Journal Homepage: - www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI: 10.21474/IJAR01/4196
DOI URL: http://dx.doi.org/10.21474/IJAR01/4196

RESEARCH ARTICLE

CHEMICAL COMPOSITION OF ESSENTIAL OIL OF *TEUCRIUM PSEUDOSCORODONIA SUBSP. BAETICUM,* ENDEMIC PLANTOF NORTH OF MOROCCO.

Nabila Tahoum[1], Abdelhay Arakrak[1], Mohamed Bakkali[1], Sorel S. Jatunov[2], Antonio G. Franconetti,[2] Manuel G. Guillén[2], Francisca C. Escribano[2] and *Amin Laglaoui[1].

1. Department of Life Sciences, Faculty of Sciences and Technics of Tangier, Ziaten. BP: 416. Tangier, Morocco.
2. Department of Organic Chemistry, Faculty of Chemistry, University of Seville, c/ professor García González, s/n c.p: 41012. Seville, Spain.

Manuscript Info

Manuscript History

Received: 15 March 2017
Final Accepted: 17 April 2017
Published: May 2017

Key words:-
*Teucrium pseudoscorodonia subsp. baeticum*of North of Morocco; essential oil; monoterpenes; alkaloids; morpholine.

Abstract

The chemical composition of essential oil of dry leaves of *Teucrium pseudoscorodonia* subsp.*baeticum* of North of Morocco from Perdicaris forest was investigated by GC-MS analysis. The detected components were aromatic compounds (12.38 %), oxygenated monoterpenes (7.78 %), fatty acids related compounds (6.91 %), alkaloids (2.12 %), flavonoids (1.82 %), and lactones (0.62 %) and the main components were N-Formylmorpholine (25.07 %), morpholine, 4-acetyl- (17.61 %) and 2-Oxabicyclo[2,2,2]octan-6-one, 1,3,3-trimethyl- (6.47 %).

Introduction:-

North of Africa houses nearly 1700 species and subspecies endemic, more than 50 % exist only in Morocco. The largest number is in Morocco and Algeria. The herbarium MPU (University of Montpellier 2) have a huge part, followed by the Museum P (National Museum of Natural History, Paris) and RAB (Scientific Institute, Rabat) with respectively 3054, 1059 and 933 exsiccata. *Teucrium pseudoscorodonia subsp. Baeticum* is an endemic plant of north of Morocco (El Oualidi J. and Khamar H., 2012) and *Teucrium* is the largest genera of the *Lamiaceae* in Morocco (Navarro T. and El Oualidi J. 1997. Synopsis of the Genus *Teucrium* L. *(Lamiaceae) In* Morocco.Acta Botanica Malacitana 22:187-203). Since the end of XVIII century, different authors have studied this genus; Desfontaines (1798), Ball (1878), Cosson (1873; 1881), Battandier (1917), Battanclier and Trabut (1890), Pau (1924), Litardierc and Maire (1921), Humbert (1924),Font Quer (1928; 1932), Emberger and Maire(1927; 1941), Maire (1929a, b; 1931; 1932;1933; 1939), Jahandiez and Maire (1934), Sennen (1936), Sauvage and Vindt (1955; 1965; 1967), Cohen (1956), El Oualidi (1987; 1991), El Oualidi and Ibn Tattou (1993), El Oualidi and Navarro (1995), Navarro and El Oualidi (1996) and El Oualidi and al. (I 997a; 1997b).

L=T. pseudoscorodonio var. *baeticum* (Boiss. and Reuter) Maire in Jahand. and Maire, Cat. Pl. Maroc 3: 613 (1932); The genus *Teucrium* L. (Lamiaceae) comprises more than 300 species (J.A. Franco, Nova Flora de Portugal (Continente e Açores), II, Lisboa, 1984. B. Valdés, S. Talavera, E. Fernández-Galiano, Flora vascular de Andalucıa Ocidental, Ketres Editora, Barcelona, 1987). It is present in the Mediterranean basin ((Boiss. and Reuter)). (Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentie, D. H., and Webb, D. A. (1976). Flora Europaea (Vol. 3). Cambridge: Cambridge University Press.

Corresponding Author:- Amin Laglaoui.
Address:- Department of Life Sciences, Faculty of Sciences and Technics of Tangier, Ziaten. BP: 416. Tangier, Morocco.

The specie of *Teucrium pseudoscorodonia subsp. baeticum* prefers broad-leaved forests, generally on acid soil, from sea level up to 1500 m (Pignatti, 1982).

Many species of *Teucrium* are known for their utilizationin traditional folk medicine and are claimed to exhibit interesting biological properties, e.g., hypoglycaemic, hypolipidemic, antipyretic, antiulcer and antibacterial (Nagao,Ito, Kohno, Kuroda, and Fujita, 1982; Autore et al., 1984;Gharaibeh, Elayan, andSalhab, 1988; Tariq, Ageel, Al-Yahya, Mossa, and Al-Said, 1989; Roman-Ramos, Flores-Saenz, Partida-Hernandez, Lara-Lemus, and Alarcon-Aguilar,1991; Fernandez, Iglesias, and Villar del Fresno, 1997;Galati et al., 2000; Rasekh, Khoshnood-Mansourkhani and Kamalinejad, 2001; Couladis, Tzakou, Verykokidou, and Harvala, 2003).

Teucrium species have been used as medicinal plants for more than 2000 years and some of them are still used in folk medicine as antispasmodic, tonic, antipyretic and antiseptic (M.M. Hassan, F.J. Muhtadi, A.A. Al-Badr, J. Pharm. Sci. 68 (1979), 800). This genus is chemically characterized by volatile constituents (A. Velasco-Negueruela, M.J. Pérez-Alonso, Phytochemistry 29 (1990) 1165. C. Cavaleiro, L.R. Salgueiro, T. Antunes, I. Sevinate-Pinto, J.G. Barroso, Flav. Frag. J. 17 (2002) 287).

Materials and methods:-

The *Teucrium pseudoscorodonia subsp. Baeticum* was collected from The Perdicaris forest (Site of Biological and Ecological interest) in Tangier in Morocco. The site is located on the outskirts of the town of Tangier (Tangiers) at the western extremity of the southern side of the Straits of Gibraltar. Forest-cover is highest on the northern slopes between 80 and 240 m in altitude. The climate is hot and humid thermomediterranean.

The leaves of *Teucrium pseudoscorodonia* subsp. *Baeticum* were dried at room temperature then submitted to hydrodistillation to extract essential oil using Clevenger apparatus. The yield was 0.2 %. The mass spectrometry chromatography (GC-MS) (Department of Organic Chemistry, Seville, Spain) was carried out using Agilent Model 7890A coupled to Agilent 5975C inert MSD with Triple-Axis Detector and Agilent Technologies 7693 Auto sampler using split ratio 5:1 Agilent 5183-4647 liner 4 mm ID LPD and HP5 column (30 m x 0.320 mm x 0.25 µm). The column temperature was kept to 280 °C for 30 min then programmed to 300 °C at a rate 3 °C/min. Flow rate of helium as a carrier gas was 20 ml/ min.

Table 1:- GC-MS Composition of essential oil of *Teucrium pseudoscorodonia* subsp. *baeticum* of Morocco

No.	Compounds	Tr (min)	%
1	2-Butenal, 3-methyl-	10.461	0.93
2	**N-Formylmorpholine**	**11.411**	**25.07**
3	2-Pentanone, 5-(acetyloxy)-	11.846	0.16
4	3-Heptanone, 2,6-dimethyl-	13.053	0.29
5	Succinicacid, cyclohexylmethylisohexyl ester	13.62	0.3
6	**Morpholine, 4-acetyl-**	**14.037**	**17.61**
7	2,2-Dimethylpentyl cyclohexanecarboxylate	14.97	0.15
8	2-n-Hexylcyclopentanone	15.582	1.05
9	Cyclobutanecarboxylicacid, 2-tetrahydrofurylmethyl ester	15.651	0.91
10	**3-Piperidinol, 6-methyl-**	**16.263**	**2.44**
11	1-Heptadecyne	17.007	0.3
12	Morpholine, 4-propionyl-	17.207	0.5
13	Allyl Isothiocyanate	19.399	0.5
14	Proline, 3-hydroxy-4-methyl-	19.891	0.19
15	1,1-Dodecanediol, diacetate	20.011	0.25
16	trans-1,2-Dimethylsilacyclohexane	20.166	0.24
17	**Cyclohexanecarboxylicacid, 2-tetrahydrofurylmethyl ester**	**20.492**	**2.2**
18	**3-Piperidinone, 1-ethyl-**	**20.766**	**2.12**
19	**Heptylcyclohexane**	**23.479**	**6.02**
20	Cyclohexanone, 2,6-dimethyl-2-(2-oxopropyl)-	23.622	0.4
21	**2-Acetyl-6-methyl-2,3-dihydropyran**	**23.816**	**1.82**
22	1,3-Hexadiene, 3-ethyl-2-methyl-,(Z)-	23.999	0.77
23	1,3-Hexadiene, 3-ethyl-2-methyl-,(Z)-	24.280	0.38
24	Pentanoicacid, morpholide	24.554	0.51

25	**2,6-Pyridinediamine**	**24.715**	**2.9**
26	**3-Methyl-2-butenoic acid, 2-ethylcyclohexyl ester**	**25.086**	**3.75**
27	**2-Oxabicyclo[2,2,2]octan-6-one, 1,3,3-trimethyl-**	**25.470**	**6.47**
28	4-Hepten-3-one, 2,6-dimethyl-	25.847	1.55
29	2-Cyclopenten-1-one, 3-methoxy-4-methyl-	26.265	0.86
30	Thiophene, 2-(2-methylpropyl)-4-Octen-3-one	26.460	1.78
31	Phosphonofluoridic acid, ethyl-, 2-methylpentyl ester	26.631	0.23
32	Cyclohexanone, 2-(1-methylethyl)-	27.467	0.27
33	Silane, dimethyldi-2-propenyl-	27.999	1.62
34	Hexanoicacid, morpholide	28.56	0.4
35	2-Chlorophenylhydrazine	28.806	0.3
36	2H-Pyran-2-one, 6-hexyltetrahydro-	28.954	0.42
37	1,3-Dioxolane, 4-[[(2-methoxy-4-octadecenyl)oxy]methyl]-2,2-dimethyl	29.498	0.43
38	2-Butyl-2,7-octadien-1-ol	29.756	0.4
39	**L-Alanine, N-L-alanyl-**	**29.876**	**2.62**
40	2,6-Dimethyl-4-thiopyrone	30.082	0.81
41	1,3-Dioxolane, 4-[[(2-methoxy-4-octadecenyl)oxy]methyl]-2,2-dimethyl	30.677	0.23
42	Piperidine, 3,5-dimethyl-	32.033	0.52
43	Acetoxyaceticacid, morpholide	32.388	0.19
44	4,8,12,16-Tetramethylheptadecan-4-olide	32.754	0.31
45	5-t-Butyl-hexa-3,5-dien-2-one	33.532	0.17
46	4-Bromo-4-methyl-5-oxo-tetrahydro-furan-2-carboxylic acid	33.807	0.17
47	trans-4a-Methyl-decahydronaphthalene	34.940	0.37
48	Bicyclo[2,2,1]heptan-2-one, 1,7,7-trimethyl-, (,+/-,)-	35.186	0.91
49	4,8,12,16-Tetramethylheptadecan-4-olide	36.605	0.21
50	**Acetohydrazide, 2-(4-morpholyl)-N2-[(4-methylcyclohex-3-enyl)methylene]-**	**36.736**	**2.9**
51	Dihydro iso-jasmone	37.154	0.25
52	2-Methyl-8-nitroisoxazolizidine	38.115	0.14
53	Acetic acid, 7-chloro-3-methyl-6-oxo-hept-2-enyl ester	38.951	0.17
54	Cycloundecanone	39.740	0.29
55	Hydrazinecarboxamide, 2-(2-thienylmethylene)-	40.467	0.15
56	E-9-Methyl-8-tridecen-2-ol, acetate	40.988	0.14
57	Oxalicacid, dimorpholide	41.903	0.3
58	2H-Pyran-2-one, 6-hexyltetrahydro-	42.252	0.2
59	3-Bornanone, oxime	43.797	0.13
60	(4R*,5R*,9S*)-5,9-Dimethylspiro[3,5]nonan-1-one	45.045	0.14
61	Methylphosphonic acid, fluoroanhydride, (2-isopropyl-5-methylcyclohexyl) ester	45.457	0.14
62	Hexanoicacid, 5-tridecyl ester	45.600	0.36
63	Benzylalcohol, 4-methoxy-6-fluoro	45.714	0.15
64	Dodecanoicacid, ethenyl ester	45.834	0.21
65	Hexanoic acid, undec-2-enyl ester	45.977	0.87
66	Phosphonofluoridic acid, methyl-, cycloheptyl ester	46.441	0.14
67	2-Benzimidazolinethione, hexahydro	47.374	0.18
68	Fumaricacid, di(3-hexyl) ester	47.854	0.14
	Oxygenated monoterpenes	7.78	
	Lactones	0.62	
	Fattyacidsrelatedcompound	6.91	
	Alkaloids	2.12	
	Flavonoids	1.82	
	Aromaticcompound	12.38	
	Others	68.37	

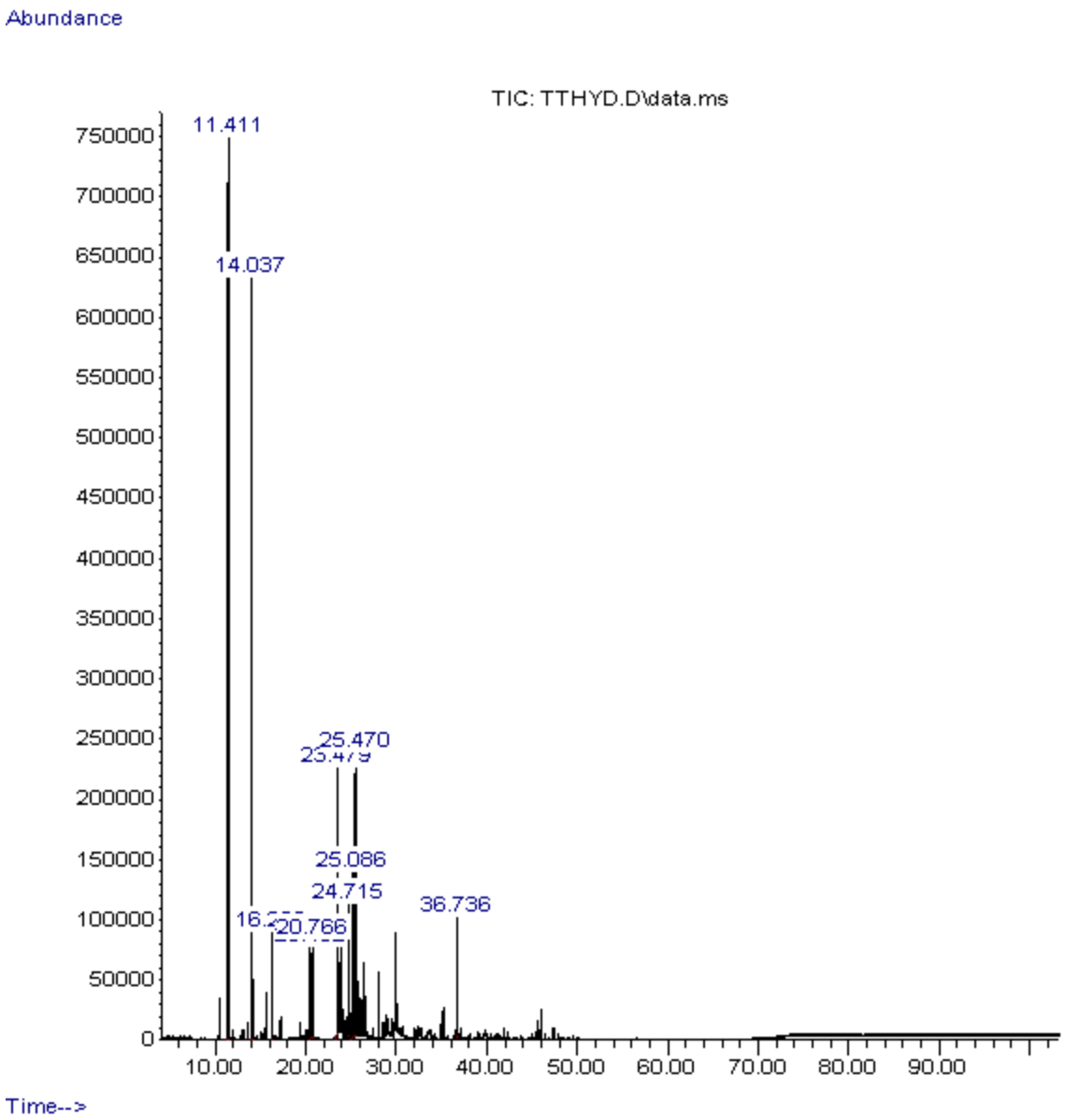

Figure 1:- GC-MS chromatogram of essential oil of *Teucrium pseudoscorodonia* subsp. *baeticum* of north of Morocco.

Results and discussion:-

The GC-MS analysis (table 1 and figure 1) showed that the essential oil of *Teucrium pseudoscorodonia* subsp. *baeticum* from Tangier is mainly composed of N-Formylmorpholine (25.07 %), morpholine, 4-acetyl- (17.61 %) and 2-Oxabicyclo[2,2,2]octan-6-one, 1,3,3-trimethyl- (6.47 %). Moreover, the amount of aromatic compounds were 12.38 %,oxygenated monoterpenes (7.78 %),fatty acids related compounds (6.91 %), alkaloids (2.12 %) and flavonoids (1.82 %).

Although, the chemical composition of essential oil of Moroccan specie is completely different of *Teucrium scorodonia* subsp. *scorodonia* sample oils from Corsica and *T. scorodonia* subsp. *Baeticum* sample oils from Algeria (Djabou N. and al. 2012). The amount of oxygenated monoterpenes found in Moroccan subspecie was 7.78 % but in Corsican and Algerian *Teucrium* oils were respectively 2 % and 4.4 %. Also the main components found in previous works (Djabou N., and al. 2012) were (E)-β-caryophyllene, germacrene B and α-humulene whose not present in the Moroccan specie.

Also, the comparison of our results with those of Maccioni S. and al. (2007) and Velasco Negueruela, A., and al. (1990) showed a total difference on the chemical composition.

These phytochemical differences could be related to genetic background, materials and method used to extract essential oil. In our investigation we extracted oil from dry leaves of the plant but in the works of Djabou N., and al. (2012) the extraction was applied on fresh aerial parts.

The obtained oil suggests an interesting application as a biopesticide because of the abundance of morpholine which derivatives are used as fungicides in cereals ergosterol biosynthesis inhibitors (Raymond, G. M., and al. 1999).

Conclusion:-

In conclusion the present work showed that *Teucrium pseudoscorodonia* subsp *baeticum* essential oil from North of morocco, have mainly components of interest like nitrogen compounds, oxygenated monoterpenes and alkaloids, which could be suitable for pharmaceutical and agricultural use.

References:-

1. Autore, G., Capasso, F., De Fusco, R., Fasulo, M. P., Lembo, M., Mascolo, N., et Menghini A. (1984). Antipyretic and antibacterial actions of *Teucrium polium* (L.). Pharmacological Research Communications, 16 (1), 21–29.
2. Ball, J. (1878).Spicilegium Florae Maroccanae*J. Linn. Soc., 16*, 281-772.
3. Battandier, J.A. (1917) Note sur un nouveau *Teucrium* de la flore marocaine.
4. Bull. (1917). Soc. Hist. Nat. Afrique N. 8 : 71.
5. Battandier, J.A. andTrabutL.C. (1890). Flore de l'Algérie et catalogue des plantes du Maroc, I. Dicotylédones. 872 p. Alger, Jourdan.
6. Cavaleiro C., Salgueiro L.R., Antunes T., Sevinate-Pinto I., and Barroso J.G. (2002). Composition of the essential oil and micromorphology of trichomes of Teucrium salviastrum., an endemic species from Portugal. *FlavFrag J., 17*, 287–291.
7. Cohen, E. (1956). Contribution à l'étude des Teucrium marocains de la section *Polium*. Tray. Inst. Sci. Chérifien. Sér. Bot. 9, 88p.
8. Cosson, E. (1873).Species novae maroccanae (serie prima). *Bull. Soc. Bol.France* 20. 239-261.
9. Cosson, E. (1881). Compendium Floraeatlanticaeseumethodicaplantarum omnium in Algeria... (Flore des Fiats barbaresques: Algérie, Tunisie, Maroc), I. Paris, Masson.
10. Couladis, M., Tzakou, O., Verykokidou, E., andHarvala, C. (2003). Screening of some Greek aromatic plants for antioxidant activity. *Phytotherapy Research, 17*, 472–476.
11. Desfontaines, A. R. (1798). Flora Allantica, 2. Paris. 923 p.
12. Djabou N., AllaliH., BattestiM.J., TabtiB., Costa J., MuselliA., VaresiL. (2012). Chemical and genetic differentiation of two Mediterranean subspecies of Teucrium scorodonia L. *Phytochemistry* 74, 123–132.
13. El Oualidi, J. (1987). Approche de l'étude biosystématique des *Teucrium* de la section *Polium* (Lamiaceace) du Maroc. Contribution à la "Flore Pratique du Maroc". DEA Sciences de l'Évolution et Ecologic, USTL, 91 p.
14. El Oualidi, J. (1991).Biosystématique et taxonomie des *Teucrium* de la section *Polium* (Lamiaceae) dans le bassin méditerranéen occidental. Différents aspects de la variation au Maroc, en France et en Espagne. Thèse Doct., USTL., Montpellier II, 220p.
15. El Oualidi, J. and M. IbnTattou(1993).Une nouvelle espèce du genre *Teucrium* section *Polium*, endémique du Maroc: *Teucrium mitecum* Ibn Tattooand El Oualidi in Acta Bol. Malacitana 18: 153-162.
16. El Oualidi, J. and T. Navarro. (1995). Position taxonomique du complexe *Teucrium houtii- Teucrium grosii* dans le rif marocain (Lamiacae). *Anales fad. Bol. Madrid 53(2*): 257-259.
17. El Oualidi, J., J. Mathezand S. Puech. (1997a)Biosystematique et variation géographique: le complexe T. huotiiEmb. and Maire (Labiatae) du Maroc. Candollea 52(1): 59-86.
18. El Oualidi, J., J. Mathezand T. Navarro (1997b).Contribution à la connaissance des *Teucrium* sect. *Polium* (Labiatae) du Maroc : le complexe de *T. chlorostachyom*. Fl. Medit.7: 21-26.
19. El Oualidi J., Khamar H, Fennane M., Ibn Tattou M., Chauvet S.and Taleb M.S., (2012). Checklist des endémiques et spécimens typesde la flore vasculaire de l'Afrique du Nord. Document de L'institut Scientifique, N°25, 2012, Université Mohammed V-Agdal, Rabat.
20. Emberger, L and R. Maire(1927).SpicilegiumRifanum. *AVM. SOC. Sci. Nat. Maroc17*: 45-46.
21. Em Berger, L and R. Maire(1941).Catalogue des plantes du Maroc, 4. Suppléments aux vols. 1, 2 and 3. Alger, Minerva.
22. Fernandez, P. B., Iglesias, P. I., and Villar del Fresno, A. M. (1997). Antiinflammatory
23. and antiulcer activity of *Teucrium buxifolium*. *Journalof Ethnopharmacology, 55*, 93–98.
24. Font Quer, P. (1928).Itermaroccanum 1927.Etiquetasnumeradas con diagnosis de novedadessobrelasetiquetas.

25. Font Quer, P. (1932).IterMaroccanum 1930. Etiquetas numeradas con diagnosis de novedades sobre las etiquetas.
26. Franco J.A., (1984). Nova Flora de Portugal (Continente e Açores), II, Lisboa,.
27. Galati, E. M. et al. (2000). Effects of *Teucrium divaricatum*Heldr.ssp. divaricatum decoction on experimental ulcer in rats. *Journal of Ethnopharmacology, 72*, 337–342.
28. Gharaibeh, M. N., Elayan, H. H., andSalhab, A. S. (1988). Hypoglycemic effects of *Teucrium polium*.*Journal of Ethnopharmacology, 24*, 93–99.
29. Hassan M.M., Muhtadi F.J., Al-Badr A.A. (1979). *J. Pharm. Sci. 68*, 800.
30. Humbert, H. (1924). Végétation du Grand Atlas marocain oriental: Exploration botanique de l'Ari Ayachi. *Bull. Soc. Hist. Nat. Afrique N. 15*. 217.
31. Jahandiez, E. and R. Maire. (1934). Catalogue des Plantes du Maroc. Alger. Minerva.
32. Litardiere, R. deand R. Ma1re (1921). Contribution à l'étude du Grand Atlas. Mém. Soc. Sci. Nat. Maroc IV n°1 20.
33. Maire, R. (1929a). Contribution à l'étude de la flore de l'Afrique du Nord, fasc. 15 (contr. 627) Mém. Soc. Sci. Nat. Maroc 21: 15.
34. Maire, R. (1931). Contribution à l'étude de la flore de l'Afrique du Nord, fasc. 17 (contr. 893); fasc. 18 (contr. 1112, 1113). Bull. Soc. Hist. Nat. Afrique Nord 22: 62-312.
35. Maire, R. (1932). Contribution à l'étude de la flore de l'Afrique du Nord, fasc. 19 (contr. 1320, 1321, 1322, 1323). Bull. Soc. Sci. Nat. Afrique Nord 23: 208-211.
36. Maire, R. (1933). Contribution à l'étude de la flore de l'Afrique do Nord, fasc. 20 (contr. 1482). Bull. Soc. Sci. Nat. Afrique Nord 24: 297-300.
37. Maire, R. (1939). Contribution à l'étude de la flore de l'Afrique du Nord, fasc. 27 (contr. 2818,2819). Bull. Soc. Sci. Nat. Afrique Nord 30: 297-300.
38. Nagao, Y., Ito, N., Kohno, T., Kuroda, H., andFujita, E. (1982). Antitumor activity of *Rabdosia* and *Teucrium*diterpenoids against P388 lymphocytic leukemia in mice.*Chemical and Pharmaceutical Bullettin, 30*, 727–729.
39. Navarro, T. andJ. El Oualid1 (1996).Systematic position of *Teucrium tananicum*Maire (Lamiaceae), rare endemic species from The Moroccan High Atlas.*Acta Bot. Malacitana 21*: 281-282.
40. Navarro Teresa andEl OualidiJalal(1997). Synopsis of the Genus *Teucrium* L. *(Lamiaceae)* In Morocco.*Acta Botanica Malacitana 22*: 187-203
41. Pau, C. (1924). Plantas del Norte de Yebala (Marruecos). *Mem. R. Soc. Esp. Hist. Nat. 12:* 263-401.
42. Pignatti, S. (1982). Flora d'Italia. Bologna: Edagricole.
43. Roman-Ramos, R., Flores-Saenz, J. L., Partida-Hernandez, G., Lara-Lemus, A., andAlarcon-Aguilar, F. (1991). Experimental study of the hypoglycemic effect of some antidiabetic plants.*Archivos de investigacion medica, 22*, 87–93.
44. Rasekh, H. R., Khoshnood-Mansourkhani, M. J., andKamalinejad, M. (2001). Hypolipidemic effects of *Teucrium polium* in rats. *Fitoterapia, 72*, 937–939.
45. Raymond, G. M. andDimitrios, A. D. (1999). Evaluation of Shellac and Sucrose Ester Fruit Coating Formulations that Support Biological Control of Post-harvest Grapefruit Decay.*Biocontrol Sci. Technol.**9 (1)***, 53–65.
46. Sauvage, Ch. and J. Vindt(1955).Synopsis du genre Teucrium sect. Polium au Maroc. *Bull. Soc. Sc. Nat. Phy. du Maroc 35*: 283-293.
47. Sauvage, Ch. and J. Vindt(1965).Synopsis du genre *Teucrium* sect. *Polium* au Maroc (suite et fin). *NaturaliaMonsp. 16*: 195-200.
48. Sauvage, Ch. and J. V1ndt (1967).Révision de l'Herbier de l'Institut Scientifique Cherifien. Notes critiques. *Le Botaniste, sér. L:* 415-436.
49. Sennen, E.C. (1936). Diagnoses des nouveautés parues dans les exsiccata Plantes d'Espagne et du Maroc de 1928 à 1 935. Ed. Anglada. Vic. 308p.
50. SimonettaMaccioni, Rosa Baldini, Marianna Tebano, Pier Luigi Cioni, Guido Flamini (2007). Essential oil of *Teucrium scorodonia L.ssp. scorodonia*from Italy. *Food Chemistry 104*, 1393–1395.
51. Tariq, M., Ageel, A. M., Al-Yahya, M. A., Mossa, J. S., and Al-Said, M. S. (1989). Anti-inflammatory activity of *Teucrium polium*.*International Journal of Tissue Reactions, 11*, 185–188.
52. Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentie, D. H., and Webb, D. A. (1976). Flora Europaea (Vol. 3). Cambridge: Cambridge UniversityPress.
53. Valdés B., Talavera S., Fernández-Galiano E.(1987). Flora vascular de Andaluc´ıaOcidental, Ketres Editora, Barcelona.
54. Velasco-Negueruela, A., Perez-Alonso, M., (1990). The volatiles of six *Teucrium* species fromthe Iberian Peninsula and the Balearic Islands.*Phytochemistry 29*, 1165–1169.