

SEED OILS OF FIFTEEN *Ebenus* TAXA GROWING IN TURKEY*

N. Azcan,^{1,2} S. Saricoban,² B. Demirci,²
Z. Aytac,⁴ and K. H. C. Baser^{2,3}

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Oil yields and compositions from seeds of 15 Ebenus taxa growing in Turkey were investigated. The yields were found between 4.0% and 13.0%. The seeds of E. barbigera showed the highest while E. plumosa var. plumosa showed the lowest yield of oil among the 15 taxa investigated. GC/MS showed that linoleic acid (42.8-55.6%), palmitic acid (13.8-23.6%), and oleic acid (15.9-23.6%) are the main fatty acid components of all the species.

Key words: Leguminosae, *Ebenus*, *E. plumosa* var. *plumosa*, *E. plumosa* var. *speciosa*, *E. macrophylla*, *E. barbigera*, *E. reesei* var. *reesei*, *E. reesei* var. *minor*, *E. haussknechtii*, *E. depressa*, *E. bourgaei*, *E. cappadocica*, *E. boissieri*, *E. longipes*, *E. hirsuta*., *E. laguroides*, *E. pisidica*, seed oil, fatty acid, palmitic acid, linoleic acid, oleic acid, linolenic acid, stearic acid.

The family Leguminosae is the second most economically important family after Graminae and in terms of numbers of species, after Compositae. The genus *Ebenus* L. (Leguminosae – subfamily Papilionoideae) is represented by 20 species worldwide. In Turkey, the genus *Ebenus* is represented by a total of 15 taxa including 13 species and 2 varieties, which are *E. plumosa* var. *plumosa* Boiss. and Bal., *E. plumosa* var. *speciosa* Hub.-Mor., *E. macrophylla* Jaub. and Spach., *E. barbigera* Boiss. *E. reesei* var. *reesei* Hub.-Mor. *E. reesei* var. *minor* Hub.-Mor. *E. haussknechtii* Bornm. ex. Hub.-Mor. *E. depressa* Boiss. and Bal., *E. bourgaei* Boiss., *E. cappadocica* Hasskn. and Siehe ex. Bornm., *E. boissieri* Barley, *E. longipes* Boiss. and Bal., *E. argentea* Siehe ex. Bornm., *E. hirsuta* Jaub. and Spach., *E. laguroides* Boiss., *E. pisidica* Hub.-Mor. All 13 are endemic. *Ebenus* species are growing in all parts of Anatolia, except for the northernmost part of the Black Sea region and South Eastern Anatolia [1-4]. While there is no Turkish common name for the genus *Ebenus*, the plants are often called “Morgeven” or “Sarigeven” by the locals because of their resemblance to milkvetch (*Astragalus*) species. *Ebenus* are used in floriculture and ornamental landscaping [1, 5].

Only a few chemical works have been recorded on the *Ebenus* species but there are no report dealing with the fatty acid composition of seed oils [4, 6–8]. We report here an investigation of the seed oils of fifteen *Ebenus* taxa.

The yields of seed oils obtained from fifteen *Ebenus* taxa varied between 4.0% and 13.0% (Table 1). The seeds of *E. barbigera* showed the highest, while *E. plumosa* var. *plumosa* showed the lowest, yield of oil among the fifteen taxa.

The oils were analyzed by GC/MS in their methyl esters forms and the results are given in Table 2.

From these data we can see that the major fatty acid components characterized in them are as follow: Linoleic acid (42.8–55.6%), oleic acid (15.9–23.6%), palmitic acid (13.8–23.6%), linolenic acid (1.3–3.3%), and elaidic acid (0.5–1.3%). 15 to 21 fatty acid components representing about 94.8–98.9% of total oil were characterized. The amounts of saturated and unsaturated fatty acids in the *Ebenus* taxa were found to be 18.9–29.8% and 65.0–78.1% respectively. These conform to the family characteristics of Leguminosae as far as the oil yield and fatty acids are concerned [9]. The U/S index (Unsaturated/Saturated) is also presented in Table 2. The U/S index, which has been used as a reliable taxonomic marker [10], appears to have significance in studies on the *Ebenus* species, since the U/S index of each oil ranged narrowly between 2.2–4.2.

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1) Anadolu University, Faculty of Engineering and Architecture, Department of Chemical Engineering, 26470 Eskisehir, Turkey; 2) Medicinal and Aromatic Plant and Drug Research Centre (TBAM), Anadolu University, 26470 Eskisehir, Turkey; 3) Faculty of Pharmacy, Department of Pharmacognosy, Anadolu University, 26470 Eskisehir, Turkey; 4) Faculty of Science and Letters, Department of Biology, Gazi University, 06500 Ankara, Turkey. Published in *Khimiya Prirodnykh Soedinenii*, No. 3, pp. 215-217, May-June, 2001. Original article submitted June 19, 2001.

TABLE 1. Seed Oil Yields and Collection Sites of *Ebenus* Species

<i>Ebenus</i> species	Collection Sites	Oil Yield (%)
<i>E. plumosa</i> var. <i>plumosa</i>	Antalya: Korkuteli-Elmalı 25 km, Beyis-Avdan village, 1.5 km, 1470 m	4.0
<i>E. plumosa</i> var. <i>speciosa</i>	Karaman: Ermenek-Mut highway, 1 km, 1300 m	5.0
<i>E. macrophylla</i>	Sivas: Kangal-Sincan highway, 57-58 km, 1280 m	6.7
<i>E. barbigera</i>	Mugla: Kale-Mugla highway, 49 km, 1170-1150 m	12.9
<i>E. reesei</i> var. <i>reesei</i>	Fethiye: Dirmil, 1060 m	8.6
<i>E. reesei</i> var. <i>minor</i>	Denizli: Acipayam, Bozdag, Olukbasi Village	11.1
<i>E. haussknechtii</i>	Elazığ: Keban road, 1310 m	8.1
<i>E. depressa</i>	Sivas: Darende-Gurun, 20 km, 1400 m	7.0
<i>E. bourgaei</i>	Antalya: Korkuteli-Elmalı, 25 km, Avdan Village, 440-1500 m	7.1
<i>E. cappadocica</i>	Nigde, 1230-1250 m	8.8
<i>E. boissieri</i>	Antalya: Kurkuteli-Elmalı, Avdan Village, 1400-1500 m	9.6
<i>E. longipes</i>	Kayseri: Develi, Bakirdagi-Saimbeyli way, 22 km, 1800-1500 m	6.0
<i>E. hirsuta</i>	Ankara: Golbasi-Haymana road, 47 km, 1080 m	8.3
<i>E. laguroides</i>	Sivas: Ulas-Tecer Village, 1500 m	7.6
<i>E. pisidica</i>	Burdur: Dirmil Village, 1650 m	5.9

TABLE 2. Fatty Acid Compositions of *Ebenus L.* Species

Fatty Acids	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
8:0	-	-	Tr.	Tr.	-	Tr.	Tr.	-	-	-	Tr.	-	-	-	-
10:0	Tr.	-	-	Tr.	-	-	-	-	Tr.	-	Tr.	-	-	-	0.1
12:0	0.1	0.1	Tr.	Tr.	Tr.	Tr.	Tr.	Tr.	0.1	0.1	Tr.	Tr.	Tr.	Tr.	0.1
13:0	-	-	-	Tr.	-	Tr.	-	-	Tr.	-	-	Tr.	-	-	-
14:0	0.4	0.5	0.2	0.3	0.3	0.4	0.5	0.6	0.5	0.4	0.5	0.5	0.4	0.4	0.5
15:0	0.3	0.1	0.2	0.3	0.2	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.3
16:0	22.6	23.7	13.9	19.0	19.2	19.3	20.1	23.6	18.2	17.0	18.3	18.5	16.3	16.9	20.5
16:1 (7 Z)	0.2	0.2	0.2	0.1	0.1	0.2	0.1	Tr.	0.3	0.2	0.1	0.2	0.1	0.2	0.2
16:1 (9 Z)	0.1	0.1	0.1	0.1	0.1	0.1	Tr.	Tr.	0.1	0.1	0.1	0.1	0.1	0.1	0.1
17:0	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
18:0	4.0	5.0	3.4	2.8	2.9	3.3	5.3	3.4	2.9	2.4	3.9	4.3	5.5	4.1	5.3
18:1 (9 Z)	15.9	18.6	23.6	19.2	19.2	21.1	18.2	19.7	17.7	18.0	18.9	18.0	21.7	17.9	19.9
18:1 (9 E)	1.3	0.6	0.6	1.0	0.9	1.2	0.5	0.8	0.9	1.3	0.7	0.8	0.6	0.9	0.6
18:2	47.7	42.8	51.2	51.9	51.4	48.1	50.0	45.5	53.9	55.6	51.1	51.4	49.2	53.0	46.7
18:3	3.3	2.5	1.9	1.9	2.0	2.1	1.7	2.5	1.3	1.6	1.9	1.7	1.6	1.9	2.1
20:0	0.6	0.3	0.5	0.5	0.4	0.5	0.6	0.7	0.5	0.3	0.5	0.6	1.1	0.5	0.7
20:1	0.3	0.2	0.5	0.6	0.5	0.4	0.6	0.4	0.5	0.5	Tr.	0.4	0.6	0.4	0.3
21:0	0.2	-	0.1	0.1	0.1	Tr.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
22:0	0.6	Tr.	0.3	0.4	0.3	0.4	0.4	0.6	0.4	0.3	0.3	0.4	0.4	0.7	0.5
23:0	Tr.	-	0.1	0.1	0.1	Tr.	Tr.	-	0.1	Tr.	0.1	0.1	0.1	0.1	Tr.
24:0	Tr.	-	0.1	Tr.	0.1	Tr.	Tr.	Tr.	0.2	0.1	0.1	0.2	0.2	0.1	Tr.
∑saturated	28.3	29.9	18.9	23.2	23.4	24.5	27.0	28.9	23.0	20.7	23.9	24.7	23.5	22.6	27.8
∑unsaturated	69.6	65.0	78.1	75.3	74.6	73.3	71.6	69.5	75.2	77.6	73.2	73.1	75.0	75.2	70.5
Total	97.9	94.9	97.0	98.5	98.0	97.8	98.6	98.4	98.2	98.3	97.1	97.8	97.8	97.8	98.3
U/S	2.5	2.2	4.2	3.3	3.2	3.0	2.7	2.4	3.3	3.8	3.1	3.0	3.0	3.3	2.5

1. *E. plumosa* var. *plumosa*; 2. *E. plumosa* var. *speciosa*; 3. *E. macrophylla*; 4. *E. barbigera*; 5. *E. reesei* var. *reesei*; 6. *E. reesei* var. *minor*; 7. *E. haussknechtii*; 8. *E. depressa*; 9. *E. bourgaei*; 10. *E. cappadocica*; 11. *E. boissieri*; 12. *E. longipes*; 13. *E. hirsuta*; 14. *E. laguroides*; 15. *E. pisidica*; Tr.: trace than 0.1; U/S: unsaturated/saturated.

TABLE 3. GC/MS Analysis Conditions

System	Hewlett Packard GCD
Column	Innowax (60 m × 0.25φ, 0.25 μm film thickness) fused silica capillary column
Carrier gas and flow rate	Helium, 1 ml/min
Injection temperature	250°C
Column temperature	60°C for 10 min, 220°C at a rate of 4°C/min and kept constant at 220°C for 10 min, 240°C at a rate of 1°C/min.
Split ratio	50:1
Electron energy	70 eV
Mass range	35-425 m/z

EXPERIMENTAL

Plant materials were collected from different regions in Turkey (Table 1). Seeds were separated from plant material. The amount of seeds from each taxa varied between 0.2 g and 1.1 g. Seed oils were obtained by using a 25 ml capacity Soxhlet apparatus with n-hexane and fatty acids were later converted to the methyl ester with 14% BF₃ in methanol [11]. The fatty acid compositions of the seed oils were determined by GC/MS. GC/MS conditions are given in Table 3.

REFERENCES

1. Z. Aytac, *The Genus Ebenus L. (Leguminosae/Fabaceae) in Turkey*, The Karaca Arboretum Magazine, 5(4), 145 (2000).
2. Z. Aytac, *Turkiye Ebenus L. Cinsinin Revizyonu*, Gazi Universitesi Arastirma Fonu Raporu, (1998).
3. P. H. Davis, *Flora of Turkey and the East Aegean Islands*, **3**, 590, (1970).
4. Z. Aytac, F. Unal, and M. N. Pinar, *Israel J. Plant Sci.*, **48**, 321 (2000).
5. J. C. Vlahos, *Hort Science*, **31** (5), 769 (1996).
6. Y. Aynehchi, M. H. Salehi Sormaghi, G. H. Amin, M. Khoshkhow, and A. Shabani, *Int. J. Crude Drug Res.*, **23**, 1, 33 (1985).
7. Y. Aynehchi, M. H. Salehi Sormaghi, M. Shirudi, and E. Souri, *Acta Pharm. Suec.* **19**, 303 (1982).
8. D. Mitrocotsa, A. L Skaltsounis, S. Mitaku, C. Harvala, F. Tillequin, *Biochem. Syst. Ecol.*, **27**, 305 (1999).
9. E. W. Eckey, *Vegetable Fats and Oils*, Reinhold Publishing Corporation, New York, (1954), p. 473.
10. P. D. Marin, V. Sajdi, S. Kapor, B. Tatic, and B. Petkovic, *Phytochemistry*, **30**, 2979 (1991).
11. S. Williams, *Official Methods of Analysis of the Association of Official Analytical Chemists*, Virginia, USA, 503 (1984).