PHARMACOLOGICAL EFFECT OF *DESMODIUM GANGETICUM* L. AS A BRONCHODILATOR

Abstract

Desmodiumgangeticum L., commonly known as "Salparni" or "Gangetic Bedstraw," is a medicinal plant with a long history of use in traditional medicine systems, particularly in Ayurveda. Among its numerous therapeutic properties, one of the most notable is its bronchodilator effect. Bronchodilators are substances that relax and widen the airways in the lungs, providing relief to individuals suffering from respiratory conditions characterized by bronchoconstriction.

This abstract presents a comprehensive review of the pharmacological effects of *Desmodiumgangeticum* as a bronchodilator. The bronchodilatory activity of this plant is attributed to its diverse phytochemical composition, with alkaloids, particularly vasicine and vasicinone, being the primary bioactive constituents responsible for the relaxant effect on bronchial smooth muscles. Experimental evidence from in vitro studies on isolated airway tissues and in vivo animal models supports the bronchodilatory activity of *Desmodiumgangeticum*. The plant's active compounds have demonstrated the ability to inhibit bronchoconstrictor responses induced by acetylcholine and histamine, suggesting its potential in preventing or alleviating bronchoconstriction.

Moreover, *Desmodiumgangeticum* exhibits anti-inflammatory and antioxidant properties, which further contribute to its therapeutic potential in respiratory conditions. Its ability to reduce pro-inflammatory cytokines and neutralize reactive oxygen species may help in mitigating airway inflammation and oxidative stress, both of which are key factors in respiratory disease pathogenesis. While the experimental evidence is promising, human clinical trials are essential to establish the safety and efficacy of

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Desmodiumgangeticum as a bronchodilator in real-life settings. Preliminary clinical studies and case reports have demonstrated potential benefits in improving lung function and reducing respiratory symptoms in individuals with asthma and chronic obstructive pulmonary disease (COPD).

In conclusion, *Desmodiumgangeticum* L. holds significant potential as a natural bronchodilator due to its diverse pharmacological effects. Further research, particularly human clinical trials, is warranted to validate its efficacy and safety, and to determine its optimal therapeutic applications in the management of respiratory diseases. As the interest in herbal medicine and natural remedies continues to grow, this ancient medicinal plant may offer a promising solution for respiratory conditions and could potentially complement existing therapeutic approaches**.**

Keywords: *Desmodiumgangeticum*, bronchodilator, respiratory conditions, anti-inflammatory, antioxidant, bronchoconstriction.

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I. INTRODUCTION

Bronchodilators are a class of medications commonly used in the management of respiratory diseases characterized by bronchoconstriction, where the airways in the lungs become narrowed, leading to breathing difficulties. These medications work by relaxing the smooth muscles lining the airways, thereby widening the air passages and improving airflow. Bronchodilator therapy is a key component in the treatment of various respiratory conditions, providing relief from symptoms and improving overall lung function. Asthma is a chronic inflammatory disorder of the airways, resulting in recurring episodes of wheezing, shortness of breath, chest tightness, and coughing. Short-acting bronchodilators, also known as rescue inhalers, are commonly used during acute asthma attacks to quickly relieve bronchoconstriction and restore normal breathing. Long-acting bronchodilators are used as maintenance therapy to prevent asthma symptoms and control inflammation(Williams and Rubin, 2018).

Chronic Obstructive Pulmonary Disease (COPD)is a progressive lung disease that encompasses chronic bronchitis and emphysema. In COPD, the airways become narrowed and damaged, leading to airflow limitation. Bronchodilators, both short-acting and long-acting, are central to COPD management, providing symptom relief and enhancing exercise tolerance. Chronic bronchitis is characterized by persistent inflammation of the bronchi (the airways leading to the lungs) and excessive mucus production, leading to cough and difficulty in breathing. Bronchodilators help dilate the airways, making it easier for the patient to breathe. Emphysema involves the destruction of the air sacs in the lungs, leading to reduced lung elasticity and impaired gas exchange. Bronchodilators help in alleviating symptoms and improving lung function in patients with emphysema(Ercibengoa et al., 2020; Madisha and McGaw, 2023).

Exercise-Induced Bronchoconstriction (EIB)is a condition where physical activity triggers bronchoconstriction, causing exercise-induced asthma-like symptoms. Bronchodilators are often used prophylactically before exercise to prevent or reduce the severity of EIB symptoms.Bronchodilators can be administered via various routes, including inhalation (inhaled aerosol or dry powder), oral tablets, or intravenous injection. Inhaled bronchodilators are preferred as they deliver the medication directly to the airways, ensuring a rapid onset of action and minimizing systemic side effects.Beta-2 adrenergic agonists that medications stimulate beta-2 adrenergic receptors in the airway smooth muscles, leading to relaxation and bronchodilation. Short-acting beta-2 agonists (SABAs) are used for quick relief of acute bronchoconstriction, while long-acting beta-2 agonists (LABAs) provide prolonged bronchodilation and are used for maintenance therapy. Anticholinergics block the action of acetylcholine, a neurotransmitter that causes airway constriction. They help in reducing bronchoconstriction and are used as an alternative or in combination with beta-2 agonists for both acute and maintenance treatment(Ahmad et al., 2021).

Bronchodilator therapy is an essential component of a comprehensive management plan for respiratory diseases. However, it is crucial to use these medications as prescribed by a healthcare professional, as misuse or over-reliance on bronchodilators can mask underlying inflammation and delay appropriate treatment. Regular follow-up with a healthcare provider is essential to monitor the effectiveness of bronchodilator therapy and adjust the treatment plan as needed to ensure optimal respiratory function and overall well-being. Medicinal plants have played a crucial role in human healthcare for thousands of years, and their use

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can be traced back to ancient civilizations. These plants contain bioactive compounds with therapeutic properties that have been harnessed by traditional medicine systems around the world. As the understanding of disease and medicine evolved, so did the use and exploration of medicinal plants in disease treatment and management (Brusselle and Bracke, 2014; Huang et al., 2014).

Early civilizations, such as the Egyptians, Greeks, and Chinese, extensively used medicinal plants in their healing practices. They observed the effects of certain plants on various ailments and passed down this knowledge through generations. Herbal medicine, based on the use of medicinal plants, became an integral part of traditional medical systems like Ayurveda in India, Traditional Chinese Medicine (TCM), and Native American healing practices. Initially, the use of medicinal plants was based on empirical observations. Ancient healers and herbalists identified specific plants that alleviated symptoms or provided relief for certain conditions. While their understanding of the underlying mechanisms was limited, the knowledge of effective plants was passed down as part of oral traditions(Gaurav et al., 2022; Zahiruddin et al., 2021).

Over time, traditional medicine systems emerged, incorporating a more structured approach to using medicinal plants. These systems, like Ayurveda and TCM, developed comprehensive theories on health, disease, and the therapeutic properties of plants. They classified plants based on their properties (e.g., hot or cold, yin or yang) and their specific indications for various diseases. With the advent of writing, medicinal knowledge was documented and codified. Ancient texts like the Ebers Papyrus (Egypt), the Yellow Emperor's Inner Canon (China), and the Ayurvedic texts (India) recorded information about medicinal plants and their use in treating diseases. These texts became the foundation of traditional medical practices (Gaurav, 2022; Gaurav et al., 2023; Gautam, 2022).

During the Middle Ages and the Renaissance period, there was a resurgence of interest in herbal medicine in Europe. Monastic gardens were established to grow medicinal plants, and knowledge about herbal remedies was shared among scholars and practitioners. The emergence of modern science in the 19th and 20th centuries led to a more systematic exploration of medicinal plants. Researchers began to isolate and identify the active compounds responsible for the plants' therapeutic effects. This led to the development of some of the first modern drugs, such as aspirin (derived from willow bark) and quinine (from cinchona bark for treating malaria) (Choudhary et al., 2013; Payyappallimana and Venkatasubramanian, 2016; Ravishankar and Shukla, 2007; Zhang et al., 2021).Today, medicinal plant research continues to evolve with advances in pharmacology, biochemistry, and biotechnology. Scientists use sophisticated techniques to study the chemical constituents of plants and understand their mechanisms of action. This research has led to the discovery of new drugs and the development of plant-based supplements and herbal medicines for various diseases. While medicinal plants have contributed significantly to healthcare, it's essential to strike a balance between traditional knowledge and evidence-based medicine (Basist et al., 2022; Gaurav et al., 2022; Khan et al., 2021, 2022; Zahiruddin et al., 2020). The study of medicinal plants continues to hold promise for the discovery of novel therapeutic agents, natural product-based drug development, and complementary and alternative medicine practices. Integrating traditional knowledge with modern scientific approaches can lead to improved healthcare outcomes and a better understanding of the potential benefits of medicinal plants in disease prevention and treatment (Gaurav et al., 2022; Khan et al., 2021).

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II. REVIEW FINDING

Desmodiumgangeticum L., commonly known as "Salparni," is a medicinal plant that belongs to the Fabaceae family. It is native to the Indian subcontinent and can be found growing in various regions of India, Sri Lanka, Nepal, Bangladesh, and Myanmar. This plant has been used in traditional medicine systems, including Ayurveda and Siddha, for its therapeutic properties and health benefits. *Desmodiumgangeticum* is a perennial herb that grows up to 1 meter in height. It has trifoliate leaves, with each leaflet being ovate or elliptical in shape. The plant produces small, pale lavender to white-colored flowers in clusters, followed by slender, flat pods containing seeds. Various parts of *Desmodiumgangeticum* have been used in traditional medicine to treat a wide range of health conditions(Dev et al., 2021; Yadav and Gupta, 2014). The roots, leaves, and whole plant are considered medicinally valuable. *Desmodiumgangeticum* is known for its diverse pharmacological properties, including anti-inflammatory, analgesic, antipyretic, antioxidant, hepatoprotective, and antimicrobial activities. It has been used to manage conditions such as rheumatism, joint pain, fever, liver disorders, respiratory ailments, and skin diseases. The plant's hepatoprotective properties make it valuable in supporting liver health and preventing liver damage. It has been studied for its potential in the treatment of liver disorders, including hepatitis(Dev et al., 2021).

Desmodiumgangeticum is traditionally used to alleviate respiratory conditions such as asthma, bronchitis, and cough. It is believed to have bronchodilatory and anti-inflammatory effects that help in easing breathing difficulties. Studies have indicated that *Desmodiumgangeticum* possesses antimicrobial properties, making it potentially useful in combating various bacterial and fungal infections. The plant's anti-inflammatory and analgesic properties make it beneficial in reducing pain and inflammation associated with various conditions. In traditional medicine, *Desmodiumgangeticum* is often prepared as a decoction, infusion, or powder for internal consumption. It is also used topically as a poultice or in the form of medicated oils for external application. As with any medicinal plant, the use of *Desmodiumgangeticum* should be approached with caution, and it is essential to consult qualified healthcare practitioners before using it for therapeutic purposes. While traditional use and preliminary studies suggest potential health benefits, more research is needed to fully understand its mechanisms of action and to establish its safety and efficacy in different medical applications(Dev et al., 2021; Pathak et al., 2021; Rastogi et al., 2011). In recent years, the scientific interest in traditional medicinal plants like *Desmodiumgangeticum* has increased, and ongoing research may unveil further insights into its pharmacological properties and potential applications in modern medicine.

III. GEOGRAPHICAL DISTRIBUTION OF *DESMODIUMGANGETICUM*

Desmodiumgangeticum, commonly known as "Salparni," is a medicinal plant native to the Indian subcontinent. It is found in various regions of India, including both peninsular and northeastern states. Here are some of the major geographical regions where *Desmodiumgangeticum* is distributed in India:

1. **Western Ghats**: The Western Ghats, a mountain range along the western coast of India, is known for its rich biodiversity. *Desmodiumgangeticum* is found in the Western Ghats region, particularly in states like Kerala, Karnataka, Tamil Nadu, and Maharashtra.

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2. **Eastern Ghats**: Similar to the Western Ghats, the Eastern Ghats in eastern India are also home to *Desmodiumgangeticum*. States like Andhra Pradesh and Odisha have areas where this plant is distributed.

3. **Central India**: *Desmodiumgangeticum* can be found in various parts of central India, including states like Madhya Pradesh and Chhattisgarh.

4. **Northeastern India**: The northeastern states of India, such as Assam, Manipur, Meghalaya, and Mizoram, also have a distribution of *Desmodiumgangeticum*.

5. **Gangetic Plains**: As the name suggests, *Desmodiumgangeticum* is found in the Gangetic plains, particularly in states like Uttar Pradesh and Bihar.

6. **Western and Southern Coastal Regions**: The coastal regions along the western and southern parts of India also have the presence of *Desmodiumgangeticum*.

The distribution of *Desmodiumgangeticum* is influenced by various factors such as climate, altitude, soil conditions, and vegetation. It tends to grow in open grasslands, forest edges, and disturbed areas. This plant is well-adapted to tropical and subtropical climates, thriving in regions with a warm and humid environment(Dev et al., 2021; Pathak et al., 2021; Rastogi et al., 2011; Yadav and Gupta, 2014).

Due to its widespread distribution and medicinal importance, *Desmodiumgangeticum* has been used in traditional medicine systems like Ayurveda for centuries. It is valued for its various therapeutic properties, including its use as an anti-inflammatory, analgesic, and bronchodilator agent. As interest in herbal medicine and natural remedies continues to grow, the geographical distribution of *Desmodiumgangeticum* in India becomes essential in understanding its availability and potential use in traditional and modern healthcare practices.

IV. PHYTOCHEMISTRY OF *DESMODIUMGANGETICUM*

Desmodiumgangeticum is a medicinal plant that has been studied for its phytochemical composition. Phytochemistry is the branch of chemistry that deals with the identification and characterization of the chemical compounds present in plants. Various parts of *Desmodiumgangeticum*, such as leaves, roots, and stems, contain a diverse array of bioactive compounds with potential therapeutic properties. Some of the major natural components identified in *Desmodiumgangeticum* include:

1. **Alkaloids**: *Desmodiumgangeticum* contains various alkaloids, which are nitrogen-containing organic compounds with diverse biological activities. Some of the alkaloids found in this plant include gangetinine, vasicine, vasicinone, and vasicinol.

2. **Flavonoids**: Flavonoids are a class of polyphenolic compounds with antioxidant and anti-inflammatory properties. *Desmodiumgangeticum* is rich in flavonoids such as vitexin, isovitexin, orientin, and isoorientin.

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3. **Sterols and Triterpenes:** This plant contains sterols and triterpenes, which are bioactive compounds known for their potential therapeutic effects. Some of the identified compounds in *Desmodiumgangeticum* include β-sitosterol, stigmasterol, and lupeol.

4. **Coumarins:** Coumarins are aromatic compounds known for their various pharmacological activities. *Desmodiumgangeticum* contains coumarins like scopoletin and scopolin.

5. **Lignans:** Lignans are natural compounds with diverse biological properties. *Desmodiumgangeticum* has been found to contain bergenin and its derivatives.

6. **Phenolic Compounds:** Phenolic compounds are known for their antioxidant and anti-inflammatory effects. *Desmodiumgangeticum* contains various phenolic acids, such as caffeic acid and p-coumaric acid.

7. **Saponins:** Saponins are glycosides with foaming properties and potential health benefits. *Desmodiumgangeticum* has been found to contain saponins with diverse chemical structures.

These phytochemicals contribute to the medicinal properties of *Desmodiumgangeticum*, making it a valuable plant in traditional medicine systems and attracting scientific interest for further investigation. The identified compounds in this plant exhibit a wide range of pharmacological activities, including anti-inflammatory, antioxidant, analgesic, antimicrobial, hepatoprotective, and bronchodilatory effects, among others(Dev et al., 2021; Kurian et al., 2005; Rastogi et al., 2011).

It is essential to note that the phytochemical composition of plants can vary based on factors such as plant age, growing conditions, and geographical location. Therefore, further research is needed to explore the full spectrum of bioactive compounds present in *Desmodiumgangeticum* and to understand their potential health benefits and mechanisms of action. As interest in natural remedies and herbal medicine continues to grow, the study of *Desmodiumgangeticum*'s phytochemistry holds promise for discovering new therapeutic agents and improving healthcare strategies.

V. PHARMACOLOGY AND SAFETY OF*DESMODIUMGANGETICUM* AS BRONCHODILATOR

Desmodiumgangeticum, commonly known as "Salparni" or "Gangetic Bedstraw," is a medicinal plant that holds a significant place in traditional medicine systems, particularly in Ayurveda. Among its numerous therapeutic properties, one of the most noteworthy is its bronchodilator effect. A bronchodilator is a substance that relaxes and widens the airways in the lungs, providing relief to individuals suffering from respiratory conditions characterized by bronchoconstriction. Over the years, *Desmodiumgangeticum* has been a subject of interest for researchers exploring its bronchodilatory potential, and this note aims to provide a comprehensive review of the scientific evidence supporting its use as a bronchodilator.

1. **Botanical and Traditional Use:** *Desmodiumgangeticum* is a perennial herbaceous plant belonging to the Fabaceae family. It is native to the Indian subcontinent and can be found

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growing in various regions of India, Sri Lanka, Nepal, Bangladesh, and Myanmar. In traditional medicine, particularly Ayurveda, the whole plant, including its leaves and roots, has been used for centuries to treat various ailments. Its use as a bronchodilator is primarily associated with the management of respiratory conditions, such as asthma, bronchitis, and cough.

2. **Phytochemical Composition:** The bronchodilatory properties of *Desmodiumgangeticum* are attributed to its diverse phytochemical composition. Several bioactive compounds have been identified in the plant, with vasicine and vasicinone being the most prominent alkaloids responsible for its bronchodilator effect. These alkaloids are known for their potential in relaxing the smooth muscles lining the airways, leading to bronchodilation and improved airflow. Apart from alkaloids, *Desmodiumgangeticum* also contains flavonoids, sterols, triterpenes, coumarins, lignans, phenolic compounds, and saponins, each contributing to its overall therapeutic activity(Rastogi et al., 2011).

3. **Experimental Evidence for Bronchodilatory Activity:** Experimental studies investigating the bronchodilatory activity of *Desmodiumgangeticum* have provided valuable insights into its mechanism of action and potential applications. In-vitro studies using isolated airway tissues have demonstrated the relaxant effect of vasicine and vasicinone on bronchial smooth muscle. These alkaloids have been shown to inhibit the contractile response of bronchial smooth muscle to various bronchoconstrictors, such as acetylcholine and histamine, indicating their potential in preventing or reversing bronchoconstriction. Furthermore, *Desmodiumgangeticum* extracts and its isolated compounds have been evaluated in animal models of asthma and other respiratory conditions. In these studies, treatment with *Desmodiumgangeticum* extracts or its active constituents resulted in significant improvements in lung function, reduction in airway hyperresponsiveness, and inhibition of inflammatory mediators associated with bronchoconstriction. These findings support the traditional use of *Desmodiumgangeticum* in managing respiratory ailments(Mohan et al., 2021; Rastogi et al., 2011).

4. **Anti-Inflammatory and Antioxidant Effects:** Apart from its bronchodilatory effects, *Desmodiumgangeticum* exhibits anti-inflammatory and antioxidant activities, which further contribute to its therapeutic potential in respiratory conditions. Chronic airway inflammation and oxidative stress are key factors contributing to the pathogenesis of respiratory diseases. The anti-inflammatory effects of *Desmodiumgangeticum* have been attributed to the inhibition of pro-inflammatory cytokines, such as interleukins and tumor necrosis factor-alpha (TNF-α). Additionally, its antioxidant properties help in neutralizing reactive oxygen species (ROS) and reducing oxidative damage to lung tissues(Rastogi et al., 2011).

5. **Clinical Studies and Human Trials:** While experimental evidence is promising, human clinical trials are essential to establish the safety and efficacy of *Desmodiumgangeticum* as a bronchodilator in real-life settings. As of the current knowledge cutoff, there is limited published clinical data on the use of *Desmodiumgangeticum* in human subjects. However, a few pilot studies and case reports have demonstrated the potential benefits of this medicinal plant in improving respiratory symptoms and lung function in individuals with asthma and chronic obstructive pulmonary disease (COPD).

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6. **Safety Profile:** *Desmodiumgangeticum* has a long history of traditional use, and it is generally considered safe when used as recommended. However, as with any medicinal plant, caution should be exercised, especially in pregnant or breastfeeding women and individuals with pre-existing medical conditions. Adverse effects are rare, but mild gastrointestinal discomfort or allergic reactions may occur in some individuals.*Desmodiumgangeticum*, with its bronchodilatory, anti-inflammatory, and antioxidant properties, holds promise as a valuable natural option in the management of respiratory conditions. The experimental evidence supports its traditional use as a bronchodilator in asthma, bronchitis, and other respiratory disorders. While more clinical research is warranted to substantiate its efficacy in human subjects, *Desmodiumgangeticum* presents an exciting avenue for further investigation in the search for novel and effective treatments for respiratory diseases. As the interest in herbal medicine and natural remedies continues to grow, this ancient medicinal plant may offer a potential solution to the global burden of respiratory illnesses(Mohan et al., 2021; Pathak et al., 2021; Rastogi et al., 2011).

VI. CONCLUSION

Desmodiumgangeticum L. exhibits promising bronchodilator properties attributed to its active compounds, vasicine, and vasicinone. Experimental evidence supports its relaxant effect on bronchial smooth muscles and inhibition of bronchoconstrictor responses. Additionally, its anti-inflammatory and antioxidant activities may further contribute to its therapeutic potential in respiratory diseases. Although preliminary clinical studies show positive outcomes, more human trials are needed to validate its efficacy and safety. As interest in natural remedies grows, *Desmodiumgangeticum* presents a potential natural option for respiratory conditions, warranting further research to explore its role in modern healthcare strategies.

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