Medicinal plants from Siddha system of medicine useful for treating respiratory diseases

Arjun Ram*, Duraisamy Arul Joseph, Selvakumar Balachandar, Vijay Pal Singh
*Molecular Immunology Laboratory, Institute of Genomics and Integrative Biology, Mall Road, Delhi-110007, India, Phone: 91-11-27666156, 157; Fax: 91-11-27667471, E-mail: aram@igib.res.in

Abstract- Siddha system of medicine (SSM) is one of the oldest traditional systems of medicine, which has been originated from India and is practiced mostly in the southern part of this country for treating various diseases including even chronic conditions. However, it is relatively veiled to the scientific community as compared to other traditional systems such as Ayurveda (a popular Indian medicine), TCM (traditional Chinese medicine) and Kampo (traditional Japanese medicine). Respiratory diseases such as asthma and chronic obstructive pulmonary disease (COPD) are a serious health problem, which are increasing rapidly worldwide. The current therapy has its own shortcomings and notable adverse effects. There is an intense need to search some safer alternative therapy for treating these epidemic diseases. The objectives of this article is, first, to increase the awareness about SSM to the scientific community, thus inviting more scientific studies on this system, and secondly, to list certain medicinal plants of this system which are commonly used for treating respiratory diseases. To explore the possibility for obtaining potential drugs from these plants, certain future perspectives have also been discussed.
Key words: Siddha system of medicine, medicinal plants, Asthma, Bronchitis, Chronic obstructive pulmonary disease, Siddhars, traditional systems, emphysema

1. Introduction

Traditional systems of medicine have been in vogue for treating various ailments in many countries such as China, Japan and India since immemorial time [1-4]. Siddha system of medicine (SSM) is one such ancient traditional system of India and practiced mostly in its southern part for treating various diseases including even chronic conditions [5]. However, it is relatively very less known to the scientific community as compared to other popular traditional systems such as Ayurveda (a popular Indian medicine), TCM (traditional Chinese medicine) and Kampo (traditional Japanese medicine). By considering this, we have surveyed the available literatures reported by experienced and intuitive minds of SSM in India and identified that a number of medicinal plants are still exploited to treat various diseases. Respiratory diseases such as asthma and COPD are one of the major causes of human mortality [6, 7]. Moreover, existing drugs are not adequate and give rise to numerous side effects. A safer alternative therapy is the need of the hour for which the therapeutic resources of SSM could be useful. In the present review, we have provided a glimpse into the prevailing respiratory diseases, described briefly Siddha system of medicine (SSM) and sorted out a category of plants from this system, which are commonly used for treating respiratory diseases. Certain future perspectives have also been discussed.

2. Overview of Respiratory Diseases

Even though research in respiratory medicine and related technology is in an advanced stage, respiratory diseases are still one of the perpetrators of the global health and are extending their vicious domain with each passing day. There are several respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD), sarcoidosis and pulmonary fibrosis. Among these, asthma and COPD are the major ones, which adversely affect a huge number of human populations. A brief description of COPD and asthma is given below.

2.1. Asthma

Asthma is characterized by reversible airway obstruction, airway hyperresponsiveness and airway inflammation. The pathological features include infiltration of lymphocytes and eosinophils into airways, damage and loss of bronchial epithelium, mast cell degranulation, hyperplasia and collagen deposition in the epithelium sub-basement membrane area. Asthma pathology is associated with the release of numerous pro-inflammatory agents including lipid mediators, inflammatory peptides, chemokines, cytokines and growth factors. The structural cells of the airways like smooth muscle cells, endothelial cells, fibroblast and airway epithelial cells are also important sources for causing asthma [8, 9]. Allergic asthma exhibits an allergen-induced immediate or early phase response with the abrupt onset of bronchoconstriction, and a secondary obstructive response, late phase response is associated with inflammation of the airways and airway hyperresponsiveness, which occurs 8 to 24 hrs after allergen exposure [10].

2.2. Chronic obstructive pulmonary disease (COPD)

Chronic obstructive pulmonary disease (COPD) is a disease state characterized by airflow limitation that is not fully reversible [11]. COPD is caused by a prolonged inhalation of irritants and toxins (e.g., cigarette smoke) into the airways

and can directly injure lung structures leading to chronic inflammation in the airways and alveolar structures of the lung [12]. COPD includes chronic bronchitis, chronic bronchiolitis and emphysema. Chronic bronchitis is associated with hyperplasia and hypertrophy of mucus secreting glands within the large airways, submucosal inflammatory cell infiltration, edema, peribronchiolar fibrosis and increased smooth muscle contraction [13]. Chronic cough is a common symptom of COPD patients [14]. Chronic bronchiolitis refers to the presence of an inflammatory response in the respiratory bronchioles and is difficult to be defined clinically but may be recognized by the tests of small airway function (i.e., in airways of 2 mm diameters or less). Emphysema involves destruction of the alveolar wall, enlargement of airspaces and loss of elastic recoil [13].

2.3. Current therapies, their adverse effects and need of new therapy

Despite increased understanding of pathogenesis of the respiratory diseases such as asthma and COPD, their incidence is increasing rapidly all over the world [6,7]. Several drugs are available which may give a temporary good relief, but they are mainly symptomatic and transient. Almost all currently available drugs such as steroids, β2-agonists, anticholinergics and phosphodiesterase (PDE) inhibitors have numerous adverse effects. For example, longer use of corticosteroids produces deficiency in bone mineral density [15-16], cardiovascular effects [17], osteoporosis and osteonecrosis [18-19] risk of cataract [20], panniculitis [21], migraine or migraine-like headache [22], pharyngitis and sore throat [23] and renal deterioration [24]. Most recently, it has been reported to cause serious pneumonia also [25]. The long acting β2-adrenoreceptor agonists produce myocardial ischaemia and osteoporosis [26, 27]. Anticholinergics cause papillary dialation, blurred vision and acute glaucoma [28]. PDE inhibitors like theophyline cause gastrointestinal symptoms to palpitations, arrhythmias, hypocalcaemia, nausea, diarrhea and headache [29, 30]. Hence continuous efforts are going on worldwide to search effective and safer remedies for these respiratory diseases preferably of natural origin, to obtain negligible or no adverse effects for treating these epidemic diseases.

3. Sidhha System of Medicine (SSM)

Siddha medicine is one of the two ancient traditional systems of India [5]. First one is “Ayurveda”, which flourished in north India and became popular all over the country and also in abroad, and the second one is “Siddha”, which originated from Tamil Nadu, a south-east state of India and practiced mostly in and around areas of its origin. SSM has been in existence and is being practiced for past 2000 years [5]; however the printed Siddha literatures are available from 18th century onwards. Before that they were documented on palm leaves by different authors [31]. The word “Siddha” denotes “Siddhi” which means achievement in life arts such as philosophy, yoga, wisdom, alchemy, medicine and above all the art of longevity [31]. The persons, who obtained this Siddhi, were respectfully called “Siddhars”. Siddhars can also be called spiritual scientists of Tamil Nadu who explored and explained the reality of nature and its relationship to man by their yogic awareness and experimental findings. They postulated the concept of spiritualism for self-improvement, and the practices initiated by them came to be known as the "Siddha System”. It is believed that Siddhi was obtained by 18 highly experienced and intuitive Siddhars [3, 32] who were believed to cure innumerable diseases [33]. Agasthiyar, one among the 18 Siddhars is believed to have contributed more in the development of SSM, whose life period is approximately between fifth to sixth centuries. He is considered as the ‘’Hippocrates of Siddha medicine and also one of the greatest philosophers of India [31-32]. Some of his works are still in standard books of medicine and surgery, which are in the daily use among the Siddha medical practitioners. The SSM is mainly concerned with the development of drugs, which have high potency and long life for their use in future. It also aims to activate the generation of cells and to maintain the longevity [31, 34-36]. Siddha system is based on 96 principles *(thathuvams)* which are broadly classified under the following categories: 5 elements *(pancha bhutam)*, 5 sense organs *(pori)*, 5 functions of sense organs *(pulan)*, 5 motor organs *(kanmenthiriyam)*, 5 perception of senses with the help of five sense organs *(gnanenthriyam)*, 4 intellectual faculties *(karanam)*, 1 wisdom of self realization *(arivu)*, 10 channels of life force responsible for the dynamics of prana *(naadi)*, 10 vital nerve forces which is responsible for all kinds of movements *(vayu)*, 5 visceral cavities *(asayam)*, 5 five states of the human body or sheath *(kosam)*, 6 stations of soul *(aatharam)*, 3 regions *(mandalam)*, 3 impurities of the soul *(malam)*, 3 humours *(tridosham/ tridosha siddhantam)*, 3 physical bindings *(eadanai)*, 3 cosmic qualities *(gunam)*, 2 acts *(vinai)*, 8 passions *(ragam)*, 5 states of consciousness *(avasthai)*. Many of these principles are found in Ayurveda also but some of them are very unique to Siddha system alone. The common specific features of these two systems are: *tridosha siddhantam*; wind *(vatham)*, bile *(pittam)* and phlegm *(siletuman)*, *pancha bhuta theory*; space (*aakasam*), air *(vayu)* ,fire *(thee)* , water *(neer)* ,earth *(munn) , three gunas*; subtle *(sattva)*, activity *(rajas)*, gross *(tamas)*, and six kinds of tastes *(arusuvai)*.

However, certain differences between them can be cited. Siddha system differs in localizations of *three doshas* in the body when compared to Ayurveda [36]. There are certain other distinguishing features, which have been described in the following sections.

3.1. Drug resources of SSM and expertise of Siddhars

The resources of SSM have been categorized into three groups: plant products (*mulavargam*), inorganic substances (*thathuvargam*), and animal products (*jivavargam*), which are characterized by means of taste (*suvai*), quality (*gunam*), potency (*veeryam*), post-digestive taste (*pirivu*), and specific action (*prabhavam*), while Ayurveda recognizes all the drugs only by quality as the main character [32, 36-37]. Siddha system used animal products such as human and canine skulls in the preparation of special ''ash'' (*chunnam*) which is said to be effective against mental disorders [37]. The alchemy in SSM has been found well developed into a science and highly used in medicine. The Siddhars were even polypharmacists who were engaged in several alchemical operations which involves several processes such as calcinations, sublimation, distillation, fusion, fermentation, separation, exaltation, purification, extraction, incineration of metals and liquefaction [37]. This was found useful in the preparation of medicine as well as in transmutation of basic metals into gold. Therefore, Alchemy is one of the highly distinguished features of SSM when compared with Ayurveda [33]. Regarding plant resources, many have been recognized; among which 108 herbs called as *karpa mooligaigal* are dominantly used in SSM for human ailments including respiratory diseases. This *karpa mooligaigal* consists of *kayakalpam* (*kaya*- body, mind and psyche, and *kalpam* – transmutation) plants. A few of those plants are *Acalypha indica, Aloe barbadensis, Azadirachta indica, Ocimum sanctum, Phyllanthus amarus, Phyllanthus emblica, Withania somnifera, Zinger officinale*, *Cynodon dactylon, Solanum trilobatum* and C*uminum cyminum* [38, 39]. These plants are believed to transform health and consciousness to prevent and give relieve even from chronic diseases [38]. In addition, many herbal formulations are also used in this system. Even nowadays, some of these herbal formulations are manufactured by pharmaceutical companies like TAMPCOL (http://www.tampcol.in/), IMCOPS (http://www.impcops.org/), SKM SIDDHA, (http://www.skmsiddha.org/), in India for their commercial use by Siddha physicians.

3.2. Efficacy of SSM in diagnosis and treatment of various diseases

The diagnosis of diseases in SSM is based on the examination of eight entities *(envagi thaervu)* such as pulse, eyes, voice, touch, appearance, tongue, face and urine [40]. Among these, urine examination is the major diagnostic method and it is a specialty of SSM. The color of the urine, smell, density, quantity and froth are noted in almost all systems of diagnosis. But in SSM, in addition to these, the surface tension and the pattern of oil spreading on the surface of the urine gives valuable information in diagnosing the diseases [36, 40]. Apart from urine examination, pulse *(nadi)* examination is another important step, which is used for diagnosis and prognosis of diseases. This is the most prominent diagnostic procedure in Siddha medicine than in Ayurveda and it has been suggested that Ayurveda pulse diagnosis not common before the late thirteenth-century was then followed by Siddha medicine [33]. The pulse examination is done for females in left hand and for males in right hand [37]. The diagnosis also involves the study of person as a whole as well as his disease. The SSM emphasizes that medical treatment is oriented not merely to disease but also take into account the patients' environment, the meteorological consideration, age, sex, race, habits, mental frame, habitat, diet, appetite, physical condition, physiological constitution etc. This means the treatment is individualistic, reducing the chance of misdiagnosis or wrong treatments. In this regard, it seems that SSM had already an insight of individualized medicine through phenotypic and behavioral characterization of individuals which now modern research is trying to achieve through pharmacogenomics and pharmacogenetics. According to SSM, the physiological function in the human system is mediated by three substances *(tridosham)* i) wind (*vatham)* ii) bile *(pitham)*, iii) phlegm *(kapam)*. If these three substances function normally in the ratio 4: 2: 1 respectively, normal health is maintained. The change in this ratio will lead to various diseases [37, 40]. Drugs of SSM are used separately or in combination for maintaining this normal ratio. The combined drugs are classified into two categories: enemy *(satru)* and friend *(mitru)*. The modern equivalent terms are compatible (potentiating the action of one drug by another) and incompatible (one drug antagonizes another and reduces the therapeutic action) [34]. It is believed that the SSM is capable of treating all types of diseases. For example, it is effective in treating skin diseases [5], arthritis [41]. Siddha medical practitioners have also reported that this system is effective in reducing the highly debilitating conditions in HIV/AIDS [42] and even found to cure HIV positive and sexually transmitted diseases (STD) [43]. Other diseases such as cancer and diabetes (literally known as *putrunoi* and *neerazhivu noi* in SSM) can also be treated with Siddha drugs [44]. This has been demonstrated scientifically also [45-49].

4. Medicnal Plants from SSM Used for Treating Respiratory Diseases

Numerous plants seem to be used in this system; but there is no adequate data because of multiple reasons. The top two of them are as follows; 1) it is only in ancestral use and inherited by disciple to disciple and generation to generation and 2) it was documented in scholarly Tamil language with numerous cryptic references which differs from the today's common Tamil language and is difficult to understand even by native Tamil people also [50]. After a long time, some of them were translated into common Tamil language, and thereafter, few of these texts were translated into English. Several organizations such as department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy (AYUSH), Government of India; Central Council for Research in Ayurveda and Siddha, New Delhi; and Gandeepam, a non government organization (NGO)) have been established. These organizations have an important role in maintaining and reviving the ancient Indian systems of medicine. In addition, they encourage the scientific studies on these systems. Alongside, some ethnomedicinal studies were also done by some groups of workers in south India [51-53] by gathering the valuable information's from the practitioners of rural area near forest region where the people depend mostly on the herbs and have a discreet knowledge of herbal medicines. Based on these literatures numerous plants have been observed for treating various human ailments. Many of these plants, which are used for multiple diseases and predominantly used for respiratory diseases, have been considered. Among them, the plants which are commonly used for these diseases and worked out scientifically to some extent are being described below. The others are listed in Table 1.

4.1 *Acalypha indica* L. (*Euphorbiaceae*); Siddha name: Kuppaimeni

The Leaves, roots, stalk and flowers of *Acalypha indica* are used in SSM for its medicinal properties. The leaf powder cures respiratory diseases. Its other actions include cathartic, anthelmintic, expectorant, emetic, anodyne, hypnotic, antimicrobial and wound healing properties [54]. Recently, the ethanolic leaf extract of this plant has been shown a potent snake venom neutralizing property in the experimental animals [55] which indicates its detoxification effect. There is no specific study on its toxicological aspect; however, one clinical report indicated its hemolytic effect in glucose-6-phosphate dehydrogenase deficient individuals [56].

4.2 Adhatoda vasica Nees (Acanthaceae); Siddha name: Adathodai

The leaf extract of *Adhatoda vasica* is used in SSM to cure bronchial asthma, eosinophilia [57] and cough [58,59]. In some areas the traditional healers use the leaves of this plant orally along with the flowers of *Hibiscus rosa-sinensis* to treat asthma [60]. The relief of bronchial obstruction by its leaf extracts may be attributed even if partially, to the presence of alkaloids [61, 62]. The plant also consists of antiinflammatory [63], antiulcer [64], hepatoprotective [65] and antitussive [66] properties.

4.3 Apium graveolens L. (*Umbelliferae*); Siddha name: Celery-keerai

The seeds and leaves of *Apium graveolens* are used in the treatment of asthma and bronchitis as well as liver and spleen diseases. Seeds are also used in the treatment of chronic skin disorders including psoriasis. One of its compound apigenin (flavonoid) has been proven to possess vasodilatory action in thoracic aorta of rat [67]. The another compound apiin (flavonoid) showed significant inhibitory activity on nitric oxide production *in-vitro* and reduces inducible nitric oxide synthase expression *in-vivo* [68]. The seeds and leaf extracts have been shown to reduce the drug induced toxicity [69, 70] in rats. Its root has been reported for some side effects such as allergy and irritation [71, 72].

4.4 *Boerhavia diffusa* L. (*Nyctaginaceae*); Siddha name: Mukaratee

The roots of *B. diffusa* are used in SSM for the treatment of asthma and also in other diseases such as dropsy, ascities, heart disease, kidney stone and colitis [59]. Recent molecular studies have shown that the ethanolic extract of *B. diffusa* has immunosuppressive effect including reduction of nitric oxide and superoxide *in vitro* [73] which are associated with asthma and COPD. It has also been demonstrated to have spasmolytic [74], anti-bacterial [75] anti-microbial [76], antidiabetic [77] and antifungal [78] activities. There is no toxic report on this plant; rather it has been shown to have chemopreventive activity in mice [79].

4.5 *Borassus flabellifer* L. (*Arecaceae*); Siddha name: Panaimaram

The seeds and whole plant are used in cough and pulmonary affections. It is also used in several other conditions such as hiccup, gastric catarrh, diabetes, pthisis, gonorrhea, indolent ulcers, carbuncles and enlarged spleen [59]. Fresh sap has diuretic, cooling, antiphlegmatic, laxative and anti-inflammatory activities. The ash of dry spadix has antacid and antibilious (used in heartburn) properties [62]. The oral feeding of mice with *B. flabellifer* flour induced the generation of T suppressor cells which were able

to suppress the delayed type hypersensitive response to serum red blood cells [80]. Some toxic effects of the shoot of this plant have been observed in experimental and subclinical studies [81, 82].

***4.6 Caesalpinia bonduc* L. (*Caesalpiniaceae*); Siddha name: Kaliccikkai**

The seeds of Caesalpinia are used in the treatment of asthma and also in intermittent and chronic fevers, colic, acute arthritis, palsy, painful and swollen testicles [59]. There is no scientific investigation of this plant on any respiratory diseases. Other activities such as anti-microbial and mosquito larvicidal effects have been reported [83, 84].

***4.7 Calotropis gigantea* L. (*Asclepiadaceae*); Siddha name: Erukku**

The flowers of *Calotropis gigantea* are used in cough, asthma, catarrh and loss of appetite. The powdered root bark is soaked in its own milky juice from which bougies are prepared and their fumes are inhaled to treat cough in SSM. The flowering tops pounded and boiled with molasses are given every morning for treating asthma (Pandanus database of plants). Its leaf juice is used in external swellings [62]. The aqueous stem bark extract had been found to be effective on bronchial irritation by ammoniac in guinea pig [85]. Exposure of the latex of this plant may cause some toxic effect such as corneal endothelial cytotoxicity [86] and local inflammation [87].

4. 8 *Crocus sativus* L. (*Iridaceae*); Siddha name: Kungumapu

The dried stigma and tops of styles are used in treating asthma and cough. Also it is used in multiple ailments such as seminal debility, leucorrhoea, diarrhea and rheumatism [59]. The herb has sedative, antispasmodic expectorant (in dry cough, whooping cough, and bronchitis), stomachic, diaphoretic [62] and antitussive effect [88].

4.9 *Euphorbia hirta* L. (*Euphorbiaceae*); Siddha name: Amman pachharisi

Euphorbia hirta is also popularly called as “asthma weed”. In SSM, the whole plant is used in treating asthma and bronchitis. Its antiasthmatic activity may be due to the presence of choline and shikimic acid [62]. The milky latex is applied topically to treat wounds and lip cracks. [60]. Recently, its ethanolic extract has been shown to have anti-allergic and anti-anaphylactic effects [89,90]. It also possesses analgesic, antipyretic and anti-inflammatory properties [91].

4.10 *Ocimum sanctum* L. (*Lamiaceae*); Siddha name: Thulasi

In SSM, the leaves *of Ocimum sanctum* are used in bronchitis, asthma, eosinophilia [57] and chronic cough [59]. It is reported to inhibit mast cell degranulation [92]. The volatile oil from fresh leaves and fixed oil from seeds showed anti-inflammatory activity against carrageenan, serotonin, histamine and PGE-2 induced inflammation in guinea pigs and rats [62]. It also has wide-ranging therapeutic applications such as in cardiopathy, haemopathy, leucoderma, catarrhal fever, otalgia, hepatopathy, vomiting, lumbago, hiccups, ophthalmia, gastropathy, genitourinary disorders, ringworm, verminosis and skin diseases [93]. It has been shown to have detoxifying activity [94-96].

4.11 *Piper longum* L. (*Piperaceae*); Siddha name: Thippili

In SSM, *Piper longum* fruits are usually dried for using in cough, cold and asthma [57]. It is also used to treat hoarseness, hiccup, colic and flatulence [59]. It also acts as counter irritant, analgesic, haematinic and general tonic [58].

4.12 *Piper nigrum* L. (*Piperaceae*); Siddha name: Milagu

In SSM, the dry unripe fruit powder of *Piper nigrum* along with the honey is given to treat asthma and bronchitis [57]. Its decoction is also used in fever and cough [58]. The milk extract of the fruit was found effective in passive cutaneous anaphylaxis in rats [62]. The methanolic extract of leaf of this plant exhibited *in vitro* inhibitory effect on compound 48/80-induced histamine release from rat peritoneal mast cells [97]. Piperine a compound from this plant was found to inhibit nitric oxide and TNF-α production *in vitro* [98]. The plant also contains antispasmodic [99], antioxidant [100] and antibacterial [101] properties.

4.13 *Solanum nigrum* L. (*Solanaceae*); Siddha name: Manathakkali

The leaves and fruits of *Solanum nigrum* are used in asthma and bronchitis [57]. The fresh extracts of leaves are also used for inhibiting inflammatory swellings, enlargement of liver and spleen, and in cirrhosis of liver tissue [62]. A glycoprotein from this plant was found to inhibit the DNA binding activities of NF-kB and AP-1 [102] which are one of the important factors for the synthesis of proinflammatory mediators which cause respiratory diseases like asthma and COPD. It’s anti-inflammatory, anti-pyretic and antinociceptive [103], antitumour [104], antiulcerogenic [105], antioxidative [106] cytoprotective [107] activities have been studied recently.

4.14 *Solanum trilobatum* L. (*Solanaceae*); Siddha name: Thuthuvalai

The whole plant is used to treat asthma, bronchitis and esinophilia [57] in SSM. It has been proven to have anti-inflammatory activities [108]. The traditional claim for the usefulness of this herb in bronchial asthma has been confirmed by a clinical study [109]. The plant also contains chemopreventive [110] and hepatopreventive [111] properties.

4.15 *Solanum xanthocarpum* (*Solanaceae*); Siddha name: Kandankatthiri

The fruits of *Solanum xanthocarpum* are used to cure bronchial asthma, eosinophilia [57] and cough [58]. It is also used in the treatment of dislodging tenacious phlegm. The traditional claim for the usefulness of this herb in bronchial asthma has been confirmed by clinical studies [109,112-113]. The beneficial effect of the drug on bronchial asthma may be attributed to the depletion of histamine from bronchial and lung tissue [62]. This plant also possesses tumoricidal [114], antifungal [115], antidiabetic [116] and mosquito larvicidal [117] activities.

4.16 *Strychnos potatorum* L. (*Loganiaceae*); Siddha name: Tetankotai

The fruits and seeds of this plant are used in SSM for treating bronchitis and are also useful in other ailments such as chronic diarrhea, gonorrhea, diabetes, boils and dysentery [59]. Recent scientific studies on animal models have shown its anti-diabetic [118], antiulcerogenic [119], hepatoprotective [120], antidiarrheal [121] and diuretic properties [122].

4.17 *Terminalia bellirica* Roxb (*Combretaceae*); Siddha name: Thandrikkai

The fruits of *Terminalia bellirica* are effective in asthma, cough, hoarseness, sore-throat, and also for other conditions such as dropsy, dysentery and diarrhea [59]. Its fruits have been indicated to have bronchodialatory and antispasmodic activities [123]. Recently, its fruit extracts have shown antidiabetic and antidepressant activities in animal models [48,124]

4.18 *Tylophora indica* Merrill (*Asclepiadaceae*); Siddha name: Kurinjan

The root and leaves of *Tylophora indica* are used as medicine in SSM for its effectiveness in asthma. These parts are also used in diarrhea, dysentery and syphilitic rheumatism [59]. Its anti-asthmatic activity has also been clinically proved [125-127]. Later, it was demonstrated to prevent mast cell degranulation [128] and immunomodulatory effects on lymphocyte proliferation [129] which are associated with asthmatic features. The alkaloids of this plant have been studied for its toxicity in rat where the higher doses only found to have lethal effect [130].

5. Conclusion and Future Perspectives

As it is observed that several conventional drugs for respiratory diseases have been derived from traditional medicinal plants [2,131], it is quite possible from SSM plants also. Since some of these plants have *kayakalpam* ability (making the body competent for long life), it may be even better because the selection of plants by Siddhars seems very tactful, in the sense that the plants they had selected have more beneficial effect than giving merely a respite from the disease alone. This concept can be well understood by interviewing with native people of South India who have an in-depth knowledge of medicinal plants of SSM. Infact, there is a real need of experts, who can understand and explain the ancient Tamil literatures written by the Siddhars. Thereafter those literatures should be translated into international (e.g., English) and at least some major national (e.g., Hindi, Chinese and Japanese) languages to make SSM widely beneficial.

Further, the medicinal plants of SSM useful for respiratory diseases can be identified and processed for isolating different fractions by using sensitive techniques such as high-performance liquid chromatography (HPLC) and liquid chromatography-mass spectrometry-mass spectrometry (LC-MS-MS) as recently being accomplished by several groups of investigators for medicinal plants [132-135]. These fractions can be first tested *in vitro* using certain molecular parameters of respiratory diseases such as inflammatory mediators of asthma and COPD. The potent components then can be evaluated and studied in animal models as recently carried out for several herbal compounds. For example, curcumin, a well known plant derived compound, has been found to inhibit the allergen-induced airway hyperresponsiveness in guinea pigs [136]. Most recently, it has been reported to attenuate elastase and cigarette smoke-induced pulmonary emphysema in mice [137]. Some other plant derived compounds such as luteolin [138], verproside [139], cannabinoids [140], glycyrrhizin [141] and carbenoxolone [142] have also been demonstrated to markedly inhibit asthma mimicking features in mice. Similarly many compounds could be evolved from the medicinal plants of SSM. Subsequent trials of those effective compounds in clinical respiratory patients can then be done for evaluating their final therapeutic efficacy. Simultaneously, the toxicological studies should also be pursued for their better therapeutic applications. The above-mentioned aspects can be accomplished by a sincere interaction between scientists involved in respiratory medicinal research on one hand and Siddha practioners on other hand.

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Table 1: Siddha plants used in respiratory diseases

S.No	Botanical Name	Siddha Name	References
1.	Achyranthes aspera L.	Nayuruvi	[60,62]
2.	Acorus calamus L.	Vasambu	[59]
3.	Aerva lanata L.	Siru peelai	[60]
4.	Albizzia lebbeck L.	Vaagai	[62]
5.	Allium cepa L.	Vengayam	[59]
6.	Allium sativum L.	Poondu	[59]
7.	Aloe barbadensis Mill.	Katralai	[60]
8.	Alpinia officinarum Hance.	Sitrarathai	[57]
9.	Alternanthera sessilis L.	Ponnanganni	[57]
10.	Cardiospermum halicacabum L.	Mudakkathan	[60,62]
11.	Cinnamomum verum Persl.	Lavangam	[57]
12.	Coleus aromaticus Benth.	Karpuravalli	[60]
13.	Curcuma longa L.	Manjal	[59]
14.	Daemia extensa (Jacq.) R.Br.	Uthamani	[57]
15.	Elettaria cardamomum Maton	Elakkai	[57]
16.	Foeniculum vulgare Mill	Sombu	[58]
17.	Glycyrrhiza glabra L.	Athimathuram	[57]
18.	Gymnema sylvestre R.Br.	Sirukurinjan	[58]
19.	Hyoscyamus niger L.	Thippiyam	[58]
20.	Leucas aspera Spreng.	Thumbai	[57]
21.	Mukia madarespatana L.	Musumusukai	[57]
22.	Myristica fragrans Houtt.	Sathikai	[58]
23.	Nigella sativa L.	Karunjeeragam	[57]
24.	Ocimum eanum Sims.	Kanjankorai	[57]
25.	Oldenlandia umbellate L.	Impural	[57]
26.	Piper cubeba L.	Vaalmilagu	[57]
27.	Saussurea costus (Falc.) Lipsch.	Kottam	[58]
28.	Taxus baccata L.	Thalisapathiri	[57]
29.	Terminalia chebula Retz.	Kadukkai	[57]
30.	Vitex negundo L.	Notchi	[60]
31.	Zingiber officinale Rosc.	Inji	[59]

