BIOCHEMICAL STUDIES ON SAGE PLANT (Salvia Officinalis L.)

By

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THESIS

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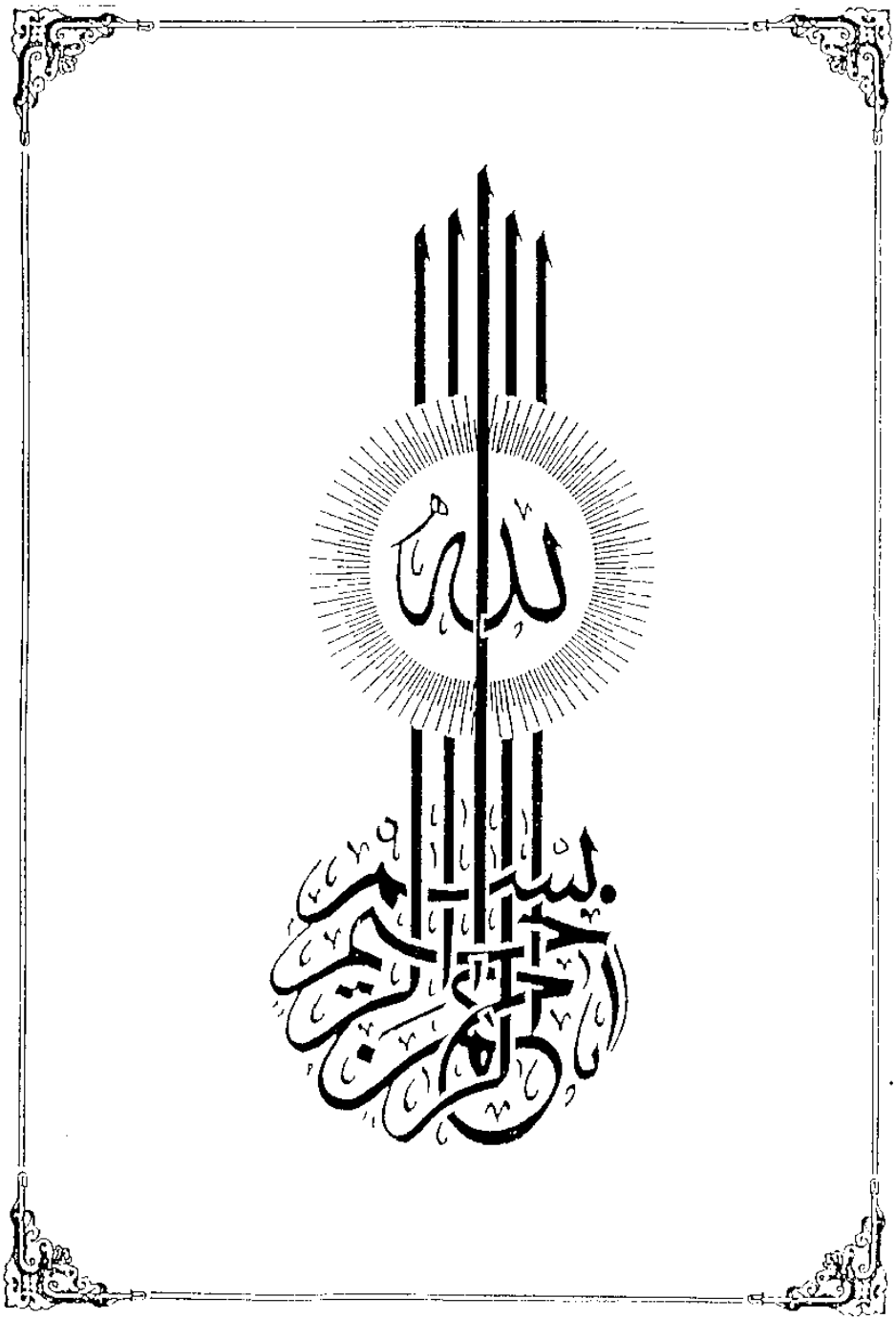

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C O N T E N T S

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INTRODUCTION

The sage plant, Salvia officinalis L. fam. Labiatae, is a perennial herb indigenus in Southern Europe, cultivated in central Europe and found now in temperature climate regions. The roots are long spindle shaped with an erect woody stalk and straight branches. It grows to approximately 60 cm in height and has pale blue or purplish flowers. The leaves are elongated spear shaped with a soft velfety texture. Greenhalgh (1979).

Sage, true sage, garden sage, common sage are vernacular names of Salvia officinalis L. Sage was used in Ancient Egypt for different reasons such as increasing fertility in the women, restoring old age, restoring energy and failing energy (Hemophill 1972). Also Arabs have had used it for similar reasons.

Sage was considered as remedy for coughs and bad colds, it is included in gargles and mouth washes. The fresh leaves help to whiten the teeth while the dried leaves are used cosmetically to restore the natural color to hair that is turning grey (Daisely 1982).

Although sage had many uses in the past, it is now almost entirely utilised in the food industry as flavouring and seasning herb and condiment.

Large quantities have been used in the commerical meat packing and processing. It is also used to flavour chees backed fish, Salad dressings, chowders and soups. Sage is also a most important ingredient of mixed herbs as well as being used in herbal teas for medicinal purposes.

Sage oil have long been known and used in flavouring condiments, cured meats, liqueure as well as in perfuming formulations.

The Sage herb most commonly found in commerce is produced mainly in Yugoslavia and Albania, and known as Dalmatian sage.

Although Sage was formerly introduced in Egypt from a few years ago and grows successfully, a restricted area is now cultivated in Egypt but not recorded oficially. Owing to its great importance, in folk mindicine and cosmetics, the Medicinal and Aromatic plant section, ARE, has been dealt with the propagation of this promising plant allover the country for both local and foreign markets.

Curently, plant growth substances constitute an active field of research for many economic crops among which Medicinal and Aromatic plants. In this regard a

fes researches were carried out in Egypt to study sage plant from the view of point of chemical analysis only but any of these researches was concerned to study the effect of growth regulators on Sage plant.

The aim of this research is to throw more light on this promising plant through studying the effect of some growth regulators on the yield, chemical composition of both leaves and essential oil in order to find out the suitable growth regulator used by the optimum concentration that can be applied to obtain the herb and the essential oil in a best yield and good quality.

REVIEW OF LITERATURE

Several studies were recorded in the literature concerning the chemical composition of sage leaves whereas little works were subjected to the flowers. The preliminary analysis of the leaves was reported by Vernazza (1959) who mentioned that sage leaves contain 1.72 - 1.90% essential oil, 5.83 - 6.00% ash, 0.26 - 0.37 ash insoluble in acid, 21.05 - 22.82% crude fiber and 26.26 - 28.32% aqueous extract. Further works were done, in this regard, to detect more precisely the compounds involved in the plant e.g. essential oils, organic acids, pigments, Sugars etc... the following is a review of the literature found in this concern.

Effect of the developmental stage on the growth and biochemical constituents:

The yield of herb as well as volatile oil content of sage plant is the ultimate purpose for sage production. Also the volatile oil quality is most important in this concern. The quantity and quality of the essential oil are dependent upon the stage of growth which is related with the specific changes in the biochemical constituents as well as the dry matter production especially in the leaves.

Blazek and Suchar (1956) reported that the moisture content at the early stage of development was lower in the whole plant than in the leaves. They added that the moisture content was increased in the stems after the flower fall and the ratio of leaves to stems was 63.0 : 63.2 before flower fall.

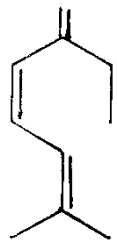
Guenther (1962) mentioned that the Dubrovink district (Yogoslavia) produces the best type of aromatic sage plant. In that region harvesting starts early in June as soon as the plants are large enough and continue through the dry weather up to the begining of September. He added that at the begining of the harvest the yield of oil raised to 2%, but it decreased towards the end of harvest to about 0.7%. Shevenchenko (1973) reported that the highest content of essential oil in S.sclarea inflorescences was observed during full bloom and the optimum time for harvesting was from 9 a.m. to 3 p.m. Chubey et al., (1976) declared that the highest levels of sage oil in Canada were attained towards the end of September. Basker and Putievsky (1978) showed that the essential oil contents of dried leaves of salvia officinalis reached maximum values in summer harvests. Putievsky et al (1978) found that the foliage yield of sage was higher in the first year than the second one, the yield was 6.1 kg/m² fresh material and 1 kg/m² of dry matter in the first

year. Karawya and El-Hawary (1980) reported that the Egyptian sage oil obtained in the non flowering stage in winter was very rich in Ketones namely thujone and camphor and the latter constituent reached 45.7% of the oil.

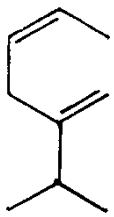
Volatile oil content and its chemical composition:

From the available literature, as will be demonstrated, about 30 compounds were detected in the volatile oil of sage plant. Charts (1,2 & 3) shows the structures of these compounds. The volatile oil in the sage leaves was 1-2.5% as reported by Sall (1944) which contains salvine and its ester, in addition to pinene, camphor, cineol, borneol, thujone and sesquiterpenes. Islip et al. (1953) studied the volatile oil of sage leaves from Cyprus, they found that the oil increased monthly by 0.79%. Oils of the coastal regions were leavorotatory and lower in quantity in the contrary with the oil obtained from the mountain regions. No relation was observed between time of collection and ketone content. Variati (1956) found that the oil percent obtained from wild salvia plants grown in Italy was 0.5 - 0.6. Kohlmunzer (1960) investigated sage as a plant containing cineol and found that this compound reached 25% in the oil Brieskorn and Dalferth (1963) and (1964) working on the

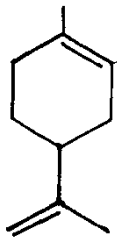
(I) Ocimene



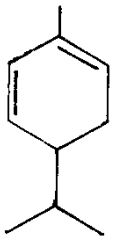
(II) Mirecene



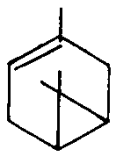
(III) 2-Methyl, 3-Methylene 5-Heptene



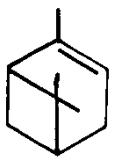
(IV) Dipentene



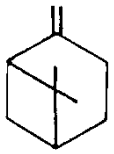
(V) Phyllandrene



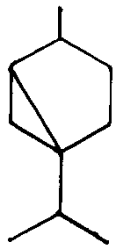
(VI) Car -3- ene



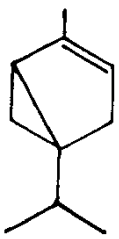
(VII) ∝-Pinene



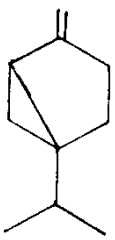
(VIII) β-Pinene



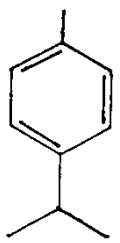
(IX) Thujane



(X) Thujene

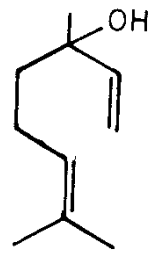


(XI) Sabenene

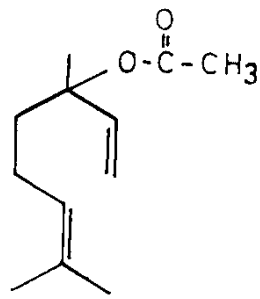


(XII) p- Cymene

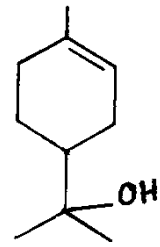
Chart (1): Monoterpene hydrocarbons detected in sage volatile oil .



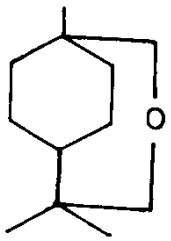
(XIII) Linalool



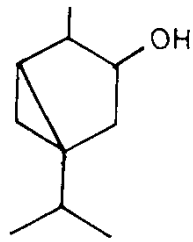
(XIV) Linalyl acetate



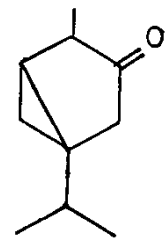
(XV) ∝-Terpeneol



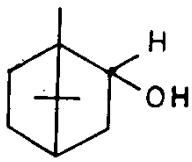
(XVI) 1,8-Cineol



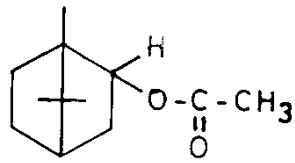
(XVII) Thujol



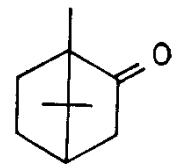
(XVIII) Thujone



(XIX) Borneol

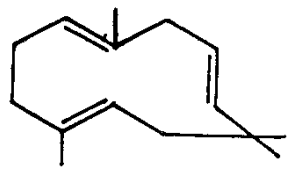


(XX) Bornyl acetate

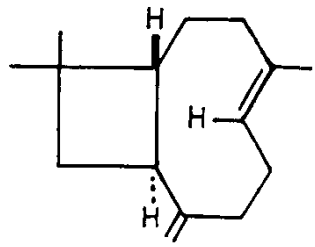


(XXI) Camphor

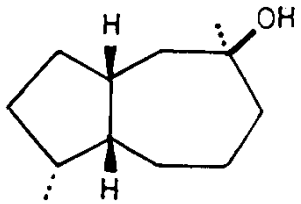
Chart (2): Oxygenated monoterpenes detected in sage volatile oil.



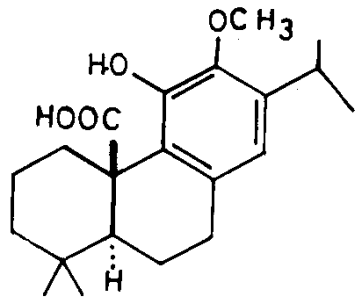
(XXII) Humulene



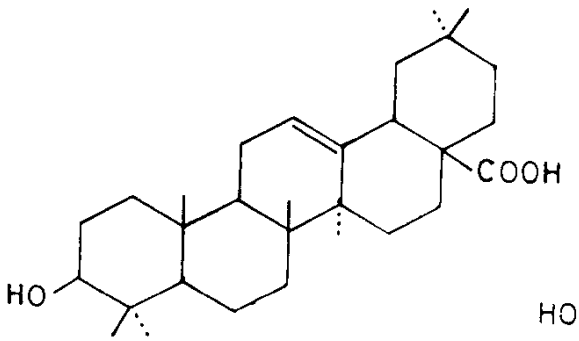
(XXIII) Caryophyllene



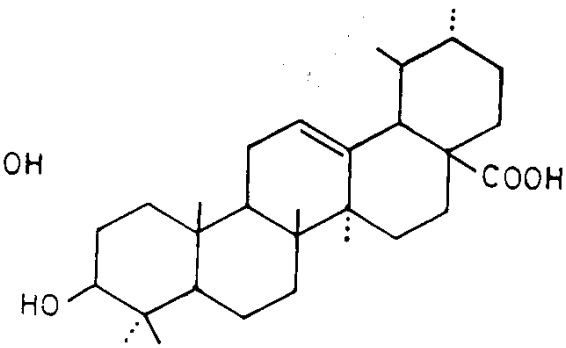
(XXIV) Viridiflorol



(XXV) Salvine



(XXVI) Oleanolic acid



(XXVII) Ursolic acid

Chart (3): Miscellaneous terpenes detected in sage plant.