Asphodeline taxa: potential sources of natural-functional ingredients for bioactive formulations

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INTRODUCTION

Plant compounds have become attractive to scientists and food producers due of their valuable biological activities. The beneficial effects associated with their consumption as food supplements are due to the presence of natural secondary metabolites, that perform different functions within the body, avoiding the classical side effects of synthetic drugs. Among plant secondary metabolites, phenolic are the most studied due of their numerous activities such as antioxidant, anti-inflammatory, antimutagenic and inhibitors of enzyme related with different diseases. *Asphodeline* is a genus of about 17 species, widespread in Mediterranean Region, mainly in the Middle East-countries. The aim of this study was to evaluate root extract of 15 *Asphodeline* species in terms of phenolics and flavonoids content and biological activities .

MATERIALS and METHODS

Asphodeline species were collected at flowering stage (May–July) in Turkey regions. The roots, dried at ambient conditions in the dark, were finely triturated (5–10 g) and macerated overnight with 250 mL of methanol at room temperature. The concentrated extracts (under vacuum; 40 °C) were stored at +4 °C in dark until analyses (extraction yields are reported in **Table 1**). The total phenolics content was determined by a reported method [1] and expressed as gallic acid equivalents (GAEs/g extract), while total flavonoids content was determined by a reported method [2] with slightly modification and expressed as rutin equivalents (REs/g extract). HPLC analyses were performed following validated method [3,4] using a Waters model 600 solvent pump.

RESULTS

Total phenolics and total flavonoids content are reported in **Table 1**. The highest and lowest levels were found in *A. cilica* and *A. brevicaulis*, respectively.

Antioxidant properties of *Asphodeline* extracts were evaluated using different assays including free radical scavenging (DPPH and ABTS), reducing power (CUPRAC and FRAP), and metal chelating activity. *A. cilicica* exhibited better performance against DPPH, followed by *A. tenuior* subsp. *tenuiflora* (**Table 2**). As to ABTS radical scavenging activity, *A. rigidifolia* and *A. cilicica* extracts possessed the highest antioxidant capacity. All extracts showed metal chelating activity, with higher values for *A. damascena* subsp. *ovoidea* and *A. prismatocarpa*. This ferrous ion chelating may prevent the reactive oxygen species (ROS) production

Table 1. Extraction yields, total phenolics and flavonoids content of *Asphodeline* extracts.

	Extraction Yield (%)	Total phenolics content (mgGAEs/extract)[a]	Total flavonoids content (mREs/extract)[b]
A.anatolica	12.19	24.21 ± 0.67*	11.39 ± 0.63
A.baytopae	24.87	18.33 ± 0.40	17.32 ± 0.11
A.brevicaulis	25.69	13.51 ± 0.26	10.58 ± 0.50
A.cilicica	6.53	49.18 ± 1.45	30.95 ± 1.40
A.sertachea	16.23	25.55 ± 0.23	23.74 ± 0.36
A.globifera	11.56	23.99 ± 0.86	24.24 ± 0.66
A.peshmeniana	16.76	24.63 ± 0.31	30.27 ± 0.60
A.rigidifolia	11.87	27.81 ± 0.24	25.29 ± 2.56
A.damascena subsp. *damascena*	14.84	22.54 ± 0.80	11.67 ± 0.39
A.damascena subsp. *gigantea*	7.57	34.03 ± 0.97	23.88 ± 0.39
A.damascena subsp. *ovoidea*	7.57	31.34 ± 0.70	23.92 ± 0.60
A.prismatocarpa	10.24	27.12 ± 0.45	24.21 ± 0.51
A.damascena subsp. *rugosa*	12.93	18.61 ± 0.31	11.87 ± 0.18
A.tenuior subsp. *tenuiflora*	3.98	27.57 ± 0.91	27.69 ± 1.36
A.turcica	12.06	26.39 ± 0.24	19.33 ± 0.26

*Values expressed are means ± S.D. of three parallel measurements. [a]GAE, Gallic acid equivalents. [b]RE, Rutin equivalents

Table 2. Free radical scavenging, reducing power and metal chelating activity of *Asphodeline* extracts

	Free radical scavenging activity (mgTEs/g extract)[a]		Reducing power (mgTEs/g extract)[a]		Metal chelating activity (mgEDTAEs/g extract)[b]
	DPPH	ABTS	FRAP	CUPRAC	FERROUS ION CHELATING
A.anatolica	27.52 ± 1.08*	137.60 ± 2.11	58.11 ± 1.25	72.61 ± 0.99	15.09 ± 0.52
A.baytopae	17.42 ± 1.31	50.88 ± 8.20	38.55 ± 2.46	54.85 ± 1.38	9.81 ± 0.20
A.brevicaulis	6.08 ± 2.35	31.57 ± 0.96	30.61 ± 1.14	41.95 ± 0.61	9.84 ± 0.28
A.cilicica	39.67 ± 1.12	213.71 ± 3.64	77.92 ± 2.03	123.59 ± 1.41	11.11 ± 0.48
A.globifera	30.01 ± 1.33	125.10 ± 7.32	54.80 ± 2.35	77.72 ± 2.32	16.01 ± 0.32
A.peshmeniana	27.71 ± 0.40	111.73 ± 3.31	56.93 ± 3.16	76.57 ± 0.76	15.72 ± 0.13
A.rigidifolia	26.70 ± 1.62	140.00 ± 2.10	55.78 ± 1.75	85.27 ± 1.55	13.70 ± 1.03
A.sertachae	29.63 ± 1.61	122.49 ± 3.91	55.44 ± 1.79	88.19 ± 0.90	13.03 ± 0.52
A.damascena subsp. *damascena*	24.14 ± 1.37	72.01 ± 0.76	45.39 ± 2.15	59.70 ± 1.15	19.90 ± 0.82
A.damascena subsp. *gigantea*	32.52 ± 1.03	117.37 ± 1.16	73.66 ± 1.54	73.76 ± 0.70	19.90 ± 0.35
A.damascena subsp. *ovoidea*	32.01 ± 1.16	101.70 ± 0.29	65.56 ± 3.78	70.58 ± 1.27	22.79 ± 0.60
A.prismatocarpa	29.86 ± 1.30	89.89 ± 0.72	62.35 ± 1.03	71.86 ± 1.23	22.38 ± 0.58
A.damascena subsp. *rugosa*	23.1 ± 0.98	63.41 ± 0.22	43.48 ± 2.40	57.07 ± 1.19	12.91 ± 0.23
A.tenuior subsp. *tenuiflora*	35.87 ± 0.93	103.11 ± 2.97	64.34 ± 1.71	79.29 ± 1.86	8.19 ± 0.09
A.turcica	26.66 ± 1.09	78.28 ± 1.50	45.40 ± 0.49	57.87 ± 1.59	19.71 ± 0.03

*Values expressed are means ± S.D. of three parallel measurements. [a]TEs, Trolox equivalents. [b]EDTAE, Ethylenediaminetetraacetic acid equivalents

The enzyme inhibitory activities of *Asphodeline* roots extracts were investigated by spectrophotometric methods against acetylcholinesterase (AChE), butyrylcholinesterase (BChE), tyrosinase, α-amylase and α-glucosidase (**Table 3**). *A. damascena* subsp. *rugosa* showed highest activity against AChE, whereas the highest activity against BChE was obtained by *A. cilicica*. *A. cilicica* also showed the highest activity against α-amylase. *A. damascena* subsp. *ovoidea*, *A. prismatocarpa* and *A. tenuior* subsp. *tenuiflora* showed higher α-glucosidase inhibitory activities than other species.

Table 3. Enzyme inhibitory activityof *Asphodeline* extracts.

	Acetylcholinesterase (mg GALAEs/g extract)[a]	Butyrylcholinesterase (mg GALAEs/g extract)[a]	Tyrosinase (mg KAEs/g extract)[b]	α-amylase (mmol ACAEs/g extract)[c]	α-glucosidase (mmol ACAEs/g extract)[c]
A.anatolica	1.73 ± 0.03*	1.76 ± 0.07	22.27 ± 2.64	0.50 ± 0.02	2.42 ± 0.08
A.baytopae	1.67 ± 0.11	1.94 ±0.37	25.04 ± 1.45	0.34 ± 0.02	1.63 ± 0.13
A.brevicaulis	1.61 ± 0.04	1.73 ± 0.28	25.50 ± 0.41	0.37 ± 0.02	1.10 ± 0.21
A.cilicica	1.62 ± 0.12	1.98 ± 0.40	18.57 ± 0.64	1.24 ± 0.03	4.99 ± 0.11
A.globifera	1.76 ± 0.09	1.75 ± 0.15	23.44 ± 0.63	0.60 ± 0.03	2.12 ± 0.28
A.peshmeniana	1.85 ± 0.05	1.67 ± 0.14	23.56 ± 2.17	0.48 ± 0.01	2.23 ± 0.20
A.rigidifolia	1.67 ± 0.04	1.88 ± 0.12	28.38 ± 1.03	0.65 ± 0.02	3.15 ± 0.16
A.sertachae	1.66 ± 0.14	1.93 ± 0.20	33.84 ± 1.92	0.77 ± 0.02	3.07 ± 0.16
A.damascena subsp. *damascena*	1.61 ± 0.05	1.27 ± 0.06	10.79 ± 0.73	0.79 ±0.03	4.12 ± 0.39
A.damascena subsp. *gigantea*	1.36 ± 0.10	0.41 ± 0.07	1.45 ± 0.44	0.75 ± 0.02	4.79 ± 1.18
A.damascena subsp. *ovoidea*	1.98 ±0.02	0.95 ± 0.02	16.98 ± 0.14	0.67 ± 0.02	10.62 ± 0.26
A.prismatocarpa	1.64 ± 0.03	0.82 ± 0.02	23.70 ± 0.85	0.80 ±0.02	10.50 ± 0.35
A.damascena subsp. *rugosa*	2.09 ± 0.05	0.95 ± 0.03	20.69 ± 0.62	0.63 ± 0.02	4.95 ± 0.11
A.tenuior subsp. *tenuiflora*	0.41 ± 0.05	0.36 ± 0.02	14.78 ± 1.28	0.85 ± 0.03	23.70 ± 0.14
A.turcica	1.81 ± 0.02	1.30 ± 0.02	20.54 ±22 0.68	0.67 ± 0.03	5.17 ± 0.08

* Values expressed are means ± S.D. of three parallel measurements. [a]GALAEs, galantamineequivalents. [b]KAEs, kojic acid equivalents. [c]ACAEs, acarbose equivalents

CONCLUSIONS

Results showed a strong relationship between biological activities (antioxidant and enzyme inhibitory activities) and bioactive compounds in *Asphodeline* extracts. However, other compounds besides phenolics, could contribute to the numerous reported activities. Based on this preliminary studies, the *Asphodeline* species could be considered as promising sources of natural-functional agents for bioactive formulations in food and pharmacological industries.

REFERENCES

[1] Slinkard K, Singleton VL. Total phenol analysis: automation and comparison with manual methods. Am J Enol Vitic 1977;28: 49–55.

[2] Zengin G, Sarikurkcu C, Aktumsek A, et al. A comprehensive study on phytochemical characterization of Haplophyllum myrtifolium Boiss. endemic to Turkey and its inhibitory potential against key enzymes involved in Alzheimer, skin diseases and type II diabetes. Ind Crop Prod 2014;53:244–51.

[3] Locatelli M, Genovese S, Carlucci G, et al. Development and application of high-performance liquid chromatography for the study of two new oxyprenylated anthraquinones produced by Rhamnus species. J Chromatogr A 2014;1225:113–20.

[4] Zengin G, Menghini L, Malatesta L, De Luca E, Bellagamba G, Uysal S, Aktumsek A, Locatelli M. Comparative study of biological activities and multicomponent pattern of two wild Turkish species: Asphodeline anatolica and Potentilla speciosa; Journal of Enzyme Inhibition and Medicinal Chemistry, 2016; 31:203–208.

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