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Characterization of Endemic *Euphorbia anacampseros* Boiss. Using FTIR Analysis Method

Neslihan BALPINAR*[1], Belgin BARDAKÇI[2]

[1] Mehmet Akif Ersoy Üniversitesi, Fen Edebiyat Fakültesi, Biyoloji Bölümü, 15030, Burdur
[2] Mehmet Akif Ersoy Üniversitesi, Fen Edebiyat Fakültesi, Nanobilim ve Nanoteknoloji Bölümü, 15030, Burdur

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Abstract: In this study, to determine the functional subgroups of the components of *Euphorbia anacampseros* Boiss., which is a perennial endemic species, FTIR (Fourier Transform Infrared) spectroscopy method was adopted. The results showed that hydrocarbons particularly terpenoids, alkanes and olefin structures exist in the composition of *E. anacampseros* Boiss. IR spectra of *E. anacampseros* Boiss. samples collected at different stations screened different peak points. There is a correlation between the vibrational frequency values and the altitudes of the areas where *E. anacampseros* Boiss. samples were collected. This study is the first attempt in analyzing of this species by using FTIR method.

Endemik *Euphorbia anacampseros* Boiss.'un FTIR Analiz Yöntemi ile Karakterizasyonu

Anahtar Kelimeler
Kurutulmuş bitki
Euphorbia,
FTIR spektroskopisi,

Özet: Bu çalışmada, çok yıllık endemik bir tür olan *Euphorbia anacampseros* Boiss.'un içerdiği bileşiklerin fonksiyonel alt gruplarını belirlemek amacıyla FTIR (Fourier Dönüşümlü Kızılötesi) spektroskopi yöntemi kullanılmıştır. Araştırmamız, *E. anacampseros* Boiss.'un bileşiminde hidrokarbonlar, özellikle terpenoidler, alkanlar ve olefin yapılarının var olduğunu göstermektedir. Farklı noktalardan toplanmış *E. anacampseros* Boiss. örneklerinin kızılötesi tayfı farklı yükselme noktaları vermektedir. Vibrasyonal frekans değerleri ile *E. anacampseros* Boiss.'un toplandığı bölgelerin rakımı arasında karşılıklı bir ilişki mevcuttur. Bu çalışma, FTIR spektroskopi yöntemi kullanılarak bu türün incelenmesi açısından bir ilk olma özelliği taşımaktadır.

1. Introduction

As known, when compared with neighboring countries, Turkey has a notably rich flora due to divergent habitats and gene centers in different phytogeographical regions as well as geological, geomorphological and climatic characteristics. According to the information we get from the last records, the total number of taxa in Turkey's flora is about 11 700, and some 3700 of them have the distiction of being endemic [1]. When the taxa in the level of subspecies and varieties is considered, the flora of Turkey reaches a number close to the total of the flora of all countries in Europe and has a higher rate of variation compared to many African countries and Asia. The factors that prompted to the formation of this diversity historically extends until the ice age period. In the mentioned period, while huge losses in the European flora occured, Anatolia performed the task of refuge for many species.

Euphorbiaceae, which is one of the the largest and most prominent families of angiosperms, shows growth forms ranging from small herbaceous plants to trees. *Euphorbia* genus that is represented by approximately 2000 species is one of the biggest genus which has wide tolerance and adaptation [2, 3, 4]. The genus represented with 118 taxa in our country contains 16 endemic species [1]. *Euphorbia anacampseros* Boiss., which is one of these species, is a perennial plant in LC category according to IUCN criteria [5].

It is known that the members of *Euphorbiaceae* family have vast chemical diversity, and especially contain cytotoxic, skin irritating ve tumor-promoting diterpenoids, and carry wide range of biological activity properties. In particular, diterpenoids takes top on lists of studies because of their both structural diversity and therapeutic properties and being

* *Corresponding author: nerdogan@mehmetakif.edu.tr*

taxonomic marker [6, 7]. *Euphorbia* species that are used as traditional and folk medicine in many contries world-wide due to wide variety of chemical compounds they contain, are utilized in our country in the treatment of various skin diseases and wounds as well as migraines, gonorrhea and warts. For this purpose, the plant seeds, roots, bark, leaves and latex are often used [7, 8, 9]. Latex contains resin, rubber, starch (amylum), cyanite and various enzimes. Besides their usage as folk medicine, it has also been identified that they have toxic peculiarities which repell insects and herbivores and cause inflammation in the skin [10, 11, 12].

In recent years, many studies have been increased rapidly, especially in the field of chemical composition and essential oil, about *Euphorbia* because of its rich genus and characteristics. The plant which is subject to studies regarding that some of its species can be utilized as renewable fuel is one of the many available biomas sources [13, 14]. This study aims to determine the functional subgroups of this species using FTIR spectroscopy method.

2. Material and Method

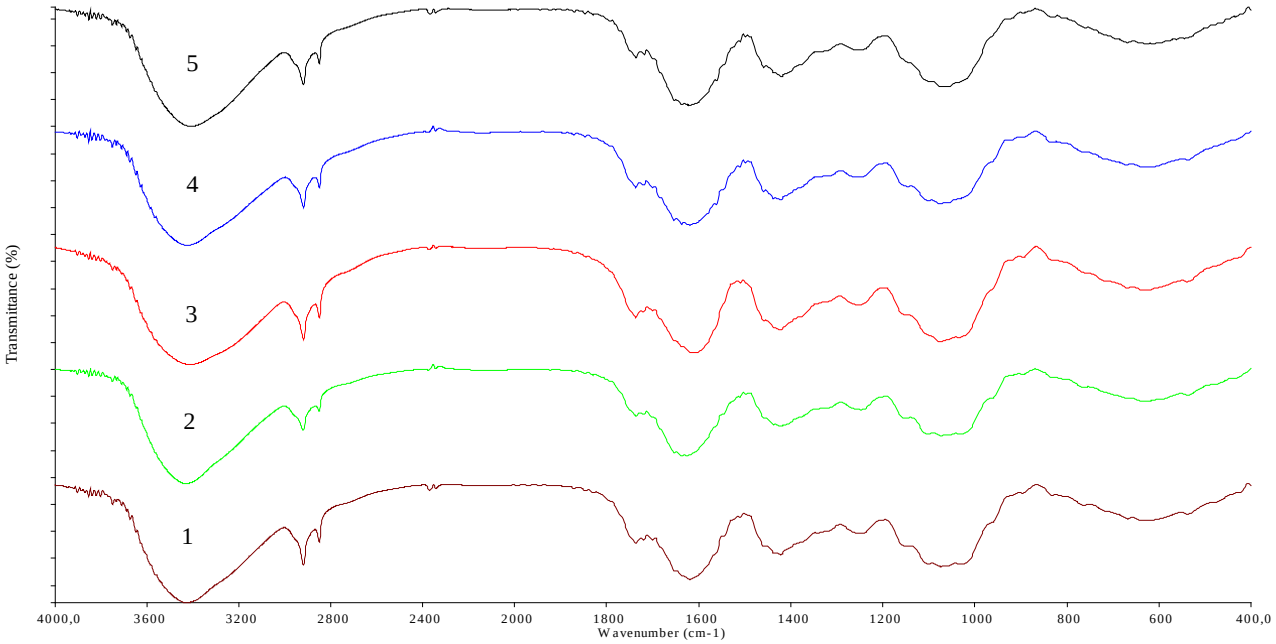
Samples of *Euphorbia anacampseros* Boiss. were collected at different stations located at different altitudes ranging between 1165 and 1440 meters in mountains near Sivrihisar, Eskişehir in May and June, which is the vegetation period for this species. The authenticated materials which were identified according to Davis [15] were deposited in the Botanical Research Laboratory of Biology Department of Mehmet Akif Ersoy University.

The samples collected were dried and ground under normal conditions. The infrared spectra of the samples which were prepared using KBr pellet technique were characterized using an infrared spectroscopy at 4 cm^{-1} resolution, 32 scans, at transmission mode and between the range of 4000-400 cm^{-1} using a Perkin Elmer FTIR spectrum BXII spectrometer. The photograph of the dried plant is given in Picture 1.

Picture 1. The photograph of the dried *Euphorbia anacampseros* Boiss.

3. Results

The IR spectra of samples are given in Graph 1. The data of vibrational frequencies are summarized in Table 1.



Graph 1. IR spectra of samples (number shows samples collected from difference stations)

Table 1. IR frequencies of samples and assigments. (cm^{-1})

Numbers of samples					
1	2	3	4	5	Assignments
3423	3429	3419	3423	3406	O-H
2919	2920	2918	2919	2920	n_{as} (CH)
2850	2852	2850	2850	2850	n_s (CH)
1735	1735	1736	1736	1736	C=O
1719	1719	1719	1720	1718	C=O
1618	1634	1606	1618	1618	C=C
1508	-	1509	-	-	C-C
1457	1456	1457	1457	1456	C-H
1421	1421	1422	1423	1420	C-H
1246	1247	1250	1257	1248	C-O
1073	1071	1074	1074	1071	C-H deformation
831	-	-	832	830	Ring deformation
668	-	669	670	668	Out of plane C-H
637	627	627	623	612	C-H

O-H stretching bands were observed at about 3420 cm^{-1} in IR spectra and this peak indicates phenol and alcohol existence [16, 17]. It was observed in IR spectra that 2919 and 2850 cm^{-1} bands are the basic bands, which are frequencies belonging to antisymmetric $-CH_2$ and symmetric $-CH_2$ groups respectively [16, 18]. While the frequency observed at 1736 cm^{-1} is defined as C=O vibration frequency belonging to low intensity esther groups, the low intensity peak near 1720 cm^{-1} indicates carboxyl existence [17, 18, 19]. The vibration frequency at 1618 cm^{-1} indicates C=C vibration [16, 19]. The peak which is near 1420 cm^{-1} belongs to C-H bending vibration [16, 18, 20]. Peaks between the range of 1460-1350 cm^{-1} may be attributed to C-H vibrations of alkanes [16, 17, 19]. The peak at 1457 cm^{-1} is the frequency value of C-H stretching vibration of terpenoid molecule [21]. *Euphorbia hirta* L., a different species of *Euphorbia*, has some constituents such as flavanoids, steroids, alkaloids and phenols [22]. In another study, it was found that *Euphorbia hirta* L. has some long chain fatty acids and alcohols [23]. These results are in good agreement with our study. Another result obtained in this study is the fact that IR spectra of plant samples collected at different stations gave different peak points. While OH group is found at 3423 cm^{-1} for sample 1, it is observed at 3406 cm^{-1} for sample 5. C-O band for sample 2 is at 1247 cm^{-1} while it is at 1257 cm^{-1} for sample 4. Another study conducted on a different species bears out that regional differences can occur with IR spectroscopy [24]. It is seen that C-O vibration frequency values are directly related to the altitudes of the areas where the plant samples were collected. While the frequency value for sample 1, which were collected at 1440 meters is 1246 cm^{-1}, it is 1250 cm^{-1} for sample 3 collected at 1190 meters and 1257 cm^{-1} for sample 4, collected at 1165 meters.

4. Discussion and Conclusion

In this study, using FTIR (Fourier Transform Infrared) spectroscopy method, we analysed *Euphorbia anacampseros* Boiss. which is a perennial endemic species. The IR spectra data from *E. anacampseros* Boiss. proved that hydrocarbons particularly terpenoids, alkanes, and olefin structures exist in the composition of this plant. When compared to other analytical studies conducted on other species belonging to *Euphorbiaceae*, it is found that our results show similarities with the literature. Using a Fourier Transform Infrared (FTIR) spectrometer, infrared spectrum is recorded in a short time, which is a simple and inexpensive method. IR spectra of plant samples were collected at different stations gave different peak points. There is a correlation between the vibrational frequency values (for C-O vibrations) to the altitudes of the areas where the plant samples were collected.

References

[1] Güner, A., Aslan, S., Ekim, T., Vural, M., Babaç, M. T. 2012. Türkiye bitkileri listesi (damarlı bitkiler). Birinci basım. Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını. İstanbul, Türkiye, 1290 pp.

[2] Webster, G. L. 1994. Classification of the Euphorbiaceae. Annals of the Missouri Botanical Garden, 81(1), 3-32.

[3] Zimmermann, N. F. A., Ritz, C. M., Hellwig, F. H. 2010. Further support for the phylogenetic relationships within Euphorbia L. (Euphorbiaceae) from nrITS and trnL–trnF IGS sequence data. Plant Systematics and Evolution, 286(1-2), 39-58.

[4] Pahlevani, A. H., Maroofi, H., Joharchi, M. R. 2011. Notes on six endemic or rare species of Euphorbia subg. Esula (Euphorbiaceae) in Iran. Willdenowia, 41(2), 267-276.

[5] IUCN. 2012. Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Version 4.0. Gland, Switzerland and Cambridge, UK: IUCN. iii + 41pp.

[6] Barla, A., Öztürk, M., Kültür, Ş., Öksüz, S. 2007. Screening of antioxidant activity of three Euphorbia species from Turkey. Fitoterapia, 78(6), 423-425.

[7] Özbilgin, S., Çitoğlu, G. S. 2012. Uses of some euphorbia species in traditional medicine in Turkey and their biological activities. Turkish Journal of Pharmaceutical Sciences, 9(2), 241-255.

[8] Shi, Q. W., Su, X. H., Kiyota, H. 2008. Chemical and pharmacological research of the plants in genus Euphorbia. Chemical reviews,108, 4295-4327.

[9] Kırbağ, S., Erecevi,t P., Zengin, F., Güvenç, A. N. 2013. Antimicrobial activities of some Euphorbia species. African Journal of Traditional, Complementary and Alternative Medicines, 10(5), 305-309.

[10] Al-Qura'n, S. 2005. Ethnobotanical survey of folk toxic plants in southern part of Jordan. Toxicon, 46(2), 119-129.

[11] Baloch, I. B., Baloch, M. K., us-Saqib, Q. N. 2005. Tumor-Promoting Diterpene Esters from Latex of Euphorbia cauducifolia L. Helvetica chimica acta, 88(12), 3145-3150.

[12] Wu, Q. C., Tang, Y. P., Ding, A. W., You, F. Q., Zhang, L., Duan, J. A. 2009. 13C-NMR data of three important diterpenes isolated from Euphorbia species. Molecules, 14(11), 4454-4475.

[13] Pütün, A. E., Gerçel, H. F., Koçkar, Ö. M., Ege, Ö., Snape, C., Pütün, E. 1996. Oil production from an arid-land plant: fixed-bed pyrolysis and hydropyrolysis of E. rigida. Fuel, 75(11), 1307–1312.

[14] Ateş, F., Pütün, A. E., Pütün, E. 2005. Fixed bed pyrolysis of Euphorbia rigida with different catalysts. Energy Conversion and Management, 46(3), 421-432.

[15] Davis, P. H. 1978. Flora of Turkey and East Aegean Islands vol. 6. Edinburgh University Press. Edinburgh, 824 pp.

[16]Özcan, A., Pütün, A. E., Keith, D. B., Pütün, E. 2000. Structural Analysis of Bio-Oils from Fixed-Bed Pyrolysis of Euphorbia rigida and Sunflower Pressed Bagasse. Energy Sources, 22, 809–824.

[17] Tuncel, F., Gerçel, H. F. 2004. Production and Characterization of Pyrolysis Oils from Euphorbia macroclada. Energy Sources, 26, 761–770.

[18] Pütün, E., Ateş, F., Pütün, A. E. 2008. Catalytic pyrolysis of biomass in inert and steam atmospheres. Fuel, 87, 815-824.

[19] Dutta, S., Mallick, M., Bertram, N., Greenwood, P. F., Mathews, R. P. 2009. Terpenoid composition and class of Tertiary resins from India. International Journal of Coal Geology, 80, 44 –50.

[20] Gerçel, Ö., Özcan, A., Özcan, A. S., Gerçel, H. F. 2007. Preparation of activated carbon from a renewable bio-plant of Euphorbia rigida by H_2SO_4 activation and its adsorption behavior in aqueous solutions. Applied Surface Science, 253, 4843–4852.

[21] Domenech-Carbo, M. T., Kuckova, S., de la Cruz-Canizares, J., Osete-Cortina, L. 2006. Study of the influencing effect of pigments on the photoageing of terpenoid resins used as pictorial media. Journal of Chromatography A, 1121, 248–258.

[22] Chitra, M., Muga, V., Sasikumar, D., Awdah, M. A. 2011. Screening of Phytochemical and In vitro activity of Euphorbia hirta L. J. Chem. Pharm. Res., 3(6), 110-114.

[23] Ogunlesi, M., Okiei, W., Osibote, A. E. 2009. Analysis of the essential oil from the dried leaves of Euphorbia hirta Linn (Euphorbiaceae), a potential medication for asthma. African Journal of Biotechnology, 8(24), 7042-7050.

[24] Kokalj, M., Kolar, J., Trafela, T., Kreft, S. 2011. Differences among Epilobium and Hypericum species revealed by four IR spectroscopy modes: transmission, KBr tablet, diffuse reflectance and ATR. Phytochemical Analysis, 22(6), 541-546.