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THIONATION OF ESSENTIAL OILS FROM ALGERIAN *ARTEMISIA HERBA-ALBA* L. AND *RUTA MONTANA* L.: IMPACT ON THEIR ANTIMICROBIAL AND INSECTICIDAL ACTIVITIES

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Abstract. Essential oils were extracted from *Artemisia herba-alba* L. and *Ruta montana* L. by means of steam distillation and thionated with a reagent combination of phosphorus pentasulfide and sodium bicarbonate. Both parent essential oils and their modified ones were screened for their biological and insecticidal activities. The results showed that essential oils were composed mainly of ketones; essential oils from *Artemisia herba-alba* L. and those from *Ruta montana* L. consisted of bicyclic monoterpenes and acyclic aliphatic ketones (thujone, camphor and 2-undecanone), respectively. The antimicrobial activity of essential oils was substantially improved upon thionation (from 10 to 34 mm and from 11 to 32 mm). The insecticidal effect of the thionated essential oil from *Ruta montana* L. was observed to be very significant, but that of the essential oil from *Artemisia herba-alba* L. was observed to decrease (from 100% to 70% after 24 h). The extracted essential oils as well as their thionated forms were characterized by GC-MS, FT-IR, and UV-visible.

Keywords: essential oil, thionation, *Artemisia herba-alba* L., *Ruta montana* L., GC-MS analysis.

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Introduction

Biologically active molecules from essential oils are known for their pharmacological [1], antimicrobial [2], insecticidal [3], and anti-oxidant [4] activities. Essential oils, acting as homogeneous matrixes, consist chiefly of hydrocarbon and oxygenated mono- and sesquiterpenes [5] and, in some instances, of aliphatic terpenes (2,4-dimethyl hexane) as in *Ruta* type [6]. Apart from the bioactive molecules, essential oils composed of tolerable terpenoids such as alcohols and aldehydes [7], and of toxic terpenes such as ketones [8]. A variety of ketones with different structures are present in variable proportions in the chemical compositions of essential oils of some species like *Absinthe* [9], *Artemisia* [10], *Salvia officinalis* L. (sage) [11], *Peppermint* [12], and *Ruta* [13].

Overall, the difference in the chemical compositions of essential oils would impart different biological activities. Some bacterial strains and fungi exhibit some resistance against some essential oils, as they are fitted with suitably adapted protecting systems. Similarly, some insects develop a certain defensive behavior against some essential oils and can be thus unaffected when treated with.

Sulfur-containing compounds are widely known for their biological and pharmacological activities [14]. Henceforth, one of the objectives is to test different essential oils and to determine which are the most effective against bacteria, fungi and insects, that is, alleviating the relative resistance of these species towards the treating molecules, that thionation of the essential oils of *Ruta Montana* L. (*Rutaceae*) and *Artemisia herba-alba* L. was undertaken. By doing so, the physicochemical properties of the essential oils from these plants, and their hydrophobicity and volatility are expected to be enhanced as a result of the formation of thioketones (or thiones), less polar groups than ketones would induce a hydrogen bonding lowering, in addition to the displacement of the tautomeric equilibrium towards the formation of the enethiol.