



# Preliminary Phytochemical Screening of Five Commercial Essential Oils

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## To cite this article:

Bachir Raho Ghalem, Bellil Ali. Preliminary Phytochemical Screening of Five Commercial Essential Oils. *World Journal of Applied Chemistry*. Vol. 2, No. 4, 2017, pp. 145-151. doi: 10.11648/j.wjac.20170204.16

Received: August 4, 2017; Accepted: September 4, 2017; Published: December 6, 2017

**Abstract:** The discovery of natural resources from plants remains crucial for the development of new therapeutic remedies. The present study focused on the phytochemical study of commercial essential oils of certain medicinal plants: Thym (*Thymus vulgaris*), basil (*Ocimum basilicum*), sage (*Salvia officinalis*), Garden cress (*Lepidium sativum*) and lettuce (*Lactuca sativa*). The qualitative dosage of twelve secondary metabolites showed the presence of terpenoids and saponins in all tested oils while steroids, alkaloids, anthraquinones and phlobatannins were absent. The results obtained are encouraging and the secondary metabolites present in these oils were responsible for certain activities, hence the interest of their uses in traditional phytotherapy as well as the pharmacological and cosmetic field.

**Keywords:** Commercial Essential Oils, Phytochemical Study, Secondary Metabolites

## 1. Introduction

Phytochemistry is in the strict sense of the word the study of phytochemical. These are chemicals derived from plants. In a narrower sense the terms are often used to describe the large number of secondary metabolic compounds found in plants [1]. The different Phyto constituents present in plants include anthraglycosides, arbutin, bitter drugs, flavonoids, alkaloids, saponins, coumarins, phenol, carboxylic acids terpenes and valepotriates [2]. These phytoconstituents confer specific characteristics and properties to plants [3]. Plant produces these chemicals to protect itself but recent research demonstrates that many phytochemicals can protect animals and humans against diseases [4]. Most of the present medicines owe their origin to plants. The knowledge of the phytochemicals present in each plant, their isolation, characterization and their efficacy in treating various diseases is being pursued widely across the globe [3]. There are many phytochemicals fruits and herbs and each works differently [4]. Therefore, the analysis of chemical constituents would help in determining various biological activities of plants [5].

*Thymus vulgaris* is a species of ever green plant in the Lamiaceae family originated from Mediterranean regions and has been adapted to many different climates around the world

[6]. It is known for its medicinal and pharmacological properties [7]. *Thymus vulgaris* is the most important species and traditionally has been administered for whooping cough, bronchitis, laryngitis gastritis, upper respiratory congestion, and diarrhea [8]. *Thymus vulgaris* leaves oil or extract has also been used in the treatment of sore throat, tonsillitis, gum diseases, rheumatism, and arthritis [6]. This essential oil has been considered as an antiseptic, antimicrobial, antispasmodic, antioxidant, and antitussive agent [9].

*Ocimum basilicum* L. (Lamiaceae) commonly known as sweet basil, is an annual herb which grows in several regions all over the world [10]. Traditionally, basil has been extensively utilized in food as a flavoring agent, and in perfumery and medical industries [11]. It has been used as a medicinal plant in the treatment of headaches, coughs, diarrhea, constipation, warts, worms, and kidney malfunctions [12] (Joshi, 2014). The essential oil has antimicrobial, antifungal, and insect-repelling, anticonvulsant, hypnotic, antitumor and antioxidant activities [13, 14, 15, 16, 17, 18, 19, 20].

*Salvia officinalis* L., a member of the Lamiaceae family popularly known as salvia or sage, is an aromatic plant widely distributed in the world. Common sage, since ancient times, has been an ingredient in perfumes, a flavoring in a variety of food preparations, and a medicinal plant used in the healthy Mediterranean diet [21]. Sage tea has been

traditionally used for the treatment of digestive and circulation disturbances, bronchitis, cough, asthma, angina, mouth and throat inflammations, depression, excessive sweating, skin, and many other diseases. Essential oils of *Salvia* have been used in the treatment of large range of diseases such as, nervous system, heart and blood circulation, respiratory, digestive, metabolic, and endocrine diseases [22]. Many properties have been reported for this plant, including its antibacterial [23], cytotoxic [24, 25], antiviral [26], antioxidant activities, anti-angiogenic and antitumor effects.

*Lepidium sativum* Linn. (Family: Cruciferae), commonly known as garden cress is a fast growing annual herb that is native to Egypt and West Asia, although it is now cultivated in the entire world [27]. In traditional system of medicine various parts of this plant have been used for the treatment of jaundice, liver problems, spleen diseases, gastrointestinal disorders, menstrual problems, fracture, arthritis, and other inflammatory conditions [28]. The seeds of *L. sativum* are also used to cure throat diseases, asthma, headache, uterine tumour, nasal polyps and breast cancer [29]. The plant shows antihypertensive [30], diuretic [31], anti-asthmatic [32], hypoglycaemic [33], antioxidant [34, 27, 35] and anti-inflammatory [36] activities.

Lettuce, *Lactuca sativa* L., is a vegetable plant belonging to Asteraceae family. It has been a food and medicinal plant since ancient times [37]. Now it is commercially cultivated worldwide as one of the most popular food items. Lettuce is most often used for salads, but also in other kinds of food like soups, sandwiches and wraps. It contains different kinds of essential elements for humans such as vitamin A and potassium, sodium and calcium as well as minor source for several other vitamins and nutrients [38]. Lettuce has been shown the health impacts in preventing cardiovascular diseases in rats and humans [39, 40], anticonvulsant and sedative-hypnotic effects [41], besides its extract had analgesic and antiinflammatory activity in rats [42], antioxidant, antimicrobial and antiviral activities [43].

Hence the present study has been made to investigate the phytochemical screening of five commercial essential oils of *Thymus vulgaris*, *Ocimum basilicum*, *Salvia officinalis*, *Lepidium sativum* and *Lactuca sativa*.

## 2. Materials and Methods

### 2.1. Essential Oils

The commercial selected EOs were obtained from five plant species: *Thymus vulgaris*, *Ocimum basilicum*, *Salvia officinalis*, *Lepidium sativum* and *Lactuca sativa*. These oils are produced by the Egyptian company El Capitaine (CAPPHARM) for the extraction of oils from natural and cosmetic plants, including the ministerial agreement on health 2848/2002 (<https://www.facebook.com/cappharm/>) and Imported by the import-export company Enour of Algeria from Eloued city.

### 2.2. Preliminary Phytochemical SCREENING

Chemical tests were carried out on essential oils using standard procedures to identify the preliminary

phytochemical screening following the methodology of Harborne (1998) [44], Abo et al. (1999) [45], Kindo et al. (2016) [46].

1. Steroids: 2 ml of acetic anhydride was added to 0.5 ml crude extract of plant sample with 2 ml H<sub>2</sub>SO<sub>4</sub>. The change in colouration from violet to blue or green in samples indicates the presence of steroids.
2. Terpenoids: 5 ml of each extract were mixed in 2 ml of Chloroform and 3 ml Concentrated sulphuric acid was carefully added to form a layer. A reddish brown colour at the interface indicates the presence of terpenoids.
3. Tannins: To 2 ml of extract was added 2-3 drops of 5% ferric chloride solution. Formation of black colour showed the presence of tannins.
4. Flavonoids: 2ml of sodium hydroxide was added in 2ml of solvent extract. Appearance of yellow color was regarded as the presence of flavonoids.
5. Alkaloids: A little amount of picric acid solution was added in 2ml of solvent extract. Formation of orange color showed the presence of alkaloids.
6. Saponins: About 1ml of solvent extract was introduced into a tube containing 1 ml of distilled water, the mixture was vigorously shaken for 2 min, and formation of froth indicated the presence of saponins.
7. Phenols: 2ml of ferric chloride solution was added in 2ml of solvent extract. Formation of blue, green or violet colour indicates the presence of phenolic compounds.
8. Anthraquinones: The presence of free anthraquinone aglycone was confirmed by adding 5 mL of chloroform to 0.5 g of extract in a clean dry test tube. This was shaken for 5 min and the extract thereafter filtered. The filtrate was then mixed with equal volume of 10% ammonia solution. The formation of a rose-pink color in the ammoniacal layer (lower layer) indicated the presence of free anthraquinones.
9. Cardiac glycoside: 0.5g of extracts was dissolved in 2ml of glacial acetic acid containing 1 drop of ferric chloride. Then 2ml of conc. Sulphuric acid was added under layered. Brown ring was formed at interphase indicated the presence of deoxy sugar which is the characteristic of cardiac glycoside.
10. Phlobatannins: Few drops of 1% hydrochloric acid was added in 1ml of solvent extract and boiled. Red precipitate was formed indicated the presence of phlobatannins.
11. Cardenolides: 2ml of benzene was added to 1ml of solvent extract. Turbid brown color was observed indicated the presence of cardenolides.
12. Volatile oils: To 2 ml of extract, were added 0.1 ml of diluted sodium hydroxide and a small amount of diluted hydrochloric acid. The formation of a white precipitate indicates volatile oils.

## 3. Results and Discussions

The results obtained for qualitative screening of phytochemicals in five commercial essential oils are

presented in Table 1. All oils showed the presence of terpenoids and saponins while steroids, alkaloids, anthraquinones and phlobatannins were absent.

Saponins from plants have long been employed for their detergent properties. It is used as mild detergents and in intracellular histochemistry staining to allow antibody access to intracellular proteins. They are used medically in hypercholesterolaemia, hyperglycaemia, antioxidant, anti-cancer, anti-inflammatory and weight loss etc, [47]. Seigler (1998) [48] reported that saponins have anticarcinogens' properties, immune modulatory activity and cholesterol lowering activity. It is also been reported to have anti-fungal properties [49]. Some saponins glycosides are cardiotonics while others are contraceptives and precursors for other sex hormones [50].

Saponins are naturally occurring structurally and functionally diverse phytochemicals that are widely distributed in plants [51]. They are high molecular weight glycosides, consisting of a sugar moiety linked to a triterpene or steroid aglycone [52]. These molecules have received considerable attention in recent years due to their various biological activities including hepatoprotective, haemolytic, anti-diabetic, hypocholesterolemic, anti-tumor, antimicrobial, anti-oxidant and anti-inflammatory activities [51, 53, 54]. In addition, saponins are used in preparation of soaps, detergents, fire extinguishers, shampoos and cosmetic [53].

Terpenoids also form a group of naturally occurring compounds majority of which occur in plants, a few of them have also been obtained from other sources [55]. The diverse array of terpenoid structures and functions has provoked increased interest in their commercial use. Terpenoids have been found to be useful in the prevention and therapy of several diseases, including cancer, and also to have antimicrobial, antifungal, antiparasitic, antiviral, anti-allergenic, antispasmodic, antihyperglycemic, antiinflammatory, and immunomodulatory properties. In addition, terpenoids can be used as protective substances in storing agriculture products as they are known to have insecticidal properties [56, 57].

The phytochemical screening of *Salvia officinalis* oils showed the presence of flavonoids, terpenoids, saponins, and cardiac glycoside.

**Table 1.** Results of the qualitative test for preliminary phytochemical analysis of five commercial essential oils.

	S.O	T.V	O.B	L.S2	L.S2
Steroids	-	-	-	-	-
Terpenoids	+	+	+	+	+
Tanins	-	+	+	+	+
Flavonoids	+	-	-	+	+
Alkaloids	-	-	-	-	-
Saponines	+	+	+	+	+
Phenols	-	-	+	-	+
Anthraquinones	-	-	-	-	-
Cardiac glycoside	+	+	+	+	-
Phlobatanins	-	-	-	-	-
Cardenolides	-	+	-	-	-
Volatile oils	-	-	+	+	-

T.V: *Thymus vulgaris*, O.B: *Ocimum basilicum*, S.O: *Salvia officinalis*, L.S1: *Lepidium sativum* and L.S2: *Lactuca sativa*; (-) absent, (+) presence

In this context, several studies were carried out on the phytochemical screening of *Salvia officinalis* essential oils, which their results are in agreement or different with our. Hernandez-Saavedra et al. (2016) [58] studied the essential oil of *S. officinalis* collected in Queretaro, (Mexico), and recognized the presence of phenols, flavonoids, saponins and alkaloids. The results of chemical analysis of the essential oil of *S. officinalis* collected by Kadhim et al. (2016) [59] from Baghdad in Iraq showed that flavonoids, terpenoids, saponins, glycoside and tanins were present. Hamidpour et al. (2014) [60] reported in their study that the sage is a very important source to flavonoids and terpenoids. In 2014, Mekhaldi et al [61] revealed the presence of flavonoids (caffeic acid, quercetin and luteoline), triterpenoids and steroids ( $\beta$ -sitosterol,  $\beta$ -amirin) in sage samples collected from Mostaganem (Algeria) and the absence of alkaloids and saponins. A Roman team guided by Coisin (2012) [62] showed the richness of sage oils in polyphenols especially Luteolin which is known by its antioxidant, anti-inflammatory, antimicrobial and anti-cancer effects [63] and flavonoids particularly rosmarinic acid. Mašterová et al (1989) [64] reported the presence of terpenoids ( $\beta$ -Ursolic and  $\beta$ -oleanolic acids), flavonoids (7-ethylosmanol, cirsimaritin, luteolin-7-O-glucoside, apigenin-7-O-glucoside), and steroids ( $\beta$ -sitosterol).

The Thyme essential oil is characterized by the presence of terpenoids, tannins, saponins, cardiac glucoside and cardenolides. However, we observe the absence of steroids, flavonoids, alkaloids, phenols, anthraquinones, phlobatanins and volatile oils (Table 1). In comparison to the literature for example, in the study of Nema et al. (2015) [65] on *Thymus vulgaris* -grown in Cairo, Egypt- oils, we note the presence of saponins, carbohydrates and glycosides, tannins, triterpenes, in addition to the alkaloids, flavonoids, resins and unsaturated sterols, which were absent in our samples. Thus, the crude extract of *Thymus vulgaris* leaves collected from the Sultanate of Oman contains essentially flavonoids, saponins and steroids [66]. In recent study on Thym (*Thymus vulgaris*) by N'Goran et al. (2017) [67], they showed the presence of sterols and polyterpenes, volatile compounds, flavonoids, saponins and quinones, and absence of tannins and alkaloids. Cowan (1999) [68] reported the presence of terpenoids (coffee acid) phenolic alcohol (Thymol) and polyphenols (tannins). The composition of essential oils of *Thymus vulgaris* has been the subject of numerous studies. Almost all of them have a high abundance of p-cymene,  $\gamma$ -terpinene (terpenoids) and thymol (phenols) [69, 70, 71, 72, 73].

The results of the phytochemical tests presented in Table 1 show that the essential oil of basil contains terpenoids, tannins, saponins, phenols, cardiac glucoside and volatile oils and was devoid of steroids, flavonoids, alkaloids, anthraquinones, phlobatanins And cardenolides.

Most previous studies on the phytochemical screening of *Ocimum basilicum* oils were released. For example, Daniel et al. (2011) [74] demonstrated the presence of saponins, tannins, cardiac glycosides and the absence of alkaloids, steroids and terpenes, flavonoids and resins in the extracts of *Ocimum*

*basilicum* leaves collected from different parts of local government of Jos-North of Plateau State, Nigeria. Another Nigerian researchers team was carried out phytochemical study on the aqueous extract of basil leaves collected at the University of Maiduguri, Borno State, and they found that they contain a high concentration of saponins and flavonoids, a mean concentration of terpenes and steroids, and carbohydrates and tannins traces [75]. Issazadeh et al. (2012) [76] and in a preliminary phytochemical screening of extracts from the bark of basil stems collected in Lahijan city, Guilan Province, Iran revealed the presence of saponins, steroids, tannins, glycosides, alkaloids and flavonoids. Fathiazad et al. (2012) [77] showed the existence of phenolic compounds (5.36%) and flavonoids (1.86%). Rosmarinic acid was the major component of phenolic compounds (15.74%).

The phytochemical examination carried out on lettuce essential oil, revealed the presence of terpenoids, tannins, flavonoids, saponins and phenols. However, we observed the absence of cardiac glycosides, volatile oils, steroids, alkaloids, anthraquinones, phlobatanins and cardenolides (Table 1). Our results are in good agreement with those of Sayyah et al (2004) [42], who reported that the essential oil of *Lactuca sativa* seeds from Iran, is composed by triterpenoids, saponins and phenols. In another study, Bhat and Al-Daihan. (2014) [78], showed that the essential oil of *Lactuca sativa* leaves of collected from Al-Qassim (Saudi Arabia) is mainly composed by alkaloids, flavonoids, steroids, saponins and tannins. In India, Harsha et al. (2014) [79] reported the presence of tannins, polyphenols, flavonoids, saponins, terpenoids and steroids and the absence of alkaloids in leaf extracts of this plant.

The phytochemical tests released on garden cress essential oils have shown the presence of terpenoids, tannins, flavonoids, saponins and phenols and the absence of cardiac glycosides, volatile oils, steroids, alkaloids, anthraquinones, phlobatanins and Cardenolides (Table 1).

Several studies have been carried out on essential oils of garden cress (*Lepidium sativum*). Raval (2016) [80] and in its bibliographic synthesis on this plant, indicated that its extracts contain mainly alkaloids, saponins, glycosides, flavonoids and sterols. Chatoui et al (2016) [81], showed that the methanol extract of *Lepidium sativum* collected in Morocco contains flavonoids, saponins, tannins, alkaloids, sterols and polyterpenes. Whereas that of ethyl acetate contains only saponins and alkaloids. In Pakistan, Riazullah et al. (2012) [82] reported that *Lepidium sativum* essential oil is characterized by the presence of flavonoids, saponins, anthraquinones, terpenoids, tannins and cardiac glycosides. In Ethiopia, the qualitative phytochemical screening done by Berehe and Boru (2014) [83] on a chloroform / methanol seeds extract of this plant showed the presence of flavonoids, terpenoids, steroids, glycosides, tannins, alkaloids, phenols and saponins. In another Indian study, Rizwan et al. (2015)[84] showed that the methanolic extract of cress seeds possesses alkaloids, phenols, volatile oils and flavonoids.

This difference in the composition of our samples and those of the literature is probably due to various conditions,

in particular the environment, genotype, geographical origin, harvest period, drying site, temperature and duration of drying, Parasites and the extraction method [85].

## 4. Conclusion

The results of this study clearly indicate that the preliminary phytochemical analysis of five commercial essential oils revealed presence of terpenoids and saponins which are compounds capable of causing varied physiochemical and pharmacological effects while steroids, alkaloids, anthraquinones and phlobatanins were absent. The diversity of phytochemicals present suggests that the commercial essential oils could be used in the development of new pharmaceuticals that address unmet therapeutic use. Furthermore, isolation purification and characterization of the phytochemicals found present will make interesting studies.

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