TITLE OF THESIS : ***« Study of the main factors determining the yield and quality of essential oils in Thymus satureioides, Thymus pallidus and Lavandula dentata, species threatened with extinction in Morocco..»***

ABSTRACT :

Global demand for essential oils (EO) and by-products extracted from aromatic and medicinal plants (MAP) is currently growing strongly. However, more than 23% of MAP species are threatened with extinction due to unfavourable environmental conditions, exacerbated by climate change and the over-exploitation of these natural resources. The aim of the work carried out in this thesis is therefore to gain a better understanding of the effects of factors determining the yield and quality (chemical composition and biological properties) of EO in endemic species of thyme (Thymus pallidus and Thymus satureioides) and lavender (Lavandula dentata), which are threatened with extinction and grow spontaneously in the semi-arid areas of the Marrakesh region, Morocco. The main results obtained show that the stage of development and mycorrhizal status of the RAS plants influence the yield, chemical composition and biological activities of the EOs. The best EO yields (10-15 µl/g DM for thyme, and 14 µl/g DM for lavender), as well as the most effective biological activities (antibacterial, antifungal, herbicidal and antioxidant) are obtained at the flowering and senescence stages, due to their richness in active compounds such as thymol and borneol in thyme, and camphor in lavender.

In addition, certain soil and climatic conditions (high altitude, high rainfall, low levels of nitrogen, phosphorus and soil organic matter) lead to a 2 to 4-fold increase in the mycorrhizogenic potential of the soil, and in the yield of HE. Molecular analysis of the microbial community structure (bacteria and fungi) in the rhizosphere soil of L. dentata revealed a significant increase in bacterial (4.43) and fungal (3.34) diversity, with a dominance of the Actinobacteria and Mucoromycota phyla during flowering and the Ascomycota phylum during senescence. The abundance of these same phyla also varies according to soil and climate characteristics (C/N, pH, altitude). Finally, inoculation of T. satureioides, T. pallidus and L. dentata, under semi-controlled conditions in the greenhouse, with two species of arbuscular mycorrhizal fungi (AMF), Funneliformis mosseae and Rhizophagus irregularis, significantly improved the biomass production of these MAPs from 37 to 52%, the yield of essential oils from 21 to 88%, as well as the effectiveness of their biological activities, linked with a change in their chemical composition. The performance of mycorrhised MAPs varied according to the strains of CMA and the MAP species, with the F. mosseae-Thymus and R. irregularis-Lavandula associations proving to be the most effective.

In conclusion, this thesis work contributes to a better understanding of the factors influencing the growth of MAPs and their capacity to produce EOs. This will enable better control of the parameters on which action needs to be taken to optimise EO yields and the efficiency of their biological activities. The applied aim of such a study is to develop innovative, eco-compatible solutions based on the use of rhizospheric microbiota, including CMAs, as biotechnological agents for improving the cultivation and productivity of RAS.

Key words :
Aromatic and medicinal plants, soil microbiota, arbuscular mycorrhizal fungi, essential oils, activities