OIL GLANDS NUMBER AND OIL GLANDS DIAMETERS OF *Thymbra spicata* var. *spicata* L. LEAVES

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In the study, a genetic pool was created with plant samples taken from the locations where the *Thymbra spicata* var. *spicata* L. plant, which is culturally and economically important, grows densely in the province of Hatay. Plants were propagated with cuttings taken from these single plants. 213 plants were collected from 68 different locations for the genetic pool. The leaves of the plants in this gene pool were examined in terms of the number of essential oil glands per unit area and the diameter of the essential oil glands. The number of glands per unit area in plant leaves showed a wide variation and ranged from 5.61 to 56.04 pieces/mm². The diameters of the oil glands varied between 75.40 - 112.86 µm and the average diameter was determined as 94.09 µm. In the study, it was determined that some plants with low essential oil ratios such as Z144 and Z158 also have low oil glands number and oil glands diameter. It would be appropriate to evaluate these values obtained as preliminary knowledge together with future ontogenetic variability studies.

Keywords: *Thymbra spicata* var. *spicata* L., essential oil gland.

INTRODUCTION

The plant species that make up plant formations do not show the same characteristics everywhere. With the emergence of local differences arising from climate, soil and geomorphological features, the plant species that make up the plant communities diversify. The region, which includes many mountains, plateaus and valley areas, especially Amanos mountains, is in a very rich position in terms of biological resources. In addition, there is a rich biological diversity with the amount of rainfall and high relative humidity in the summer months (Çakan and Byfield, 2005; Vural and Aytay 2005; Avcı, 2005). There are plant species that are naturally found in this region, almost all of which are collected from nature or traded for various purposes. Among these, *Thymbra spicata* var. *spicata* L. comes first.

Thyme species are most export products made of medicinal and aromatic plants in Turkey (Özgüven ve ark. 2005). Flora of Turkey has four species of this plant is located naturally which are *Thymbra spicata* var. *spicata*, *Thymbra spicata* var. *intricata*, *Thymbra sintenisii* var. *sintenisii* and *Thymbra sintenisii* var. *isaurica* (Davis, 1982; Başer, 2002). *Thymbra spicata* var. *spicata* L., which is called sater, zahter or blackhead thyme (Baytop, 1994) naturally grows intensively in the Eastern Mediterranean region, especially in the province of Hatay. The plants collected from nature are mostly consumed fresh traditionally in the region. In addition, it is dried and used as a spice and tea, and its essential oil, which is rich in carvacrol, is also used for different purposes. *T. spicata* L. is a plant that naturally grows intensively in Mediterranean countries and in the Mediterranean region of Turkey, especially in Hatay province.

Although there are many studies on the morphology, anatomy, amount of essential oil, components and antimicrobial properties of the thymbra plant, studies on agriculture are very limited in Turkey (Doğan *et al.*, 1987; Hancı *et al.*, 2003; Özel *et al.*, 2003; Baydar *et al.*, 2004; Erken, 2005; Özcan *et al.*, 2008). Inan *et al.* (2011), in their study on *Thymbra spicata* L., which they collected from Adıyaman region, determined that the amount of essential oil changed in different harvest times and that the highest rate of

essential oil was obtained from plants harvested during the flowering period. Kızıl (2013) made evaluations on 28 different populations collected from Southeast Anatolia and the Mediterranean region and determined that there were significant differences between the populations. Carvacrol is the most abundant component as the main component (Başer, 2002). But Hancı *et al.* (2003) stated that this species also has thymol-containing chemotypes.

Although standardization is important in all other agricultural products, it is even more important for medicinal plants. Because products that do not meet certain quality standards cannot be traded. Ensuring standardization in agricultural products is possible by growing standard products. This can only be achieved through variety breeding. Breeding studies are long-term but must be done. First of all, the genetic material we have should be well known and its genetic potentials should be revealed. In this study, the number of glands per unit area and the size of the oil glands in the leaves of the thymbra grown in different locations in the flora of Hatay, and the infrastructure for future single plant selection improvement. is intended to be created. For this purpose, a genetic pool was created for *T. spicata* L. plant with plant samples selected from different locations where the plants are densely grown and these plants were examined in terms of oil glands.

MATERIALS AND METHODS

Survey studies were carried out in areas where *Thymbra spicata* L. plant spread in Hatay province and collection studies were carried out in these areas. As a result of the studies 213 single plants were selected from 68 different locations and were examined in terms of the number of oil glands per unit area and the size of oil glands. Plants were selected primarily different, well developed and healthy ones according to the single plant selection method. The oil cells of the *Thymbra spicata* L. species are found in sessile glandular hairs (Davis, 1982). In the study, the number of oil glands and the size of oil glands for each individual plant were determined. Later, plants propagated with cuttings taken from these plants were planted in the collection garden.

Number of Oil Glands per Unit Area (pcs/mm²)

JEOL brand JSM-5500LV model SEM (Scanning Electron Microscope, X 300.000) electron microscope was used at Science Research and Application Center in Mustafa Kemal University. In each sample, the number of oil glands per unit area on 4 leaves (4 replication) of the plant was determined in terms of units/mm² and averaged. The largest middle part of the leaf samples was used in counting and measurements made in SEM.

Average Oil Gland Diameter (µm)

In the imaging performed to determine the number of oil glands per unit area, the diameter of 5 oil glands of these 4 leaves was determined for each plant and the average was obtained. A total of 20 measurements were made for each plant.

RESULTS AND DISCUSSION

Number of Oil Glands per Unit Area (pcs/mm²)

As a result of the counts and measurements made on the SEM (Scanning Electron Microscope) images on the leaves of thymra plants collected from the flora of Hatay, the number of essential oil glands per mm² was determined and given in Table 1. The average number of oil glands of ecotypes in the experiment was 18.74 pcs/mm². The lowest oil gland numbers were obtained from the ecotypes Z158 with 5.61 pcs/mm² and Z144 with 5.89 pcs/mm². The highest numbers of oil glands were obtained from ecotypes Z98 (56.04 pcs/mm²), Z131 (44.57 pcs/mm²) and Z102 (41.59 pcs/mm²) respectively.

Table 1. The number of oil glands of *T. spicata* var. *spicata* L. leaves (pcs/mm²)

Code	Glands	Code	Glands	Code	Glands	Code	Glands	Code	Glands
Z1	20.23	Z44	17.43	Z87	14.76	Z130	16.18	Z173	16.67
Z2	9.26	Z45	28.44	Z88	16.17	Z131	44.57	Z174	21.04
Z3	26.63	Z46	11.13	Z89	15.39	Z132	9.81	Z175	20.17
Z4	15.91	Z47	16.32	Z90	19.25	Z133	15.90	Z176	19.75
Z5	16.41	Z48	15.87	Z91	24.24	Z134	10.09	Z177	18.05
Z6	28.11	Z49	16.57	Z92	22.10	Z135	20.31	Z178	19.87
Z7	22.63	Z50	17.28	Z93	21.69	Z136	9.05	Z179	21.07
Z8	16.57	Z51	16.34	Z94	22.33	Z137	11.97	Z180	20.19
Z9	7.82	Z52	14.62	Z95	28.08	Z138	12.78	Z181	18.74
Z10	17.13	Z53	25.27	Z96	23.79	Z139	19.47	Z182	20.14
Z11	19.46	Z54	25.43	Z97	31.10	Z140	22.02	Z183	20.78
Z12	17.88	Z55	13.41	Z98	56.04	Z141	16.41	Z184	19.84
Z13	12.46	Z56	19.84	Z99	14.98	Z142	10.12	Z185	18.96
Z14	18.66	Z57	23.37	Z100	15.47	Z143	22.75	Z186	19.32
Z15	17.34	Z58	10.04	Z101	16.32	Z144	5.89	Z187	21.04
Z16	12.26	Z59	30.40	Z102	41.59	Z145	9.98	Z188	20.78
Z17	19.32	Z60	12.48	Z103	9.65	Z146	22.40	Z189	19.43
Z18	15.24	Z61	18.58	Z104	28.38	Z147	16.70	Z190	17.54
Z19	12.92	Z62	19.48	Z105	15.87	Z148	13.36	Z191	16.35
Z20	15.32	Z63	18.98	Z106	11.99	Z149	36.86	Z192	19.03
Z21	24.98	Z64	27.03	Z107	12.56	Z150	6.82	Z193	16.79
Z22	14.20	Z65	21.02	Z108	9.62	Z151	18.27	Z194	21.08
Z23	20.10	Z66	10.73	Z109	23.16	Z152	15.73	Z195	22.05
Z24	14.78	Z67	18.87	Z110	14.36	Z153	36.54	Z196	19.56
Z25	10.30	Z68	15.10	Z111	10.55	Z154	28.66	Z197	18.96
Z26	20.53	Z69	22.59	Z112	10.96	Z155	12.19	Z198	18.61
Z27	19.12	Z70	16.54	Z113	16.07	Z156	22.14	Z199	18.97
Z28	18.65	Z71	17.02	Z114	26.43	Z157	19.78	Z200	20.14
Z29	30.30	Z72	21.75	Z115	22.12	Z158	5.61	Z201	21.59
Z30	29.42	Z73	20.74	Z116	12.02	Z159	19.28	Z202	22.03
Z31	22.10	Z74	19.18	Z117	18.02	Z160	10.88	Z203	16.57
Z32	20.11	Z75	16.84	Z118	17.45	Z161	18.11	Z204	20.45
Z33	19.17	Z76	10.12	Z119	17.68	Z162	19.81	Z205	19.52
Z34	18.66	Z77	19.19	Z120	16.37	Z163	22.14	Z206	17.51
Z35	18.94	Z78	21.05	Z121	12.94	Z164	21.94	Z207	16.29
Z36	11.79	Z79	20.12	Z122	17.65	Z165	17.89	Z208	18.97
Z37	22.02	Z80	19.01	Z123	27.21	Z166	6.34	Z209	21.04
Z38	13.95	Z81	11.73	Z124	28.85	Z167	8.21	Z210	20.10
Z39	11.87	Z82	17.92	Z125	20.95	Z168	19.62	Z211	19.87
Z40	11.04	Z83	24.57	Z126	28.84	Z169	15.79	Z212	19.10
Z41	33.35	Z84	12.49	Z127	12.62	Z170	18.04	Z213	19.12
Z42	14.52	Z85	21.15	Z128	20.04	Z171	17.93		
Z43	30.91	Z86	13.2	Z129	19.87	Z172	18.97		

Min: 5.61; Max: 56.04; Average: 18.74; Std. deviation: 6.45; Coef. of variation: 34.41

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Average Oil Gland Diameter (µm)

In the study, measurements made for each individual thymbra plant collected and the average diameter was determined as µm and given in Table 2. The diameters of the oil glands of the collected thymbra varied between 75,40-112,86 µm. The highest average diameter values were obtained from plants with code number Z17 (112.86 µm), Z31 (106.57 µm) and Z141 (105.25 µm), respectively. In the experiment, the lowest mean diameter values were obtained from ecotypes Z158 (75.40 µm), Z52 (80.29 µm), Z137 (81.60 µm) and Z144 (82.20 µm). The diameter of an oil glands in the thymbra leaves was determined to be 94.09 on average.

Table 2. The average oil gland diameters of *T. spicata* var. *spicata* L. leaves (µm)

Code	Gland.	Code	Glands	Code	Glands	Code	Glands	Code	Glands
Z1	99.75	Z44	99.76	Z87	92.22	Z130	93.00	Z173	104.86
Z2	88.44	Z45	99.71	Z88	101.75	Z131	97.00	Z174	87.80
Z3	103.25	Z46	96.22	Z89	99.60	Z132	88.22	Z175	95.73
Z4	83.80	Z47	91.72	Z90	89.15	Z133	92.00	Z176	94.10
Z5	86.86	Z48	99.89	Z91	94.00	Z134	84.50	Z177	88.20
Z6	89.56	Z49	98.12	Z92	91.25	Z135	91.12	Z178	87.75
Z7	88.24	Z50	100.00	Z93	90.00	Z136	84.90	Z179	98.98
Z8	96.12	Z51	97.40	Z94	97.14	Z137	81.60	Z180	99.70
Z9	93.20	Z52	80.29	Z95	88.86	Z138	93.17	Z181	94.58
Z10	92.22	Z53	98.25	Z96	94.50	Z139	95.10	Z182	98.20
Z11	90.00	Z54	91.80	Z97	98.57	Z140	94.00	Z183	94.58
Z12	98.45	Z55	91.43	Z98	101.59	Z141	105.25	Z184	99.72
Z13	96.26	Z56	94.44	Z99	95.25	Z142	97.64	Z185	91.43
Z14	100.80	Z57	94.75	Z100	91.60	Z143	84.57	Z186	96.40
Z15	98.50	Z58	84.75	Z101	89.13	Z144	82.20	Z187	95.18
Z16	96.75	Z59	96.00	Z102	97.14	Z145	88.89	Z188	99.20
Z17	112.86	Z60	94.00	Z103	92.00	Z146	86.25	Z189	90.22
Z18	96.64	Z61	93.25	Z104	104.29	Z147	88.60	Z190	94.00
Z19	92.60	Z62	90.76	Z105	89.00	Z148	90.31	Z191	85.90
Z20	90.76	Z63	90.13	Z106	96.80	Z149	97.14	Z192	84.60
Z21	99.75	Z64	91.00	Z107	94.20	Z150	85.40	Z193	95.17
Z22	96.60	Z65	90.56	Z108	84.50	Z151	99.43	Z194	93.00
Z23	95.75	Z66	98.50	Z109	99.14	Z152	99.25	Z195	88.57
Z24	90.12	Z67	94.68	Z110	96.32	Z153	98.57	Z196	83.20
Z25	100.22	Z68	80.75	Z111	99.74	Z154	101.43	Z197	88.98
Z26	92.60	Z69	92.57	Z112	85.80	Z155	98.20	Z198	86.25
Z27	82.76	Z70	96.74	Z113	102.00	Z156	88.16	Z199	88.60
Z28	84.10	Z71	90.00	Z114	100.86	Z157	84.12	Z200	90.31
Z29	94.75	Z72	96.32	Z115	93.75	Z158	75.40	Z201	97.14
Z30	96.86	Z73	86.66	Z116	95.00	Z159	104.00	Z202	86.40
Z31	106.57	Z74	84.88	Z117	92.66	Z160	94.25	Z203	99.43
Z32	84.14	Z75	96.76	Z118	90.60	Z161	93.11	Z204	99.25
Z33	87.75	Z76	93.80	Z119	88.30	Z162	100.75	Z205	98.57
Z34	90.75	Z77	96.25	Z120	86.00	Z163	89.80	Z206	98.20
Z35	96.13	Z78	94.18	Z121	85.75	Z164	104.29	Z207	88.40
Z36	91.11	Z79	93.27	Z122	96.98	Z165	96.90	Z208	94.25
Z37	96.50	Z80	86.45	Z123	96.57	Z166	85.71	Z209	93.11
Z38	96.60	Z81	77.60	Z124	92.57	Z167	89.25	Z210	88.71
Z39	93.40	Z82	87.78	Z125	99.00	Z168	100.61	Z211	89.25
Z40	102.40	Z83	93.71	Z126	99.71	Z169	87.75	Z212	87.75
Z41	96.29	Z84	99.00	Z127	89.43	Z170	101.67	Z213	97.67
Z42	96.64	Z85	88.25	Z128	96.00	Z171	97.67		
Z43	94.86	Z86	92.25	Z129	86.22	Z172	88.87		

Min: 75.40; Max: 112.86; Average: 94.09; Std. deviation: 5.82; Coef. of variation: 6.19

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Figure 1. SEM images of some thymbra leaves with the plant code number Z17, Z92, Z144 and Z158, respectively

CONCLUSION

In the study, first of all, 213 different, well-developed and healthy plants were selected from 68 different locations by single plant selection method. The thymbra plants collected were examined in terms of the number of oil glands per unit area and oil glands diameters in their leaves. It was determined that some plants with low essential oil ratios such as Z144 and Z158 also have low oil grease number and oil gland diameter. It would be appropriate to evaluate these values obtained as preliminary knowledge together with future ontogenetic variability studies.

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REFERENCES

- Avcı, M. (2005), "Çeşitlilik ve endemizm açısından Türkiye'nin bitki örtüsü", *İstanbul Üniv. Edebiyat Fakültesi Coğrafya Dergisi*, (13), 27-55.
- Başer, K.H.C. (2002), "Aromatic biodiversity among the flowering plant taxa of Turkey", *Pure Appl. Chem.*, 74(4), 527-545, <https://doi.org/10.1351/pac200274040527>.
- Baydar, H., Sağdıç, O., Özkan, G. and Karadoğan, T. (2004), "Antibacterial activity and composition of essential oils from *Origanum*, *Thymbra* and *Satureja* species with commercial importance in Turkey", *Food Control*, 15, 169-172, [https://doi.org/10.1016/S0956-7135\(03\)00028-8](https://doi.org/10.1016/S0956-7135(03)00028-8).

<https://doi.org/10.24264/icams-2020.II.14>

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- Baytop (1994), *Türkçe Bitki Adları Sözlüğü*, Ankara: Atatürk Kültür, Dil ve Tarih Yüksek Kurumu Türk Til Kurumu Yayınları, No: 578, P. 168.
- Çakan, H. and Byfield, A. (2005), "Amanos dağları" Türkiye'nin 122 önemli bitki alanı (Ed: N.Özhatay, A. Byfield ve S. Atay) WWF Türkiye doğal hayatı koruma vakfı yayını, s:254-257 İstanbul.
- Davis, P.H. (1982), *Flora of Turkey and the east Aegeans Islands*, Vol. 7. Edinburg University Press.
- Doğan, A., Bayrak, A. and Akgül, A. (1987), "Thymol/carvacrol containing *Labiatae* species and volatile composition of essential oil of *Thymbra spicata*", *Gıda*, Sayı: 6, 359-362.
- Ekim, T., Koyuncu, M., Vural, M., Duman, H., Aytaç, Z. and Adıgüzel, N. (2000), *Türkiye Bitkileri Kırmızı Kitabı (Eğrelti ve Tohumlu Bitkiler)*, Türkiye Tabiatını Koruma Derneği, Van 100. Yıl Üniv. s:246. Barışcan Ofset. Ankara.
- Erken, S. (2005), "Morphological and anatomical studies on *Thymbra sintenisii* Bornm & Azzav. (*Labiatae*)", *Turk. J. Bot.*, 29, 389-397.
- Hancı Sonsuzer, S., Şahin, S. and Yılmaz, L. (2003), "Isolation of volatile oil from thyme (*Thymbra spicata*) by steam distillation", *Nahrung/Food*, 47(4), 252-255, <https://doi.org/10.1002/food.200390059>.
- İnan, M., Kırpık, M., Kaya, D.A. and Kırıcı, S. (2011), "Effect of harvest time on essential oil composition of *Thymbra spicata* L. Growing in flora of Adıyaman", *Advances in Environmental Biology*, 5, pp.356-358.
- Kızıl, S. (2013), "Selection of A clones from *Thymbra spicata* var. *spicata* by clonal selection method", *Industrial Crops and Products*, 41, 1-9, <https://doi.org/10.1016/j.indcrop.2012.04.013>.
- Özcan, M.M., Ünver, A., Uçar, T. and Arslan, D. (2008), "Mineral content of some herbs and herbal teas by infusion and decoction", *Food Chemistry*, 106, 1120-1127, <https://doi.org/10.1016/j.foodchem.2007.07.042>.
- Özel, M.Z., Göğüş, F. and Lewis, A.C. (2003), "Subcritical water extraction of essential oils from *Thymbra spicata*", *Food chemistry*, 82, 381-386, [https://doi.org/10.1016/S0308-8146\(02\)00558-7](https://doi.org/10.1016/S0308-8146(02)00558-7).
- Özgüven, M., Sekin, S., Gürbüz, B., Şekeroğlu, N., Ayanoğlu, F. and Ekren, S. (2005), Tütün, Tıbbi ve Aromatik Bitkiler Üretimi ve Ticareti. Türkiye Ziraat Mühendisliği VI. Teknik Kongresi. 481-501.
- Saraç, A. and Tunç, I. (1995), "Residual toxicity and repellency of essential oils to stored-product insects. Rucktandstoxizität und abstossende wirkung von ätherischen ole auf vorratsschädliche insekten", *Zeitschrift-für-Pflanzenkrankheiten und Pflanzenschutz*, 102(4), 429-434.
- Vural, M. and Aytaç, Z. (2005), "The Flora of Erciyes Dağı (Kayseri, Turkey)", *Tur. J. of Bot.*, 29, 185-236.