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Gundelia (*Compositae*), from one to many species – an ignored diversity*

Abstract

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For long time in scientific botany the genus *Gundelia* (*Compositae*) was treated with only one polymorphic species *Gundelia tournefortii* L. When finding new populations in Armenia it was realized, that several species are hidden in the variety. At the moment 15 species are accepted as distinct taxa. The genus can be found from Turkey eastwards to Afghanistan, southwards to Israel and Iraq. The centre of diversity is in Eastern Turkey.

Key Words: Mediterranean Flora, systematics.

Introduction

Linnaeus (1753) described *Gundelia tournefortii*, all later described species and varieties have been put back into synonymy by later authors (e.g. Kupicha 1975; Rechinger 1989). Therefore during the OPTIMA excursion in Armenia in 2002 plants of this genus have been presented to the participants as *"Gundelia tournefortii"*. In 2005 two new localities of *Gundelia* have been found in Armenia, and comparing these populations it became clear that there is more than one species in the genus. After finding the important characters to distinguish the species, step by step all published names of whatever rank have been checked, typified and – as far as possible – the type localities visited. The plants of the genus *Gundelia* are called „Kenger" in Turkish, „Akub" in Arabic and „Kuub" in Farsi language, with some local dialectic variations. Young shoots are used as vegetables or as food for animals. The latex of the cut shoots can be dried and used as chewing gum. The roasted fruits can be used to replace coffee beans.

Results

At the moment 15 species are accepted (Vitek & Jarvis 2007; Vitek & al. 2010; Vitek & al. 2014; Nersesyan 2014; Armağan 2016; Fırat 2016, 2017a; Vitek & al. 2017a, 2017b; Vitek & Noroozi 2017a, 2017b; Fırat 2017b; Çakılcıoğlu & al. 2018; Vitek 2018). They can be distinguished by size of the plant, colour of flowers (Fig. 1), number of flowers in one partial synflorescence, indumentum, shape and size of fruits, climatic and ecological requirements (Table 1).

*Extended and enriched version of the oral presentation given at the International Symposium "Botany at the intersection of Nature, Culture, Art and Science", Selinunte, 28-30 June 2018.

Table 1. Gundelia species and their characters.

Taxon	Plant size (cm)	Synflorescences per plant	Flower colour (inside)	Number of flowers	Indumentum (in synflorescence)	Distribution (countries)
G. anatolica	30–60	10–15	yellowish green to green	6	young shoots with dense arachnoid hairs	Turkey
G. aragatsii subsp. *aragatsii*	50–80	5–15	brown	3 (–5)	arachnoid hairs when young	Armenia, Azerbaidjan
G. aragatsii subsp. *steineri*	50–80	5–15	brown	3	arachnoid hairs when young	Armenia
G. armeniaca	50–80	5–15	violet	6	glabrous	Armenia, (Turkey?)
G. asperrima	20–50	5–10	blackish brown	3 (–5)	very dense arachnoid hairs	Turkey
G. cilicica	30–70	5–10	golden yellow	(5–) 6	arachnoid hairs when young	Turkey
G. colemerikensis	50–80	15–30	reddish maroon to pinkish–maroon	5–6	glabrous or arachnoid hairs when young	Turkey
G. dersim	60–100	5–15	brown to reddish–brown	6–7	densely covered with tomentose (and arachnoid) hairs	Turkey
G. glabra	30–60	5–10	brown	3–4	glabrous	Turkey
G. komagenensis	30–60	1–5	golden yellow	3 (–5)	glabrous or sparsely arachnoid hairs	Turkey
G. mesopotamica	50–80	5–20	whitish to pale yellowish	6–7	glabrous to tomentosely hairy	Turkey
G. microcephala	20–60	3–10	yellow	6–7	young state covered with hairs	Iran, Iraq
G. munzuriensis	30–80	5–10	bright pink to pink	3–6	sparsely hairy with arachnoid hairs	Turkey
G. rosea	40–120	10–60	pale violet	(7–) 8 (–10)	arachnoid hairs when young	Iran, Iraq, Turkey
G. tehranica	40–120	10–60	yellow	(7–) 8	glabrous, rarely few arachnoid hairs on young shoots	Iran
G. tournefortii	40–100	5–10	bright yellowish to yellow	5–7	hairy to densely hairy	Cyprus, Israel, Syria, Lebanon, Turkey, (Iran?, Iraq?)
G. vitekii	40–60	1–5	dark pink to red	3 (–5)	arachnoid hairs when young	Turkey

Accepted taxa:

Gundelia L., Sp. Pl. 2: 814 (1753), type species: *G. tournefortii.*

G. anatolica Fırat, *Gundelia* Spec. Anatolia: 23–24 (2016). – Fig. 1c.
Type: Turkey, B4, Kırıkkale, Delice province, Tuzkayası region, 700 m, 39°58'20" N, 34°04'12" E, 2. 5. 2015, M. Fırat 32645 [holotype VANF, isotypes ANK, Herb. Yıldırımlı, Herb. Fırat].

G. armeniaca Nersesyan, Ann. Naturhist. Mus. Wien, B 116: 192 (2014). – Fig. 1f.
Type: Абовянский район, окр. с. Гехадир, 10. 06. 1988, А. Нерсесян, [Abovian region, surroundings of Geghadir village, 10. 06. 1988, A. Nersesyan] [holotype ERE 137773, isotypes ERE 137772, ERE 149115, ERE 149116, ERE 149117, W 2006-0005938, W 2006-0005939].

G. aragatsi Vitek, Fayvush, Tamanyan & Gemeinholzer subsp. *aragatsi*, Ann. Naturhist. Mus. Wien, B 111: 92 (2010).
Type: Armenia, Aragatsotn province, Mt. Aragats SW-slope, track between Avtona water reservoir and Kakavadzor, 1880 m s. m., 40°22'5"N/44°2'49"E, 23. 6. 2007 G. Fayvush, K. Tamanyan, H. Ter-Voskanyan, E. Vitek 07-1373 [holotype ERE, isotypes W (four sheets) 2009-18514–2009-18517, B, BC, BM, BRNU, E,MO, MSB, NY, WU].

G. aragatsi subsp. *steineri* Vitek, Fayvush, Tamanyan & Gemeinholzer, Ann. Naturhist. Mus. Wien, B 111: 96 (2010).
Type: Armenia, Vayots Dzor province, mainroad to south Armenia,Wof Yeghegnadzor, SE of crossroad to Erechgnadzor, slope S of river, 1050 m. s. m, dry rocky slope, 39°44'21"N/45°15'3"E, 2009-06-01 G. Fayvush, K. Tamanyan, E. Vitek 09-0700 [holotype ERE, isotypes W2009-18513, B, BC, E, MO, MSB, NY, WU].

G. asperrima (Trautv.) Fırat, Ot Sist. Bot. Dergisi 24(2): 62 (2017) [31 Dec 2017?]
≡ *G. asperrima* (Trautv.) Çakılcıoğlu, Yüce & Vitek, Ann. Naturhist. Mus. Wien, B, 120: 240 (2018). [Jan 2018, isonym]
Type: "In Turciae districtu Erzerum, in montibus Palänteken, altit. 6300' [1920 m], Radde" [TB n. v.].

G. colemerikensis Fırat, Gundelia Spec. Anatolia: 15–16 (2016). – Fig. 1b.
Type: Turkey, C9, Hakkâri Province (Colemerîk) from Karadağ hill to Berçelan plateau, 2284 m, 37°36'39" N, 43°44'44" E, 11. 6. 2015, M. Fırat 32465 [holotype VANF, isotypes ANK, Herb. Yıldırımlı, Herb. Fırat].

G. dersim Vitek, Yüce & Ergin, Phytotaxa 161: 131 (2014).
Type: Turkey, Province Tunceli (Dersim), Ovacık, c. 11. 7 km WWSW Ovacık, 1. 9 km ENE Ziyaret (fountains of river Munzur), 1300 m s. m., 39°20'16" N / 39°4'57" E, 12. 06. 2013, E. Vitek, E. Yüce, C. Ergin & H. H. Makal 13-0030 [holotype W 2013-0006146, isotypes Tunceli University, HUB, ISTE, E, G, US].

G. glabra Mill., Gard. Dict., ed. 8. n. 2 (1768). – Fig. 1a.
Type: Turkey, province Bayburt, c. 4.4 km SSE Bayburt, road to Gümüşsu, c. 100 m from main road, 1595 m s.m., 40°13'37"N 40°15'43"E, 14.6.2013 E. Vitek, E. Yüce, C. Ergin & H. H. Makal 13-0173 [neotype W 2013-0006162, iso-neotypes Tunceli University, B, E, G, HUB, INU, ISTE, NY, US].

G. komagenensis Fırat, Gundelia Spec. Anatolia: 6–7 (2016). – Fig. 1g.
Type: Turkey, C7, Adlyaman: Kahta Province, Nemrut mountain, 1445 m, 31'57'01" N,

38°45'38" E, 26. 5. 2015, M. Fırat 32494 [holotype VANF, isotypes ANK, E, Herb. Yıldırımlı, Herb. Fırat].

G. mesopotamica Fırat, Acta Biol. Turc. 30: 65 (2017).
Type: Turkey. C8 Mardin: 2–3 km from Mardin to Nusaybin (Nisêbîn), eroded slopes, aride steppe, 807 m, 37°17'36"N, 40°46'20"E, 8. 5. 2017, M. Fırat 33725 [holotype VANF, isotypes ANK, Herb. M. Fırat].

G. microcephala (Bornm.) Vitek, Ann. Naturhist. Mus. Wien, B, 120: 235 (2018).
Type: Inter Kermandschahan et Bagdad, prope Khanegyn [Chanekin, Chanaqin] ad fines Persiae, Grenzstation, 3. 4. 1894, Strauss s. n. [JE 00015288].

G. munzuriensis Vitek, Yüce & Ergin, Phytotaxa 161: 135 (2014).
Type: Turkey, Province Tunceli (Dersim), Ovacık, c. 2 km WWSW Ovacık, 1275 m s. m., 39°21'19" N / 39°11'29" E′, 12. 6. 2013, E. Vitek, E. Yüce, C. Ergin & H. H. Makal 13-0025 [holotype W 2013-0006270 (inflorescence) and 2013-0006269 (additional leaf), isotypes Tunceli University, HUB, INU, ISTE, B, E, G, L, US].

G. rosea M. Hossain & Al-Taey, Notes Roy. Bot. Gard. Edinburgh 42 (1): 41 (1984). – Fig. 1d–e.
Type: Iraq, c. 60 km. N. E. of Mosul, 10. 5. 1978, Hossain s. n. [holotype MSUH, isotypes BAG, E00385310, K000797235]

G. tehranica Vitek & Noroozi, Ann. Naturhist. Mus. Wien, B, 119: 246 (2017).
Type: Iran, Tehran, Tuchal Mt., above Velenjak, 2200-2300 m, 35°49'26"N, 51°23'30"E, 6. 5. 2016, J. Noroozi [holotype W 2016-0011195, isotypes E, G, IRAN, NY, TARI, W 2016-0011196].

G. tournefortii L., Sp. Pl. 2: 814 (1753).
Lectotype: [Aleppo,] Rauwolf 1583, t. 74. Epitype: [Aleppo,] Rauwolf, hort. sicc. 81 [L].
= *G. cilicica* Fırat, *Gundelia* Spec. Anatolia: 19–20 (2016).
Type: Turkey, C5, Mersin, Erdemli province, Tozlu village, 1460 m, 36°48'12" N, 34°07‘09" E, 5. 5. 2016, M. Fırat 32705 [holotype VANF, isotypes ANK, Herb. Yıldırımlı, Herb. Fırat].

G. vitekii Armağan, Ann. Naturhist. Mus. Wien, B, 118: 130 (2016).
Type: Turkey, province Tunceli (Dersim), Tunceli Merkez, c. 8 km N of Tunceli, mountain slope NW of Tüllük Bucağı, 39°10'32"N 39°32'04"E, 1745 m s. m., 31. 5. 2015, E. Vitek, M. Armağan & M. Özel 15-0042 [holotype VANF, isotype W 2015-11168].

Names still needing clarification:
Gundelia tenuisecta Freyn & Sint., Oesterr. Bot. Z. 42: 168 (1892).
G. tournefortii var. [β] *araneosa* DC., Prodr. Syst. Nat., 5: 88 (1836).
G. tournefortii var. *armata* Freyn & Sint, Österr. Bot. Z. 42: 168 (1892).
G. tournefortii var *tenuisecta* Boiss., Fl. Orient. 3: 421 (1875).

Discussion

It is a surprising fact, that the diversity in the genus has been ignored for long time. Probably this is partly due to the difficulties in collecting these often rather big, spiny and badly drying plants. In the herbarium specimens some characters as the flower colour can-

Fig. 1. *Gundelia,* synflorescence. a) *G. glabra,* b) *G. colemerikensis,* c) *G. anatolica,* d–e) *G. rosea,* f) *G. armeniaca,* g) *G. komagenensis.* – a, d, e, g © Vitek, b, c, f © Armağan.

not be seen and in most cases there is no information on the habitat. Some authors (e.g. Bornmüller 1906; Trautvetter 1876) found the important differencing characters, but described the taxa as varieties.

All species are clearly differentiated in their characters (Table 1), but also well defined in their ecological needs. E.g. *G. glabra* has been found in the province Elaziğ, near Sivrice growing on a dry slope (Vitek & al. 14-0189 [W 2014-0014879]; Vitek & al. 2017: Fig. 4c), and *G. dersim* in about 30 m distance in a grassy humid ditch (Vitek & al. 14-188 [W 2014-0014881], new record for the province Elaziğ). No plants could be found in between showing the strict limitation to the required habitat. In Armenia *G. aragatsi* subsp. *aragatsi* is found in mountain (steppe) meadows (1700-1900 m), *G. aragatsi* subsp. *steineri* on a stony slope with Shibljak vegetation (1000-1100 m) and *G. armeniaca* in semi-humid to dry meadows in lower altitude (1300-1600 m).

Gundelia has its centre of diversity in Turkey with 12 (-13) species, reaching Afghanistan in the East, Israel in the South and Cyprus. Based on photos and information found in the internet there are still some species to describe. There is insufficient information on the variability in Iran and Iraq with 3 (-4) species at the moment. For other countries from which *Gundelia "tournefortii"* is reported, e.g. Azerbaijan or Turkmenistan, there is no reliable information to assign a species, but with high certainty this is not *G. tournefortii.* The same is valid for Afghanistan - the photo in Breckle & Rafiqpoor (2010: 271) shows some similarity to *G. tehranica*, but does not allow a clear assignment. Anyway the total number of species could go up to 20-25 species in future.

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