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# Response of Some Marjoram Cultivars to Fertilization under Sandy Soil Conditions II- *Origanum majorana marcelka, Origanum majorana blart, Origanum majorana*, *Origanum majorana kruiden,* and *Origanum majorana* (local)

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## ABSTRACT

The present work was carried out in 2001 and 2002 seasons in the Experimental Farm of Faculty of Agriculture, Suez Canal, Ismailia University, to evaluate the production of some marjoram cultivars namely *Origanum majorana marcelka, Origanum majorana blart, Origanum majorana* and *Origanum majorana kruiden* compared to local one *Origanum majorana* (Syn. *Majorana hortensis* M.) grown under sandy soil conditions and normal fertilization doses of organic manure (20 $m^3$), calcium super phosphate (300 kg/feddan), ammonium sulphate (300 kg/feddan) and potassium sulphate (100 kg/feddan) were added. The results revealed that *Origanum majorana marcelka* was superior in growth characters in terms of number of branches and both plant fresh and dry weights. Moreover, it gave high oil percentage in the two seasons (1.14% and 1.02%, v/w) compared to the local cultivar (0.69% and 0.71%, v/w). Also, it was pioneer in the oil constituents, as it recorded the highest total of oxygenated and hydrocarbon compounds in the oil (94.02%) compared to the other studied cultivars. Identification of volatile components was performed using the modern technique of Gas Chromatography equipped with Head Solid State technique. The major oxygenated compounds of *Origanum majorana marcelka* were terpinene-4-ol, linalyl acetate and linalool (19.11, 17.01 and 16.54%, compared to the local cultivar, 17.97, 13.99 and 15.59%, respectively).

**Key words:** Essential oil constituents, Head Solid State technique, *Oregano, origanum* cultivars, sandy soil.

## INTRODUCTION

Marjoram (*Origanum* sp., syn. *Majorana* sp.), which belongs to family Lamiaceae, is a perennial herb. The genus *Origanum* contains many species, cultivars, and huge number of strains and lines (De Mastro, 1996; Kintzios and Piridon, 2002). The cultivated area in Egypt is about 4000-5000 feddan according to the National Agriculture Income (2003). Marjoram herb contains about 1% essential oil (Refaat *et al.,* 1990). *Origanum* (Marjoram) has many uses, some of them were recorded as a folklore uses (Chandler-Ezell, 2004), others as medicinal herb; e.g. protective against lead acetate toxicity (Ibrahim *et al*., 2005), carminative, stimulant, toothpastes, antimicrobial and fungicide agent (Deans and Waterman, 1993; Jeno, 1996), antispasmodic, diaphoretic, diuretic, antioxidant, antifungal, tonic, against asthma and headache, rheumatism, and employed in the treatment of cancer (Simon *et al*., 1984; Deans and Waterman, 1993; Jeno, 1996). Antiviral activities of marjoram were reported (Skwarek *et al*., 1994; Jeno, 1996). Sweet marjoram oil has been reported to be non-irritating and non-sensitizing to human skin (Opdyke, 1976). Also it has multiple uses in food industry and in kitchen; e.g., spice, poultry soups, sausages (Prakash, 1990; Jeno 1996; Belsinger and Wilcox, 2004), pesticide as nematicide and insecticide (Deans and Waterman, 1993; Abd Elgawad and Omer, 1995). Recently, the oil composition of marjoram herb was analyzed by Abdallah (2000), Daferera *et al*. (2000), Novak *et al*. (2001), Refaat *et al*. (2001), Novak *et al*. (2002), El-Kady (2003), Mahfouz (2003), Salgueiro *et al*. (2003) and Vagi *et al*. (2005) who mentioned that terpinen-4-ol, linalyl acetate and linalool were detected as major components, and α-terpinene, γ-terpinene and citral were found in minor amounts.

The aim of this work was to study the differences in some growth characters and both essential oil production and constituents as well as chemical composition of some marjoram cultivars (nitrogen, phosphorus, potassium and carbohydrates contents) among five imported marjoram cultivars namely *Origanum majorana marcelka*, *Origanum majorana blart*, *Origanum majorana, Origanum majorana kruiden* and *Origanum majorana* (local).

## MATERIALS AND METHODS

The present work was conducted in the Experimental Farm of Faculty of Agriculture, Suez Canal University, Ismailia, during two successive seasons of 2001 and 2002. Seeds of marjoram cultivars; *Origanum majorana marcelka, Origanum majorana blart, Origanum majorana* and *Origanum majorana kruiden* were purchased from Saatzusch Quedlingburg, Erfurter Saatgut, Quatitas Saatgut, Royal Sluis, and Peto seed companies (Germany), as well as local one *Origanum majorana* L. (Syn. *Majorana hortensis* M.). They were sown in a well prepared soil in nursery in 15th of September for both seasons, then seedlings were transplanted at the 1st of November in the experimental

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plots. The plot area was 8 $m^2$ with 5 rows. The ridges were 60 cm a part, while the distance between seedlings was 25 cm. Two cuts were taken from plants as follows: the first one was in March 15th and the second one was in September 15th for the first and the second season. The normal agronomical practices were used as recommended in cultivation of marjoram in Egypt, adding both organic (20 $m^3$) and calcium super phosphate (300 kg/feddan) during land preparation, while ammonium sulphate (300 kg/feddan) and potassium sulphate (100 kg/feddan) were added during the season (El-Gamasy *et al*., 1980; Omer *et al*., 1994; Omer, 1998; Omer, 1999; Mahfouz, 2003). All previous treatments were added as basal dressing to all cultivars. Data were recorded on some growth characters (plant height, number of branches, and both fresh and dry herb weights per plant). Essential oil percentage in the fresh herb was determined using Head Solid State (HSS) and Gas chromatography technique (GC) analysis to identify oil constituents as follows: A sample of 2 g of fresh herb was placed in the HSS vial, sealed in the presence of an inert gas ($N_2$), then vials were incubated at 80ºC with fast shaking for about 60 min in the Dani-HSS. After that the head space aroma was automatically injected into the column (HP-5 capillary 30 m × 0.320 mm × 0.5 µm film thickness) in the GC HP5890 Series Gas Chromatograph. The injection conditions were as follows: nitrogen gas was used as the carrier with a flow rate of 2.00 ml/min. Air and hydrogen flow rates were 330 and 30 ml/min, respectively. Temperature program was as follows: injection temperature at 50ºC was held for 5 min, increased from 50º to 200ºC at a rate of 5ºC/min. The maximum temperature was maintained for a further 10 min before cooling. A set of standard compounds, representing different chemical groups with a stated purity of 99% by GLC, was obtained from Drugago Company (Holzmiden, Germany).

Nitrogen content was determined according to Pregl (1945), potassium content (Brown and Lilleland, 1946), phosphorus content (Jackson, 1958), and carbohydrates content according to A.O.A.C. (1985). Oil percentage was determined according to Guenther (1960) and the British Pharmacopoeia (1963).

Complete randomized design was used, and mean comparison was made using Duncan's Multiple Range test at 5% significant level (Duncan, 1955).

## RESULTS

### Plant height

Data in Table (1) show significant differences in plant height among cultivars, especially between the local one *Origanum majorana* (Syn. *Majorana hortensis* M.) (33.87 and 26.74 cm) and *O. majorana kruiden* (45.54 and 43.37 cm), in both seasons, respectively. Allover the studied cultivars, the data show that the plant height was taller in the first cut of both seasons than the second one.

### Number of branches

Data in Table (1) show no significant differences in number of branches. The local cultivar *Origanum majorana* had the lowest value (19.04 and 22.79 branch/plant), while *O. majorana marcelka* gave the best results (24.83 and 29.74 branch/plant, respectively), in both seasons. Generally, number of branches in the second cut of both seasons was greater than the first one.

### Plant fresh weight per plant

Results of fresh weight (Table 1) reveal significant differences in plant fresh weight especially between the local cultivar *Origanum majorana* (200.34 and 204.74 g) and *O. majorana marcelka* (329.48 and 293.55 g) in both seasons, respectively.

### Plant Dry weight

Concerning results of dry weight per plant, Table (1) shows significant differences in plant dry weight. Furthermore, a similar trend like plant fresh weight was observed. Similar results were also observed when the yield of dry weight per feddan was calculated.

**Table (1):** Vegetative growth of *Origanum majoranum* cultivars as affected by fertilization treatment during 2001 and 2002 seasons.

| | Plant height (cm) | | | No. of branches (branch/plant) | | | Fresh weight (g) | | | Dry weight (g/plant) | | | Dry weight (Kg/feddan) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | First season (2001) | | | | | | | | |
| **Cultivars** | 1st cut | 2nd cut | Mean | 1st cut | 2nd cut | Mean | 1st cut | 2nd cut | Mean | 1st cut | 2nd cut | Mean | 1st cut | 2nd cut | Mean |
| Cv1 | 41.80a | 44.52a | 43.16 | 22.22a | 27.44a | 24.83 | 278.06a | 380.90a | 329.48 | 87.20a | 120.45a | 103.83 | 2325.28a | 3211.92a | 2768.73 |
| Cv2 | 42.00a | 44.73a | 43.37 | 21.24a | 26.23a | 23.74 | 265.65a | 363.90a | 314.78 | 84.79a | 116.15a | 100.47 | 2261.01a | 3097.26a | 2679.13 |
| Cv3 | 42.30a | 45.05a | 43.68 | 20.54a | 25.37ab | 22.96 | 262.36a | 360.40a | 311.38 | 64.28b | 88.05b | 76.17 | 1714.09b | 2347.94b | 2031.15 |
| Cv4 | 44.10a | 46.97a | 45.54 | 19.49ab | 24.07ab | 21.78 | 226.37a | 310.10ab | 268.24 | 60.80b | 83.29b | 72.05 | 1621.29b | 2221.01b | 1921.29 |
| Local | 32.80a | 34.93b | 33.87 | 17.04b | 21.04b | 19.04 | 169.07b | 231.60b | 200.34 | 51.24b | 70.19b | 60.72 | 1366.37b | 1871.69b | 1619.16 |
| | | | | | | | Second season (2002) | | | | | | | | |
| **Cultivars** | 1st cut | 2nd cut | Mean | 1st cut | 2nd cut | Mean | 1st cut | 2nd cut | Mean | 1st cut | 2nd cut | Mean | 1st cut | 2nd cut | Mean |
| Cv1 | 31.10a | 33.12a | 32.11 | 26.61a | 32.86a | 29.74 | 247.73a | 339.36a | 293.55 | 66.89a | 91.93a | 79.41 | 1783.69 | 2451.41a | 2117.55 |
| Cv2 | 36.60ab | 38.98a | 37.79 | 25.43ab | 31.40a | 28.42 | 242.46a | 332.14a | 287.30 | 65.46a | 89.68a | 77.57 | 1745.56 | 2391.41a | 2068.48 |
| Cv3 | 38.10ab | 40.58ab | 39.34 | 24.59ab | 30.37ab | 27.48 | 241.39a | 330.67a | 286.03 | 65.18a | 89.28a | 77.23 | 1738.09 | 2380.74a | 2059.42 |
| Cv4 | 42.00b | 44.73b | 43.37 | 23.34ab | 28.82ab | 26.08 | 180.26b | 246.93b | 213.60 | 48.67b | 66.67b | 57.67 | 1297.83 | 1777.82b | 1537.83 |
| Local | 25.90a | 27.58c | 26.74 | 20.40b | 25.19b | 22.79 | 172.78b | 236.69b | 204.74 | 46.65b | 63.90b | 55.23 | 1243.97 | 1703.96b | 1472.76 |

Values with the same letter (s) do not differ significantly at $p \leq 0.05$, **Cv1** = *Origanum majorana marcelka,* **Cv2** = *Origanum majorana blart*, **Cv3** = *Origanum majorana* **Cv4** = *Origanum majorana kruiden,* **Local** = *Origanum majorana* (local).

**Nitrogen content**

Plant nitrogen contents were represented in Table (2). It is clear that among the different cultivars, the imported cv. (*Origanum majoranum*) exhibited the highest content of nitrogen (1.607-1.507%). Contrarily, *O. majoranum marcelka* had the lowest nitrogen content (1.482-1.403%) compared to other studied cultivars during both seasons.

**Phosphorus content**

Data on phosphorus content presented in Table (2) show that among different cultivars, the imported cv. (*Origanum majoranum*) exhibited the highest content of phosphorus (0.410-0.0.225%). While, the local cv. resulted in the lowest phosphorus content (0.255-0.140%) compared to other studied cultivars during both seasons.

**Potassium content**

In concern of potassium content, it is clear from the results obtained (Table 2) that among different cultivars, the imported cv. *(O. majoranum*) gave the highest content of potassium (0.334-0.475%). However, the local cv. exhibited the lowest potassium content (0.135-0.191%) compared to other studied cultivars during both seasons.

**Carbohydrate content**

Among different cultivars, *O. majoranum kruiden* gave the highest content of carbohydrates (18.44-19.99%) compared to other studied cultivars during both seasons (Table 2).

**Essential oil percentage**

Taking essential oil percentage into consideration, Table (2) shows that among different cultivars, *Origanum majorana marcelka* was superior in oil percentage in both seasons. It also resulted in significant differences compared to other cultivars, especially the local one.

**Essential oil constituents**

Components identified in volatile oil of different cultivars were divided into three main groups namely, hydrocarbons, oxygenated and unidentified ones. The data showed that *O. majorana marcelka* was superior allover other cultivars in all active constituents (Table 3). Generally, the main constituents of volatile oil of the studied cultivars were terpinene-4-ol (17.97-21.49%), linalyl acetate (13.99-17.19%) and linalool (15.59-22.58%).

## DISCUSSION

Two seasons of field experiments 2001 and 2002 were carried out to investigate the effect of fertilization on four imported cultivars *O. majorana marcelka, O. majorana blart, O. majorana* and *O. majorana kruiden* in comparison with the local one *O. majorana* (Syn. *Majorana hortensis* M.). Data recorded in Table (1) showed that, *O. majorana marcelka* gave the highest yields of both fresh and dry herb. These results were in line with those obtained by Eid and El-Ghawwas (2002) and Attia and Abdel-Azeem (2004).

The chemical composition and volatile oil percentage which represented in Table (2) revealed that imported *O. majorana* cultivar was superior in N, P and K percentages in both seasons. This may be attributed to genetical and geographical origin. These results were in agreement with those observed by Harridy and Soliman (1998).

Regarding to the oil constituents in Table (3), the cultivar *O. majorana marcelka* exhibited the highest total of both oxygenated and hydrocarbon compounds. The importance of the essential oil generally is represented from its content of those compounds i.e. gamma Terpinene (insectifuge), p-cymene (analgesic, antiflu, antirheumatic and vermifuge) and carvacrol (anti-inflammatory, antiseptic and expectorant). The biological properties of these compounds may justify some of the reported traditional uses (Skoula and Kamenopoulos, 1996).

**Table (2):** Chemical composition of *Origanum majoranum* cultivars as affected by fertilization (mean of 2001 and 2002 seasons).

| | N (%) | | | P (%) | | | K (%) | | | Carbohydrates (%) | | | Volatile oil (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | First season | | | | | | | |
| **Cultivars** | **1st cut** | **2nd cut** | **Mean** | **1st cut** | **2nd cut** | **Mean** | **1st cut** | **2nd cut** | **Mean** | **1st cut** | **2nd cut** | **Mean** | **1st cut** | **2nd cut** | **Mean** |
| Cv1 | 1.44 | 1.53 | 1.48 | 0.37 | 0.39 | 0.38 | 0.25 | 0.26 | 0.26 | 15.71 | 16.69 | 16.20 | 0.96 | 1.32 | 1.14 |
| Cv2 | 1.52 | 1.61 | 1.56 | 0.34 | 0.37 | 0.36 | 0.23 | 0.24 | 0.24 | 16.85 | 17.89 | 17.37 | 0.92 | 1.26 | 1.09 |
| Cv3 | 1.56 | 1.66 | 1.61 | 0.40 | 0.42 | 0.41 | 0.32 | 0.34 | 0.33 | 15.88 | 16.86 | 16.37 | 0.91 | 1.25 | 1.08 |
| Cv4 | 1.47 | 1.56 | 1.52 | 0.29 | 0.31 | 0.30 | 0.31 | 0.32 | 0.31 | 17.89 | 18.99 | 18.44 | 0.78 | 1.08 | 0.93 |
| Local | 1.45 | 1.54 | 1.50 | 0.25 | 0.26 | 0.26 | 0.13 | 0.14 | 0.14 | 16.32 | 17.33 | 16.82 | 0.59 | 0.80 | 0.69 |
| | | | | | | | | Second season | | | | | | | |
| **Cultivars** | **1st cut** | **2nd cut** | **Mean** | **1st cut** | **2nd cut** | **Mean** | **1st cut** | **2nd cut** | **Mean** | **1st cut** | **2nd cut** | **Mean** | **1st cut** | **2nd cut** | **Mean** |
| Cv1 | 1.36 | 1.45 | 1.40 | 0.20 | 0.21 | 0.21 | 0.35 | 0.38 | 0.36 | 18.12 | 19.24 | 18.68 | 0.86 | 1.18 | 1.02 |
| Cv2 | 1.43 | 1.52 | 1.47 | 0.19 | 0.20 | 0.20 | 0.32 | 0.34 | 0.33 | 18.83 | 19.99 | 19.41 | 0.84 | 1.15 | 1.00 |
| Cv3 | 1.46 | 1.55 | 1.51 | 0.22 | 0.23 | 0.23 | 0.46 | 0.49 | 0.48 | 18.30 | 19.44 | 18.87 | 0.84 | 1.15 | 0.99 |
| Cv4 | 1.39 | 1.48 | 1.43 | 0.16 | 0.17 | 0.17 | 0.43 | 0.46 | 0.45 | 19.39 | 20.59 | 19.99 | 0.62 | 0.86 | 0.74 |
| Local | 1.37 | 1.46 | 1.41 | 0.14 | 0.14 | 0.14 | 0.19 | 0.20 | 0.19 | 13.30 | 14.12 | 13.71 | 0.60 | 0.82 | 0.71 |

**Cv1** = *Origanum majorana marcelka*, **Cv2** = *Origanum majorana blart*, **Cv3** = *Origanum majorana,* **Cv4** = *Origanum majorana kruiden,* **Local** = *Origanum majorana* (local).

**Table (3):** Chemical composition of *Origanum* sp. essential oil fractionated by GC technique.

| Compounds | RT | % Area in oil | | | | |
|---|---|---|---|---|---|---|
| | | Cv1 | Cv2 | Cv3 | Cv4 | Local |
| **Hydrocarbons** | | | | | | |
| α-Pinene | 2.325 | ---- | 1.69 | 0.24 | 0.28 | 2.60 |
| β-Pinene | 2.360 | 2.81 | 1.48 | 0.71 | 1.03 | 1.28 |
| Sabinene | 2.421 | 7.10 | 3.95 | 1.57 | 1.55 | 0.77 |
| α-Terpinene | 2.627 | 0.91 | ----- | 0.22 | 0.26 | ---- |
| γ-Terpinene | 3.099 | 1.22 | 0.87 | 0.43 | 0.89 | 1.36 |
| p-Cymene | 9.529 | 5.67 | 7.29 | 4.86 | 4.93 | 5.94 |
| t-Sabinene | 9.797 | 4.58 | 4.99 | 3.37 | 3.22 | 3.80 |
| **Total** | | 22.29 | 20.27 | 11.40 | 12.16 | 15.75 |
| **Oxygenated compounds** | | | | | | |
| Linalool | 12.102 | 16.54 | 19.34 | 22.58 | 20.14 | 15.59 |
| Neryl acetate | 13.356 | 4.93 | 4.81 | 6.26 | 6.04 | 4.55 |
| Linalyl acetate | 14.834 | 17.01 | 14.79 | 16.73 | 17.19 | 13.99 |
| α-Terpineol | 15.383 | 6.79 | 10.41 | 2.50 | 1.90 | ----- |
| Terpinene 4-ol | 17.945 | 19.11 | 19.81 | 20.76 | 21.49 | 17.97 |
| Citral | 18.691 | ---- | ----- | 1.40 | 1.46 | ---- |
| Geranyl acetate | 21.100 | ----- | ----- | 1.50 | 1.82 | ---- |
| Carvacrol | 27.312 | 7.35 | 4.42 | 5.82 | 8.24 | 7.70 |
| **Total** | | 71.73 | 73.58 | 77.55 | 78.28 | 59.80 |
| **Unknown** | | | | | | |
| Unknown 1 | 15.339 | ---- | ---- | ---- | ---- | 15.09 |
| Unknown 2 | 15.601 | 5.98 | 6.15 | 7.58 | 6.20 | 6.30 |
| Unknown 3 | 20.014 | ----- | ----- | 3.46 | 3.36 | 3.06 |
| **Total** | | 5.98 | 6.15 | 11.05 | 9.56 | 24.45 |

**Cv1** = *Origanum majorana marcelka,* **Cv2** = *O. majorana blart*, **Cv3** = *O. majorana,* **Cv4** = *O. majorana kruiden*, **Local** = *O. majorana* (local).

Generally, it can be recommended that for yields of herb and oil percentage, *O. majorana marcelka* can substitute the local variety *O. majorana* (Syn. *Majorana hortensis* M.). Regarding to Egyptian flora, it must be recognized that the wild type *O. syriacum* must be conserved in both its origins South Sinai and cultivated in North Sinai. The new cultivar *O. majorana marcelka* must be cultivated in places faraway from the wild one. This will help to conserve and keep the wild type, *Origanum syriacum* and its gene pool pure status away from hybridization. Also the germ plasm of this plant and genetric resources should be preserved in gene banks as stated for anothers by Spada and Perrino 1996.

## REFERENCE


ABD ELGAWAD, M., AND E.A. OMER. 1995. Effect of essential oils of some medicinal plants on phytonematodes. Anz. Schaedlingskd, Pflanzen-schutz, Umweltsscutz **68** (4): 82-84.

ABDALLAH, A. MONA. 2000. Biochemical studies on some medicinal plants. M.Sc. Thesis, Faculty of Agriculture, Cairo University, Egypt.

A.O.A.C. 1985. Association of official Agriculture Chemistry. In:Official methods of analysis. 14th Ed. Publisher. Benjamin Franklin station, Washington D.C., U.S.A.

ATTIA, M., ELHAM ABDEL AZEEM, AND H.M. HODA. 2004. Effect of biofertilization with some strains of bacteria and chemical fertilization on *Mentha viridis* L. cultivated in Maruit location. 9th Conference of Agricultural Development Researches, Ain Shams University, Cairo, Egypt. Annals of Agriculture Science, special Issue **2:** 431-442.

BELSINGER, S., AND WILCOX M. TINA. 2004. Our favourite oregano in kitchen. The Herbarist. (2004) **70:** 4-9.

BRITISH PHARMACOPREA, 1963. The Pharmaceutical Press 17 Bloomsbury Square, London W.C.L.

BROWN, J.D., AND O. LILLELAND. 1946. Determination of potassium and sodium in plant material and soil extract by flame photometry. Proceedings of the American Society of Horticulture Science 73: 813].

CHANDLER-EZELL, K. 2004. Folklore of oregano. The Herbarist **70:** 16-24.

DAFERERA, D.J., B.N. ZIOGAS, AND M.G. POLISSIOU. 2000. GC-MS analysis of essential oils from some Greek aromatic plants and their fungitoxicity on *Penicillium digitatum*. Journal of Agriculture and Food Chemistry **48** (6).2576-2581.

DEANS, S.G., AND P.G. WATERMAN. 1993. Biological activity of volatile oils. In: Volatile oil crops: their biology, biochemistry and production. Longman group, U.K. limited.

DE MASTERO G. 1996. Crop domestication and variability within accessions of *Origanum* genus. Proceedings of the IPGRI International Workshop on Oregano, Ciheam, Valenzano (Bari), Italy.

DUNCAN, D.B. 1955. Multiple ranges and multiple F test. Biometrics **11:** 1-42.

EID, M.I., AND E.O. EL GHAWWAS. 2002. Study on the responsibility of marjoram plants to biofertilizer in sandy soil. Egypt. Journal Applied Science **17** (3): 2002.

EL GAMASY, A.M., K.M. EL GAMASY, AND F.A. EL SHARKAWY. 1980. Effect of some cultural treatments on the growth and yield of sweet marjoram plants, Majorana hortensis. Annals of Agriculture. Science, Ain Shams University, **25** (1/2): 283-298.

EL-KADY, A.T.M. 2003. Technochemical studies on some horticulture crops (Basil, Marjoram). Ph.D. Thesis, Faculty of Agriculture, Moshtohor, Zagazig University, Benha Branch, Egypt.

GUENTHER, E. 1960. The essential oil. D. Van Nostrand Company, New York, Torento, London, Volume 1.

HARRIDY, I.M.A. AND S.G.I. SOLIMAN. 1998. Evaluation of some coriander *Coriandrum sativum* L. cultivars. Journal of agriculture Sciences, Mansoura University **23** (6): 2659-2665.

IBRAHIM, M.E., EL NAHAS, F. ABEER, AND O.M. SLAMA. 2005. Protective effect of volatile oil, alcoholic and aqueous extracts of Origanum majorana on lead acetate toxicity in mice. Basic, clinical, Pharmacology and Toxicology, Volume **97**(4**):** 238-243.

JACKSON, N.L. 1958. Soil chemical Analysis Constable. Limited Co., London.

JENO, B. 1996. Some scientific and practical aspects of production and utilization of oregano in central Europe. Proceedings of the IPGRI International Workshop on Oregano, Ciheam, Valenzano (Bari), Italy.

KINTZIOS, S., AND E. PIRIDON. 2002. Oregano: The genera Origanum and Lippia. Taylor and Francis Pub., London and New York.

MAHFOUZ, S.A.S. 2003. Effect of biofertilization on growth and oil production of marjoram (*Majorana hortensis Moench*) plant. Ph.D. Thesis, Faculty of Agriculture, Cairo University, Egypt.

NATIONAL AGRICULTURE INCOME 2003. Ministry of Agriculture and Land reclamation, Economic Affairs Sector (EAS), Agriculture Planning Central Administration, General administration of Agriculture, Economic Resources.

NOVAK, I., M. HEJJA, H. HORVATH, AND E. HETHELYI. 2001. Sensory analysis as a supporting method for marjoram breeding. International Journal of Horticultural Science **7**(2): 73-77.

NOVAK, J., J. LANGBEHN, F. PANK, AND C.M. FRANZ. 2002. Essential oil compounds in a historical sample of marjoram (*Origanum majorana* L., Lamiaceae). Flavour and Fragrance Journal **17**(3): 175-180.

OMER, E.A. 1998. Response of wild Egyptian Oregano to nitrogen fertilization in sandy soil. Egypt. Journal of Horticulture **25** (3): 295-307.

OMER, E.A. 1999. Response of wild Egyptian Oregano to nitrogen fertilization in sandy soil. Journal of Plant Nutrition **22** (1): 103-114.

OMER, E.A., H.E. OUDA, AND S.S. AHMED. 1994. Cultivation of sweet marjoram, *Majorana hortensis*, in newly reclaimed lands of Egypt. Journal of Herbs, Spices and Medicinal plants **2** (2): 9-16.

OPDYKE, D.L.J. 1967. Food Cosmet Toxicology 14: 469. [C.F. ALBERT, Y.L. 1980. Encyclopedia of Common Natural Ingredients used in Food, Drugs and cosmetics. John Wiley and Sons Incorporation, Glen Rock, New Jersey, U.S.A.]

PRAKASH, V. 1990. Leafy spices. Boca Raton, Florida, U.S.A.; CRC Press, Incorporation.

PREGL, F. 1945. Quantitative Organic Microanalysis. 4th ed. J.A. Churchill Limited, London.

REFAAT, A.M., H.H. BAGHDADI, E.H. OUDA, AND S.S. AHMAD. 1990. A comparative study between the Egyptian and Romanian sweet marjoram (*Majorana hortensis*). Egyptian Journal of Horticulture **19**(1): 99-108.

REFAAT, A.M., M.R. ABD AL-MOEZ, AND S.S. AHMAD 2001. The impact of phosphorus rate and methods of application on yield and oil quality of Romanian sweet marjoram. Egyptian Journal of Soil Science. **41**(1-2): 93-109.

SALGUEIRO, L.R., C. CAVALEIRO, E. PINTO, C. PINA. VAZ, A.G. RODRIGUES, A. PALMEIRA, C. TAVARES, S. COSTA OLIVERA, M.J. GONCALVES, AND J. MORTINEZ OLIVEIRA. 2003. Chemical composition and antifungal activity of the essential oil of *Origanum virens* on candida species. Planta Medica **69** (9): 871-874.

SIMON, J.E., A.F. CHADWICK, AND L.E. CRAKER. 1984. Herbs. The scientific literature on selected herbs, and aromatic and medicinal plants of the temperate zone. Archon Books, C.T. Hamdan, U.S.A.

SKOULA, M. AND S. KAMENOPOULS. 1996. *Origanum dicatmnous* L. and *Origanum vulgare* L. subsp. *hrtum* (link) Letswaart : traditional uses and production in Greece. Proceedings of the IPGRI International Workshop on Oregano, Ciheam, Valenzano (Bari), Italy.

SKWAREK, T., Z. TYNECKA, K. GLOWNIAK, AND E. LUTOSTANSKA. 1994. Plant inducers of interference. Herba Polonica **40** (1-2): 42-49.

VAGI, E., E. RAPAVI, M. HADOLINE, VASARHELYINE K. PEREDI, A. BALAZS, A. BLAZOVICS, AND B. SINADI. 2005. Phenolic and triterpenoid antioxidants from *Origanum majorana* L. herb and extracts obtained with different solvents. Journal Agriculture. Food Chemistry **53** (1): 17-21.

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# إستجابة بعض أصناف البردقوش للتسميد الكيماوي تحت ظروف الأراضي الرملية 2 : أصناف

## *Origanum majorana marcelka, Origanum majorana blart, Origanum majorana, Origanum majorana kruiden* and *Origanum majorana* (local)

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## الملخص العربي

أجري هذا البحث خلال موسمي 2001 ،2002 في المزرعة البحثية لكلية الزراعة جامعة قناة السويس بالإسماعيلية وذلك لتقييم إنتاج بعض أصناف البردقوش *Origanum majorana marcelka* و *Origanum majorana blart* و *Origanum majorana* (imported) و *Origanum majorana kruiden* مقارنة بالصنف *Origanum majorana* (المحلى) والنامية تحت ظروف الأراضي الرملية والتسميد الموصي به (20م$^3$ سماد عضوي ،300 كجم/فدان من كل من سوبر فوسفات الكالسيوم وسلفات الأمونيوم و100كجم/فدان سلفات البوتاسيوم).

وقد أظهرت النتائج أن الصنف *Origanum majorana marcelka* كان متفوقاً في النمو (عدد الأفرع وكل من الوزن الطازج والجاف). هذا بالإضافة إلي أنه كان أيضاً متفوقاً في نسبة الزيت الطيار ومكوناته حيث سجل أعلي محتوي من نسبة الزيت الطيار (1.14% و1.02% وزن/حجم) مقارنة بالصنف المحلي (0.69% و0.71% وزن/حجم) كما سجل أعلي محتوي من إجمالي المكونات الأكسوجينية والهيدروكربونية (94.02%) مقارنة ببقية الأصناف تحت الدراسة. وقد تم التعرف علي مكونات الزيوت الطيارة بإستخدام تقنية الفراغ القمي وكروماتوجرافيا الغاز. وكانت المركبات الأكسوجينية الرئيسية في *Origanum majorana marcelka* هي terpinene-4-ol و linalyl acetate و linalool بنسب 19.11% و17.01% و16.54% علي الترتيب مقارنة بمثيلتها الموجودة في الصنف المحلي (17.97% و13.99% و15.59% علي الترتيب).