



A Review on Bronchodilator Herbs in Siddha Medicine

S.Deepa^{*1}, V.Banumathi¹, V.Velpandian¹, M.Ramani¹, M.Pitchiahkumar¹

1. Post Graduate Dept. of Gunapadam (Pharmacology), Govt. Siddha medical college, Arumbakkam, Chennai-600106, Tamilnadu, India.

ABSTRACT

Siddha system of medicine is one among the ancient systems of medicine treasured with a wide range of therapeutics for a vast range of diseases. Bronchial asthma is a chronic respiratory disorder threatening physically and mentally a major group of population especially in India 15-20 million asthmatics. Today several synthetic Bronchodilators and Antihistamine drugs available. Side effects of prolonged usage of these drugs became a great matter of concern. Several herbals in *Siddha system* ensure a safe and effective line of treatment in these chronic disorders. Some of the herbs indicated for Bronchial asthma are *Acorus calamus*, *Alpinia galangal*, *Carum copticum*, *Clerodendrum serratum*, *Justicia beddomei*, *Ocimum sanctum*, *Piper longum*, *Taxus baccata*, *Vitex negundo*, *Zingiber officinale*. These herbs possess potent bronchodilator and Antihistamine properties. Hence this review is mainly focusing the ethno pharmacological activities of the herbals in management of Bronchial asthma and providing a better wellbeing for the society with safe line of treatment.

Keywords: Siddha system, Bronchial asthma, Antihistamine, Bronchodilator, Herbs

*Corresponding Author Email: dr.deepasivaji@gmail.com

Received 20 October 2015, Accepted 27 October 2015

INTRODUCTION

Bronchial asthma is one among the major non-communicable diseases which is characterised by frequent attacks of respiratory impairments such as wheeze, dyspnoea, chest tightness etc. Asthma occurs in all age groups but often starts in childhood. Allergies are the major causative factor for bronchial asthma. These allergic factors induce the inflammation of air passages in the lungs resulting in reduction of airflow in and out of the lungs. According to WHO, asthmatics range from 100-150 million across the globe. Meanwhile India has its estimated population of about 15-20 million asthmatics in 2014, while the prevalence in children population is between 10% and 15%. Bronchial asthma tends to be a major health problem nowadays due to Dust, tobacco smoke, chemical irritants and indoor allergens (domestic mites in Bedding, carpets and stuffed furniture, cats and cockroaches), a family history of asthma or allergy, certain drugs (Aspirin and Non-Steroidal Anti-Inflammatory drugs) etc. Environment hygienic places a vital role in human health and well-being. Air pollution is a major health risk in environment hazards. The most important air pollution causing health hazard is bronchial asthma¹. The stress and economic burden due to this condition is widely increasing. Bronchial asthma cannot be cured but still can be controlled. Anti-inflammatory drugs and broncho-dilators are the majorly prescribed drugs to reduce bronchospasms. Today numbers of synthetic bronchodilator drugs like Theophylline, Isoprenaline, Salbutamol, Ketotifen and etc., are available for symptomatic control of asthma along with their adverse effects. For example Theophylline causes some adverse effects such as convulsions, shock, arrhythmias, tachypnoea, hypotension, tremors, palpitation, and insomnia. Like this Isoprenaline causes tachycardia and Salbutamol causes muscle tremors, palpitation, restlessness, nervousness, throat irritation and ankle oedema. Therefore the world is looking for an appropriate traditional remedy to control asthma without causing adverse effects². In the present scenario herbal remedies gain more importance in various aspects. Among them a finite number of herbs are indicated for bronchial asthma in Siddha texts. Bronchodilator & Anti-histamine activities have been counterclaimed for many single herbs in the literature. Different entirety have evaluated that many medicinal herbs have Bronchodilator & Anti-histamine activity are listed in the below table.

Table 1: Bronchodilator Herbs in Siddha Litrature³

S. No	Vernacular name	Scientific name	Family	Part used
1.	<i>Adatodai</i>	<i>Justicia beddomei</i>	<i>Acanthaceae</i>	Whole plant
2.	<i>Arattai</i>	<i>Alpinia galangal</i>	<i>Zingiberaceae</i>	Rhizome
3.	<i>Chukku</i>	<i>Zingiber officinale</i>	<i>Zingiberaceae</i>	Rhizome
4.	<i>Erukku</i>	<i>Calotropis gigantean</i>	<i>Asclepidaceae</i>	Whole plant

5.	<i>Inji</i>	<i>Zingiber officinale</i>	<i>Zingiberaceae</i>	Rhizome
6.	<i>Jadamanji</i>	<i>Nardostachys grandiflora</i>	<i>Valerianaceae</i>	Roots
7.	<i>Kandangkattari</i>	<i>Solanum surattense</i>	<i>Solanaeaceae</i>	Whole plant
8.	<i>Kanduparangi</i>	<i>Clerodendrum serratum</i>	<i>Verbenaceae</i>	Roots, leaves
9.	<i>Karunjchirakam</i>	<i>Nigella sativa</i>	<i>Ranunculaceae</i>	Seeds
10.	<i>Karuppuravalli</i>	<i>Anisochilus carnosus</i>	<i>Lamiaceae</i>	Leaves
11.	<i>Kottam</i>	<i>Costus speciosus</i>	<i>Costaceae</i>	Roots
12.	<i>Kuppaimeni</i>	<i>Acalypha indica</i>	<i>Euphorbiaceae</i>	Whole plant
13.	<i>Lavangappattai</i>	<i>Cinnamomum verum</i>	<i>Lauraceae</i>	Bark
14.	<i>Lavangapathiri</i>	<i>Cinnamomum tamala</i>	<i>Lauraceae</i>	Leaves
15.	<i>Manjal</i>	<i>Curcuma longa</i>	<i>Zingiberaceae</i>	Rhizomes
16.	<i>Musumuskkai</i>	<i>Mukia maderaspatana</i>	<i>Cucurbitaceae</i>	Leaves, Root
17.	<i>Notchi</i>	<i>Vitex negundo</i>	<i>Verbenaceae</i>	Whole plant
18.	<i>Omam</i>	<i>Carum copticum</i>	<i>Apiaceae</i>	Fruits
19.	<i>Sathikkai</i>	<i>Myristica fragrans</i>	<i>Myristicaceae</i>	Fruit
20.	<i>Thalisapaththiri</i>	<i>Taxus baccata</i>	<i>Pinaceae</i>	Leaves
21.	<i>Thavasumurumgai</i>	<i>Rungia parviflora</i>	<i>Acanthaceae</i>	Leaves
22.	<i>Thettran</i>	<i>Strychno spotatorum</i>	<i>Loganiaceae</i>	Fruits
23.	<i>Thippili</i>	<i>Piper longum</i>	<i>Piperaceae</i>	Dried spikes
24.	<i>Thulasi</i>	<i>Ocimum sanctum</i>	<i>Lamiaceae</i>	Whole plant
25.	<i>Thumbai</i>	<i>Leucas aspera</i>	<i>Lamiaceae</i>	Leaves, flower
26.	<i>Thuthuvalai</i>	<i>Solanum trilobatum</i>	<i>Solanaceae</i>	Leaves, flower
27.	<i>Umattai</i>	<i>Datura metal</i>	<i>Solanaceae</i>	Whole plant
28.	<i>Uttamani</i>	<i>Pergularia daemia</i>	<i>Asclepiadaceae</i>	Leaves
29.	<i>Vasambu</i>	<i>Acorus calamus</i>	<i>Araceae</i>	Rhizomes
30.	<i>Vettilai</i>	<i>Piper betle</i>	<i>Piperaceae</i>	Leaves

Some of the herbs in table are described here.

***Alpinia galanga* (Linn) Willd**

Common names: Tamil: Arattai, English: Galangal the lesser, Galangal the greater, Telugu: Sanna-rashtram, Malayalam: Aratha, Sanskrit: Rasna, Kannadam: Rasmi

Distribution: Throughout the Western Ghats, also cultivated.

Description of the plant: A perennial, aromatic, rhizomatous herb, 1.8-2.1 metre in height, leaves oblong-lanceolate, glabrous, acuminate, very shortly petioled, ligule short, rounded, ciliate, flowers fragrant, greenish white with red veined lips, in dense panicles, fruits capsules orange red when ripe⁴.

Part used: Rhizomes

Active components: Essential oil contained α -and- β -pinenes, 1, 8-cineole, linalool, cedrol and eugeneol⁵.

Research studies: The formulations containing *Alpina galangal* showed significant antitussive activity in sulphur dioxide induced cough model. Thus, these formulations can be useful for alleviating cough⁶.

***Justica beddomi* (Clarke) Bennet**

Common names: Tamil: Adatodai, English: Malabar-nut, Telugu: Addasaram, Malayalam: Atalotakam, Kannadam: Adasogae, Sanskrit: Vasaka, Hindhi: Arusa

Distribution: In Kerala and the hilly regions. Description of the plant: A large glabrous shrub, leaves opposite, short petioled upto 15cm long, 3.75cm broad, main nerves about 8 pairs, flowers heads short, dense or condensed spikes, fruits capsules with a long solid base.⁷

Part used: Whole plant

Active components: Vasicinone and vasicine identified from leaves and also Ca, Mg, K, Na, Fe, Mn, Cu contents estimated in leaves. A new alkaloid 9-acetamido-3-4 dihydroprido[3,4,-b]indole and a new glucoside o-ethyl- α -D-glucoside. Galactose, deoxyvasicinone, vasicol, vasicinolone isolated from roots. Vasicinone isolated from inflorescence.⁵

Biological activity: Bronchodilator activity of vasicinone was compound with that of isoprenaline and aminophylline.⁵

Research studies: A study revealed that *Adhatoda vasica* has good antitussive activity in anaesthetized guinea pigs and rabbits.⁸

***Datura metal* Linn.**

Common names: Tamil: Umattai, English: Dhatura, Telugu: Ummeth-tha, Malayalam: Ummaththam, Kannadam: Ummatte-gida, Sanskrit: Datura, Hindhi: Dhatura

Distribution: Throughout India, common as a weed growing in waste places and road sides.

Description of the plant: An erect, succulent, spreading annual herb or shrub, a metre or more in height with divaricate, often purplish branches, leaves triangular ovate in outline, unequal at the base, flowers large, solitary short pericelled, purplish outside and white inside, fruit subglobose capsules covered all over with numerous, fleshy prickles, irregularly breaking when mature; seeds numerous, smooth, yellowish brown⁹.

Part used: Whole plant

Active components: Scopolamine isolated from fresh plant. Hyoscyamine and meteloidine isolated from leaves and seeds. Leaves also contained quercetin-7-glucoside-3-sophoroside, quercetin-7-glucoside-3-glucogalactosid. Roots contained 3 α ,6 β -ditigloyloxytropane, 6 β -propanoyloxy-3 α -tigloyloxytropane⁵. Research studies: In *datura metal* especially the leaves and seed is anti-asthmatic, 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 anti-asthmatic cigarettes. Here the active component present in the *datura* had significant effect on asthma¹⁰.

***Clerodendram serratum* (Linn). Moon**

Common names: Tamil: Kanduparangi, English: Beetle killer, Telugu: GantuBharag, Malayalam: Cherutekka, Kannadam: Bharangi, Sanskrit: Bharngi, Hindhi: Gant-Bharangi

Distribution: It is a native of the evergreen forest of India.

Description of the plant: A slightly woody shrub with bluntly quadrangular stems and branches leaves usually 3 at a node, sometimes opposite, oblong or elliptic, coarsely and sharply serrate, flowers blue, many in long cylindrical thyrus with a pair of acute bracts at each branching and flower in the fork, fruit a 4 lobed purple drupes. The roots are bitter, acrid⁹.

Part used: Roots, leaves

Active components: Caryophylleneoxide, Eugenol, Acetophenone, Benzylsalicylate, Palustrol.¹¹

Research studies: Alcoholic extract of Bharangyadi produced significant dose dependent protection by egg albumin induced anaphylaxis. This study evidence that drug has potent bronchodilator and anti-anaphylactic properties.¹²

***Leucas aspera* (Wild) Link**

Common names: Tamil: Thumbai, English: Thumbbe, Telugu: Tummi, Malayalam: Thumba, Kannadam: Thumba, Sanskrit: Dronapushpi, Hindhi: Gumamadhupati

Distribution: Throughout India, as a weed on waste lands and road sides upto 900m.

Description of the plant: An erect or diffuse much branched herbaceous annual, 15-60cm in height with hispid or scabrid quadrangular stems and branches, leaves sub-sessile linear or linear-oblong or linear-lanceolate, obtuse, entire or crenate, pubescent upto 7.5cm long and 1.25cm broad, flowers pure white; small, indense terminal or axillary whorls, fruits are nutlets, 2.5cm long, oblong, brown, smooth, inner face angular and outer face rounded⁷.

Part used: Leaves, flower

Active components: Laballenic acid, 5,6octadecadienoic acid.⁵

Research studies: Methanolic extract of *Leucas aspera* shows significant anti-histaminic, bronchodilatory, anti-inflammatory, mast cell stabilizing, anti-allergic and anti-spasmodic activity in various anti-asthmatic models¹³.

***Abies spectabilis* (D.Don) Mirb**

Common names: Tamil: Thalispattthiri, English: Flaurtiacalaphracta, Telugu: Talispatram, Malayalam: Talispatri, Kannadam: Talispatram, Sanskrit: Talispathra, Hindhi: Talispatri.

Distribution: Upper Himalayan tracts. Description of the plant: A very tall evergreen tree attaining a height of 60m with strong horizontally spreading branches, young shoots covered with short brown hair, leaves simple, densely covering the twigs spreading in all directions, but more or less distichous. When the twigs are viewed from below, each leaf 1.5-2.3cm long, the cones are bluish in colour, seeds winged⁴.

Part used: Leaves, Active components: Abiesin⁵.

Research studies: The extract of *Taxus baccata* leaves had protective effect by preventing the infiltration of inflammatory cell, thereby decreasing the release of preformed inflammatory mediators, which can also prevent the direct damage to airway and hyper responsiveness. Here by treating with T. baccata can prevent the inflammation and bronchoconstriction¹⁴.

***Curcuma longa* .Linn**

Common names: Tamil: Manjal, English: Turmeric, Telugu: Pasupu, Malayalam: Mannal, Kannadam: Arisina, Sanskrit: Haridra, Hindi: Haldi.

Distribution: Throughout India cultivated.

Description of the plant: A perennial herb, 60-90cm in height, with a short stem and tufts of erect leaves, rhizome cylindrical, orange coloured and branched, leaves simple, very large, petiole as long as the blade, oblong lanceolate, tapering to the base upto 45cm long, flowers pale yellow in spikes concealed by the sheathing petioles flowering bracts pale green.⁹

Part used: Rhizomes

Active components: Dihydrocurcumin, β -pinenes, camphene, limonene, terpinene, caryophyllene, curcumene, linalool, turmerone, ar-turmerone, boreneol, camphor, eugenol, curcumin, cineole, curdione, monodemethoxycurcumin and didemethoxycurcumin identified in rhizomes⁵.

Research studies: The crude extract of turmeric, inhibits the contraction of smooth muscles.¹⁵ Curcumin present in the turmeric had effectiveness in improving the airway hyperresponsiveness and Anti asthmatic property¹⁶.

***Acorus calamus* .Linn**

Common names: Tamil: Vasambu, English: Sweet-flag, Telugu: Vasa, Malayalam: Vayamba, Kannadam: Baja, Sanskrit: Vacha, Hindi: Bach.

Distribution: Throughout India in areas elevated upto 1,800 metre in marshes also cultivated.

Description of the plant: A semi-aquatic rhizomatous perennial herb, rhizome creeping much branched, as thick as the middle finger, cylindrical are slightly compressed, light brown or pinkish brown externally, internally white and spongy⁴.

Part used: Rhizome

Active components: Acoradin, 2,5-dimethoxy benzoguinone, galangin and sitosterol isolated from rhizomes. Essentialoil, Acolanone, Acoramone, Acoragermacrone.⁵

Research studies: *Acorus calamus* leave extracts exerted anticholinesterase activity, anti-nicotinic neuromuscular blocking effect, antihistaminic and anti-muscarinic activities. These receptor activities of *Acorus calamus* might be responsible for the effective treatment of asthma.¹⁷

***Nigella sativa*. Linn**

Common names: Tamil: Karunjchirakam, English: Black cumin, Telugu: Nalla-jilakarra, Malayalam: Karinchirakam, Kannadam: Kari-jirige, Sanskrit: Upakunchika, Hindhi: Kulanji.

Distribution: In Punjab and Bihar it is cultivated.

Description of a plant: A pretty small herb, 30-60 cm in height, leaves compound, 2-3 pinnatisect, cut into linear or linear-lanceolate segments, flowers pale blue solitary, long peduncles without an involucre. Seeds trichonous black, rugulose tubercular¹¹.

Part used: Seeds

Active components: Essential oil contains limonene, p-cymene, citronellyl acetate, carvone, citronellol, seeds contained esters of dehydrosteraric acid and linoleic acids⁵.

Research studies: The crude extract of *Nigella sativa* seeds exhibits spasmolytic and bronchodilator activities, mediated possibly through calcium channel blockade and this activity is concentrated in the organic fraction¹⁸.

***Ocimum sanctum*. Linn**

Common names: Tamil: Thulasi, English: Holy Basil, Telugu: Thulasi, Malayalam: Thulasi, Kannadam: Thulasi, Sanskrit: Thulasi, Hindhi: Thulasi.

Distribution: Throughout India it is cultivated.

Description of the plant: An erect much branched softly pubescent under shrub, 30-60 cm height, red or purple with sub quadrangular branches, leaves simple, opposite, elliptic oblong, obtuse or acute, entire serrate or dentate, pubescent on both sides, minutely gland dotted, petioles slender, hairy, flowers purplish elongate, racemes in close whorls, stamens exerted, upper pair with a small beard appendage at the base, fruits nutlets, smooth not mucilaginous when wetted.¹¹

Part used: Whole plant

Active components: Eugenol, methyl eugenol, caryophyllene, sesquiterpenes, terpenes in essential oil⁵.

Research studies: *Ocimum sanctum*, the ethanolic extract of that fresh leaves, volatile oil extracted from that fresh leaves and fixed oil from the seeds significantly protected the guinea pigs against histamine and acetylcholine-induced pre-convulsive dyspnoea (PCD)¹⁹.

***Vitex negundo*, Linn.**

Common names: Tamil: Notchi, English: Five leaved chaste tree, Telugu: Vavili, Malayalam: Indrani, Kannadam: Niragundi, Sanskrit: Nirgundi, Hindhi: Sambhalu.

Distribution: Throughout India, on waste lands up to 1500 metres.

Description of the plant: An aromatic large shrub or small tree of about 3m in height with quadrangular branches, leaves opposite, exstipulate, long petioled and digitately 3-5 foliolate, all leaflets with petiolules, the middle one longer, flowers bluish purple in panicles up to 30 cm long, fruits globose or ovoid or obvoid, four seeded, dark black when ripe²⁰.

Part used: Whole plant

Active components: Hishindaside and negundoside isolated from leaves. Two new flavonoids are 6-c-glucosyl-5-o-rhamnopyranosyltrimethoxywogonin and acerosin-5-o glucosidemonoacetate isolated from bark. Vitexincafeate isolated from stem bark. α -pinene, limonene, camphene, methylheptenone, linalool, camphor, 4-terpinol, citral, terpinyl acetate, benzaldehyde and cinnamaldehyde identified in essential oil⁵.

Research studies: The bronchodilator activity of *Vitex negundo* is effected through PDE inhibiting & Calcium entry blocking constituents.²¹

***Carum copticum* Benth and Hook**

Common names: Tamil: Omam, English: The Bishops weed, Telugu: Omamu, Malayalam: Omam, Kannadam: Voma, Sanskrit: Yavani, Hindhi: Ajvayam.

Distribution: It is cultivated throughout India.

Description of the plant: An erect branched annual herb, stems striate, leaves 2-pinnate, ultimate segments all linear, flowers pure white in compound umbels, fruits ovoid, ultimately shining, yellow, aromatic cremocarps, mericarps, with faint ridges compressed²⁰.

Part used: Fruits

Active components: Thymol, Cymene, Terpinene, *o*-Cymene, Ethylene methacrylate, Hexadecane, Carvacrol²².

Research studies: The *Carum copticum* seeds, indicate the presence of calcium antagonist(s), carbachol and K⁺-induced contraction in isolated guinea-pig tracheal preparations. This study shows antispasmodic, bronchodilator activity²³.

***Piper longum* Linn.**

Common names: Tamil: Thippili, English: Long pepper, Telugu: Pippilu, Malayalam: Thippili, Kannadam: Hippili, Sanskrit: Pippali, Hindi: Pipar

Distribution: This plant mostly occurring in hotter parts of the India from central Himalayas to Assam up to lower hills of the west Bengal and evergreen forests of western Ghats as wild and also cultivated in north east and south. It grows in Kuringinellam.

Description of the plant: A slender aromatic climber and male spikes longer, slender, 2.5 to 7.5 cm long. Female spikes short, cylindrical, 1.5 to 2.5 cm long, 5 to 7 mm thick. Fruit greenish-black to black, cylindrical, 2.5 to 5 cm long and 0.4 to 1 cm thick, consisting of minute sessile fruits, arranged around an axis. Surface rough and composite; broken surface shows a central axis and 6 to 12 fruitlets arranged around an axis. Odour is aromatic; taste is pungent producing numbness of the tongue.

Part used: Dried spikes

Active components: Piperine, piperidine, Piperlongumine, Pipernonaline, Sesamin, Piperundecalidine, Futoamide, Piplasterol, Volatile oil²⁴.

Research studies: The effect of the fruits of *P. longum* was studied and it study reveals significantly inhibited the histamine induced bronchospasm and also shows significant decrease in number of leukocytes for anti-allergic activity which is evaluated using milk induced leukocytosis.²⁵

***Piper betle*, Linn.**

Common names: Tamil: Vetrilai, English: Betal leaf, Telugu: Tamalapaku, Malayalam: Vetilla, Kannadam: Vilayadele, Sanskrit: Nagavalli, Hindi: Pan.

Distribution: Native to South or Southeast Asia, this climbing plant is commonly cultivated in these regions as well as in several island areas of the tropical western Pacific²⁶.

Description of the plant: A perennial root climber with semi woody stems. Leaves are oval or heart-shaped, smooth, shining and long-stalked leaves, with pointed apex and simple, alternate, cordate, acuminate or acute, entire and bright green, 7-10 cm (3-4 in.) long, and unequally rounded at the base, with 5-9 prominent veins²⁷.

Part used: Leaf

Active components: Arecoline, carvacrol, clavibetol, cadinene, caryophyllene, piperbetol, eugenol, isoeugenol, chavicol, safrole, anethole²⁸.

Research studies: The *piper betle* leaves, expressed calcium channel antagonism in ethyl acetate fractions and K (+) - induced contraction in guinea pig revealing its cholinomimetic activity.²⁹

CONCLUSION

Bronchial asthma stands as a major ailment for several decades. The above research studies reveal the effectiveness of herbs in Siddha system recommended for Bronchial asthma and the harmless treatment methods for the betterment of the society. The main aim of controlling the symptoms of bronchial asthma and prevention from its recurrence can be achieved by the usage of above drugs.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the Principal and Faculties of Post Graduate Department of Gunapadam (Pharmacology), Government Siddha Medical College, Chennai for their continual support, advice and expertise throughout this study.

REFERENCE

1. Bronchial asthma Fact sheet. <http://www.who.int/mediacentre/factsheets/fs206/en>
2. Side effects of bronchodilator medicines. <http://www.nhs.uk/conditions/bronchodilator-drugs/pages/side-effects.aspx>. 19th May 2014.
3. K.S.MurukaesaMudhaliyar.Siddha MateriaMedica (medicinal plants division).Indian medicine and homeopathy Dept, Chennai-600106.
4. Vaidyaratnam PS Varier.Indian medicinal plants. volume 1, Orient Longman Ltd, 160, Anna Salai, Madras, 600002; 7, 51, 106
5. Ram P.Rastogi.Compendium of Indian medicinal plants. Volume 3, central drug research institute, Lucknow publications and information directorate, New Delhi; 11, 15, 33, 184, 220, 237, 388, 452, 456, 677
6. Gupta Y K, KatyalJatinder, Kumar Gajendra, MehlaJogender, Katiyar C K, Sharma Naveen, YadavSatpal. Evaluation of antitussive activity of formulations with herbal extracts in Sulphur Dioxide (SO₂) induced cough model in mice. Indian Journal of Physiology and Pharmacology. 2009; 53(1): 61-66.
7. Vaidyaratnam PS Varier.Indian medicinal plants. volume 3, Orient Longman Ltd, 160 Anna salai, Madras, 600002; 268, 316
8. Antitussive effect of *Adhatodavasica* extract on mechanical or chemical stimulation-induced coughing in animals.Journal of ethnopharmacology, Volume 67, 1999;30(3), 361–365
9. Vaidyaratnam PS Varier.Indian medicinal plants. volume 2, Orient Longman Ltd, 160 Anna Salai, Madras, 600002; 305, 121, 259

10. Teotia, Anand Kumar Mishra, Rajneesh Kumar, Deepa, Vipin Kumar. Anti-asthmatic Potential of Some Medicinal Plants UVS. Asian Pac. J. Health Sci., 2014; 1(3): 155-161.
11. Vaidyaratnam PS Varier. Indian medicinal plants. volume 4, Orient Longman Ltd, 160 Anna Salai, Madras, 600002; 139, 168, 290
12. DivyaK, J.S T, S.K T, B.L P. Evaluation of Bronchodilator and Anti-Anaphylactic Activity Of Hydroethanolic Extract of Polyherbal Compound bharangyadi. IAJPR. 2013; 3(5): 4010-4016.
13. Limbasiya KK, Modi VR, Tirgar PR, Desai TR, Bhalodia PN. Evaluation of Anti-asthmatic Activity of Dried Whole Plant Extract of *Leucasaspera* Using Various Experimental Animal Models, International Journal of Phytopharmacology. 3(3), 2012, 291-298.
14. Patel PK, Patel KV and Gandhi TR. Evaluation of Effect of *Taxusbaccata* Leaves Extract on Bronchoconstriction and Bronchial Hyperreactivity in Experimental Animals. J Young Pharm. 2011; 3(1): 41-47.
15. Gilani AH, Shah AJ, Ghayur MN, Majeed K. Pharmacological basis for the use of turmeric in gastrointestinal and respiratory disorders. Life Sci. 2005; 76(26):3089-105.
16. Krup V, Prakash LH, Harini A. Pharmacological Activities of Turmeric (*Curcuma longa* linn): A Review. J Homeop Ayurv Med 2: 133, 2013, doi:10.4172/2167-1206.1000133 Page 2 of 4.
17. Pandey Vijayapandi, Vamsi Krishna, Annabathina, Siva Naga Srikanth B, Vankadari Manjunath, Praveena Boggavarapu, Ameen Kunhu Mohammed P, Konasani Rajendra Prasad and Kumarappan CT. *In Vitro* Anticholinergic and Antihistaminic Activities of *Acorus calamus* Linn. Leaves Extract. Afr J Tradit Complement Altern Med. 2013; 10(1): 95-101.
18. Gilani AH, Aziz N, Khurram IM, Chaudhary KS, Iqbal A. Bronchodilator, spasmolytic and calcium antagonist activities of *Nigella sativa* seeds (Kalonji): a traditional herbal product with multiple medicinal uses. J Pak Med Assoc. 2001; 51(3):115-20.
19. Surender Singh, Shyam Agrawal S. Anti-Asthmatic and Anti-Inflammatory Activity of *Ocimum sanctum*. Pharmaceutical Biology. 1991, 29(4):306-310
20. Vaidyaratnam PS varier. Indian medicinal plants. volume 5, Orient Longman Ltd, 160 Annasalai, Madras, 600002; 299, 387
21. Munasib Khan, Abdul Jabbar Shah, Anwarul Hassan Gilani. Insight into the Bronchodilator Activity of *Vitexnegundo*. Pharm Biol 2015; 53(3):340-4

22. Mohammad Hossein Boskabady, Saeed Alitaneh, and Azam Alavinezhad. *Carumcopticum* L.: A Herbal Medicine with Various Pharmacological Effects. Bio Med Research International, Volume 2014 (2014), Article ID 569087, 11 pages.
23. Gilania AH, Jabeena Q, Ghayura MN, Janbazb KH, Akhtarc MS. Studies on the antihypertensive, antispasmodic, bronchodilator and hepatoprotective activities of the *Carumcopticum* seed extract. Journal of Ethnopharmacology, Volume 98, Issues 1–2, 2005; 127–135.
24. Dr.K.S.Krishnanmarg. The treatise on Indian medicinal plants. Volume: 1, National Institute of Science Communication, CSIR, Newdelhi-110012; 29.
25. DhirenderKaushik, Ruby Rani, PawanKaushik, DishaSacher and JyotiYadav. In vivo and in vitro Anti-asthmatic Studies of Plant *Piper longum* Linn. International Journal of Pharmacology,2012, 8: 192-197
26. Piper betle – University of Hawaii at Manoa. http://manoa.hawaii.edu/botany/plants_of_micronesia/index.php/full-database/457-piper-betle
27. Pharmacognosy: Piper betle. <http://p-cognosy.blogspot.in/2008/08/piper-betle.html>, 25th Aug 2008.
28. Piper betle: globinmed. http://www.globinmed.com/index.php?option=com_content&view=article&id=79090:piper-betle-linn&catid=718
29. Gilani AH, Aziz N, Khurram IM, Rao ZA, Ali NK. The presence of cholinomimetic and calcium channel antagonist constituents in *Piper betle* Linn. Phytother Res. 2000; 14(6):436-42.



AJPHR is
Peer-reviewed
monthly
Rapid publication
Submit your next manuscript at
editor@ajphr.com / editor.ajphr@gmail.com