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## Asthma and medicinal Plants: A Review

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### ABSTRACT

Asthma is a common disease that is rising in prevalence worldwide with the highest prevalence in industrialized countries. Asthma affect about 300 million people worldwide and it has been estimated that a further 100 million will be affected by 2025. Since the ancient times, plants have been exemplary sources of medicine. Current asthma therapy lack satisfactory success due to adverse effect, hence patients are seeking complementary and alternative medicine to treat their asthma. Ayurveda and other Indian literature mention the use of plants in various human ailments. India has about 45 000 plant species and among them several thousand are claimed to possess medicinal properties. Researches conducted in the last few decades on the plants mentioned in ancient literature or used traditionally for asthma have shown antiasthmatic, antihistaminic and antiallergic activity. This review reveals that some plants and their extract have antiasthmatic and antiallergic activity.

**Keywords:** Asthma; lung; medicinal plants; traditional medicine, Ayurveda, Herbal medicines.

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### Introduction

**Asthma** severity is the intrinsic intensity of the disease process and dictates which step to initiate treatment. Asthma is a most common chronic inflammatory syndrome characterized by airway narrowing, recurrent episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night and awaking in the morning. [1] It is a highly prevalent global disease, affecting approximately 300 million individuals worldwide. Its evidence and severity are increasing day by day. It is associated with changes in the levels of eosinophils, mast cells, lymphocytes, cytokines and other inflammatory cell products.

Asthma patients have high levels of specific IgE that binds to mast cell receptors. [2] Interaction between IgE antibody and antigen results in the activation of a series of cellular reactions which are inflammatory in nature, including the release of mediators such as histamines, prostaglandins and leukotrienes, which

further lead to contraction of airway smooth muscle and bronchoconstriction. [3] Current asthma therapy lack satisfactory success due to adverse effect, hence patients are seeking complementary and alternative medicine to treat their asthma. Medicinal plants are used for treatment of asthma which possess antiinflammatory, immunomodulatory, antihistaminic, smooth muscle relaxant and allergic activity. [4]

### Classification of asthma [5]

- Intermittent.
- Mild persistent.
- Moderate persistent.
- Severe persistent

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Type	Symptoms
<b>Intermittent</b>	Difficulty in breathing, chest tightness, and coughing: 1. Occur on fewer than 2 days a week. Do not interfere with normal activities. 2. Night time symptoms occur on fewer than 2 days a month.
<b>Mild persistent</b>	1. Symptoms occur on more than 2 days a week but do not occur every day. 2. Attacks interfere with daily activities. 3. Nighttime symptoms occur 3 to 4 times a month.
<b>Moderate persistent</b>	1. Symptoms occur on more than 2 days a week but do not occur every day. 2. Attacks interfere with daily activities. 3. Nighttime symptoms occur 3 to 4 times a month.
<b>Severe persistent</b>	1. Symptoms occur daily. Inhaled short-acting asthma medication is used every day. 2. Symptoms interfere with daily activities.

### Mechanism involved in Asthma

Children in the early stages of asthma show signs of excessive inflammation in their airways. Epidemiological findings give clues as to the pathogenesis: the incidence of asthma seems to be increasing worldwide, and asthma is now very much more common in affluent countries. In 1968 Andor Szentivanyi first described *The Beta Adrenergic Theory of Asthma*; in which blockage of the Beta-2 receptors of pulmonary smooth muscle cells, causes asthma. Szentivanyi's In 1995 Szentivanyi and colleagues demonstrated that IgE blocks beta-2 receptors. Since over production of IgE is central to all atopic diseases, this was a watershed moment in the world of allergy. [6, 7]

### Causative factors of asthma

Factors	How it causes asthma
Environmental	1. Environmental tobacco smoke, especially maternal cigarette smoking, is associated with high risk of asthma prevalence and asthma morbidity, wheeze, and respiratory infections 2. Poor air quality, from traffic pollution or high ozone levels, has been repeatedly associated with increased asthma morbidity and has a suggested association with asthma development that needs further research[8,9]
Genetic	100 genes have been associated with asthma in at least one genetic association study. However, such studies must be repeated to ensure the findings are not due to chance. Through the end of 2005, 25 genes had been associated with asthma in six or more separate populations[10]

### Medicinal plants used in asthma

***Aerva lanta* Linn** (Amaranthaceae)

*Aerva lanta* (*A. lanta*) is an erect or prostrate herbaceous common wayside weed which is recognized by its white axillary bunches of small

woolly flowers. It is abundant on the plains in the warmer parts of India. Ethanol extract of aerial parts of *A. lanata* at 100 mcg/mL in the isolated goat tracheal chain preparation model and 30 and 60 mg/kg doses orally in clonidine-induced catalepsy.[11]

***Ageratum conyzoides* Linn** (Compositae)

*Ageratum conyzoides* (*A. conyzoides*) is an erect, herbaceous annual plant from the family Asteraceae (Compositae), native to tropical America, but with a distribution range in tropical and subtropical areas around the world. Hydroalcoholic extract of leaves of *A. conyzoides* at doses of 250, 500 and 1 000 mg/kg shows antihistaminic activity by inhibiting clonidine induced catalepsy in mice[12]

#### **Argemone mexicana**

*Argemone mexicana* (*A. mexicana*) is common everywhere by road-sides and fields in India. It possesses antiallergic and antistress activity of aqueous extracts of *A. Mexicana* stem at dose 50 mg/kg, i.p. using milk-induced leucocytosis and milk-induced eosinophilia[13]

#### **Asystasia gangetica T. Adams** (Acanthaceae)

*Asystasia gangetica* (*A. gangetica*) is used in many parts of Nigeria for the management of asthma. Akah, et al. evaluated hexane, ethylacetate, and methanol extracts of the leaves of *A. gangetica* for antiasthmatic activity using guinea pig trachea; rat stomach strip; guinea pig ileal preparation and egg albumin-induced acute inflammation.[14]

#### **Acorus calamus** (Araceae)

It is highly beneficial in the treatment of asthma; it removes catarrhal matter and phlegm from the bronchial tubes. About 65 centigrams of the herb is taken every 2 or 3 hours in this condition[15]

#### **Adhatoda vasica** (Acanthaceae)

The traditional healers are using this herb for the treatment of chronic Asthma. Adusa is known as Vasa or Vasak in Sanskrit and is a reputed drug for Asthma mentioned in Ayurveda. *Adhatoda vasica* is considered in the east to be the best possible treatment for all chest diseases and used in India as an expectorant, antitussive and in other respiratory disease. It is also used widely to relieve asthma. *Adhatoda vasica* has been traditionally used in the management of allergic disorders and bronchial asthma. Research performed over the last three decades revealed that the alkaloids present in the leaves, vasicine and vasicinone, possess powerful respiratory stimulant activity.[16]

#### **Aegle marmelos** (Rutaceae)

Its leaf extract is being used in Indian system of medicine as an antidiabetic agent and traditional text of India prescribe it in the management of asthma. Therefore the effect of the alcoholic extract of the leaves of *Aegle marmelos* Corr. on guinea pig isolated ileum and tracheal chain was investigated using the isolated organ bath method. 1mg/ml and

2mg/ml doses of the alcoholic extract of this plant produced a positive relaxant effect in isolated guinea pig ileum and tracheal chain, respectively. In addition, they antagonized the contractions, which are produced by histamine.[17]

#### **Alstonia scholaris** (Apocynaceae)

The ethanol extract of *Alstonia scholaris* leaves, induced pronounced bronchodilator activity in anaesthetized rats with the probable involvement of prostaglandins. However, *in-vitro* preparations of guinea-pig trachea did not confirm this property, indicating that bronchodilation is not due to the direct tracheal smooth muscle relaxation. [18]

#### **Andrographis paniculata** (Acanthaceae)

Persistent activation of nuclear factor (NF) - kappa B has been associated with the development of asthma. Andrographolide, the principal active component of the medicinal plant *Andrographis paniculata* has been shown to inhibit NF-Kappa B activity. [19]

#### **Bacopa monnieri L.** (Scrophulariaceae)

*Bacopa monnieri*: Samiulla, et al. evaluated petroleum ether, chloroform, methanol and water extracts of *B. monnieri* leaves at doses 10 mcg/mL for mast cell stabilizing activity in rats. The result of investigation observed that all the extract significantly inhibits mast cell degranulation.[20]

#### **Cassia sophera** (caesalpiniaceae)

*Cassia sophera* (*C. sophera*) is used in traditionally for treatment of asthma and bronchitis. Chloroform, ethyl acetate and ethanol fractions isolated from ethanol extract of leaves of *C. sophera* possesses significant antiasthmatic activity in carrageenan induced paw edema, histamine induced bronchoconstriction, clonidine and haloperidol induced catalepsy, milk induced leukocytosis, and eosinophilia and passive paw anaphylaxis animal models at doses 250, 500 and 750 mg/kg [21].

#### **Casuarina equisetifolia Linn** (Casuarinaceae)

The methanol extract of extracts of wood and bark possesses antihistaminic activity by inhibiting the histamine induced contraction of trachea (10-80 mcg/mL), clonidine induced catalepsy and mast cell degranulation at doses 100 mg/kg[22].

#### **Clerodendrum serratum Linn** (Verbenaceae)

It is traditionally useful in treating pain, inflammation, rheumatism, respiratory diseases, and malarial fever. Ethanol extract of roots of *C. serratum* showed antiasthmatic activity using isolated goat tracheal chain preparation, clonidine induced catalepsy; Milk induced leukocytosis and

eosinophilia in mice at doses 50,100 and 200 mg/kg[23].

***Cnidium monnieri*** (Umbelliferae)

*Cnidium monnieri* (*C. monnieri*) has been used for treatment of pain in female genitalia, impotence and suppurative dermatitis as an antipruritic agent. [24].

***Crinum glaucum*** (Amaryllidaceae)

It is popular in Yoruba of South West Nigeria. Traditional medicine practitioners reported it as an effective remedy in the relief of cough, asthma and convulsions. Its aqueous extract of possesses antiallergic activity at dosed 100-400 mg/kg [25].

***Curculigo orchoides Gaertn*** (Amaryllidaceae)

Alcoholic extract of *C. orchoides* rhizomes at doses (100-400 mg/kg) shows mast cell stabilizing and antihistaminic activity on Compound 48/80-induced mast cell degranulation and systemic anaphylaxis[26].

***Camellia sinensis*** (Theaceae)

The anti-allergic effect of tea-leaf saponin (TLS), which was a mixture of saponins separated from the leaves of *Camellia sinensis* var. *sinensis*, in guinea pigs and rats. TLS (20-100 mg/kg) dose-dependently inhibited experimentally-induced asthma, and ID50 was 61.7 mg/kg. TLS (20-100 mg/kg) dose dependently inhibited a 48 h homologous PCA (passive cutaneous anaphylaxis) reaction, and the inhibitory effect was similar to that of tranilast.[27]

***Calotropis procera*** (Asclepiadaceae)

In a traditional treatment of asthma patients arka flowers have been shown to have therapeutic effect. [28]

***Cannabis sativa*** (Cannabaceae)

Tetrahydrocannabinol (THC), the chief pure component of cannabis is a bronchodilator when administered orally or as an aerosol and the effect is of long duration.[28]

***Datura metel*** (Solanaceae)

The whole plant, but especially the leaves and seed is antiasthmatic, antispasmodic, antitussive, and bronchodilator. In China, the plant is used in the treatment of asthma. In Vietnam, the dried flowers and leaves are cut into small chips and used in antiasthmatic cigarettes. [29]

***Ephedra sinica*** (Ephedraceae)

This is the most widely known Chinese herb used to treat asthma Ephedra plants contain about 2 to 3% naturally occurring ephedra alkaloids, mostly ephedrine and pseudoephedrine Both alkaloids

stimulate the alpha and beta adrenergic receptors, and in general act similarly to norepinephrine (adrenaline).[29]

***Eclipta alba*** Linn (Asteraceae)

The 50% ethanol extract shows antianaphylactic and antihistaminic activity at doses 250 and 500 mg/kg on compound 48/80-induced degranulation of mast cell, egg albumin induced passive Cutaneous and paw anaphylaxis; bronchoalveolar lavage (BAL) study on guinea pig trachea; and determination of histamine[30].

***Euphorbia hirta*** (Euphorbiaceae)

*Euphorbia hirta* is an herbaceous wild plant which grows in the hotter parts of India. Ethanol extract of whole aerial part of the plant at doses (100-1000 mg/kg) shows antihistaminic and antiallergic activity by inhibiting inhibited the passive cutaneous anaphylaxis[31]

***Picrorhiza kurroa*** (Scrophulariaceae)

It is a potent antiasthmatic herb in Indian traditional medicine. The major constituents in picrorhiza are the glycosides picroside I, kutkoside, androsin, and apocynin. They have been shown in animal studies to be antiallergic, to inhibit platelet-activating factor (an important proinflammatory molecule). Two preliminary trials suggest that picrorhiza may improve breathing in asthma patients and reduce the severity of asthma[35]

***Ficus bengalensis*** Linn (Moraceae)

Ethyl acetate, ethanol and aqueous extracts as well as fractions isolated from aqueous extract of *F. bengalensis* bark possesses antihistaminic activity by inhibiting clonidine induced catalepsy in mice at dose 50 mg/kg.[36]

***Gakani*** (Olacaceae)

The antiasthmatic potential of Gakani, was investigated using guinea pig tracheal chain; guinea pig ileum preparation; on the rat stomach strip and egg albumin induced hind paw edema. Result indicates that the extract blocked the effects of histamine and isoprenaline on the guinea pig tracheal chain. It shows inhibition contraction of isolated guinea pig ileum and rat stomach strip, caused by histamine and 5-hydroxytryptamine (5-HT). The extract had good anti-inflammatory effect in rats[37]

***Hemidesmus indicus*** R. Br. (Asclepiadaceae)

antiasthmatic activity of ethanol extract of *H. indicus* roots is investigated at doses 25, 50, 100 mg/kg using isolated goat tracheal chain.[38]

***Sida cordifolia*** (Malvaceae)

Ephedrine is used primarily as a chronic medication for mild or only acute cases, especially in children. In severe asthma the response to ephedrine is usually poor. Compared with epinephrine, ephedrine is less reliable, is slower in action and longer in duration and probably more often produces undesired side effects. The average dose is 25-50mg orally, repeated Y times a day.[39]

*Solanum melongena* (Solanaceae)

The methanol extract of fresh leaves of *Solanum melongena* L. was evaluated for its capacity to alter the tone of isolated, precontracted guinea pig tracheal chains, as well as for its possible mechanism(s) of action. *Solanum melongena* extract exerted a bronchospasmogenic rather than a bronchospasmolytic effect, probably through muscarinic receptor.[39]

*Striga orobanchioides* Benth. (Scrophulariaceae)

Ethanol and aqueous extracts of whole plant shows antihistaminic and mast cell stabilizing activity by inhibiting histamine-induced contractions of the guinea pig ileum at the concentration 2.5-25 mcg/mL in a doserelated manner and inhibiting degranulation of mast cells at dose 100 and 200 mg/kg[40].

*Sphaeranthus indicus* Kurz (Asteraceae)

The ethanol extract at the doses of 150, 300 mg/kg and its ethyl acetate extract at the dose of 100,150 mg/kg and 300 mg/kg showed slightly better protection against sheep serum[41]

*Ulmus rubra* (Ulmaceae)

Thins down the thick sticky mucus that clogs the airways.

*Withania somnifera* (Solanaceae)

*Withania somnifera* is an anti stress herb having powerful anti inflammatory properties. It significantly reduces inflammation and blockages in respiratory tract.

*Xanthoxylum nepalensis* (Berberidaceae)

*Xanthoxylum nepalensis* is used in traditional herb remedies to treat inflammatory diseases such as asthma, bronchitis, rheumatism, and skin disorders presumed to be mediated by leukotrienes. The methanolic extracts of the leaves of *Xanthoxylum nepalensis* were tested for their activity to inhibit the biosynthesis of leukotriene B<sub>4</sub> in bovine polymorphonuclear leukocytes.

*Zingiber officinale* (Zingiberaceae)

It is a powerful natural expectorant used widely in Chinese as well as Indian formulations for coughs, colds, and chronic bronchitis. [42]

**CONCLUSION:** All the traditional medicinal plants discussed in the review have exhibited significant clinical and pharmacological activity. Some medicinal plants alternatives employed in these traditions are proven to provide symptomatic relief and assist in the inhibition of disease development as well asthma caused by dust, mites, pollen, exercise or even by air, which produce mucus, saline, pain on breathing or unusual breathing. It is basically diagnosed by some synthetic and remedies. This review revealed that many of medicinal plants used by traditionally as antiasthmatic agent are reported to have scientific evidence.

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