from the entire plant is topically applied to the afflicted areas in ethnomedical practices [41].
11. **Central nervous depressant activity:** At dosages of 100, 200, and 500 mg/kg, p.o., the hydroalcoholic extract of *Argyreia nervosa* roots showed depressive effects on the central nervous system in its n-hexane, chloroform, ethyl acetate, and aqueous fractions. This was demonstrated by the mice's increased pentobarbital-induced hypnosis and decreased spontaneous motor activity [42].

Abbreviations

Abbreviation Full Form
A. nervosa: *Argyreia nervosa*
A. speciosa: Argyreia speciosa
An-AgNPs.: Argyreia nervosa-mediated Silver Nanoparticles
AgNPs: Silver Nanoparticles
CAM: Chorioallantoic Membrane
CNS: Central Nervous System
DTH: Delayed-Type Hypersensitivity
LDH: Lactate Dehydrogenase
LSD: Lysergic Acid Diethylamide
SRBC: Sheep Red Blood Cells
5-HT: 5-Hydroxytryptamine (Serotonin)
WHO: World Health Organization
UV-Vis: Ultraviolet-Visible Spectroscopy
FTIR: Fourier Transform Infrared Spectroscopy
SEM: Scanning Electron Microscopy
TEM: Transmission Electron Microscopy
XRD: X-ray Diffraction
n-HF: n-Hexane fraction
CF: Chloroform fraction
EAF: Ethyl acetate fraction
WF: Aqueous fraction
CNS: Central Nervous System
p.o: Per os (oral route)
mg/kg: Milligram per kilogram

Conclusion

Argyreia nervosa (Burm. f.) Bojer, widely recognized as Elephant Creeper or Woolly Morning Glory, is an important Rasayana herb in Ayurveda, valued for its extensive therapeutic potential. The plant exhibits a broad spectrum of phytochemical diversity, encompassing alkaloids, flavonoids, triterpenoids, steroids, fatty acids, and glycosides, which contribute to its multifaceted pharmacological activities. Traditional applications of A. nervosa in managing disorders related to the nervous system, diabetes, inflammation, wounds, and reproductive health have been substantiated by several experimental studies confirming its antipyretic, antidiabetic, aphrodisiac, antioxidant, anti-inflammatory, analgesic, immunomodulatory, antiviral, and antimicrobial properties. The presence of ergoline alkaloids such as ergine and isoergine explains its psychoactive and neuromodulatory actions, while flavonoids like quercetin, kaempferol, and rutin contribute to its strong antioxidant and hepatoprotective effects. Therefore, future research should focus on systematic isolation of bioactive compounds, mechanistic studies, and standardized clinical trials to establish its safety, efficacy and therapeutic dosage.

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