**Review article**

# Potential applications of medicinal plants in symptomatic treatment of asthma: A review

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## ABSTRACT

Over the year herbal medicine has achieved significant growth in the global medical field. Compared to other countries India is a major manufacturer of medicines. Herbal medicines play a vital role for the treatment of diseases due to safety and efficacy. In Universe there are many medicinal plants each having potency to treat disease some of them reported and some even not known due to lack of knowledge and less research it has not been identified. Asthma is one of the most common inflammatory diseases of the airways with relapses due to regeneration of airway smooth muscle. Asthma is common and widespread throughout the world. In the United States, approximately 4% of the population suffers from this disease. In adults, both sexes are equally affected, and in children, the ratio of males to females is 2:1. The latest Global Burden of Disease (GBD, 1990-2019) estimates the total burden of asthma in India at 34.3 million, accounting for 13.09% of the global burden. In India, asthma deaths are estimated at 13.2 per 1,000 of the population. Asthma accounts for 27.9% of disability-adjusted life years (DALYs) in the Indian population. The current review focuses on the herbs recently tested for the treatment of asthma. This paper will focus on various beneficial aspects of herbal medicines compare to allopathic medicines as anti-asthmatic activity which has been proved in animal model. This paper will also focus on medicinal plants which can be used in introducing new herbal formulation effective in treatment of asthma.

**Keywords:** Pulmonary disease; asthma; anti-asthmatic; herbal medicine.

## INTRODUCTION

The term 'pulmonary disease' refers to several conditions that affect lung function. Lungs affect diseases such as asthma, corona virus, lung cancer, chronic obstructive pulmonary disease (COPD), influenza, pneumonia, and infectious diseases such as tuberculosis, cystic fibrosis (CF), and idiopathic pulmonary fibrosis (IPF) disease (Fig. 1). Asthma is one of the most common inflammatory diseases of the airways, with relapses due to regeneration of airway smooth muscle. In this condition, the mucous membranes and bronchial muscle layers become tight causing the mucous membranes to expand and reduce airflow in the lower respiratory tract. Also called recurrent obstruction, it is a disease in which the trachea bronchial smooth muscle responds excessively to a variety of factors, resulting in severe airway narrowing (1-3). Asthma is now recognized as a primary inflammatory condition, i.e., inflammation underlying hyperactivity. Allergic causes are present in many adults and in higher proportions in pediatric patients. In others various provoking factors (infection, irritants, pollution, exercise, exposure to cold, psychogenic) may be involved, and invasion is dominated by eosinophils, lymphocytes, and mast cells. Airway remodeling professionally exacerbates the disease. A severe and persistent condition known as asthma can be fatal. Asthma common inflammatory diseases of the airways with relapses due to regeneration of airway smooth muscle. Asthma is common and widespread throughout the world. In the United States, approximately 4% of the population suffers from this disease. In adults, both sexes are equally affected, and in children, the ratio of males to females is 2:1. Asthma is not usually a progressive disease, unlike chronic bronchitis, cystic fibrosis, or bronchiectasis. It does not always result in crippling chronic obstructive pulmonary disease. Rather, the clinical course of asthma is marketed by exacerbations and remissions. Mortality from asthma is rare, but morbidity results in significant hospital and outpatient costs. The latest Global Burden of Disease (GBD, 1990-2019) estimates the total burden of asthma in India at 34.3 million, accounting for 13.09% of the global burden. In India, asthma deaths are estimated at 13.2 per 1,000 of the population. Asthma accounts for 27.9% of disability-adjusted life years (DALYs) in the Indian population (4-6).

### Causes of asthma

The standard cause of bronchial asthma is constrictive allergic reaction of the bronchioles in reaction to overseas substances within the air. In approximately 70% of suffers below the age of 30, bronchial asthma is resulting from allergic hypersensitive reaction to non-allergic airborne irritants which include: irritants in smog humans with traditional allergies tend to produce abnormally excessive levels of immunoglobulin E (IgE) antibodies, and those antibodies motive a hypersensitive reaction once they react with the unique antigens that first induced them. In patients with asthma, these antibodies primarily bind to mast cells presents in the pulmonary interstitium, which is closely associated with the

bronchioles and smooth bronchi. When asthma sufferers inhale sensitive pollen, the pollen reacts with antibodies bound to mast cells, causing the mast cells to release various substances. Among them are (a) histamine, (b) slow-acting drugs of anaphylaxis, (c) eosinophilic chemo attractants, and (d) bradykinin. In addition, the chest permanently expands over the years and becomes a 'barrel chest', permanently increasing both functional and pulmonary residual capacity (7). The main factors contributing to dyspnea are contraction of bronchial smooth muscle, secretion of thick mucus that adheres to the walls of the bronchioles, and edema of the airway mucosa. The effect of air pollution on the development of asthma has been studied for many years. There is growing evidence that both outdoor and indoor pollution contributes to the development of asthma. Numerous cross-sectional studies have demonstrated an association between poor air quality and the development of asthma. Traffic-related air pollution, nitrogen dioxide, and second-hand smoke are important risk factors for developing asthma in children.

**Symptoms of asthma**

Common symptoms of asthma include cough, dyspnea, wheezing, tachycardia, respiratory acidosis, tachypnea, upper airway hyper-responsiveness, inflammation of mucous membranes, and increased mucus secretion (Fig. 2; 8-10).

**Classification of asthma**

Bronchial asthma is traditionally classified into two broad etiological types based on the triggering stimuli. First one is extrinsic asthma is one of the most common types of asthma. It usually begins in childhood or early adulthood. It is also called atopic asthma or allergic asthma. Most of these patients have a personal or family history of allergic disease. Allergens that had negative effects when inhaled include house dust, animal hair, mold, etc. Gases, vapors, and organic and chemical dusts aggravate occupational asthma. In exogenous asthma, serum IgE levels are elevated. Second is intrinsic asthma that develops in late adulthood without a personal or family history of allergies. Also known as idiosyncratic or non-atopic asthma. In most patients, endogenous asthma develops a typical symptom complex after a viral infection of the upper respiratory tract. Although there are no specific allergens, about 10% of patients are hypersensitive to drugs, especially low doses of aspirin. In exogenous asthma. Serum IgE levels are normal. Third is mixed asthma in which the patient is clearly inconsistent with exogenous or endogenous asthma. Patients with early-onset asthma have a strong allergenic component, and those with late-onset asthma are less likely to have allergies. This type of asthma can be triggered by cold weather, exercise, and emotional stress (11).

**Disadvantages of allopathic drugs used as anti-asthmatics**

Various disadvantages of allopathic drugs are listed in Table 1 (12,13). Herbs can be defined as plants that have been used since ancient times for their culinary, medicinal, or aromatic properties. Despite recent advances in modern medical technology plants make important contributions to healthcare (14). According to the World Health Organization (WHO), the use of herbal medicines worldwide is two-to-three times greater than that of conventional medicines. Currently herbal medicines have a strong reputation for treating pulmonary disease, and their efficacy and safety are strongly supported by controlled clinical trials. Recent global studies have also provided valuable information regarding the specific mechanisms of action of these alternative herbs (15).

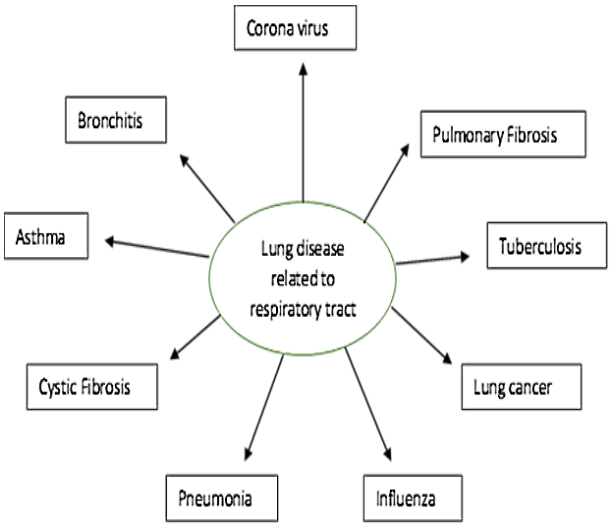


**Fig. 1:** Lung diseases related to respiratory tract

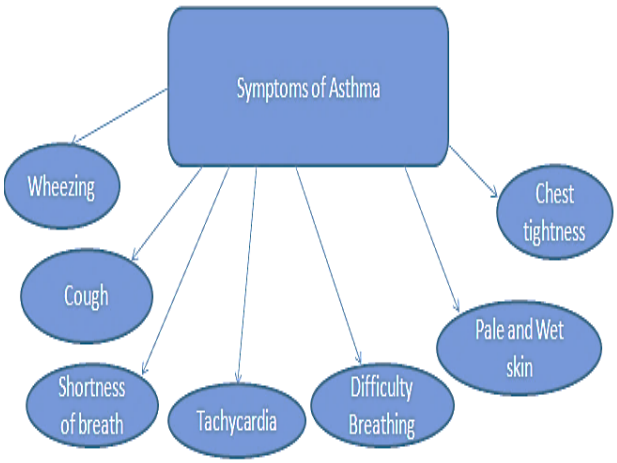


**Fig. 2:** Symptoms of asthma

**Table 1:** Allopathic medicine used as anti-asthmatic and their side effects (12,13)

| Drugs | Regimen | Side Effects |
|---|---|---|
| **Aminophylline** | 250-300mg oral | Nausea, vomiting, headache, insomnia, irritability, restlessness, increase in urine volumes, shakiness, increased gastric acid secretion and gastro esophageal reflex. |
| **Bambuterol** | Oral single evening dose of 10-20mg | Headache, tremor, palpitation and tachycardia. |
| **Budesonide** | 200-400 µg Twice daily by inhalation in asthma. | Sore throat, dysphonia/hoarseness, cough during inhalation, thirsty feeling after inhalation, oral candidiasis, tongue hypertrophy and perioral dermatitis |
| **Doxophylline** | 400 mg oral once daily in the evening | Head ache, dyspepsia, nausea, vomiting and anorexia |
| **Montelukast** | 10mg oral once daily | Headache, gastrointestinal symptoms, hypersensitivity reactions, sleeps disorders, drowsiness, increased bleeding tendency and hallucination. |
| **Salbutamol** | 2-4 mg oral, 0.25-0.5 mg intramuscular/subcutaneous, 100-200 µg by inhalation | Palpitation, tachycardia, hyperactivity, insomnia, shakiness and unpleasant taste |
| **Terbutaline** | 5 mg oral, 0.25 mg subcutaneous, 250 µg by inhalation. | Pulmonary oedema, myocardial ischemia, cardiac arrhythmias and hypotension. |
| **Theophylline (Anhydrous)** | 100-300 mg oral three times a day | Nausea, headache, dizziness and vomiting |

**Table 2:** Herbal drugs used as anti-asthmatic

| Biological Name | Common name | Part used | Family | Extracts | Animal model | Screening method used |
|---|---|---|---|---|---|---|
| *Adhatodavasica* (16) | Malabar nut | Leaves | Acanthaceae | Ethanolic | Guinea pig | Histamine and acetylcholine induced contraction |
| *Alternantherasessilis* (17) | Dwarf copper leaf | Leaves | Amaranthaceae | Ethanolic | Guinea pig | Histamine aerosol induced bronchospasm |
| *Anchomanesdifformis* (18) | Forest Anchomanes | Leaves | Araceae | Aqueous | Guinea pig | Histamine induced bronchoconstriction |
| *Argemonemexicana* (19) | Ghamoya | Stems | Papaveraceae | Ethanolic | Swiss albino mice and guinea pig | Isolated guinea pig ileum preparation and isolated guinea pig tracheal chain preparation, Histamine and acetylcholine induced bronchospasm in guinea pigs and milk induced eosinophilia in mice models. |
| *Artocarpusheterophyllus* (20) | Jak fruit | Leaves | Moraceae | Ethanolic | Guinea pig | Histamine induced bronchospasm and acetylcholine-induced bronchospasm |
| *Berleriaprioninslinn* (21) | Porcupine flowers | Aerial parts | Acanthaceae | Methanolic | Adult goat tracheal tissue | Histamine induced bronchospasm |
| *Bryonialacintosa* (22) | Shivlingi | Whole parts | Cucurbitaceae | 70% alcoholic | Albino rats | Mesenteric mast cell count by atopic allergy method |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Calotropisprocera* (23) | Apple of Sodom | Roots | Ascelpidaeaceae | Methanolic and aqueous | Guinea pig ileum preparation | Isolated goat tracheal chain and guinea pig ileum preparation, histamine induced bronchospasm, milk-induced leucocytosis |
| *Capparis decidua* (24) | Karira | Leaves | Capparaceae | Ethanolic | Guinea pig and albino mice | Histamine-induced bronchoconstriction in guinea pigs and milk-induced leucocytosis in mice, histamine induced bronchospasm in guinea pigs |
| *Coleus amboinicus lour* (25) | Mexican Mint | Leaves | Lamiaceae | Methanolic and aqueous | Old BALB/c male and female mice | Immunoglobulin E (IgE) determination |
| *Elaeagnus* (26) | Eleagnus | Leaves | Eleagnaceae | Aqueous | Guinea pig | Histamine induced bronchospasm and acetylcholine induced contraction |
| *Eugenia jambolana* (27) | Indian Blackberry | Bark | Myrtaceae | Aqueous | Swiss albino mice | Histamine induced bronchoconstriction, acetylcholine induced bronchoconstriction, clonidine induced mast cell degranulation, milk induced eosinophilia and leucocytosis |
| *Euphorbia thymifolia* (28) | Nanidudheli | Aerial parts | Euphorbiaceae | Ethanolic | Adult male Wistar albino rats | Histamine-induced bronchospasm |
| *Ficusracemosa* (29) | Gular | Stem Bark | Moraceae | Butanolic and ethyl acetate | Guinea pig | Histamine induced broncho-constriction |
| *Lawsoniainermis* (30) | Henna | Aerial parts | Lythraceae | Methanolic | Wistar albino rats | Goat trachea chain preparation |
| *Luffa cylindrical* (31) | Sponge gourd | Leaves | Cucurbitaceae | Hydroalcoholic | Swiss albino mice and Sprague Dawley rat | Histamine induced contraction of goat tracheal chain, clonidine induced catalepsy, milk induced eosinophilia |
| *Moringaoleifera* (32) | Horse radish tree | Leaves | Moringaceae | Aqueous | Female BALB/c mice | Mast cell degradation method, milk induced eosinophilia |
| *Neuracanthussphaerostachyus* (33) | Pin cushion | Leaves | Acanthaceae | Methanolic and Aqueous | Female Wister rats, Swiss albino mice | Compound 48/80 induced systemic anaphylaxis, compound 48/80 induced mast cell degranulation, milk induced leucocytosis and eosinophilia |
| *Ocimumgratissimum* (34) | Clove basil | Leaves | Lamiaceae | Aqueous | Guinea pig | Histamine induced bronchospasm |
| *Polysciasfruticosa* (35) | Tea tree | Leaves | Araliaceae | Ethanolic | Guinea pig | Acetylcholine induced bronchoconstriction, histamine induced bronchoconstriction, guinea pig ileum |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | preparation, mast cell stabilization |
| *Symplocosracemosa* (36) | Lodhra | Barks | Symplocaceae | Ethanolic | Guinea pig | Guinea pig ileum and histamine induced bronchospasm model |
| *Syzygiumcumini* (37) | Jamun | Barks | Myrtaceae | Ethanolic | Wister albino rats, Guinea pig | Histamine induced bronchoconstriction and mast cell degradation method |
| *Tinosporacordifolia* (38) | Indian Tinospora | Roots | Menispermaceae | Ethanolic | Wistar rats | Histamine induced bronchospasm and acetylcholine induced contraction |
| *Trigonellafoenumgraecum* (39) | Methi | Seeds | Fabaceae | Methanolic | Guinea pig and Swiss albino mice | Histamine induced bronchospasm, compound 48/80 passive cutaneous anaphylaxis, and egg-albumin induced asthma |
| *Vitus vinifera L* (40) | Grapes | Fruits | Vitaceae | Ethanolic | Male Wistar rats | Ovalbumin-induced animal model |
| *Wrightiatinctoria* (35) | Kapar | Leaves | Apocynaceae | Ethanolic | Male albino Wistar rats | Milk induced leucocytosis and ovalbumin induced leucocytosis |

## DISCUSSION

Our review results indicate that the above medicinal plants are useful in the treatment of asthma, various plant products have been reported to have this function. Review studies have found herbs to be more susceptible and safer than symptomatic treatments that have been demonstrated in various animal models. Various herbal remedies and their extracts have important anti-asthmatic properties. Review studies therefore show that the herbal drugs have anti-asthmatic activity that has been proved in different animal species, providing many links for improving future research, as summarized in Table 2(16-41).

## CONCLUSION

It is concluded from this review study that medicinal plants play an important role in asthma control. Extracts of various herbal plants have significant anti-asthmatic activity. Therefore, the review study concluded that the herbal medicine mentioned above has anti-asthmatic activity, and since this has been demonstrated in various animal models, great efforts will be devoted to clinical development in the future.

### CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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