Chapter-1
VA-MYCORRHIZAL STUDIES IN SOME IMPORTANT MEDICINAL PLANTS

INTRODUCTION

It is well known that plants generally owe their virtues as medical agents to the active principles present in them. The interest on medicinal plants has increased considerably in recent years. Apart from the therapeutic values described in ancient texts and current interpretations by ayurveda specialists, laboratories in several countries have initiated the study and research on the efficacy of better-known medicinal plants. Because of their secondary metabolites such as alkaloids, tannins, essential oils and other chemical constituents these medicinal plants are very important which are employed in drug preparation. According latest literature more than 12,000 medicinal plants are exploited all over the world for their potential chemical constituents. The western countries are involved in doing advanced research with reference to the biomass production and enhancement in chemical content.

The use of medicinal plants in India can be traced thousands of years ago with the earliest mention in the Rigveda written between 4500 and 1600 B.C. Ayurveda had a glorious past record even during Buddhist times. It was practically taught in Universities of Nalanda and Taxasila. So, in the dawn of human cultural evolution, the art of curing was essentially magical (Pardal, 1937; Lain Entralgo, 1982; Naranjo, 1984). The Egyptian king Pharaohs sent team of men far and wide in search of medicinal plants. Alexander the great
emperor, a student of Theophrastus (Father of Botany), sent his team to Asia to collect the information on the cultivation of medicinal plants. In the early part of 19th century, botanical studies were conducted on most useful medicinal plants. The rich heritage of China is still very alive with some of the written records dating from the beginning of the Christian era. The traditional knowledge of the medicinal importance of plants from Africa, South America, China and India has given several new drugs to modern medicine. Even today, a considerable bulk of Ayurvedic knowledge is in the form of ancient palm leaf manuscript hidden in remote libraries and private collections and few individuals.

A number of plant-based drugs (Vincristine, Quinine, Recerpine, Coumarins etc.) are still a part of standard therapy, which does not have any synthetic substitutes. Like this several other plant products are used in formulations that are sold across several countries. So the role of plants in standard therapy will virtually be enhanced several fold in future, provided we make the base needed for it. Some alkaloids, volatile oils and other compounds of plant origin have served to clarify the difference between the normal and pathological mechanism of action of some medicinal mediators. Today, medicinal costs putting it beyond the reach of the vast majority of the world’s population. Standard (scientifically prepared) medicines serve only 30-35% of total population in developing countries (Naranjo, 1981 and 1995). So the rest of the population depends on the traditional medicines, which is based on the use of easily accessible low cost medicinal plants.
The following aspects are made to use of medicinal plants desirable.

1. Available with low cast, while the new synthetic drugs are not accessible to majority of people.
2. Often they are only resources available.
3. Have less harmful side effects and hence their direct use got little risk of disorders.
4. Presence of active compound like alkaloids, glucosides, volatile compounds etc., justify the use in treatments of many diseases.

It has been seen that some natural products suffer from certain disadvantages like, they occur in minute quantities in source material, poor solubility, stability, absorption and failure to reach the target. In current times the need to study medicinal plants in details from various points of view is generally well recognized.

Recognizing the merits of wider usage of medicinal plants and research since 1977, the WHO (World Health Organization) has encouraged the study of traditional medicine in the hope of deriving benefits for the world population. WHO has suggested the government should plan a role for the favorable aspects of used medicinal plants in their primary health care procedures.

It is well recognized that, VAMF influences the plant growth, and lead to enhancement of biomass production. Vittadiny in (1842) proposed tree rootlets are nourished by certain fungal mycelia, which mantle them. Later this hypothesis formed the bases for the theory of mutalistic symbiosis by Frank.
(1885) who named the fungus as “Mycorrhizae”. Early pot experiments conducted by Mosse (1973) clearly demonstrated the use of VA-mycorrhizal fungi as biofertilizer for plants better growth and productivity. There are conflicting reports on the association of VAM in medicinal plants. Mohankumar and Mahadevan (1984) said that medicinal plants are non mycorrhizal because of their secondary metabolites. However, Abbott and Rabson (1981) and Davis et al., (1984) reported that medicinal plants had secondary metabolites with VAMF in their root system. Taber and Trappe (1982) reported association of VAMF in scaly leaves and roots of ginger. Selvaraj and Subramanian (1990) reported incidence of VAM fungi in ten medicinal plants. Lakshman and Raghavendra (1997) have recorded VAM association in forty medicinal plants from Karnataka.

The beneficial effects of VAM fungi on plants has been studied by different workers (Mosse and Hayman, 1971; Khan, 1972; Powell, 1979) VAMF association in tropical plants like legumes, cereals, forage crops, oil seed crops, forest plants, plantation crops were studied by many workers (Gerdmann, 1964; Trappe, 1981; Thaper and Khan, 1985; Manjunath and Bagyaraj, 1984 and 1986; Gianinazzi et al., 1988; Manoharachary et al., 1986; Mohankumar and Mahadevan, 1988; Sharma and Roy, 1991).

The aim of mycorrhizal research is to utilize these fungi to accelerate the growth and productivity of plants in question with reduced need for the fertilizers and water. The growing necessity to understand the diversity of life contained within a gram of soil as well as intricacies of lining these living entities to terrestrial life in general, provided, the impetus to work on VAM
association in medicinal plants. The literature survey clearly indicates that, there is much to be digged out from the soil about VAMF, their association and their role with reference to the productivity of medicinal plants.

However, the studies are very meagre on medicinal plants using VAMF inoculation to understand growth response, biomass production and P uptake and changes in the chemical constituents of VAM inoculated medicinal plants. Therefore, there is need of research in improving the production of native medicinal plant drugs in relatively shorter period and lower expense by utilizing biological organisms like vesicular arbuscular mycorrhizal fungi.

Keeping all these in mind, the present study has been undertaken to assess VAM and its influence on growth, nutrients uptake, biomass production, and change in medicinally important chemical components especially with regard to volatile oil and its constituents in medicinal plants.

The selected medicinal plants are

1. *Coleus amboinicus* Lour.
2. *Ocimum basilicum* Linn.
4. *Ruta chalepensis* Linn.
A brief description of experimental plants


Family : *Lamiaceae*
Kannada name : Dodda patre (Ajwanada ele)
Hindi name : Patharchur
English name : Indian borage

The plant is large succulent herb with aromatic leaves. Plants produce pale purple flowers, commonly cultivated in gardens, nurseries throughout India. It is native of East Indies. The thick fleshy leaves are characterized by the pleasant aromatic odour and pungent taste, usually used for flavouring meat and salad, and it is good borage for wines and beer.

Parts used: Whole plant.

Properties and Medicinal values: Plant juice is used for urinary diseases, vaginal discharges, in dyspepsia, asthma, chronic, cough, epilepsy, toxic to *Aspergillus flavus* and *Aspergillus niger*. 
2. *Ocimum sanctum* Linn. (*Ocimum tenuiflorum* Linn.)

Family : *Lamiaceae*
Kannada name : Tulasi
Hindi name : Tulsi
English name : Holy basil / Sacred basil

An erect much branched softly pubescent under shrub, grow up to 30-60cm height with red or purple sub quadrangular shape stem branches. Leaves are simple, opposite, elliptic, oblong, obtuse or acute, entire, serrate or dentate, pubescent on both sides. Minutely gland dotted, petioles slender, hairy. Flowers purplish in elongated racemes in close whorls, stamens exerted, and upper pair with a small bearded appendage at the base. Fruit nutlets, smooth, non-mucilaginous when wetted.

Parts used: Whole plant.

Properties and medicinal values: Stimulant, diaphoretic and expectorant. Used in catarrh, bronchitis, ringworm, cutaneous disease, stomachache, malarial fevers, genito urinary disorders, and asthma etc. Antifungal to species like *Aspergillus flavus* Link. *A.parasiticus* Speare. I has got insect repelling properties (mosquito). Antibacterial to species like *Mycobacterium tuberculosis* and *Micrococcus pyrogens* var.aureus. Active against *Salmonella typhosa* and *Escherichia coli*. 
3. *Ocimum basilicum* Linn

**Family**: *Lamiaceae*
**Kannada name**: Kamkastoori
**Hindi name**: Babul
**English name**: Sweet basil / Common basil

The plant is erect, aromatic, branched herb grows up to 60-90 cm height, stem green or purple. Cultivated throughout India, found wild indifferent places. Leaves simple, opposite, ovate, acute, entire or toothed, glabrous on surfaces, flowers white or purple. Native of central Asia and Northwest India.

**Parts used**: Whole plant.

**Properties and Medicinal values**: Plant is bitter, aromatic, anti-inflammatory, alexipharmic, appetizing, digestive, stomachic, expectorant, insecticidal, antibacterial etc. Used for ringworms, piles, as flavoring agent for confectionary, baked goods, tomato pastes, vinegars, perfumes, soap perfumes.
Effective against houseflies, mosquitoes, *Salmonella typhosa* and *Aspergillus flavus*.
4. *Ruta chalepensis* Linn. (*Ruta graveolens* L. var. angustifolia sensu Hook. f.)

Family : *Rutaceae*
Kannada name : Satap
Hindi name : Satari
English name : Garden rue/Common rue

It is aromatic perennial herb grows up to 75 cm height, cultivated in Indian gardens. Leaves compound, shortly petiolate, ultimate segments oblong or obovate-oblong, with yellow flowers and capsule type of fruits.

Parts used: Whole plant

Properties and Medicinal values: The plant is bitter, laxative, acrid, diuretic, aphrodisiac, digestive. Useful in vitated conditions of kapha and vata, fever, stimulates the nervous system, hysteric, amenorrhoea, early stages of paralysis, for rheumatism of joints, feet, relieve ear ache, tooth ache, for scorpion sting and indigestion, stomachache, skin disease, urinary discharges. Antibacterial against *Micrococcus pyogenes* var. aureus and *Escherichia coli.*
The following objectives are considered for the present investigation

- VAM quantification on four experimental plants.
- VAM spore types, distribution and population dynamics in different forest nurseries.
- Effect of VAM on growth, biomass production, nutrient uptake and changes in volatile oil content of two VAM inoculated experimental plants.
- Effect of ‘P’ fertilization on VAM inoculated medicinal plants.
- Histochemical studies on four experimental plants.
- Effect of proportional garden soil, mined spoil and VAM on three medicinal plants.