بسم الله الرحمن الرحيم

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PHYSIOLOGICAL STUDIES ON AMBROSIA MARITIMA,L. AND *OCIMUM BASILICUM*, L.

BY

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Approval Sheet

Physiological studies on *Ocimum basilium*, L. and *Ambrosia maritima*, L.

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ABSTRACT

Physiological studies on *Ocimum basilicum*, L. and *Ambrosia maritima*, L. plants.

Two pot experiments were conducted at the Horticulture Research Station, El-Tahrir in two successive seasons of 1998 and 1999, aiming to study the response of two aromatic plants namely. *Ocimum basilicum*, L. and *Ambrosia maritima*, L. to salinity of irrigation water as nine (9) treatments of saline irrigation water plus the control treatment in which the irrigation water was not salinized with any salt were used. Salts used were NaCl, $CaCl_2$ and their mixture at 1 : 1 by weight as the concentrations of each salt were 1500, 3000 and 4500 ppm.

The following results were obtained for each chosen plant:

1- The different levels of NaCl, $CaCl_2$ and their mixture in the irrigation water decreased the plant height, number of shoots, fresh and dry weight of herb, root length and fresh and dry weight of roots. The highest level of salinity gave the lowest values for all parameters.

2- The different salinity levels in the irrigation water decreased oil percentage and oil yield / plant in the herb.

3- All salinity treatments decreased plant pigments content (Chlorophyll a and b) in the leaves.

4- The different levels of NaCl, $CaCl_2$ and their mixture in irrigation water decreased nitrogen, phosphorus, potassium and magnesium, percentages in the leaves of each plant.

5- For sodium and calcium the different levels of NaCl, $CaCl_2$ and their mixture in irrigation water increased their percentages in the leaves of each plant.

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CONTENTS

INTRODUCTION

INTRODUCTION

The production of aromatic and medicinal plants has been extensively increased in the recent years, and the trend is to return back to use the herbs in the populist medicine in most countries.

The plant Kingdom includes large number of plants containing volatile oils which are distributed all over the world. Most of these plants grow well in Egypt. However, two plants were chosen:

1- *Ocimum bacilicum*, L. (sweet basil) Fam. Labiatae which occupied an interesting position in many industrial purposes for scenting meat products, soap, beverages and canned foods and to overcome undesirable odour for which it is used in the tooth pastes and pharmaceuticals, **Singh *et al.*, (1971).** Essential oil composition of *Ocimum basilicum*. L. plants varies due to genetic and environmental factors that influence genetic expression, **Bernath, (1986).** The essential oil content of plant tissue varies also with developmental stage, **Burpott and Loomis, (1967).**

2- *Ambrosia maritima*, L. (damssissa) Fam. Compositae is an annual herbaceous plant, richly branched, grey herb with finely dissected fragrant leaves. The plant is widly distributed throughout the Mediterranean Region, **Tackholm, (1974).** In Egypt it considered as a wild herb growing on the banks of canals and the River Nile as a common weed, **Bedevian, (1936).** When plants are grown near the banks of canals, snails escape far from these plants and even some dead snails were found, **Sherif *et al.*, (1962).** The plants were proved to show a molluscicidal activity for the control of Bilhariziasis and has a lethal effect on meracidium and corariae of schistosoma, **Sherif and El-Sawy, (1977).** The active ingredients of this plant were ambrosin and damsin shown to be toxic to the snails representing the

intermediate host of schistosomiasis and fascioliasis found in canals **Bicman *et al.*, (1986).** Damssissa is used in Egyptian folk medicine as remedy of rheumatic pains, decoction of plant for asthma, diabetees Bilharziais and expel kidney stones. Flowring branches are stimulant stomachic, slightly astringent, emollient, vulnerary, diuretic in remal troubnes and expel renal stones **Amin, (1990).** One of the Nationnal prioroties for agricultural expansion in Egypt is the introduction of aromatic and medicinal plants into newly reclaimed desert soils, where salinity is a limiting factor for growth of many crops. Plants grown in these areas are suffering from irrigation by saline water from the wells not only for production of green mass, but also oil production of herb. So the aim of this work was to study the effect of salinity of irrigation water on growth, oil production and plant composition of *Ocimum basilicum,* L. and *Ambrosia maritima,* L.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Mechanism of salinity effects on growth.

The accumulation of salts in soil depends on the salinity of the applied water, the salinity of the native soil and the rate at which salts are leached out of the root zone (Drever, 1982, Gelhurd, 1985 and Szaboles, 1989). So, salinity of water or soil markedly affects plant growth, some plants can tolerate high levels of salinity but others are sensitive to salinity. However, there are many factors involved in the salt tolerance of plants such as climatic, genetic, physiological and pathological factors and their interactions. Several investigators suggested various views to explain salinity effects on growth and development of plants.

Hewitt (1963) pointed out that, the decrease in growth may be due to near toxic level of anions and cations being reached, that is, level in the roots which inhibits the growth process, or may be due to the osmotic pressure of the culture solution being too high to permit normal uptake and absorption of water and other nutrients.

Ruff *et al.*, (1963) claimed that the decrease in plant height by salinity was due to the inhibition of meristematic activity and cell elongation. **Jennings (1976)** added that the reduction in the leaf surface and leaf expansion resulting in salinity stress was mainly due to an inhibition in cell division. This might be supported by the findings of **Gauch (1972) and Levitt (1972)** who suggested that some of the effects of salinity would be due to ion induced nutrients deficiency. Where high concentrations of ions; e.g., sodium and chloride, sulphate of magnesium might adversely affect the uptake or such nutrient ions as potassium phosphate or nitrate.

Everardo *et al.*, (1975) proposed three theories to explain the effect of salinity on the plants. First, soluble salts in soil decrease the free energy of the soil water, thereby, decreasing the availability of water to plants. The second is that growth is inhibited by an excess of salts taken up by plants from saline media as energy spent by plants to maintain turgor pressure is at expense of the growth. Finally, salts may exert deterimental effects on plant growth through toxicity of one or more specific ions present in higher relative concentration.

Browgwski *et al.*, (1977) reported that the ionic balance, especially in the anion group, was good index of plant resistance to salinity. Recently, **Gratten and Grieve (1992)** reported that salinity disrupted minerals, nutrient acquisition by plants in two ways, first, the ionic strength of the substrate, regardless of its composition which influenced nutrient uptake and translocation. Evidence for this was that salinity induced phosphate uptake in certain plants and cultivars. The second and more common was mechanism by which salinity disrupts the mineral relation of plants is by reduction of nutrients availability by competition with major ions (i.e Na^+ and Cl^-) in the substrate. These interactions often led to sodium induced Ca^{++} and/or K^+ deficiencies and Ca^{++} induced Mg^{++} deficiencies.

Effect of salinity on plant growth, essential oil productivity and chemical composition of plants.

A- Effect of salinity on plant growth:

Many researches have investigated the effect of salinity on vegetative growth of several plant species. Concerning medicinal and aromatic plants, many researchers have stated that the effect of salinity on plant growth varied according to plant species.

On *Cassia acutifolia*, **Ayoub (1977)** in studies on the germination of seeds indicated that they were highly tolerant to salinities up to 16 mmhos/cm, and 50% reduction in germination occurred at about 20 mmhos/cm. He added that air temperature had a significant effect on germination at substrate salinities between 10 and 25 mmhos/cm and seedling growth was more sensitive to salinity and alkalinity than the germination stage. Young plants survival and total pod yield were significantly reduced in soil salinities higher than 11 mmhos/cm, and this was more pronounced, when plants were irrigated at short intervals with saline water. The sensitivity of senna to higher levels of salinities was correlated with the higher rate of chloride accumulation in the tissue resulting in specific chloride injury. However, the possibility of Na injury cannot be excluded. Likewise, **Ayoub and Squires (1994)** on *Cassia acutifolia* reported that, under high salinity, plant growth was reduced without injury symptoms, but with shedding of some lower leaves. Lower leaf shedding could, therefore, be a physiological measure for reducing plant salt level tolerance and transpiration. Studies on seed germination under controlled conditions indicated that they were highly tolerant to salinities up to 16.0 mmhos/cm and that 50% reduction in germination occurred at about 20 mmhos/cm. Studies in open air indicated that plants were more sensitive to salinity and alkalinity at seedling stage than at germination. Young plants survival and total pod yield were significantly reduced in soil salinities higher than 11.0 mmhos/cm. This was more pronounced at shorter than at longer irrigation intervals with saline water.

Helaly (1977) on henbane plant obtained a significant reduction in fresh and dry weight of shoots and roots with increasing salinity levels (sea