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Anti-Tubercular effects of medicinal plants: A short review

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Abstract
Tuberculosis is considered as one of the deadliest diseases in India and rest of the world. The best source of drugs without hazardous effect to human systems is plant source. Herbs are the wonder source of phyto constituents which have varied inhibitory effects on deadly diseases. Various synthetic medicines are being used in the treatment of tuberculosis that are proved to cause anarchic side effects. Medicines derived from plants are nontoxic and work effectively unlike synthetic drugs. In this short review an attempt has been made to review some of the medicinal plants which proved to be anti tuberculic such as *Globularia alypum*, *Ranunculi Ternati*, *Ipomea turpethum*, *Vitex trifolia*, *Withania somnifera*, *Humulus lupulus* etc., of about 18 species have been reviewed.

Keywords: Tuberculosis, Drugs, Herbs, Synthetic drugs.

Introduction

Tuberculosis remains one of the major deadliest infectious diseases for humans [1]. Each year approximately 2 million people die of tuberculosis and about 9 million people get effected [2]. The prevalence of tuberculosis is increasing because of patients immuno deficiency virus (HIV), and bacterial resistance [3]. In India approximately 2 million people acquire TB every year [4]. Tuberculosis (TB) is an infectious disease that primarily affects the lungs and is caused by the slow-growing acid-fast bacillus Mycobacterium tuberculosis [5]. The increasing incidence of multi drug resistant and extensive drug resistant–tuberculosis highlight the urgent need to search for newer anti-tuberculosis drugs [6]. Natural products, either as pure compounds or as standardized plant extracts, provide unlimited opportunities for new drug leads because of the unmatched availability of chemical diversity [7]. The best source of drugs without hazardous effect to human systems could be the plant source and this has been proved by the Traditional healing system and the recent studies conducted on the experimental animals [8]. Lot of information from the traditional healers still to be known and has to be gathered and necessarily formulated [9].

Types and Symptoms of Tuberculosis [10]

1. Latent TB.
In this condition of TB infection, the bacteria remain in the body in an inactive state and cause no symptoms. Latent TB, also called inactive TB or TB infection, isn't contagious. It can turn into active TB, so treatment is important for the person with latent TB and to help control the spread of TB in general.

2. Active TB. This condition makes person sick and can spread to others. It can occur in the first few weeks after infection with the TB bacteria, or it might occur years later.

Signs and symptoms of active TB include [10]

1. Coughing that lasts three or more weeks
2. Coughing up blood
3. Chest pain, or pain with breathing or coughing
4. Unintentional weight loss
5. Fatigue
6. Fever
7. Night sweats
8. Chills
9. Loss of appetite

Drugs used to treat Tuberculosis [11]

Active tuberculosis, particularly drug-resistant strain, will require several drugs at once. The most common medications used to treat tuberculosis include:
1. Isoniazid
2. Rifampin (Rifadin, Rimactane)
3. Ethambutol (Myambutol)
4. Pyrazinamide

Add-on therapy drugs to the current drug-resistant including:
1. Bedaquiline
2. Delamanid
3. PA-824
4. Linezolid
5. Sutezolid

Anti-Tubercular Plants

Globularia alypum (Globulariaceae)
The susceptibility of M. tuberculosis strain H37Rv to all extracts was evaluated using a colorimetric micro assay based on the reduction of MTT (3-(4, 5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) to formazan by metabolically active cells. Anti-tuberculosis activity was obtained for the petroleum ether extract [12].

***Ranunculi Ternati* Radix** (Ranunculaceae)
Lin Zhang *et al*., (2014), investigated the anti-tuberculosis activities of Ranunculi Ternati Radix extracts to demonstrate the effect of active part of Ranunculi Ternati Radix, which could be enriched through macroporous resin, on mycobacterium tuberculosis infections. EEPMR possessed better anti-tuberculosis effects than other extracts and Radix

Ranunculi Ternati Capsules. This supported the use of macroporous resin to enrich the active part of Ranunculi Ternati Radix to cure mycobacterium tuberculosis infections [13].

Barlaria buxifolia (Acanthaceae)
Shivakumar *et al*., (2012) [14] evaluated the antimycobacterial activity against M. tuberculosis H37Rv using the microplate almar bluedye assay has been carried out. Extracts of roots, stem and leaves of the Barlaria buxifolia Linn from the family Acanthacea, demonstrated significant antimycobacterial activity. This study shows that ethanol extract of the stem and leaves was found to be active at minimum inhibitory concentrations (MIC) of 25 and 50µg/ml and provides potential for the development of urgently needed novel antituberculous therapeutics [14].

Ipomea turpethum (Convolvulaceae)
Rathnan *et al*., (2013) investigated the callus induction and the antituberculosis activities of leaf and callus extracts of Ipomea turpethum. The leaf segments of Ipomea turpethum were cultured on MS medium supplemented with BAP, Kinetin and combination of both. Maximum callus was recorded on medium containing 2ppm BAP. The first callus induction was observed after two weeks of incubation. The antituberculosis properties of leaf and callus extracts were screened by broth dilution method. Among the extract tested, significant inhibitory activity was observed in ethanol extract of leaf callus, the aqueous extract did not show any significant activity [15].

Vitex trifolia (Verbenaceae)
A new halimane diterpenoid, 13-hydroxy-5(10),14-halimadien-6-one (1) and two new labdane diterpenoids, 6α,7α-diacetoxy-13-hydroxy-8(9),14-labdadien (2) and 9-hydroxy-13(14)-labden-15,16-olide (3), were isolated for the first time, along with fifteen known compounds, from the hexane soluble fraction of methanolic extract of Vitex trifolia leaves. The structures of these new diterpenoids were elucidated by spectral analysis. Their relative configurations were established using analysis of NOESY correlations and coupling constants observed in 1H NMR. Compounds 2, 3 and another known diterpenoid, isoambreinolide (4) were evaluated for antitubercular activity. 3 and 4 exhibited antitubercular activity (MIC=100 and 25_g/ml) against Mycobacterium tuberculosis H37Rv in BACTEC-460 assay [16].

Humulus lupulus (Cannabibaceae)
Serkani et al., (2012), evaluated the effect of Humulus lupulus alcoholic extract on rifampin-sensitive and resistant isolates of Mycobacterium tuberculosis. The results of the study of hops antimycobacterial effect showed that different concentrations of hops ethanolic extract (4 and8 mg/ml) had a remarkable inhibitory effect on sensitive and resistant phenotype of M. tuberculosis [17].

Withania somnifera (Solanaceae)
Adaikkappan *et al*., (2012), evaluated the anti-mycobacterial activity of Withania somnifera. *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 [18].

Table 1: Shows the plants having anti tuberculic activity

S. No	Plant Name	Family	Extract	Reference
1	*Ocimum basilicum*	Lamiaceae	Methanolic	19
2	*Croton macrostachyus*	Euphorbiaceae	Methanolic	19
3	*Calpurnia aurea*	Leguminosae	Methanolic	19
4	*Eucalyptus camaldulensis*	Myrtaceae	Methanolic	19
5	*Artemisia abyssinica*	Asteraceae	Methanolic	19
6	*Cassia occidentalis*	Caesalpiniaceae	Petroleum Ether, Benzene, Chloroform, Methanol, Water.	20
7	*Camellia sinensis*	Theaceae	Petroleum Ether, Benzene, Chloroform, Methanol, Water.	20
8	*Salvadora persica*	Salvadoraceae	Methanolic	21
9	*Euphorbia scarlatica*	Euphorbiaceae	Methanolic	21
10	*Cordia sinensis*	Boraginaceae	Methanolic	21
11	*Cuminum cyminum*	Apiaceae	-	22

Conclusion
Herbs are the wonder source of phyto constituents which have varied inhibitory effects on deadly diseases. Each of the phytochemical would have its own mechanism to inhibit the diseases. Tuberculosis is one of the deadly disease till known. Various synthetic medicines are being used in the treatment of tuberculosis. Synthetic drugs are proved to cause anarchic side effects. Plant based source drugs are non-toxic and work effectively unlike synthetic drugs. The above mentioned plants are proved to be anti tuberculic. This review would be useful for the scientific world to find efficient herbal based drugs to cure tuberculosis effectively. It is the responsibility of the scientific community to do much greater work for the effective herbal medications [23-24].

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