



Scorzonera Coriacea A. Duran & Aksoy (Asteraceae, Cichorieae), a New Species from South Anatolia, Turkey

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Scorzonera coriacea A. Duran & Aksoy (Asteraceae, Cichorieae), a new species from South Anatolia, Turkey

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Abstract

DURAN, A., B. DOGAN, E. HAMZAOĞLU & A. AKSOY (2011). *Scorzonera coriacea* A. Duran & Aksoy (Asteraceae, Cichorieae), a new species from South Anatolia, Turkey. *Candollea* 66: 353-359. In English, English and French abstracts.

A new species, *Scorzonera coriacea* A. Duran & Aksoy (Asteraceae) from Anatolia, Turkey, is described and illustrated. The species grows in open *Pinus nigra* forest and on the serpentine stony slopes of the Kızıldağ Mountain in the district of Derebucak (Konya province) and in the Kızıldağ National Park in the district of Şarkikaraağaç (Isparta province). *Scorzonera coriacea* is a very distinct species, and with no obvious allies among other *Scorzonera* species in Turkey in terms of morphological features. The new species is an endemic confined to the Southern Anatolia. Notes on its ecology, biogeography and its conservation status are also presented. The geographical distribution of the new species is mapped.

Key-words

ASTERACEAE – LACTUCEAE – *Scorzonera* – Turkey – Taxonomy

Résumé

DURAN, A., B. DOGAN, E. HAMZAOĞLU & A. AKSOY (2011). *Scorzonera coriacea* A. Duran & Aksoy (Asteraceae, Cichorieae), une nouvelle espèce du sud de l'Anatolie (Turquie). *Candollea* 66: 353-359. En anglais, résumés anglais et français.

Une nouvelle espèce, *Scorzonera coriacea* A. Duran & Aksoy (Asteraceae) d'Anatolie (Turquie), est décrite et illustrée. La plante pousse dans des forêts ouvertes à *Pinus nigra*, sur des rochers de serpentine du Mont Kızıldağ, district de Derebucak (province de Konya) et dans le parc national de Kızıldağ, district de Şarkikaraağaç (province d'Isparta). *Scorzonera coriacea* est une espèce très distincte, sans taxon affine parmi les autres représentants du genre *Scorzonera* en Turquie en terme de morphologie. La nouvelle espèce est endémique du sud de l'Anatolie. Des notes sur son écologie, sa biogéographie et son statut de conservation sont présentées. Une carte précise sa distribution.

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Introduction

The genus *Scorzonera* L. includes about 180 species and being of an ancient Mediterranean origin, it is widely spread in arid regions of Eurasia and Africa (LACK, 2007). The first thorough classification of the genus *Scorzonera* is given by CANDOLLE (1805). According to his system, *Scorzonera* includes perennial herbs and shrubs with simple, entire, rarely pinnatifid leaves, and phyllaries always deprived of horns. Considerable changes in the treatment of the genus *Scorzonera* were introduced by BOISSIER (1875) who included *Podospermum* DC. and *Epilasia* (Bunge) Benth. as sections within the genus *Scorzonera*. The most complete and much changed system is given by Lipschitz in two parts of this classical “Fragmente monographiae *Scorzonera*” (LIPSCHITZ, 1935, 1939). The concept of the genus introduced by Lipschitz is accepted in many regional “Floras” (CHAMBERLAIN, 1975; CHATER, 1976; RECHINGER, 1977).

According to CHATER (1976) the genus *Scorzonera* is represented with 28 species in Europe. CHAMBERLAIN (1975) gives 39 species for Turkey, among them only five of the European species, namely *S. cana* (C. A. Mey.) O. Hoffm., *S. cretica* Willd., *S. hispanica* L., *S. laciniata* L., *S. mollis* M. Bieb. Since the revision of the genus *Scorzonera* by CHAMBERLAIN (1975) for the Flora of Turkey, some other new taxa, such as *S. pisidica* Hub.-Mor. (DAVIS & al., 1988), *S. latifolia* var. *angustifolia* Lipsch. (GÜNER, 2000), *S. sandrasica* Hartvig & Strid (GÜNER, 2000), *S. longiana* Sümbül (GÜNER, 2000), *S. adilii* A. Duran (DURAN, 2002), *S. ulrichii* Parolly & N. Kilian (KILIAN & PAROLLY, 2002), *S. karabelensis* Parolly & N. Kilian (PAROLLY & KILIAN, 2003), *S. yildirimlii* A. Duran & Hamzaoglu (DURAN & HAMZAOĞLU, 2004), *S. ketzkhoveli* Grossh. & Sosn. have been added to the Flora of Turkey (HAMZAOĞLU & al., 2010). In recent years, *S. argyria* Boiss. and *S. amasiana* Hausskn. & Bornm. which have been poorly known endemic species, were studied based on their morphological, karyological, and palynological descriptions and their current conservation statuses were re-evaluated with respect to the latest IUCN criteria (KARAER & CELEP, 2007; DİNÇ & BAĞCI, 2009). Forty-nine *Scorzonera* species are now known to inhabit Turkey. In this paper, a new *Scorzonera* species is described and illustrated.

During a field trip, we collected some specimens of the genus *Scorzonera* in Southern Anatolia, in the Konya and Isparta provinces. Following a careful examination, and by studying the specific descriptions of *Scorzonera* in CHAMBERLAIN (1975), CHATER (1976), DAVIS & al. (1988) and GÜNER (2000), ÖZHATAY & al. (1999), ÖZHATAY & KÜLTÜR (2006), ÖZHATAY & al. (2009), as well as comparing with specimens in the herbaria E, G, GAZI, HUB, K, KNYA and ANK, we found that our specimens represent a species new to science. In the description below, each numerical value is the average of ten measurements from different specimens.

Scorzonera coriacea A. Duran & Aksoy, **spec. nova** (Fig. 1, 2)

Typus: TURKEY. C3 Konya: Derebucak, Çamlık district, Kızıldağ, serpentine stony places, 1400 m, 37°21.869'N 31°40.501'E, 12.VI.2009, A. Duran 8349 & B. Doğan (holo-: KNYA; iso-: GAZI, ANK, HUB, Selçuk Univ., Herbarium of the Faculty of Education).

Planta perennis; foliis veternis basi reliquis; caule 5-11-folio, cavo, glabro, tumido basi capitulis; folio integro, lineari vel lineari-lanceolato, plane coriaceo, amplexicauli, 10-29 × 0.6-1.5 cm; capitulo uno per caule; achenio 16-22 × 2-3 mm.

Cauliscent perennial herb. *Rootstock* thickened, cylindrical, clearly clothed with the remains of old leaf bases. *Stem* with 5-11 leaves, erect, hollow, glabrous, clearly striate, 20-50 cm tall, 3-5 mm diam. at base, more thickening towards the capitulum, unbranched, tomentose and significantly swollen below the capitulum. *Basal leaves* crowded, entire, narrowly linear or linear-lanceolate, distinctly coriaceous, glabrous to sparsely tomentulose, greenish, amplexicaul, 10-29 × 0.6-1.5 cm, margins plane, apex acute to acuminate, lamina gradually narrowed towards the base, the main veins distinctly conspicuous; cauline leaves very similar to basal leaves but smaller, decreasing in size upwards. *Capitula* one per stem, 25-50 × 12-20 mm. *Outer phyllaries* 10-20 × 5-10 mm, broadly lanceolate to ovate, acute to acuminate at apex, glabrescent or sometimes with densely tomentose upper sides; *inner phyllaries* 25-40 × 8-10 mm, lanceolate, ± acute, sparsely tomentose and scarious margins below part. *Flowers* yellow, ligules longer than inner phyllaries, 10-12 × 1-1.5 mm, style branches filiform. *Achenes* 16-22 × 2-3 mm, ridged, furrow, regularly verrucose-muricate, narrowly ellipsoid, glabrous; pappus 24-26 mm, straw-coloured, hairs plumose below, plumose and barbelate only above.

Flowering period. – May-June, fruiting period June-July.

Distribution and ecology. – *Scorzonera coriacea* appears to be endemic of limited range in the south-eastern edge of the Çamlık and Kızıldağ National Park areas, forming the western part of the Central Taurus. The specimens were collected in Derebucak (C3 Konya province) and Şarkikaraağaç (B3 Isparta province) districts, where the species appears to be rare and local (Fig. 3). *Scorzonera coriacea* grows on serpentine stony slopes, within open *Pinus nigra* forest together with *Noccaea camlikensis* Aytaç, Nordt & Parolly, *Sideritis ozturkii* Aytaç & Aksoy, *Bornmuellera kiyakii* Aytaç & Aksoy, *Centaurea kizildaghensis* Uzunh. & al., *Silene ozyurtii* Aksoy & Hamzaoglu, *Eryngium trisectum* Wörz & H. Duman, *Rindera dumonii* Aytaç & R. R. Mill, *Stipa cacuminis* H. Scholz & Parolly, *Medicago orbicularis* (L.) Bartal., *Polygala pruinosa* subsp. *megaptera* Cullen, *Briza humilis* M. Bieb., *Fumana procumbens* (Dun.) Gren. & Godr., *Eryngium kotschy* Boiss., *Campanula stricta* L. var.



Fig. 1. – Holotype of *Scorzonera coriacea* A. Duran & Aksoy.

[Duran 8349 & B. Doğan, KNYA]



Fig. 2. – *Scorzonera coriacea* A. Duran & Aksoy. **A.** Habit; **B.** Capitulum at anthesis; **C.** Capitulum in fruit; **D.** Achene.

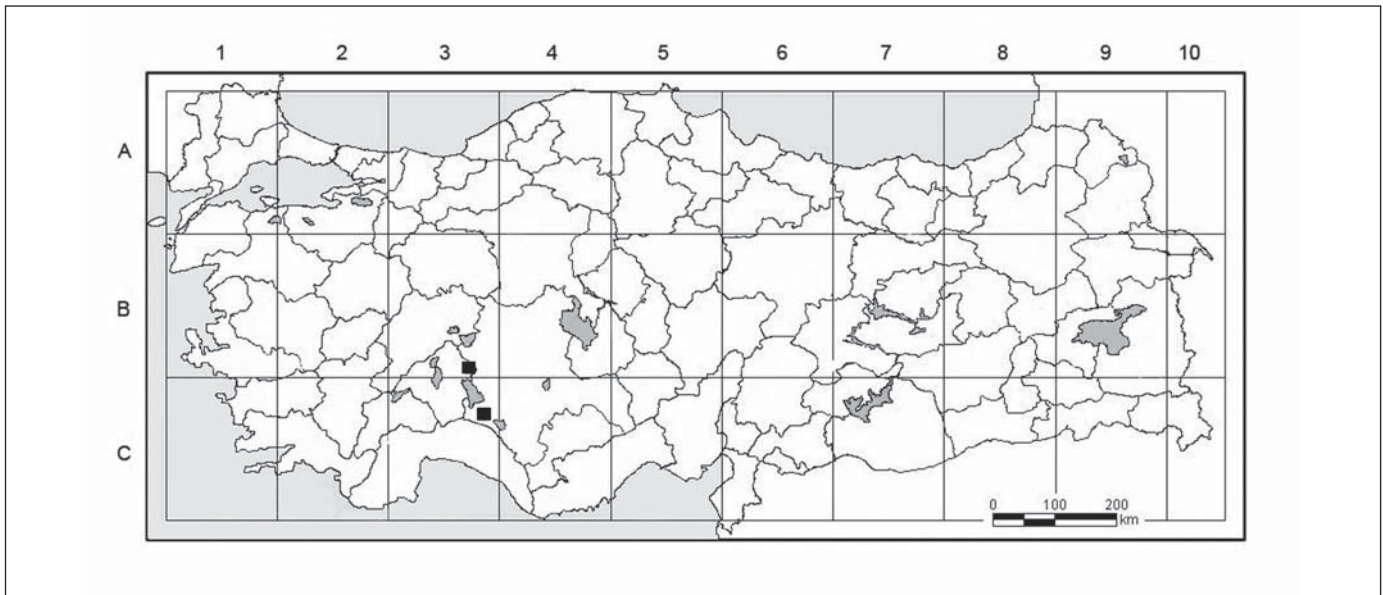


Fig. 3. – Distribution map of *Scorzonera coriacea* A. Duran & Aksoy (■) in Turkey.

stricta, *Rosularia chrysantha* (Boiss.) Takht., *Phleum boissieri* Bornm., *Myosotis lithospermifolia* (Willd.) Hornem., *Salvia frigida* Boiss., *Helichrysum arenarium* subsp. *aucheri* (Boiss.) P. H. Davis & Kupicha.

Scorzonera coriacea spreads out in the regions of both Kızıldağ (Derebucak, Konya Province) and the Kızıldağ National Park (Isparta province). Kızıldağ (Derebucak) is positioned to the south of the Beyşehir Lake while the Kızıldağ National Park resides in the north of the lake. Both localities consist of serpentine areas that are locally isolated from their surroundings in terms of their rocky characteristics. Many local endemic species inhabit such localities of serpentine areas.

Conservation status. – *Scorzonera coriacea* is endemic to the Derebucak (Konya province) and Kızıldağ National Park (Isparta province), Anatolia. The species is known only from two populations within an area of approximately 7000 m² (criterion B2a). The populations are in a poor condition and the number of individuals is estimated to be approximately 150-160. Therefore it should be regarded as ‘Critically Endangered’ (IUCN, 2001).

Notes. – *Scorzonera coriacea* seems to be a very distinct species of the genus *Scorzonera* without any close relatives. It differs from all other *Scorzonera* species, possessing a clear clothing with the remains of old leaf bases; hollow stems, glabrous, more thickening towards capitula, significantly swollen below capitula; leaves distinctly coriaceous, glabrous to sparsely tomentulose, amplexicaul, the main veins distinctly conspicuous; cauline leaves similar to basal leaves; capitula one per stem, achenes of 16-22 mm long; and pappus of 24-26 mm long.

Scorzonera coriacea resembles to *S. parviflora* Jacq. in general appearance. *Scorzonera parviflora* grows in salt marshes habitats in Eurasia, and it is readily distinguished from *S. coriacea* by its creeping rootstock; glabrous leaves; capitula 20-25 mm long; inner phyllaries 15-20 mm long and achenes 7-8 mm long (Table 1).

Scorzonera coriacea is superficially similar to *S. semicana* DC. It mainly differs from *S. semicana* by its clear stem clothing with the remains of old leaf bases (not clothed); stem unbranched, hollow (not branched, solid); capitula 1 per stem (not 1-4 per stem), and flowers drying yellow (not light purple); achene narrowly ellipsoid (not swollen at base) (Table 1).

Palaeopalynological data show that Anatolia had a dense vegetation cover in the last interglacial period. The topography of Turkey has since changed many times, introducing different microclimates in the tectonic valleys (GEMICI, 1993). The Taurus mountain range is a botanically interesting area, occupying the Mediterranean phyto-geographical region. The area is very rich in local endemic plants (DURAN & al., 2005). *Scorzonera coriacea* grows in the Taurus Mountains which are under the influence of the Mediterranean Sea (Fig. 4). Recently many publications were published on new species from this particular region, notably *Noccaea camlikensis* (AYTAÇ & al., 2006), *Sideritis ozturkii* (AYTAÇ & AKSOY, 2000a), *Bornmuellera kiyakii* (AYTAÇ & AKSOY, 2000b), *Centaurea kizildaghensis* (UZUNHISARCIKLI & al., 2007), *Silene ozyurtii* (AKSOY & al., 2009), *Eryngium trisetum* (WÖRZ & DUMAN, 2004), *Rindera dumanii* (AYTAÇ & MILL, 2005), and *Stipa cacuminis* (PAROLLY & SCHOLZ, 2004).

Table 1. – Comparison between the diagnostic characters of *Scorzonera coriacea* A. Duran & Aksoy, *S. parviflora* Jacq. and *S. semicana* DC.

Characters	<i>Scorzonera coriacea</i>	<i>Scorzonera parviflora</i>	<i>Scorzonera semicana</i>
Root	thick, cylindrical, clearly clothed with the remains of old leaf bases	creeping rootstock, not clothed with the remains of old leaf bases	rootstock thick, not clothed with the remains of old leaf bases
Stem	unbranched, clearly caulescent, significantly swollen below the capitulum, hollow	branched or unbranched, ± subscapigerous, not swollen below the capitulum, hollow	branched or unbranched, subscapigerous or shortly caulescent, not swollen below the capitulum, solid
All leaves	distinctly coriaceous	not coriaceous	not coriaceous
Leaves	narrowly linear or linear-lanceolate, 6-15 mm wide, entire, glabrous to sparsely tomentulose	fleshy, linear-lanceolate, 3-8 mm wide, entire, glabrous	linear to linear-lanceolate, 8-20 mm wide, undulate, lanate or glabrous
Capitula	1 per stem, 25-50 mm long	1 per stem, 20-25 mm long	1-4 per stem, 30-50 mm long
Outer phyllaries	broadly lanceolate to ovate, 10-20 mm long	ovate-triangular, 7-8 mm	ovate-triangular, 6-7 mm
Inner phyllaries	lanceolate, ± acute, 25-40 mm	oblong-lanceolate, obtuse, 15-20 mm	oblong-lanceolate, obtuse, 15-50 mm
Achene size	16-22 mm long	7-8 mm long	17-30 mm long
Achene shape	ridged, furrow, regularly verrucose-muricate, narrowly ellipsoid	smooth along ridge, cylindrical	ridged, narrowly cylindrical, swollen at base, smooth to transversely lamellate-muricate
Pappus	straw-coloured	white	snow-white
Habitat	serpentine stony places	salt marshes	meadows, banks

The serpentine habitats are characterized by their lack of nutrients and their high concentration of heavy metals, especially nickel, which may be toxic for many plants. Physiological adaptations to these habitats include either tolerance, or accumulation and storage of these toxic metal ions. Hyperaccumulation of nickel is frequently observed in many Turkish species of the *Brassicaceae* (*Thlaspi*, *Cochlearia*) (REEVES, 1988), *Alyssum* (REEVES & al., 1983) and of *Centaurea* (REEVES & ADIGÜZEL, 2004).

Paratypes. – **TURKEY. C3 Konya:** Derebucak, Çamlık, Kızıldağ, serpentine stony places, 1445 m, 37°21.028'N 31°39.082'E, 30.V.2005, *E. Hamzaoğlu 3707 & Aksoy* (KNYA); Derebucak, Çamlık, Suluin road, serpentine stony places, 1300 m, 37°21.299'N 31°36.467'E, 11.VI.2008, *A. Duran 8042* (KNYA). **B3 Isparta:** Şarkikaraağaç, Kızıldağ National Park, 1600-1700 m, 25.VI.1994, *B. Mutlu 928* (HUB); Şarkikaraağaç, Kızıldağ National Park, 1100-1250 m, 25.V.1994, *B. Mutlu 579* (HUB).

Additional specimens examined. – *Scorzonera semicana* DC.: **TURKEY. B5 Aksaray:** Taşkestik tepesi, step, 1100 m, 19.V.2005, *M. Öztürk 401* (MR). **B9 Van:** Başkale, Güzeldere pass, 2700 m, 15.VI.2002, *M. Armağan 2388* (VANF). **C7 Urfa:** Siverek, 15 km E. of Siverek, 900 m, 19.V.1957, *Davis 28286* (ANK). **C8 Mardin:** 5 km N. of Mardin, 1100 m, 25.V.1957, *Davis 28603* (ANK).

Scorzonera parviflora Jacq.: **TURKEY. B4 Aksaray:** Eskil, Gölyazı to Tuz lake, 910 m, 29.VI.2009, *B. Doğan 2104* (KNYA); Eskil, Gölyazı to Tuz lake, 920 m, 10.VI.2005,

A. Duran 7029 & B. Doğan (KNYA). **B4 Konya:** Kulu to Tuz lake, 910 m, 27.VI.2006, *A. Duran 7144* (KNYA). **B5 Kırşehir:** Sifegöl (Seyfe Lake), Mucur, 17.VI.1954, *Davis 21787* (ANK).

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References

- AKSOY, A., E. HAMZAOĞLU & Ü. BUDAK (2009). *Silene ozyurtii* (Caryophyllaceae), a new species from Anatolia, Turkey. *Ann. Bot. Fenn.* 46: 431-434.
- AYTAÇ, Z. & A. AKSOY (2000a). A new *Sideritis* L. species (Labiatae) from Turkey. *Fl. Medit.* 10: 181-184.
- AYTAÇ, Z. & A. AKSOY (2000b). A new species of *Bornmuellera* Hausskn. (Brassicaceae) from south Anatolia, Turkey. *Bot. J. Linn. Soc.* 134: 485-490.
- AYTAÇ, Z. & R. R. MILL (2005). Two new Boraginaceae (Tribe Cynoglosseae) from Turkey. *Edinburgh J. Bot.* 61: 109-118.
- AYTAÇ, Z., B. NORDT & G. PAROLLY (2006). A new species of *Noccaea* (Brassicaceae) from South Anatolia, Turkey. *Bot. J. Linn. Soc.* 150: 409-416.
- BOISSIER, E. P. (1875). *Scorzonera* L. *Fl. Orient.* 3: 755-783. Genevae & Basileae.

- CANDOLLE, A.-P. DE (1805). *Scorzonera*. In: LAMARCK, J.-B. DE & A.-P. DE CANDOLLE, *Fl. Franç.* 4: 59-62. Paris.
- CHAMBERLAIN, D. F. (1975). *Scorzonera* L. In: DAVIS, P. H. (ed.), *Fl. Turkey* 5: 632-657. Edinburgh Univ. Press.
- CHATER, A. O. (1976). *Scorzonera* L. In: TUTIN, T. G. & al. (ed.), *Fl. Eur.* 4: 317-322. Cambridge Univ. Press.
- DAVIS, P. H., R. R. MILL & K. TAN (1988). *Scorzonera* L. *Fl. Turkey* 10: 169-170. Edinburgh Univ. Press.
- DINÇ, M. & Y. BAĞCI (2009). Taxonomical and chorological notes on the Turkish endemic *Scorzonera amasiana* Hausskn. & Bornm. (Asteraceae). *Turk. J. Bot.* 33: 127-130.
- DURAN, A. (2002). A new species of *Scorzonera* L. (Asteraceae) from Anatolia, Turkey. *Pakistan J. Bot.* 34: 385-389.
- DURAN, A. & E. HAMZAOĞLU (2004). A new species of *Scorzonera* (Asteraceae) from South Anatolia, Turkey. *Biologia (Bratislava)* 59: 47-50.
- DURAN, A., M. SAĞIROĞLU & H. DUMAN (2005). *Prangos turcica* (Apiaceae), a new species from south Anatolia, Turkey. *Ann. Bot. Fenn.* 42: 67-72.
- GEMICI, Y. (1993). Tersiyer'den günümüze Türkiye'nin Flora ve Vejetasyonu. *Turk. J. Bot.* 17: 221-226.
- GÜNER, A. (2000). *Scorzonera* L. In: GÜNER, A., N. ÖZHATAY, T. EKİM & K. H. C. BAŞER (ed.), *Fl. Turkey* 11: 167. Edinburgh Univ. Press.
- HAMZAOĞLU, E., A. AKSOY, E. MARTIN, N. M. PINAR & H. ÇOLGEÇEN (2010). A new record for the flora of Turkey: *Scorzonera ketzkhovellii* Grossh. (Asteraceae). *Turk. J. Bot.* 34: 57-61.
- IUCN (2001). *IUCN red list categories, ver. 3.1*. IUCN Species Survival Commission.
- KARAER, F. & F. CELEP (2007). Rediscovery of *Scorzonera amasiana* Hausskn. and Bornm. - a threatened endemic species in Turkey. *Bangladesh J. Bot.* 36: 139-144.
- KILIAN, N. & G. PAROLLY (2002). *Scorzonera ulrichii* Parolly & N. Kilian, sp. nova. In: GREUTER, W. & T. RAUS (ed.), *Med-Checklist Notulae*, 21. *Willdenowia* 32: 198-200.
- LACK, H. W. (2007). Compositae. Tribe Cichorieae Lam. & DC. In: KUBITZKI, K. (ed.), *The Families and Genera of Vascular Plants* 8: 180-199. Springer-Verlag.
- LIPSCHITZ, S. J. (1935). *Fragmenta monographiae generis Scorzonera* 1. Moscow [in Russian].
- LIPSCHITZ, S. J. (1939). *Fragmenta monographiae generis Scorzonera* 2. Moscow [in Russian].
- ÖZHATAY, N. & Ş. KÜLTÜR (2006). Check-list of additional taxa to the Supplement Flora of Turkey III. *Turk. J. Bot.* 30: 281-316.
- ÖZHATAY, N., Ş. KÜLTÜR & N. AKSOY (1999). Check-list of additional taxa to the Supplement Flora of Turkey II. *Turk. J. Bot.* 23: 151-170.
- ÖZHATAY, N., Ş. KÜLTÜR & S. ASLAN (2009). Check-list of additional taxa to the Supplement Flora of Turkey IV. *Turk. J. Bot.* 33: 191-226.
- PAROLLY, G. & N. KILIAN (2003). *Scorzonera karabelensis* (Compositae), a new species from SW Anatolia, with a key to the subscapigerous *Scorzonera* species in Turkey. *Willdenowia* 33: 327-335.
- PAROLLY, G. & H. SCHOLZ (2004). *Oreopoa* gen. novum, two other new grasses and further remarkable records from Turkey. *Willdenowia* 34: 145-158.
- RECHINGER, K. H. (1977). *Scorzonera*. *Fl. Iran.* 122: 16-79. Akademische Druck- u. Verlagsanstalt.
- REEVES, R. D. (1988). Nickel and zinc accumulation by species of *Thlaspi* L., *Cochleria* L., and other genera of the Brassicaceae. *Taxon* 37: 309-318.
- REEVES, R. D. & N. ADIGÜZEL (2004). Rare plants and nickel accumulators from Turkish serpentine soils, with special reference to *Centaurea* species. *Turk. J. Bot.* 28: 147-153.
- REEVES, R. D., R. R. BROOKS & T. R. DUDLEY (1983). Uptake of nickel by species of *Alyssum*, *Bornmuellera*, and other genera of Old World tribus *Alysseae*. *Taxon* 32: 184-192.
- UZUNHISARCIKLI, M. E., E. DOĞAN & H. DUMAN (2007). A new species of *Centaurea* (Cardueae: Asteraceae) from Turkey. *Bot. J. Linn. Soc.* 153: 61-66.
- WÖRZ, A. & H. DUMAN (2004). *Eryngium trisectum* (Apiaceae, Saniculoideae), a new species from Turkey. *Willdenowia* 34: 421-425.