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Artemisia pallens: An Indian Plant with Multifarious Pharmacological Potentials

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ABSTRACT

Natural herbal medications are in great demand for basic health care in poor nations due to their efficacy, potency, and absence of side effects. Since ancient times, plants and their extracts have been researched and identified for bioactive components that result in a range of therapeutic qualities. Artemisia pallens Wall, a medicinal plant, belongs to the Asteraceae family. Alkaloids, phenols, phenylpropanoids, glycosides, flavonoids, saponin, triterpene, hormones, fatty acids, fatty esters hydrocarbons, and other chemicals found in plant components were identified and may be used in herbal medicines to treat a range of illnesses. Ayurvedic medicine has used A. pallens to treat measles, asthma, colds, obesity, diabetes, and high blood pressure. Davana, the essential oil extracted from the plant, possesses antibacterial, anthelmintic, antipyretic, anti-spasmodic, wound-healing, stimulant, and other therapeutic qualities. India is the world's biggest supplier of Davana oil, which is the most vital aromatic plant used commercially in the perfumery and cosmetics sectors. The current study focuses on A. palllens' current clinical relevance as well as many prospective discoveries.

Key Words: *Artemisia pallens*, Phytochemicals, Davana, Natural, Traditional, Therapeutics

INTRODUCTION

Mother Nature has been a rich supply of medicinal compounds since the beginning of time, with a wide variety of medicines extracted from various natural sources. [1] Our ancient writings, such as the Vedas, go into great detail on these remedies. [2] These medicines or herbal remedies play an essential part in treating a variety of illnesses since they contain natural bioactive components that are responsible for their various therapeutic activities. [3] Natural components are utilised in the production of more than half of all new clinical medications, and they play a significant role in drug development programmes at pharmaceutical firms. [4] India is home to one of the world's most varied medicinal and aromatic plant populations. [5] India's natural flora and wildlife are abundant, and they constitute the country's most valuable asset. [6] India's agro-climatic conditions and habitats range from moderate in the Himalayas to hot in the south, from dry in Central India to warm and rainy in Assam and Kerala. [7] This cultivar encourages the growth of a diverse array of medicinal and fragrant plants. [8] Herbal medicines are simple to use, safe, and effective in a wide variety of situations; as a consequence of these advantages, demand for plant-based medicines is increasing throughout the globe. [9] Plants have long been utilised as a source of medicine, and they seem to be a significant component of the healthcare systems in India and other nations today. [10] These are utilised for basic healthcare not just in developing nations, but also in developed ones when sophisticated medicines are readily available. [11] The Artemisia genus, which belongs to the Asteraceae (Compositae) family, is one of the most difficult to understand taxa. [12] The Greek goddess Diana inspired the name 'Artemisia.' Artemisia is a flowering plant genus having approximately 500 species worldwide, 45 of which are found in India. [13] Only a few Artemisia species have had their essential oils analysed, including some cultivated species like A. pallens and A. annua, whose essential oils are well-known, marketed, and in great demand. [14] Aromatic plants are used as a natural source of perfumes and scents by basic oil companies all over the globe. After France and the United Kingdom, India is the world's third-largest producer of essential oils. [15].

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It is valued for its leaves and berries, which are used in flower arrangements and essential oils. A number of experts have studied the chemical makeup of A. pallens plant oil. [16] The blooms are yellow and the leaves are small, bluish-green, and inconspicuous. A. pallens oil is used to flavour cakes, pastries, cigarettes, and certain high-end beverages. [17] The plant's pharmacological characteristics include anthelmintic, tonic, anti-pyretic, anti-diabetic, anti-fungal, anti-bacterial, anti-microbial, anti-oxidant, analgesic, stimulant, immunomodulator, and anti-inflammatory action. [18]

Davana is a high-value annual fragrant herb cultivated commercially in south India as a short-season bloom from November to March. India had a monopoly on the production and export of davana oil. Davana, which is often employed in religious rituals and in the creation of garlands, bouquets, flower arrangements, and floral chaplets, gives religious events a touch of freshness and a rich, delicious scent. [19]

PLANT PROFILE

Davana is a fragrant, towering plant that grows to about 60 cm tall and has numerous split leaves and tiny yellow blooms. Tomentum gives a grayish-white colour to the stem and leaves. The leaves are lobed, alternating, and petiolate, and they are lobed, alternating, and petiolate. Flowers are simple, heterogamous, peduncle to sessile, axillary or producing loose racemes, with bisexual disc florets in the centre and a few pistillate ray florets on the inflorescence's perimeter. The outer florets are tubular and typically three-lobed, with just a few cottony hairs. The stigma is typically two lobed, although it may be three lobed as well. The inner florets are tubular, 5-lobed, and bisexual; the stamens are 5 in number with open, epipetalous filaments and a dithecous inflorescence; and the anthers are syngenecious, prolonged, tapering style, and bifid. [20]

CULTIVATION

It is commercially cultivated across a 1000-hectare area in Karnataka, Maharashtra, Kerala, Tamil Nadu, and Andhra Pradesh for its aromatic leaves and blooms. From seed or cuttings to maturity, it takes four months. The plant has annual branches, however the lowest portion of the stem is woody. Davana is mostly cultivated in red-soil regions of South India. It thrives on loamy soils that are rich in nutrients. Davana is an annual plant that takes four months to mature and grows to be approximately one and a half feet tall. The season is very important when cultivating a crop for oil production. The crop is allowed to grow until it blooms, which takes about four months after it is sown. From November to February/March, it is cultivated as a short-term crop, as well as a rotation crop from April to May. Heavy rains are detrimental to the crop. After shade drying and distillation, the total output of the main crop and ration crop is approximately 14 tonnes per hectare, producing around 10 kg of Davana oil. In large-scale distillation, a yield of 3.2 percent from a material dried for approximately 2 days may be considered acceptable. The oil absorbs the most in the flower head, with the leaf and stem containing somewhat less. [21]

TRADITIONAL USES

Davana oil is extracted from the leaves and bulbs. Essential oil is produced by a variety of species, some of which are used as feed and include the anthelmintic drug santonin. Throughout the day, devotees present Shiva, the God of Transformation, with Davana flowers and adorn his shrine. Davana has long been utilised in Iraqi and Indian medicine to avoid diabetes mellitus. Oral administration of an aqueous/methanolic extract from the aerial parts of the plants reduced diabetes in glucose-fed hyperglycemic and alloxan-treated rabbits and rats. Davana oil is used in perfumery and perfumes. The therapeutic qualities of davana oil help with rough, dry, chapped skin, skin infections, and wounds. The larvae of many butterfly species choose A. pallens as a feeding source. Davana's leaves and stalks are used to make bouquets, garlands, and fresh and dried flower arrangements. Davana oil provides a calming and emotional balancing effect that aids in anxiety relief. When Davana is applied to the skin, it is known to smell differently on various individuals. This unique characteristic is valued in high-end perfumery, where it is utilised to create scents with really unique overtones. In Indian traditional medicine, Davana has long been used to treat diabetes mellitus. There are immunomodulatory, anthelmintic, antipyretic, and wound-healing properties. It's both a mood booster and an aphrodisiac. It's an excellent antiseptic and disinfectant. This oil may also be used as a natural insect repellant. It's used to reduce the risk of chronic diseases, 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]

PHARMACOTHERAPEUTIC POTENTIALS

Analgesic and Anti-inflammatory activity

The anti-inflammatory effect of A. pallens was tested using carrageenin-induced rat paw edoema. The tail-flick and hot plate techniques were used to evaluate the analgesic effect in albino rats and rodents. The methanolic extract of A. pallens at doses of 100 mg/ml, 200 mg/ml, and 500 mg/ml reduced paw edoema by 68.85%, 74.53 percent, and 81.13 percent, respectively, at the end of three hours. In the hot plate and tail-flick models, the methanolic extract of A. pallens significantly increased pain tolerance, and administration of A. pallens in all experimental animal models showed dose-dependent behaviour. The fruit was rich in saponins, flavonoids, sesquiterpenoids, oils, phenols, and tannins. A. pallens possesses strong analgesic and anti-inflammatory effects, according to the results of this review. [24]

Anti-oxidant

Antioxidants are chemicals that readily attach to free radicals, preventing the chain reaction from harming vital components. Dietary antioxidants include selenium, vitamin A and related carotenoids, vitamin C, vitamin E, and other phytochemicals such as lycopene, lutein, and quercetin. They are also thought to prevent cancer, heart attack, stroke, Alzheimer's disease, rheumatoid arthritis, and cataract. A. pallens is a beneficial plant. The essential oils of Artemisia have both botanical and therapeutic uses. To cure a range of diseases, traditional medicines utilise the base, stem, bark, leaves, fruits, nuts, and seed oil. The anti-oxidant activity of various extracts is assessed using specttrophotometric assays. The results of the DPPH and Nitric Oxide tests show that A. pallens root extracts have anti-oxidant effects. [25]

Anti-microbial activity

Terpenoids, phenols, alcohols, aldehydes, ketones, and other chemical components are found in essential oils, which are secondary metabolites of plants. Terpenoids, which are present in these plants, are more likely to be to blame for the organisms' sluggish growth. Secondary metabolites were screened in aerial sections of A. pallens to see whether they have antibacterial action. To extract powdered plant material that had been air-dried, non-polar (n-hexane), semi-polar (chloroform), and polar (methanol) solvents were employed (methanol). The extracts were evaluated for antibacterial activity against six bacterial strains as well as a yeast strain. The antibacterial activity was determined using the disc diffusion method. Bacillus cereus was found to be a more susceptible strain. Only the methanolic extract of A. pallens had the activity. As a result, it was selected for further investigation to determine whether it had therapeutic potential. Non-polar and semi-polar extracts show minimal impact on the test species, while A. pallens methanolic extract has a greater antibacterial effectiveness. Two distinct A. pallens extracts were evaluated for antibacterial activity (zone of inhibition) in triplicate, with the mean value computed. Antimicrobial activity was tested in triplicate using the gold standard, 0.2 percent chlorhexidine, and the mean value was calculated. In the acetone and ethanol extracts, the zones of inhibition (ZOI) are 0.5 mm and 2 mm, respectively. In comparison to acetone extract, the inhibitory region of ethanol extract is the largest. The acetone extract's usual ZOI (1 mm) is the same as the gold standard. When ethanol extract was applied, the growth of bacteria was substantially inhibited. [26]

Anthelmintic activity

The essential oil of A. pallens was shown to exhibit excellent anthelmintic effectiveness against earthworms, roundworms, and tapeworms at all three concentrations. Piperazine phosphate was unsuccessful against these worms, while essential oil proved more beneficial. Essential oil took two to three times longer than piperazine phosphate to paralyse and kill roundworms and tapeworms in the same quantities. At 0.1 percent concentration, basic oil is 85 percent more effective against earthworms than piperazine phosphate. Regulation Tween 80 and normal saline had no effect on the worms. The anthelmintic activity of the essential oil against these worms not only backs up the Indian system of medicine's documented use of A. pallens as an anthelmintic. [27]

Anti-cancer activity

Saponins are plant glycosides that suppress tumour cell development via cell cycle arrest and death, with an IC50 of up to 10 g/ml. Bcl-2, an anti-apoptotic protein, was discovered to be downregulated, allowing caspases to function. The number of novel saponins extracted and characterised is constantly increasing, and due to improved purification and detection techniques, many more saponins will be found in the near future. Saponins contain anti-cancer characteristics that may help in the development of more effective cancer therapies. Combining saponins with other anticancer medicines may be a significant step forward in cancer treatment, since some studies have shown additive or even synergistic efficacy between the two. These combinations have the potential to substantially expand cancer treatment choices. The capacity to overcome drug resistance and saponin-mediated potentiation of tumour growth inhibition are the most important features. [28]

Anti-diabetic activity

The discovery of numerous natural chemicals that may play a function in diabetes control could shed light on the plant's anti-diabetic properties. Oral administration of a methanol extract of the aerial parts of A. pallens Wall, which has been used in Indian traditional medicine to treat diabetes mellitus, causes significant blood glucose reduction in glucose-fed hyperglycemic and alloxan-induced diabetic rats. The extract's effect was found to be dose-dependent. At larger doses, the extract had a moderate hypoglycemia impact in fasted normal rats, while the water extract had no effect. The methanolic extract of A. pallens seems to be the ideal option for producing anti-diabetic medications due to its anti-diabetic properties. [29]

Larvicidal activity

Mosquitoes, like other pests and insects, will transmit severe illnesses and kill millions of people each year. Furthermore, synthetic market medications are growing resistant to them over time, which is concerning to us. As a consequence, alternative medications like herbal or Ayurvedic are needed to avoid such problems. Because A. nilagirica includes many essential oils and other chemical components, an investigation of the plant's larvicidal activity was conducted. In this study, Aedesal bopictus was shown to be effective against the plant extract. [30]

CONCLUSION

This thorough study included the general fundamentals, plant profile, traditional applications, agricultural features, phytochemical screens, significant pharmacotherapeutic potentials, and key phytochemicals. This information would be very beneficial to today's dedicated researchers in a range of areas in creating various vital formulas for treating a variety of common illnesses. This study may potentially lead to new treatment options for people and animals alike.

CONFLICTS OF INTEREST

No conflict of interest is declared.

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