

**ANTI TUBERCULOSIS POTENTIAL OF SIDDHA HERBS - A REVIEW****Giftillda Selva Elsee T.^{*1}, Poonkuzhali S.², Helen Sathiya X.³ and Velpandian V.⁴**^{1,2}PG Scholar, Post Graduate Department of Gunapadam (Pharmacology), Government Siddha Medical College, Arumbakkam, Chennai, TN, India.³PG Scholar, Post Graduate Department of Maruthuvam (General Medicine), Government Siddha Medical College, Arumbakkam, Chennai, TN, India.⁴HOD, Post Graduate Department of Gunapadam (Pharmacology), Government Siddha Medical College, Arumbakkam, Chennai, TN, India.***Corresponding Author: Dr. Giftillda Selva Elsee T.**

PG Scholar, Post Graduate Department of Gunapadam (Pharmacology), Government Siddha Medical College, Arumbakkam, Chennai, TN, India.

Article Received on 19/10/2018

Article Revised on 08/11/2018

Article Accepted on 29/11/2018

ABSTRACT

Tuberculosis is a granulomatous infectious bacterial disease caused by *Mycobacterium tuberculosis*. *Mycobacterium tuberculosis* must gain entry into the body to produce tuberculosis commonly, the infection occurs by inhalation of droplets containing tubercle bacilli. The common site of lodgement is lower border of upper lobe or upper border of lower lobe because of adequate ventilation. Incubation period is about 4 – 8 weeks. The emergence of multi drug resistance strains of MTB and more recently extensively drug resistance TB poses a formidable challenge to the control of the disease there is a need to develop new drugs for the control of TB, particularly towards the multi-drug resistance and extensively drug resistant tuberculosis strains. The anti-tuberculosis activity of plants was proven by various examples, in the form of both essential oils and extracts. Various phytochemicals like alkaloids, xanthenes, flavonoids, tannins, triterpenes, quinones *etc.* were involved in anti-tubercular activity. In this review ten potential anti-tuberculosis herbs which includes *Piper longum*, *Allium cepa*, *Tinospora cordifolia*, *Withania somnifera*, *Allium sativum*, *Pueraria tuberosa*, *Ocimum basilicum*, *Psorelia corylifolia*, *Alpinia galangal*, *Justicia adhatoda* are discussed. This article provides a systematic review examined the effects of Siddha treatment for tuberculosis (TB), most potent herbal formulations and active substances present in plants and their medicinal applications in a scientific way.

KEYWORDS: *Anti tuberculosis activity, Mycobacterium tuberculosis, Siddha, Herbal formulations, Lungs.***INTRODUCTION**

Tuberculosis is a granulomatous infectious bacterial disease caused by *Mycobacterium tuberculosis*. *Mycobacterium tuberculosis* must gain entry into the body to produce tuberculosis commonly, the infection occurs by inhalation of droplets containing tubercle bacilli. The bacilli discharged from a pulmonary focus are brought out by the patient during coughing, spitting and sneezing as droplets. These infected tiny droplets of mucus get dried and become droplet nuclei. The droplets about 1 - 5 microns in diameter is prone to cause infection. The infection can also occur by ingestion.^[1] Globally more than one third of the world population approximately 2 billion are infected with the bacterium that causes TB.^[2]

The common site of lodgement is lower border of upper lobe or upper border of lower lobe because of adequate ventilation. Incubation period is about 4 – 8 weeks. The initial infection occurs in lungs or tonsil or GI tract. Symptoms are fever, fretfulness, loss of appetite, cough, wheeze *etc.* In 2014, 1.5 million people died of

Tuberculosis, of these people 0.4 million people were HIV Positive. Tuberculosis now annually causes more deaths worldwide than HIV. There were an estimated 9.6 million new cases of Tuberculosis in 2014.^[3]

The emergence of multi drug resistance strains of MTB and more recently extensively drug resistance TB poses a formidable challenge to the control of the disease there is a need to develop new drugs for the control of TB, particularly towards the multi-drug resistance and extensively drug resistant tuberculosis strains. There is also need to alleviate the shortcoming of current drug regime by developing safer, more effective and more affordable agents that can act over short periods of time. Medicinal plants have been a source of effective chemotherapeutic agents for various infectious diseases and there is growing interest in the development of therapeutic drugs of plant origin.^[4]

World Health Organization has also advocated that the medicinal plants would be the best source for obtaining a variety of drugs for malaria, tuberculosis and immune

compromised patients. Several secondary metabolites of plant origin that include a wide chemistry like alkaloids and flavonoids has already been in use as anti-viral, anti-bacterial, anti-amoebal and anti-cancer agents.^[5]

Many therapeutic measures from Siddha system of medicine available today which gives curative remedy to relieve symptoms and improve prognosis, which is a very positive impact on the quality of life of those affected. The use of medicinal herbs for prevention and treatment are major strategy exist in the ancient traditional medical practice of mankind.

In the treatment of tuberculosis, Siddha medicine has been identified as a potential benefit of therapy. This article provides a systematic review examined the effects of Siddha treatment for Tuberculosis (TB), with the most popular herbals and active substances present in plants and their medicinal usage in a scientific way.

THE FOLLOWING HERBS ARE HAVING ANTI TUBERCULOSIS ACTIVITY

1. Piper longum
2. Allium cepa
3. Tinospora cordifolia
4. Withania somnifera
5. Allium sativum
6. Pueraria tuberosa
7. Ocimum basilicum
8. Psorelia corylifolia
9. Alpinia galanga
10. Justicia adhatoda

1. Piper longum

Common name : Long pepper

Tamil name : *Tippili*

Family : Piperaceae

Distribution : Throughout India, in evergreen forests often cultivated.

A slender aromatic climber, rooting at the nodes, the branches erect, subscaudent, swollen at the nodes. The mature spikes collected and dried form the commercial form of tippali. Roots are known as tippalimulam.^[6]

Parts used: Roots, dried spikes.

Actions: anti-microbial, immunomodulatory, anti-oxidant activities.

Active principles: piperin, piperlongumine, pipelatin, brachyamide A, brachyamide B, brachystine, sterols, glycosides, asarinine.^[7]

After successful characterization of piperine from fruit extract of *Piper longum*, an anti-mycobacterial activity bioassay was performed against two multi drug resistant strains *Mycobacterium tuberculosis*. phytochemical analysis of *Piper longum* fruit extract, thus revealed that piperine is the most active ingredient of fruit extract of *Piper longum* plant that has significant activity against an array of pathogenic bacterial strains. This is the first report on bioactivity guided fractionation for lead

molecule having maximum antimycobacterial potential in *Piper longum* fruit.^[8]

2. Allium cepa

Common name: Onion

Tamil name: *Venkayam*

Family: Liliaceae

Distribution: Throughout India

A biennial or perennial herb with aromatic fleshy underground bulb; leaves linear, hollow, cylindrical and fleshy.

Parts used: bulbs, shoots and seeds.^[9]

Actions: anti-bacterial, expectorant, immunomodulatory, anti-oxidant, anti-spasmodic activities.

Active principles: quercetin, quercitrin, myricetin, kaempferol, allyl sulphide.^[10]

Aqueous extracts and ethanolic extracts of *Allium cepa* was observed to have anti-TB activity against *M. tuberculosis* H37Ra.^[11]

3. Tinospora cordifolia

Common name: Gulancha tinospora

Tamil name: *Amrutavalli*

Family: Menispermaceae

Distribution: Throughout India

A large extensively spreading glabrous, perennial deciduous twiner with succulent stems and papery bark. The surface of the stems appears to be closely studded with warty tubercles and the surface skin is longitudinally fissured.

Parts used: stem, leaves and roots.^[12]

Actions: anti-allergic, anti-histamine, expectorant, immunity booster, immunomodulator activities.

Active principles: columbin, tinosporaside, jatrorhizine, palmative, berberine, tembeterine, tinocordifolioside, phenylpropene, choline, tinosporic acid, tinosporal and tinosporon.^[13]

Chloroform and Ethanol extracts of *Tinospora Cordifolia* collected from south India were screened against three strains of mycobacterium tuberculosis using agarwell diffusion method. As per Result conclude that *Tinospora Cordifolia* contains principles active against *M. Tuberculosis*.^[14]

4. Withania somnifera

Common name: Winter cherry

Tamil name: *Amukkara*

Family: Solanaceae

Distribution: Throughout the drier parts of India.

An erect branching undershrub reaching about 150cm in height usually clothed with minutely stellate tomentum.

Parts used: roots, leaves and seeds.^[15]

Actions: anti-microbial, anti-bacterial, immunomodulatory activities.

Active principles: withanine, somine, somniferine, anferine and withanolides.^[16]

Withania somnifera against *M. tuberculosis* H37Rv. *Mycobacterium tuberculosis* activity was tested using minimal inhibitory concentration method (MIC). Aqueous extract of *W. somnifera* (0.01-1.0 mg/mL) had

significant effect against *M. tuberculosis*. The outcomes are possibly demonstrating a comprehensible evidence of the effective anti-tubercle activity of *W. somnifera*.^[17]

5. *Allium sativum*

Common name: Garlic

Tamil name: *Vellaiipuntu*

Family: Liliaceae

Distribution: Cultivated throughout India

A scapigerous foetid perennial herb with underground compound bulbs covered over by outer white thin scales and with simple, smooth, round stem surrounded at the bottom by tubular leaf sheath.

Parts used: Bulbs.^[18]

Actions: anti-microbial, immunomodulator, anti-bacterial, anti-oxidant activities.

Active principles: allicin, ajoene, allyl-methylsulfide, diallyl-sulfide, diallyl-disulfide.^[19]

Ethanol extract of garlic was prepared by maceration method. Minimum inhibitory concentration (MIC) was performed by using 7H9 middle brook broth dilution technique. MIC of garlic extract was ranged from 1 to 3 mg/ml; showing inhibitory effects of garlic against both non-MDR and MDR *M. tuberculosis* isolates.^[20]

6. *Pueraria tuberosa*

Common name: Indian kudzu

Tamil name: *Karikkummati*

Family: Fabaceae

Distribution: Throughout India

A large spreading tuberous herbaceous twiner with very large tuberous roots.

Parts used: Tuberous roots.^[21]

Actions: anti-microbial, anti-oxidant, anti-pyretic, immunity booster, rejuvenative and tonic.

Active principles: daidzein, malic acid, pterocarpens, hydroxytuberosone, B sitosterol glucoside, stigmaterol, tuberosin.^[22]

Pueraria tuberosa DC. (tuber) were tested on *Mycobacterium tuberculosis* H37Rv intracellularly using an epithelial cell (A549) infection model. The extracts found to be active intracellularly were further studied axenically under reducing oxygen concentrations. *P. tuberosa* (aqueous) showed bactericidal activity under microaerophilic and anaerobic conditions implying the influence of anaerobiosis on its efficacy.^[23]

7. *Ocimum basilicum*

Common name: Sweet basil

Tamil name: *Tirunetrapacchai*

Family: Lamiaceae

Distribution: Cultivated throughout India

An erect, aromatic, nearly glabrous branching herb, 60-90cm in height, branches green or purplish.

Parts used: Whole plant.^[24]

Actions: anti-microbial, anti-bacterial, anti-oxidant activities.

Active principles: eugenol, limonene, camphene, linalool, ocimene, terpineol, beta-caryophyllene, camphor octanane, methyl eugenol, methyl chavicol.^[25]

Nine compounds were assayed for antituberculosis activity which exhibited upto 49% inhibition of *M. tuberculosis* H37Rv at 6.25 µg/mL. These include one new compound bacilicin, the structure of which was elucidated based on 2D-NMR (HSQC, HMBC, COSY and NOESY) and Ms spectral analysis.^[26]

8. *Psorelia corylifolia*

Common name: Babchi seeds

Tamil name: *Karpokkarisi*

Family: Fabaceae

Distribution: Throughout India cultivated

An erect herbaceous annual, 60-120cm high with grooved and gland-dotted stems and branches.

Parts used: Seeds.^[27]

Actions: anti-microbial, anti-oxidant, anti-inflammatory, astringent activities

Active principles: isopsoralen, psoralen, bavachalcone, dehydriopsoralidin, methyl 4-hydroxybenzoate, psoralidin, corylin.^[28]

Crude methanolic extracts from *P. corylifolia* were found to have significant antimycobacterial activity against *M. aurum* (MIC=62.5 µg/ml). bakuchiol (**3**) from the seeds of *P. corylifolia*.^[29]

9. *Alpinia galanga*

Common name : Greater galangal

Tamil name : *Peraratthai*

Family : Zingiberaceae

Distribution: In Kerala, in hilly regions, all around TamilNadu

A large glabrous shrub, leaves opposite, short petioled upto 15cm long, main nerves about 8 pairs.

Parts used: Root.^[30]

Actions: Anti-bacterial, Anti-fungal, Anti-oxidant.

Active Principles: 1, 8 cineol, α -fenchyl acetate, β -farnesene, β -bisabolene

A. galanga exhibits anti *M.tb* activity with multiple modes of action. Since the activity of the extracts was observed under reducing oxygen concentrations, it may be effective in treating the dormant and non-replicating bacteria of latent TB.^[31]

10. *Justicia adhatoda*

Common name: Malabar Nut

Tamil name: *Adathodai*

Family: Acanthaceae

Distribution: In Kerala, in hilly regions, all around TamilNadu

A large glabrous shrub, leaves opposite, short petioled upto 15cm long, main nerves about 8 pairs.

Parts used: Whole plant

Actions: Expectorant, Styptic, Anti spasmodic.^[32]

Active principles: Six different quinazoline alkaloids (vasicoline, vasicolinone, vasicinone, vasicine, adhatodine and anisotine) were found in the leaf of *Justicia adhatoda* (*J.adhatoda*).

The presence of the peaks obtained through HPLC indicated the diverse nature of alkaloid present in the leaf. The enzyme β -ketoacyl-acyl-carrier protein synthase III that catalyses the initial step of fatty acid biosynthesis (FabH) via a type II fatty acid synthase has unique structural features and universal occurrence in *Mycobacterium tuberculosis* (*M.tuberculosis*). Thus, it was considered as a target for designing of anti-tuberculosis compounds.^[33]

CONCLUSION

Science has long acknowledged the value of healing substances found in nature. There has been a resurgence of interest, both scientifically and popularly, in the utilization of natural approaches. Numerous studies on the pharmacology of medicinal plants have been accomplished, since they constitute a potential source for the production of new medicines and may enhance the effects of conventional antimicrobials, which will probably decrease costs and improve the treatment quality. The antituberculosis activity of plants was proven by various examples, in the form of both essential oils and extracts. Various phytochemicals like alkaloids, xanthenes, flavonoids, tannins, triterpenes, quinones *etc.* were involved in anti-tubercular activity. Thus, this property can be a promising ally in the development of medicines necessary to combat the increasing number of bacterial strains that become resistant to conventional antibiotics. Furthermore, in depth studies to determine the active component(s) could lead to potential formulations that serve not only as adjunct to current therapy but as options in emerging clinical drug resistance.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the Principal and Faculties of Post Graduate department of Gunapadam (Pharmacology), Government Siddha Medical College, Chennai for their support and advice.

REFERENCE

1. Tuberculosis guy p. youmans G.P. pp. 53.
2. Centres for Disease Control (2005). Worldwide emergence of *Mycobacterium tuberculosis* with extensive resistance to second-line drugs. *Trends in Tuberculosis – United States, MMWR*, 55(10).
3. <http://www.tbfact.org/tb-statistics-India/>.
4. The anti-mycobacterial activity of *Tinospora Cordifolia* medicinal plant used for the treatment of leprosy and Tuberculosis. *International Journal of Scientific & Engineering Research*, Volume 4, Issue 6, June-2013 2953 ISSN 2229-5518.
5. Chandan Singh et al., Anti-mycobacterial activity of *Piper longum* L. fruit extracts against multi drug resistant *Mycobacterium* Spp.
6. Orient Longman, *Indian Medicinal Plants* Volume 4, pp. 290.
7. Suresh kumarji et al., Overview for various aspects of the health benefits of *Piper longum* Linn. Fruit
8. Chandan Singh et al., Anti-mycobacterial activity of *Piper longum* L. fruit extracts against multi drug resistant *Mycobacterium* Spp.
9. Orient Longman, *Indian Medicinal Plants* Volume 1, pp. 88.
10. S.Y.Gazuwa et al., The Phytochemical composition of *Allium cepa* / *Allium sativum* and the effects of their aqueous extracts (cooked & raw forms) on the lipid profile and other hepatic biochemical parameters in female albino wistar rats.
11. A.Sivakumar and G. Jayaraman , Anti-tuberculosis activity of commonly used medicinal plants of south India. School of Bio Sciences and Technology, Vellore Institute of Technology University, Vellore, 632014 Tamil Nadu, India.
12. Orient Longman, *Indian Medicinal Plants* Volume 5, pp. 283.
13. N M Reddy et al., *Tinospora cordifolia* Chemical Constituents and Medicinal Properties: A Review.
14. The anti-mycobacterial activity of *Tinospora Cordifolia* medicinal plant used for the treatment of leprosy and Tuberculosis. *International Journal of Scientific & Engineering Research*, Volume 4, Issue 6, June-2013 2953 ISSN 2229-5518.
15. Orient Longman, *Indian Medicinal Plants* Volume 5, pp. 409.
16. Ruchi Tiwari et al., Ashwagandha (*Withania somnifera*): Role in safeguarding health, immunomodulatory effects, combating infections and therapeutic applications: A review.
17. Periyakaruppan Adaikkappan et al., Anti-mycobacterial activity of *Withania somnifera* and *Pueraria tuberosa* against *Mycobacterium tuberculosis* H37Rv.
18. Orient Longman, *Indian Medicinal Plants* Volume 1, pp. 93.
19. Antimycobacterial and antibacterial activity of *Allium sativum* bulbs V.Viswanathan, A.G.Phadatare, and Alka Mukne *Indian J Pharm Sci*, 2014 may-jun; 76(3): 256-261.
20. Abdul hannan et al., Anti-mycobacterial activity of Garlic (*Allium sativum*) against multi-drug resistant and non-multi-drug resistant *Mycobacterium tuberculosis*. *Pakistan journal of pharmaceutical sciences* 24(1):81-5 · January 2011.
21. Orient Longman, *Indian Medicinal Plants* Volume 4, pp. 391.
22. Amal Maji et al., *Pueraria tuberosa* ; A Review on its phytochemical & therapeutic potential.
23. Purva D. Bhattar et al., Activity of Medicinal Plant Extracts on Multiplication of *Mycobacterium tuberculosis* under Reduced Oxygen Conditions Using Intracellular and Axenic Assays.
24. Orient Longman, *Indian Medicinal Plants* Volume 4, pp.160.
25. Md Shahidul Islam (4 february 2011) Transient receptor potential channels. Springer. pp.50-. ISBN.
26. Siddiqui BS et al., Evaluation of the antimycobacterium activity of the constituents from

- Ocimum basilicum against Mycobacterium tuberculosis.
27. Orient Longman, Indian Medicinal Plants Volume 4, pp. 374.
 28. Psoralea corylifolia Linn.- “kushtanashini” P.S. Kushboo, V.M. Jadhav, V.J. Kadam, and N.S. Sathe pharmacogn rev. 2010 jan-jun.
 29. Sandra M. Newton et al., The evaluation of forty-three plant species for in vitro antimycobacterial activities; isolation of active constituents from *Psoralea corylifolia* and *Sanguinaria Canadensis*.
 30. Orient Longman, Indian Medicinal Plants Volume 1, pp 120.
 31. Pooja Gupta et al., Evaluating the Anti-mycobacterium tuberculosis activity of *Alpinia galanga* (L.) Willd. axenically under reducing oxygen conditions and in intracellular assays.
 32. Orient Longman, Indian Medicinal Plants Volume 3, pp. 268.
 33. Deepak Kumar Jha et al., Detection and Confirmation of Alkaloids in Leaves of *Justicia adhatoda* and Bioinformatics Approach to Elicit Its Anti-tuberculosis Activity. Received: 3 January 2012 / Accepted: 6 August 2012.