

TOTAL PHENOL CONTENT OF SOME *Hypericum* SPECIES GROWING IN TURKEY

T. Ozen,¹ A. K. Ayan,² C. Cirak,³ and K. Kevseroglu³

UDC 547.972

The *Hypericum* genus of *Guttiferae* is represented in Turkey by 89 species of which 43 are endemic. *Hypericum* species are widespread in Turkey and the most abundant [1]. There are numerous investigations on the chemistry of *H. perforatum*, but little effort has been dedicated to the study of the chemistry of other *Hypericum* species such as *H. organifolium*., *H. tetrapterum*, *H. linarioides*, *H. bithynicum*, *H. monbretii* [2], *H. androsaemum* [3], *H. scabrum* [4], *H. triquetrifolium* [5], *H. hirsutum* [6], and *H. hyssopifolium* [7], and to the authors' knowledge, there are, so far, no published reports related to *H. aviculariifolium*, *H. heterophyllum*, *H. pruinatum*, *H. orientale*, *H. Lydum*, *H. nummularioides*, and *H. venustum* growing wild in rocky slopes and stream sides in very high altitudes in Turkey. Due to the lack of such information, in the present study our goal was to determine the total phenol contents of the all *Hypericum* species mentioned above.

Plant Materials. *Hypericum* plants were collected between August and September, 2003 from five sites in Northern Turkey: Rize, Trabzon, Amasya, Samsun, and Kastamonu and identified by Dr. Hasan Korkmaz, Department of Biology, University of 19 Mayıs, Samsun-Turkey. The top 1/3 of the crown was harvested between 10:00 AM and 2:00 PM. Samples were dissected into tissue parts and dried overnight (or until constant weight) at 65°C, the current temperature used by wildcrafters in USA for industrial production [8].

Extraction. For water extraction, each *Hypericum* (2.0 g) was powdered in a mill and was mixed with 100 ml boiling water by a magnetic stirrer for 15 min. The water extract was lyophilized. For ethanol extraction, a 2.0 g sample was ground into a fine powder in a mill. The sample was extracted in a soxhlet apparatus until the extraction solvent became colourless. The ethanol was removed by a rotary evaporator to obtain a dry extract at 40°C.

Determination of Total Phenol. The amount of total soluble phenolics in the water and ethanol extracts of samples was determined with slight modifications, with pyrocatechol as a standard [9]. The standard curve was plotted using pyrocatechol. The amount of total phenolic compounds in the water and alcohol extracts was calculated as pyrocatechol equivalents in milligrams per kilogram of freeze-dried plant material.

Phenolic compounds are reported to have multiple biological effects, including antioxidant activity, antitumor, antimutagenic, and antibacterial properties [10]. They have many favorable effects on human health, such as inhibition of the oxidation of low-density proteins [11], thereby decreasing heart disease risks [12]. They also have anti-inflammatory activity and anti-carcinogenic properties [13]. Therefore, the presence of phenolic compounds in plant species is very important in term of their medicinal and nutritional evaluation.

According to the results from the present study, all *Hypericum* species evaluated herein contain phenolic compounds in different levels with varying extraction types. Thus, it may be concluded that the occurrence of total phenol in *Hypericum* species has an important pharmacological value especially for their medicinal evaluation. Moreover, this is the first report on *H. aviculariifolium* subsp. *depilatum*, *H. heterophyllum*, *H. pruinatum*, *H. orientale*, *H. lydum*, *H. nummularioides*, and *H. venustum* and further studies will be needed to clarify the chemistry of these species.

The results from the quantification of total phenol are presented in Table 1 where the species are listed alphabetically and reported.

1) Faculty of Science and Art, Department of Chemistry, University of Ondokuz Mayıs, Samsun, Turkey, tel (90362) 457 60 20, fax (90362) 457 60 81, e-mail: tevfikoz@omu.edu.tr; 2) The High School of Profession of Bafra, University of Ondokuz Mayıs, Samsun, Turkey; 3) Faculty of Agriculture, Department of Agronomy, University of Ondokuz Mayıs, Samsun, Turkey. Published in *Khimiya Prirodnykh Soedinenii*, No. 2, pp. 184-185, March-April, 2005. Original article submitted May 5, 2004.

TABLE 1. Total Phenol Content of Some *Hypericum* Species Growing in Turkey

Species	Total phenol contents	
	Ethanol extracts (µg) ^b	Water extracts (µg) ^b
<i>Hypericum androsaemum</i> L.	54.28	39.08
<i>H. aviculariifolium</i> Jaup.& Spach subsp. <i>depilatum</i> (Freyn & Bornm.) Robson var. <i>depilatum</i> ^a	26.84	15.47
<i>H. bihynicum</i> Boiss.	46.84	23.01
<i>H. heterophyllum</i> Vent.	43.65	24.47
<i>H. hirsutum</i> L.	27.71	45.31
<i>H. hyssopifolium</i> L.	22.19	41.24
<i>H. linarioides</i> Bosse	31.50	20.55
<i>H. lydum</i> Boiss.	10.73	30.13
<i>H. monbretii</i> Spach.	32.53	43.05
<i>H. nummularioides</i> Trautv.	19.43	40.46
<i>H. orientale</i> L.	18.39	25.72
<i>H. origanifolium</i> Willd.	20.12	32.02
<i>H. perforatum</i> L.	15.03	19.95
<i>H. pruinatum</i> Boiss. & Bal.	21.67	13.13
<i>H. scabrum</i> L.	18.48	31.58
<i>H. tetrapterum</i> Fries.	29.26	25.66
<i>H. triquetrifolium</i> Turra.	27.61	27.44
<i>H. venustum</i> Fenzl.	29.26	44.26

^aEndemic; ^bMeans of three determinations.

REFERENCES

1. P. H. Davis, *Flora of Turkey and the East Aegean Islands*, Edinburgh, Edinburgh University Press (1988).
2. M. K. Gerassim, *Biochem. Syst. Ecol.*, **29**, 171 (2001).
3. P. Valentao, A. Dias, M. Ferreira, B. Silva, P. B. Andrade, M. L. Bastos, and R. M. Seabra, *Nat. Prod. Res.*, **17**, 135 (2003).
4. M. Matsuhisa, Y. Shikishima, Y. Takaishi, G. Honda, M. Ito, Y. Takeda, H. Shibata, T. Higuti, O. K. Kodzhimatov, and O. Ashurmetov, *J. Nat. Prod.*, **65**, 290 (2002).
5. B. Ozturk, S. Apaydın, E. Goldeli, I. Ince, and U. Zeybek, *J. Ethnopharm.*, **80**, 207 (2002).
6. H. B. Karl, K. B. Buter, A. Engesser, W. Burkard, and W. Schaffner, *Pharmaceutica Acta Helvetiae*, **72**, 153 (1997).
7. A. Cakir, A. Mavi, A. Yildirim, M. E. Duru, M. Harmandar, and C. Kazaz, *J. Ethnopharm.*, **87**, 73 (2003).
8. T. Sirvent, L. Walker, N. Vance, and G. Donna, *Econ. Bot.*, **56**, 41 (2002).
9. K. Slinkard and V. L. Singleton, *Am. J. Biochem.*, **215**, 213 (1977).
10. G. Shui and L. P. Leong, *J. Chromatogr.*, **77**, 89 (2002).
11. E. Frankel, J. Kanner, J. German, E. Parks, and J. E. Kinsella, *Lancet*, **34**, 454 (1993).
12. R. L. Williams and M. S. Elliot, *Natural Antioxidants: Chemistry, Health Effects and Applications*, AOCS Press, Illinois, 150 (1997).
13. F. Shahidi and P. K. Wanasundara, *Crit. Rev. Food Sci. Nutr.*, **31**, 67 (1992).