



Medicinal Plants and their Anti-Tuberculous Property

Gaurav Tyagi

Applied Microbiology, Banaras Hindu University

ABSTRACT

Mycobacterium tuberculosis, the causative agent of tuberculosis, was responsible for the infection in approximately 9 million people worldwide in 2013 alone. All people who get infected with TB don't develop active disease. Those who don't develop the active diseases are referred to as "latent TB" cases. As per WHO, people with active disease might infect 10-15 people in their vicinity. Non-compliance of the available drug regime leads to the emergence of drug resistance tuberculosis which is even more difficult to manage. There is a constant need to upgrade the armamentarium that we have for the treatment of tuberculosis. In the present situation, synthetic as well as drugs from the natural sources might play an important role in combating the pathogen. India with a vast variety of fauna can be a good contributor to the ever expanding field of natural anti-tuberculous agents.

KEYWORDS : *Mycobacterium tuberculosis*, Anti-tuberculosis activity, Herbal Plants.

Introduction

Even when the society debated the existence of microbes, it was well known that some of the plants extracts have healing effect. The use of the plants for the treatment of human disorders was a well-established practice worldwide. In the present time a wide range of scientific data is available that point towards the efficiency and efficacy of the various species of plant kingdom as antimicrobial agents. 61% of 877 new molecules that have been introduced as drugs from 1982-2002 were directly or indirectly related to the plant active molecules (NCI USA) (Newman *et al.*, 2003). India has a tradition of using medicinal plant for the treatment of various diseases since antiquity as imbibed in Ayurveda. Approximately 7500 plant species have been reported to be used in traditional Indian Medicine. India is endowed with the rich biodiversity of the Himalayas as well as Western Ghats and is 7th among the total 16 countries that account 70% of total plant biodiversity (sanjappa 2005).

The role of plant extracts as an anti-tuberculous agent is also a hot topic of research among the various TB research groups. Tuberculosis, which is caused by *Mycobacterium tuberculosis*, leads to 1.5 million deaths per year worldwide (WHO report 2014). Non-compliance of the recommended first line drugs lead to the emergence of MDR (Multi Drug Resistance) and XDR (Extreme Drug Resistance) strains that have further increased the threat to the mankind. In 2013, 23289 (around 25000) people were diagnosed with MDR-TB in India alone (RNTCP Report 2014). The high rate of emergence of MDR & XDR strains has put the pressure on the scientific community for the discovery of anti-mycobacterial agents. Medicinal plants provide new vistas in the field of anti-mycobacterial drug discovery because of their external biological and inherent chemical diversity.

Side effects of the anti-tuberculous drugs

Current drug regime that is being used today for the treatment of tuberculosis, although is effective, but has adverse effects on the body. First line drugs and second line drugs that are being used today are, Pyrazinamide, Ethambutol, Isoniazid, ethionamide, ofloxacin, flouroquinolones, Streptomycin, Kanamycin, Rifampicin, Para-aminosalicylic acid, rifabutin etc. Many of the medicine stated above have significant side effects on the liver, kidney and skin (Daphne Y *et al.*, 2003). Pyrazinimide, Rifampicin (Jasmer RM *et al.*, 2002) as well as isoniazid (Ferebee SH, 1970) may cause hepatitis.

Interactions of anti-mycobacterial drugs with other medications have also been reported. In case of co-infection with HIV, anti-retroviral therapy may have little effect because rifampicin or rifabutin interacts with these drugs and decreases their efficacy. Antiretroviral drugs i.e. protease inhibitors in turn also decreases the efficiency of rifabutin metabolism enzymes which inhibits its metabolism (Eagling VA *et al.*, 1997) in liver and intestine that leads to toxicity (Iatsimirskaia E. *et al.*, 1997). Therefore use of plants in combating this disease may prove to be very fruitful

Plants and their effect on *Mycobacterium tuberculosis*

In Vedic times tuberculosis was known by the name of *Yakshama*,

which was later scripted as *Rajayakshama* in Ayurveda (Vasanthakumari R, 2007). Later streptomycin proved to be very effective in the management of tuberculosis but with the emergence of drug resistant tuberculosis it was soon realized that discovery of new and effective drugs is the need of the hour for tuberculosis management. Research on the anti-tuberculous property of various medicinal plants has started to emerge lately. Various plants have shown the promising results eg *Soraleacorylifolia*, *Sanguinaria Canadensis*, *Salvia hypergeia*. (Newton SM *et al.* 2002) (Ulubelen A *et al.* 1988). Study carried out by Gupta *et al.* have recently confirmed the activity of extracts of *Acalypha indica*, *Adhatodavasisca*, *Allium cepa*, *Allium sativum* and *Aloe vera* against MDR-TB (Gupta Ret. *al.*, 2010). Although active molecules involved in the inhibition are not known. Much work needs to be done to gain insight into the active molecules that are present in them.

Conclusion

It is a well-established fact that currently used anti-tuberculous therapy as well as its interactions with other medications has adverse effect on the body. Emergence of drug resistance tuberculosis has further complicated the problem. Drug Resistance tuberculosis poses a major threat in the developing countries especially India where we have large burden of TB patients (WHO report 2014). According to WHO report 2013 the estimated incidence of TB in India alone is 2.1 million out of 9 million cases globally. Also it is estimated that approximately 40 percent of Indian population has TB out of which vast majority has latent rather than active infection. Majority of synthetic drugs are although effective but have anathema of side effects. Various studies have pointed towards the ability of various plants crude extract against *Mycobacterium tuberculosis*. Active research on the subject is required to identify active molecules of plant origin that have already been proved to be useful against drug sensitive as well as drug resistant tuberculosis plants being a natural source of molecules with anti-tuberculous properties can overcome the harmful side effects of prolonged anti-tuberculosis drug therapy. What needs to be done is an active involvement of the researchers from all spheres of sciences to come together and explore the possibilities of plants active molecules in combating the various infectious agents including tuberculosis. Encouraging the drug therapy development based on medicinal plant extracts will be a great relief for the patients from side effects of present treatment. This would also lead to a huge thrust to preserve natural reservoirs of herbal plants of which India is the leading repository. The vast variety of flora of the Western Ghats and Himalayas needs to be conserved as their conservation is the only key to the open new vistas in the field of herbal medicine. Therefore initiative by Govt. of India in establishing a dedicated ministry i.e. Ministry of AYUSH is a welcome step in this direction. It must also work in popularizing the importance of Yoga, Ayurveda etc. in the overall well-being of an individual not only in India but across the globe. "Back to Ayurveda" might make an important contribution to social as well as economic welfare of the people of India.

REFERENCES

- Central Tuberculosis Division (2014) Tuberculosis India 2014. Annual Report of the Revised National Tuberculosis Control Programme. Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India. | Daphne Y, Chantal V, Marthe P, Isabelle P, Isabelle R & Dick M 2003. 'Incidence of Serious Side Effects from First-Line Antituberculosis Drugs among Patients Treated for Active Tuberculosis'. *Am J Respir Crit Care Med*, vol. 167, pp. 1472–1477. | Eagling VA, Back DJ & Barry MG 1997: Differential inhibition of cytochrome p450 isoforms by the protease inhibitors, ritonavir, saquinavir, and Indinavir'. *Br J Clin Pharmacol*, vol. 44, pp. 190–4. | Ferebee, S. H. 1970. Controlled chemoprophylaxis trials in tuberculosis: a general review. *Adv. Tuberc. Res.* 17:28–106. | Gupta, R., B. Thakur, P. Singh, H.B. Singh, V.D. Sharma, V.M. Katoch and S.V. Chauhan, 2010. Antituberculosis activity of selected medicinal plants against multi-drug resistant *Mycobacterium tuberculosis* isolates. *Indian Journal of Medical Research*, 131: 809-813. | Iatsimirskaia E, Tulebaev S & Storozhuk E. 'Metabolism of rifabutin in human enterocyte and liver microsomes: kinetic parameters, identification of enzyme systems, and drug interactions with macrolides and antifungal agents'. *Clin Pharmacol Ther*, vol. 61, pp. 554–62. | Jasmer RM, Saukkonen JJ, Blumberg HM, Daley CL, Bernardo J, Vittinghoff E, King MD, Kawamura LM & Hopewell PC, 2002. 'Short-Course Rifampin and Pyrazinamide for Tuberculosis Infection (SCRIPT) Study Investigators. Short-course rifampin and pyrazinamide compared with isoniazid for latent tuberculosis infection: a multicenter clinical trial'. *Ann Intern Med*, vol. 137, pp. 640–647. | Newman, D.J., Cragg, G.M., Snader, K.M., 2003. Natural products as sources of new drugs over the period 1981–2002. *Journal of Natural Products* 66:1022–1037. | Newton SM, Lau C, Gurcha SS, Besra GS, Wright CW. The evaluation of forty-three plant species for *in vitro* antimycobacterial activities: isolation of active constituents from *Psoralea corylifolia* and *Sanguinaria canadensis*. *J Ethnopharmacol* 2002; 79 : 57-67. | Sanjappa, M., 2005. Plant diversity in India—status, conservation and challenges (P. Maheshwari Medal Award Lecture). In: XXVIII Conference of Indian Botanical Society, Oct. 24–26, 2005, B.S.I., Dehradun, pp. 5–6 | Ulubelen A, Euren N, Tuzlaci E, Johanson C. Diterpenoids from the root of *Salvia hypergeia*. *J Nat Prod* 1988; 51 : 1178- 83. | Vasanthakumari R. "Text book of microbiology": BI Publications, New Delhi 2007. | WHO, Global Tuberculosis Report 2014, 2014.