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ARTEMISIA PALLENS WALL: LOOKING INTO EMERGING PHARMACOLOGICAL POTENTIALS OF THIS IMPERATIVE INDIAN MEDICINAL PLANT

Anupama Yadav*

Department of Pharmacognosy, School of Pharmacy, Chouksey College of Engineering, NH-49, Masturi - Jairamnagar Road, Lalkhadan, Bilaspur 495004, Chhattisgarh.

***Corresponding Author: Anupama Yadav**
Department of Pharmacognosy, School of Pharmacy, Chouksey College of Engineering, NH-49, Masturi - Jairamnagar Road, Lalkhadan, Bilaspur 495004, Chhattisgarh.

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ABSTRACT

Because of their effectiveness, potency, and lack of side effects, natural herbal medicines are in high demand for primary health care in developing countries. Plants and their extracts have been studied and identified for bioactive components that lead to a variety of medicinal properties since ancient times. The Asteraceae family includes *Artemisia pallens* Wall, a medicinally significant herb. The phytochemical analysis of plant parts revealed the existence of alkaloids, phenols, phenylpropanoids, glycosides, flavonoids, saponin, triterpene, hormones, fatty acids, fatty esters hydrocarbons, among other substances that may be included in herbal medications to treat a variety of ailments. Measles, asthma, cold, obesity, diabetes, and high blood pressure have also been treated with *A. pallens* in Ayurvedic medicine. The plant's essential oil, Davana, has antimicrobial, anthelmintic, antipyretic, anti-spasmodic, wound-healing, stimulant, and other medicinal properties. It is the most essential aromatic plant used commercially in the perfumery and cosmetics industries, and India is the world's largest exporter of Davana oil. The present research focuses on the current clinical significance of *A. palllens*, as well as several possible potential insights.

KEYWORDS: *Artemisia pallens*, Phytochemicals, Davana, Natural, Traditional, Therapeutics.

INTRODUCTION

From the dawn of time, Mother Nature has become a rich source of therapeutic substances, with a large range of medicines isolated from different natural sources.[1] Our ancient scriptures, such as the Vedas, identify these medicines in depth.[2] Since it includes natural bioactive compounds that are responsible for its numerous medicinal functions, these medicines or herbal remedies play an important role in curing a number of ailments.[3] Natural ingredients are used in the manufacture of more than half of all new clinical medicines, and they play an important part in pharmaceutical companies' drug development programs.[4]

India has one of the most diverse medicinal and aromatic plant populations in the world.[5] Natural flora and fauna are plentiful in India, and they are the country's greatest asset.[6] From temperate in the Himalayas to hot in South India, from dry in Central India to warm and wet in Assam and Kerala, India has a wide variety of agro-climatic environments and habitats.[7] This variety fosters the development of a wide range of medicinal and aromatic plants.[8] Herbal medications are easy to use, safe, and have a large range of activities; as a result of these benefits, demand for plant-based medicines is rising across the world.[9]

Plants have long been used as a source of medication, and they appear to be an important part of India's and other countries healthcare systems today.[10] These are used not only in emerging countries for primary healthcare, but also in industrialized countries where advanced drugs are widely accessible.[11]

The Artemisia group, which belongs to the Asteraceae (Compositae) class, is one of the most complex and challenging taxa to comprehend.[12] The word 'Artemisia' comes from the Greek goddess Diana. Artemisia is a genus of flowering plants that has around 500 species worldwide, with 45 of them present in India.[13] However, only a few Artemisia species have been collected and their essential oil tested, and among these are several cultivated species such as *A. pallens* and *A. annua*, whose essential oils are well-known, sold, and in high demand.[14] Basic oil factories all over the world depend on aromatic plants as a natural source of perfumes and fragrances. India is the world's third-largest producer of essential oils, behind France and the United Kingdom.[15]

A. pallens Walls ex D.C. (Davana) (Asteraceae) is an aromatic medicinal herb native in the southern part of India, especially in the states of Tamil Nadu, Karnataka, and Andhra Pradesh.[16] Its leaves and berries are prized for use in floral arrangements and oils. The chemical

composition of *A. pallens* plant oil has been documented by a variety of researchers. The leaves are minute, bluish-green, and inconspicuous, with yellow flowers. Cakes, pastries, cigarettes, and certain expensive drinks use *A. pallens* oil as a flavoring agent.[17] Anthelmintic, tonic, anti-pyretic, anti-diabetic, anti-fungal, anti-bacterial, anti-microbial, anti-oxidant, analgesic, stimulant, immunomodulator, and anti-inflammatory activity are among the plant's recorded pharmacological properties.[18]

Davana is a high-value annual aromatic herb grown commercially in south India from November to March as a short-season flower. The manufacture and export of davana oil were monopolized by India. Davana, which is typically used in religious ceremonies and in the development of garlands, bouquets, floral arrangements, and floral chaplets, adds a touch of freshness and a deep, sumptuous fragrance to religious occasions.[19]

PLANT PROFILE

Davana is a fragrant, erect herb with many divided leaves and small yellow flowers that grows to around 60 cm tall. Tomentum coats the stem and leaves with a grayish-white tint. The leaves are lobed, alternating, and petiolate. Flowers are peduncle to sessile, axillary or forming lax racemes, simple, heterogamous with bisexual disc florets in the center and a few pistillate ray florets on the periphery of the inflorescence. The outer florets are tubular and usually 3-lobed, glabrous except for a few cottony hairs. The stigma is usually two-lobed, but it may also be three-lobed. The inner florets are glabrous except for a few cottony hairs, tubular, 5-lobed, and bisexual; the stamens are 5 in number with open, epipetalous filaments and a dithecous inflorescence; and the anthers are syngenecious, protracted, tapering style, and bifid.[20]

CULTIVATION

For its fragrant leaves and flowers, it is commercially grown in Karnataka, Maharashtra, Kerala, Tamil Nadu, and Andhra Pradesh over a 1000-hectare range. It takes four months to mature from seed or cuttings to maturity. The plant has annual branches but is woody in the lower part of the stem. Davana is mostly grown in South India's red-soil areas. Rich loamy soils are ideal for growing it. Davana is an annual herb that requires about four months to develop and develops to about one and a half feet in height. When growing a crop for oil production, the season is very critical. The crop is permitted to mature until it flowers, which takes approximately 4 months from the time it is planted. It is grown as a short-term crop from November to February/March, as well as a rotation crop from April to May. Heavy rains have a negative impact on the crop. The combined yield of the main crop and ration crop is about 14 tons per hectare, yielding around 10 kg of Davana oil after shade drying and distillation. A yield of 3.2 percent from a substance dried for around 2 days can be deemed satisfactory in large-scale distillation. The flower head absorbs the most oil, while the leaf and stem contain slightly fewer.[21]

TRADITIONAL USES

Oil of Davana is obtained from the leaves and bulbs. Several organisms produce essential oil, and some are used as fodder; some contain the useful anthelmintic medication santonin. Throughout the day, the faithful give Davana blossoms to Shiva, the God of Transformation, and decorate his altar. For the prevention of diabetes mellitus, davana has long been used in Iraqi and Indian medicine. In glucose-fed hyperglycemic and alloxan-treated rabbits and rodents, oral administration of an aqueous/methanolic extract from the aerial portions of the plants decreased diabetes. Perfumery and fragrances are made with davana oil. Rough, dry, chapped face, skin infections, and cuts benefit from davana oil's healing properties. Several butterfly species prefer *A. pallens* as a food source for their larvae. The leaves and stalks of davana are used to produce bouquets, garlands, and new and dried flower arrangements. Davana oil has a soothing and emotional balancing influence, which helps to relieve anxiety. Davana is known to smell distinct on different people as it is added to the skin. This unusual property is highly prized in high-end perfumery, where it is used to produce fragrances with truly exclusive notes. Diabetes mellitus has long been treated with Davana in Indian folk medicine. Immunomodulation, anthelmintic, antipyretic, and wound-healing effects are all present. It's a mood enhancer and aphrodisiac. It works as an antiseptic and disinfectant in spades. This oil also works as a gentle pest repellent. It's used to lower the incidence of lifelong illnesses, heart failure, and cancer.[22]

PHYTOCHEMICAL CONSTITUENTS

The chemical constituents of *A. pallens* are 1-eicosanol, 2-propenoic acid, 4-epipallensin, 4-epivalgarin, 18,19-secoyohimban-19-oic acid, alpha-dihydrorosefuran, artemone, artesin, ascorbic acid, beta-dihydrorosefuran, *cis*-davanone, davanafurans, davanone, dehydro-alpha-linalol, epipallensin, eudesmanolide, formic acid, gamolenic acid, germacranolide, germacranolidone, hotrienol, isodavanone, isophytol, lilac alcohol, linalool, *n*-hexadecanoic acid, paromomycin, pallensin, santonin, tannins, terpinen-4-ol, valgarin, etc (**Figure 1**). Apart from it, various pharmacologically active components such as ester, mucilage, oxygenated compounds, phenols, saponin alkaloids, sesquiterpene ketones, stereoisomers hydrocarbons, and sterol glycosides are also found in this plant.[23]

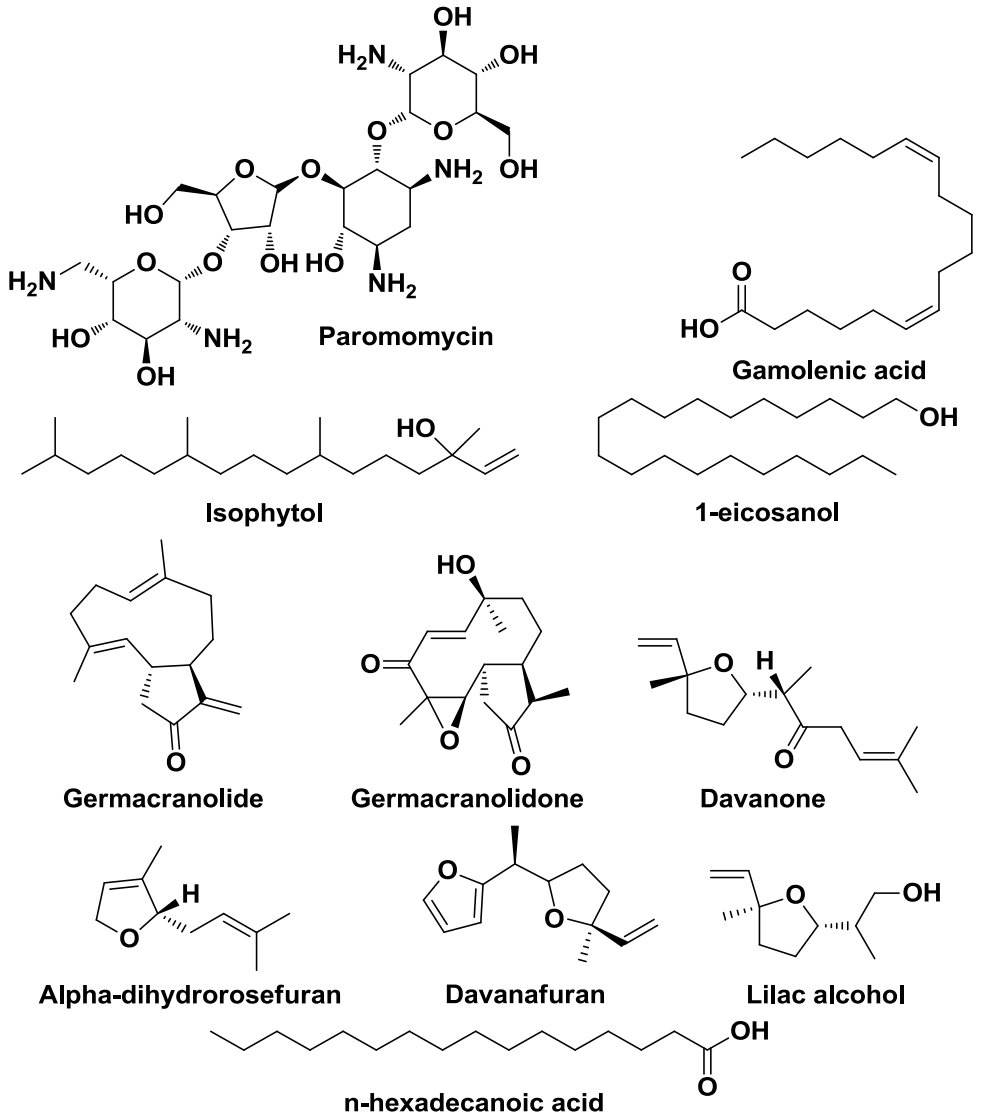

Figure 1. Structures of some pharmacologically active phytoconstituents.

PHARMACOTHERAPEUTIC POTENTIALS

Analgesic and Anti-inflammatory activity

Carrageenin-induced rat paw edema was used to assess *A. pallens* for anti-inflammatory activity. In albino rats and rodents, the analgesic effect was assessed using the tail-flick and hot plate methods. At the end of three hours, the methanolic extract of *A. pallens* in concentrations of 100 mg/ml, 200 mg/ml, and 500 mg/ml prevented paw edema by 68.85%, 74.5%, and 81.13%, respectively. The methanolic extract of *A. pallens* in the latter doses greatly raised the pain tolerance in the hot plate and tail-flick models, and administration of *A. pallens* in all laboratory animal models demonstrated dose-dependent behavior. Saponins, flavonoids, sesquiterpenoids, oils, phenols, and tannins were found in abundance in the fruit. According to the findings of this review, *A. pallens* has powerful analgesic and anti-inflammatory properties.[24]

Anti-oxidant

Antioxidants are compounds that can easily bind with free radicals to avoid the chain reaction from causing harm to essential molecules. Selenium, vitamin A and associated carotenoids, vitamin C, vitamin E, and various phytochemicals including lycopene, lutein, and quercetin are all examples of dietary antioxidants. Cancer, heart attack, stroke, Alzheimer's disease, rheumatoid arthritis, and cataract are also considered to be avoided by them. *A. pallens* is a useful herb. Artemisia essential oils have both botanical and medicinal applications. Traditional remedies use the base, stem, bark, leaves, fruits, nuts, and seed oil to treat a variety of ailments. Spectrophotometric tests are used to evaluate the anti-oxidant activity of different extracts. The findings of the DPPH and Nitric Oxide assays demonstrate that extracts from *A. pallens* roots have anti-oxidant properties.[25]

Anti-microbial activity

Essential oils are secondary metabolites of plants that include terpenoids, phenols, alcohols, aldehydes, ketones, and other chemical components. Terpenoids, which are found in these plants, are more likely to blame for the organisms' slow development. Screening of aerial parts of *A. pallens* was done in order to look for antimicrobial activity of secondary metabolites. Non-polar (n-hexane),

semi-polar (chloroform), and polar (methanol) solvents were used to remove powdered plant content that had been air-dried (methanol). The antibacterial ability of the extracts was tested against six bacterial strains as well as a yeast strain. Using the disk diffusion process, the antibacterial activity was calculated. *Bacillus cereus* was discovered to be a strain that is more vulnerable. The activity was only contained in the *A. pallens* methanolic extract. As a consequence, it was chosen for further research to see if it has medicinal value. The antibacterial efficacy of *A. pallens* methanolic extract is observed to be higher, whereas non-polar and semi-polar extracts have little effect on the test species. In triplicate, two different *A. pallens* extracts were tested for antimicrobial properties (zone of inhibition), and the mean value was calculated. The gold norm, 0.2% chlorhexidine, was measured in triplicate for antimicrobial activity, and the mean value was determined. The zones of inhibition (ZOI) in the acetone and ethanol extracts are 0.5 mm and 2 mm, respectively. In contrast to acetone extract, ethanol extract has the highest inhibition region. The typical ZOI (1 mm) of the acetone extract is equal to that of the gold standard. The development of microorganisms was significantly slowed when ethanol extract was used.[26]

Anthelmintic activity

At all three concentrations, the essential oil of *A. pallens* was shown to have outstanding anthelmintic efficacy against earthworms, roundworms, and tapeworms. Piperazine phosphate was found to be ineffective against these worms, but essential oil was found to be more effective. Under the same amounts, essential oil took two to three times less time to paralyze and destroy roundworms and tapeworms than piperazine phosphate. The basic oil has 85% greater efficacy against earthworms than piperazine phosphate at 0.1% concentration. The worms were unaffected by the regulation Tween 80 or regular saline. The essential oil's anthelmintic action against these worms not only supports the Indian method of medicine's recorded usage of *A. pallens* as an anthelmintic.[27]

Anti-cancer activity

Saponins are plant glycosides that have anti-tumorigenic effects, inhibiting tumor cell growth by cell cycle arrest and apoptosis with an IC_{50} of up to 10 µg/ml. The anti-apoptotic protein Bcl-2 was found to be downregulated, and caspases were enabled. The number of newly extracted and defined saponins is continuously the, and thanks to enhanced purification and detection methods, even more saponins will be discovered in the near future. Saponins have potent anti-cancer properties, which could aid in the development of more effective cancer treatments. Since some researchers have shown additive or even synergistic activity between saponins and other medications, combining saponins with other antitumor drugs may be an important advance in cancer care. These mixtures can significantly increase cancer care options. The saponin-mediated potentiation of tumor growth inhibition and the ability to resolve drug resistance are the most significant aspects.[28]

Anti-diabetic activity

The existence of several natural compounds that may play a role in diabetes regulation may clarify the plant's anti-diabetic behavior. In glucose-fed hyperglycemic and alloxan-induced diabetic rats, oral administration of a methanol extract of the aerial sections of *A. pallens* Wall, which has been used in Indian traditional medicine to manage diabetes mellitus, induces substantial blood glucose reduction. It was discovered that the extract's impact was dose-based. The extract generated a mild hypoglycemic effect in fasted regular rats at a higher dosage, while the water extract was inactive. Because of its anti-diabetic effects, *A. pallens*'s methanolic extract seems to be the perfect alternative for making anti-diabetic medicines.[29]

Larvicidal activity

Mosquitoes, as well as other pests and insects, will spread serious diseases and kill millions of people per year. Furthermore, synthetic market medicines are becoming immune to these over time, which is a matter of worry for us. As a result, substitute medicines such as herbal or Ayurvedic are required to prevent such issues. Due to the fact that *A. nilagirica* contains several essential oils and other chemical compounds, an analysis was undertaken to investigate the plant's larvicidal behavior. *Aedesal bopictus* was found to be effective against the plant extract in this analysis.[30]

CONCLUSION

The overall basics, plant profile, traditional uses, cultivation aspects, phytochemical screenings, prominent pharmacotherapeutic potentials, and major phytochemicals were all highlighted in this comprehensive review. This data would be immensely useful to today's passionate researchers in a number of fields in developing different essential formulations for treating a variety of main ailments. This research would also open up potential therapeutic possibilities for both humans and animals.

CONFLICTS OF INTEREST

No conflict of interest is declared.

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