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A conspectus of *Scorzonera* s.l. in Turkey

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Abstract: A comprehensive taxonomic study based on comparative morphology of *Scorzonera*, here maintained in its wide sense, is presented for the territory of Turkey. This study has produced several changes of classification at sectional and species ranks. An updated list of *Scorzonera* taxa occurring in Turkey, along with their infrageneric classification, is provided. A new section, *S.* sect. *Anatolia* Makbul & Coskunç., is described. Chromosome numbers, threat categories, and distribution maps are given for 6 endemic taxa (*S. boissieri*, *S. karabelensis*, *S. longiana*, *S. sandrasica*, *S. ulrichii*, and *S. zorkunensis*) placed in or transferred to the newly described section. A revised identification key to all *Scorzonera* species in Turkey is presented.

Key words: Identification key, *Podospermum*, *Pseudopodospermum*, *Scorzonera*, systematics, Turkey

1. Introduction

The genus *Scorzonera* L. (Asteraceae), with about 160 species belonging to the subtribe Scorzonerinae Dumort. of the tribe Cichorieae, is widespread in the more arid regions of Eurasia and northern Africa (Bremer and Anderberg, 1994; Nazarova, 1997).

After the genus *Scorzonera* s.str. was revised by Chamberlain (1975) for the *Flora of Turkey*, many new species have been recorded from Turkey. The classification of the genus has been highly controversial (Nazarova, 1997; Mavrodiev et al., 2004), and because of this different taxonomic treatments have been used in the floras. Starting with De Candolle (1805), frequently *Scorzonera* species with a conspicuous cylindric carpopodium were placed under a separate genus, *Podospermum* DC. (Cassini, 1826; Dumortier, 1827; Endlicher, 1838; Grosheim, 1949; Kuthatheladze, 1978; Pignatti, 1982). Conversely, the genus was maintained in a wider circumscription but divided into 4 sections by Boissier (1875), *Podospermum*, *Euscorzonera* Lipsch., *Lasiospora* Less., and *Epilasia* (Bunge) Benth. or divided into 3 subgenera (*Podospermum*, *Pseudopodospermum* (Lipsch. et Krasch.) Lipsch., and *Scorzonera*) by Lipschitz (1935, 1939) and Kamelin and Tagaev (1986). *Scorzonera* in a wide circumscription was used in many floras as well, e.g., Chamberlain (1975) and Chater (1976); Pignatti (1982), however, was an exception. First phylogenetic analyses of *Scorzonera* by Mavrodiev et al. (2004) and Owen et al. (2006) provided evidence that the previous morphology-based classifications are at least partly artificial. These 2 analyses arrived at partly different phylogenetic reconstructions with respect to the relationships of the major clades. According to Mavrodiev et al. (2004), *Scorzonera*, *Podospermum*, and *Lasiospora* should be recognized as distinct genera. The Turkish species *S. rigida* and *S. seidlitzii*, treated under the sect. *Pulvinares* by Kamelin and Tagaev (1986), were grouped together with *Lasiospora latifolia* Fisch. & C.A.Mey. and *L. hirsuta* (Gouan) Cass. with 100% bootstrap value (Mavrodiev et al., 2004). In addition, the phylogenetic reconstruction by Owen et al. (2006) revealed that *Lasiospora* represents a lineage separate from *Scorzonera*.

Since the genus *Scorzonera* in its wide sense was revised by Chamberlain (1975) to comprise 42 species in Turkey, many botanists have published new taxa (Coskuncelebi et al., 2012; Makbul et al., 2012) and new records (Doğan and Duran, 2010) from Turkey without considering classification. According to Makbul (2012), the genus *Scorzonera* s.l. is represented with 49 species (57 taxa) in Turkey. Currently, *Scorzonera* in its wide sense is represented by 52 species (59 taxa) in Turkey, and among these 31 are endemics. Recently, some palynological (Blackmore, 1982; Türkmen et al., 2010), anatomical (Makbul et al., 2011a, 2011b), cytological (Owen et al., 2006; Martin et al., 2012), and phylogenetic (Mavrodiev et al., 2004) studies have been

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carried out on Turkish *Scorzonera*. In this comprehensive study, an updated infrageneric and generic classification, together with a checklist and new key for *Scorzonera* taxa distributed in Turkey, is presented.

2. Materials and methods

This study was based on the examination of herbarium specimens from the following herbaria: E, K, LE, ANK, EGE, HUB, GAZI, KNYA, ISTE, ISTF, and ISTO, and the author's own specimens collected between 2009 and 2012 from the country and stored in the herbarium of Karadeniz Technical University, Department of Biology (KTUB) and the Recep Tayyip Erdoğan University, Department of Biology (RUB). Additionally, we have used photographs from the herbaria B, G, GOET, LINN, and W. All examined specimens (see Appendix on Journal's wessite) have been identified by the first and second authors. In total 739 samples (518 stored in national herbaria, including our own specimens, and 221 stored in international herbaria) that originated from Turkey were observed, and several taxonomical names have been assessed according to all available data.

For karyological analysis, achenes of *Scorzonera boissieri* Lipsch., *S. hieraciifolia* Hayek, *S. karabelensis* Parolly & N.Kilian, *S. longiana* Sümbül, *S. sandrasica* Hartvig & Strid, *S. ulrichii* Parolly & N.Kilian, and *S. zorkunensis* Coskunç. & Makbul were germinated in petri dishes to obtain root tips. Chromosome count was carried out according to a modified procedure of Coskuncelebi and Vladimirov (2008).

Threat categories of the taxa belonging to sect. *Anatolia* were assessed according to criteria of IUCN (2012) based on the number of subpopulations and on the size and quality of the habitats.

3. Results and discussion

3.1. New section

Scorzonera sect. *Anatolia* Makbul & Coskunç., **sect. nov**.

Type: *Scorzonera zorkunensis* Coskunç. & Makbul in Turkish Journal Bot. 36: 299–310, 2012.

Turkey. C6 Osmaniye: Amanos mountain, Zorkun plateau, Keldaz hill, 2075 m, 05.07.2010, S.Makbul & K.Coskuncelebi 242 (holo.: KTUB!, iso.: RUB, ANK!).

Diagnoses: *S.* sect. *Anatolia* is similar to sect. *Fibrillosae* Nakai but differs from *S.* sect. *Fibrillosae* by having brown dead leaf residues (not fiber-like) at root-collar, densely hairy leaves (not glabrous), several (not 1–3) basal leaves crowded near the base, completely yellow ligulate flowers (not pink and yellow), glabrous and lanate achenes (not glabrous achenes), and plumose and barbellate pappus hairs (not plumose and scabrous).

Description: Perennial herbs. Stem scapigerous or subscapigerous. Root collar covered by brown old leaf residues, leaves mainly basal, rarely scape with leaflets. Capitula generally 1, but occasionally 2–5 per stem, ligules are yellow. Achene glabrous or lanate. Pappus bristles plumose below, barbellate above.

According to Lipschitz (1935, 1964) subg. *Scorzonera* is characterized by cylindrical roots, corniculate phyllaries, astipitate achenes, and simple or pinnatisect leaves. Other comparisons of traditionally accepted subgenera within the *Scorzonera* are given in Table 1. Kamelin and Tagaev (1986) reported 22 sections within the subg. *Scorzonera.* The newly described section (sect. *Anatolia*) differs from the sections described previously within the subg. *Scorzonera* by the following characters given in Table 2. In total, the number of sections represented in Turkey is 13, including the newly described section (Table 3).

Table 1. Comparison of accepted subgenera within the *Scorzonera*. Heterogeneous means pericarp consists of both parenchymatic and sclerenchymatic cells and homogenous means the pericarp consists of only parenchymatic cells.

Characters	**Subg.** *Scorzonera* **sect.** *Anatolia*	**Subg.** *Podospermum*	**Subg.** *Pseudopodospermum*
Root	Cylindrical	Cylindrical	Tuberous
Phyllaries	Without corniculate appendage	With corniculate appendage	Without corniculate appendage
Achene	Non stipitate	Stipitate	Stipitate
Achene surface	Faveolate or smooth and vertical stripes or rugose	Faveolate and with horizontal stripes	Faveolate and rugose or vertical stripes
Lacuna type	Lanata or laciniata	Lanata	Laciniata
Basic chromosome number (X)	6, 7	7	7
Pericarp structure	Heterogeneous	Homogeneous	Heterogeneous
Distribution of vessel in root	Diffuse or radially rays	Radially rays	Diffuse rays
Cross section of the main midrib	V-shaped or elliptic	Triangular	Semicircular

Table 2. Comparison of the sections within the *Scorzonera*.

Characters	sect. *Anatolia*	sect. *Fibrillosae*	sect. *Pulvinares*
Stem	Mostly subscapigerous	Mostly subscapigerous	Mostly scapigerous
Leaf residues	Not fiber-like	Fiber-like	Not fiber-like
Basal leaves	Several (>3)	1–3	1–3
Leaf indumentum	Densely hairy	Glabrous	Slightly pubescence or subglabrous
Ligules	Yellow	Pink or yellow	Yellow
Achene	Glabrous	Lanate	Glabrous
Pappus	Plumose below, barbellate above	Plumose below, scabrous above	Plumose below, barbellate above
Habitus	Not caespitose	Not caespitose	Distinctly caespitose
General distribution	Mediterranean element (endemic to Turkey)	Endemic to Russia and China	Irano-Turanian and Euro-Siberian element

Six endemic taxa (*Scorzonera boissieri*, *S. karabelensis*, *S. longiana*, *S. sandrasica*, *S. ulrichii*, and *S. zorkunensis*) were treated under sect. *Anatolia* in the present study. All members of sect. *Anatolia* share similar micro- and macromorphological features and are mainly distributed in South Anatolia (Figure 1). Although an unpublished phylogenetic analysis by the authors based on sequence data of nrDNA-ITS and cpDNA supports establishment of sect. *Anatolia* under the *S.* subg. *Scorzonera*, Mavrodiev et al. (2004) and Owen et al. (2006) stated that *Scorzonera* s.l. is clearly polyphyletic and includes distinct lineages, to be recognized as separate genera. Mavrodiev et al. (2004) also reported that these lineages consist of many groups that are still not sufficiently delimited based on molecular data. On the other hand, Owen et al. (2006) reported that the genus *Scorzonera* s.l. could be divided into 2 distinct groups based on cytogenetic and molecular data: 1 with 2n = 12 and a second with 2n = 14; however, Nazarova (1997) also reported that *S.* subg. *Scorzonera* includes taxa with 2n = 12 (sect. *Nervosae*: *S. latifolia*; sect. *Pulvinares*: *S. seidlitzii*, *S. rigida*) and 2n = 14 (sect. *Nervosae*: *S. ketzkhovelii*) and does not confirm the division of the genus into the sections suggested by Lipschitz (1964). *Anatolia* includes taxa with 2n = 14 (*S. longiana*, *S. boissieri*), 2n (4x) = 28 (*S. zorkunensis*), and 2n = 12 (*S. karabelensis*, *S. sandrasica*, *S. ulrichii*). Our results agree with the view of Nazarova (1997), but do not concur with the view of Owen et al. (2006). Mavrodiev et al. (2004) and Owen et al. (2006) suggested treating *Lasiospora* as a separate genus including the Turkish species *S. rigida, S. seidlitzii*, and *S. latifolia*; however, our cytologic and morphologic data of *S. rigida* and *S. seidlitzii* show that these taxa should be placed under the subg. *Scorzonera* sect. *Pulvinares*, as indicated by Lipschitz (1964) and Nazarova (1997).

Members of *S.* sect. *Anatolia* generally grow on rocky-stony slopes in alpine meadows (*S. boissieri*, *S. longiana*, *S. zorkunensis*) and clearance or boundaries of pine forests (*S. karabelensis*, *S. ulrichii*, *S. sandrasica*) under the effect of the Mediterranean climate. Members of this section are given in an alphabetical order together with the updated threat category, chromosome number, and other valuable data as follows.

3.1.1. *Scorzonera boissieri* Lipsch., Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 22: 293 (1963).

Type: Turkey, B6 Adana: Saimbeyli, Bozoğlan mountain, above Obruk plateau, 2300 m, Davis, Dodds & Çetik, D. 19751 (holo.: E!).

Chromosome number: 2n = 14 (Makbul & Coşkunçelebi, 250).

Flowering/fruiting period: May–June/June–July.

Habitat: Clay meadows, slope steppes.

Distribution: Endemic, Southeast Central Anatolia, Irano-Turanian element.

Reassessed threatened category: VU: B2ab (ii, iii) (VU, according to Ekim et al., 2000).

This endemic taxon was not previously placed under any subgenus. The phenetic features supported to place this taxon under the newly described sect. *Anatolia*. Subgeneric classification and chromosome number of *S. boissieri* are given here for the first time.

3.1.2. *Scorzonera karabelensis* Parolly & N.Kilian, Willdenowia 33: 328 (2003).

Type: Turkey, C2 Muğla: Fethiye–Korkuteli road, below Karabel pass, NE Kemer, steep, gravely, rocky slopes, open *Pinus nigra* Arnold var. *caramanica* (Loudon) Rehder forest, N-exp., limestone, 1040 m, 20.05.2003, R. Ulrich 3/7a (holo.: B photo!; iso.: E! ISTE!).

Table 3. Infrageneric grouping of the Turkish *Scorzonera*.

Species	According to cited literature	Present study
S. cana	Subg. *Podospermum* (Lipschitz, 1964)	Subg. *Podospermum*
S. armeniaca	Subg. *Podospermum* (Lipschitz, 1964)	Subg. *Podospermum*
S. laciniata	Subg. *Podospermum* (Lipschitz, 1964)	Subg. *Podospermum*
S. hieraciifolia	Subg. *S.* sect. *Pseudopodospermum* (Kamelin & Tagaev, 1986)	Subg. *Podospermum*
S. aksekiensis		Subg. *Pseudopodospermum*
S. elata	Subg. *S.* sect. *Foliosae* (Kamelin & Tagaev, 1986)	Subg. *Pseudopodospermum*
S. inaequiscapa	Subg. *S.* sect. *Papposae* (Kamelin & Tagaev, 1986)	Subg. *Pseudopodospermum*
S. suberosa	Subg. *Pseudopodospermum* (Lipschitz, 1964)	Subg. *Pseudopodospermum*
S. phaeophappa	Subg. *S.* sect. *Pseudopodospermum* (Kamelin & Tagaev, 1986)	Subg. *Pseudopodospermum*
S. mollis	Subg. *Pseudopodospermum* (Lipschitz, 1964)	Subg. *Pseudopodospermum*
S. semicana	Subg. *S.* sect. *Pseudopodospermum* (Kamelin & Tagaev, 1986)	Subg. *Pseudopodospermum*
S. boissieri	Subg. *S.* sect. *Nervosae* (Parolly & Kilian, 2003)	Subg. *S.* sect. *Anatolia*
S. karabelensis	Subg. *S.* sect. *Nervosae* (Parolly & Kilian, 2003)	Subg. *S.* sect. *Anatolia*
S. longiana	Subg. *S.* sect. *Nervosae* (Parolly & Kilian, 2003)	Subg. *S.* sect. *Anatolia*
S. sandrasica	Subg. *S.* sect. *Nervosae* (Parolly & Kilian, 2003)	Subg. *S.* sect. *Anatolia*
S. ulrichii	Subg. *S.* sect. *Nervosae* (Parolly & Kilian, 2003)	Subg. *S.* sect. *Anatolia*
S. zorkunensis	Subg. *S.* sect. *Nervosae* (Coskuncelebi et al., 2012)	Subg. *S.* sect. *Anatolia*
S. acuminata	Subg. *S.* sect. *Foliosae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Foliosae*
S. davisii	Subg. *S.* sect. *Foliosae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Foliosae*
S. pacis		Subg. *S.* sect. *Foliosae*
S. incisa	Subg. *S.* sect. *Incisae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Incisae*
S. lacera	Subg. *S.* sect. *Incisae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Incisae*
S. violacea	Subg. *S.* sect. *Incisae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Incisae*
S. acantholimon	Subg. *S.* sect. *Infrarosulares* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Infrarosulares*
S. argyrea	Subg. *S.* sect. *Nervosae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Nervosae*
S. cinerea	Subg. *S.* sect. *Nervosae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Nervosae*
S. ketzkhovelii	Subg. *S.* sect. *Nervosae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Nervosae*
S. mirabilis	Subg. *S.* sect. *Nervosae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Nervosae*
S. veratrifolia	Subg. *S.* sect. *Nervosae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Nervosae*
S. bella	Subg. *S.* sect. *Nervosae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Nervosae*
S. latifolia	Subg. *S.* sect. *Nervosae* (Lipschitz, 1964; Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Nervosae*
S. dzhawakhetica	Subg. *S.* sect. *Nervosae* (Lipschitz, 1964; Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Nervosae*
S. tomentosa	Subg. *S.* sect. *Gelasia* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Nervosae*
S. papposa	Subg. *S.* sect. *Papposae* (Lipschitz, 1964; Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Papposae*
S. parviflora	Subg. *S.* sect. *Parviflorae* (Lipschitz, 1964; Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Parviflorae*
S. tuzgoluensis		Subg. *S.* sect. *Parviflorae*
S. amasiana	Subg. *S.* sect. *Pulvinares* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Pulvinares*
S. lasiocarpa	Subg. *S.* sect. *Pulvinares* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Pulvinares*
S. sericea	Subg. *S.* sect. *Pulvinares* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Pulvinares*
S. seidlitzii	Subg. *S.* sect. *Pulvinares* (Lipschitz, 1964)	Subg. *S.* sect. *Pulvinares*
S. rigida	Subg. *S.* sect. *Pulvinares* (Lipschitz, 1964; Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Pulvinares*
S. pygmaea	Subg. *S.* sect. *Pulvinares* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Pulvinares*
S. yildirimlii		Subg. *S.* sect. *Pulvinares*
S. ahmet-duranii		Subg. *S.* sect. *Scorzonera*
S. coriacea		Subg. *S.* sect. *Scorzonera*
S. aucheriana	Subg. *S.* sect. *Subaphyllae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Subaphyllae*
S. sublanata	Subg. *S.* sect. *Tuberosae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Tuberosae*
S. pseudolanata	Subg. *S.* sect. *Tuberosae* (Lipschitz, 1964)	Subg. *S.* sect. *Tuberosae*
S. renzii	Subg. *S.* sect. *Turkestanicae* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Turkestanicae*
S. pisidica	Subg. *S.* sect. *Nervosae* (Parolly and Kilian, 2003)	Subg. *S.* sect. *Vierhapperia*
S. kotschyi	Subg. *S.* sect. *Vierhapperia* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Vierhapperia*
S. eriophora	Subg. *S.* sect. *Vierhapperia* (Kamelin & Tagaev, 1986)	Subg. *S.* sect. *Vierhapperia*

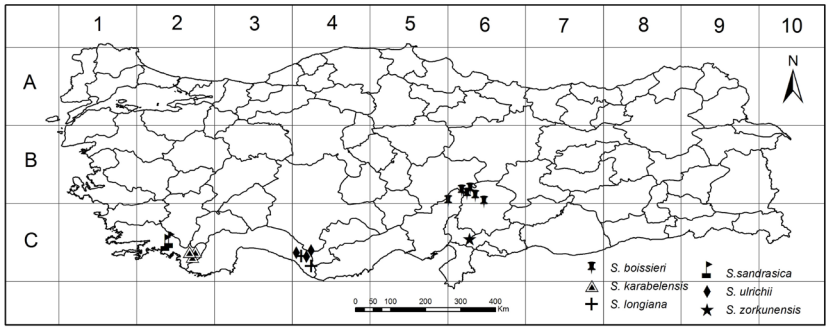

Figure 1. Distribution map of sect. *Anatolia* in Turkey.

Chromosome number: 2n = 12 (first report in this study) (Makbul 134).

Flowering/fruiting period: May–June/June–August.

Habitat: Rocky-stony slopes, clearance of *Pinus nigra* forest.

Distribution**:** Endemic, South Anatolia, Mediterranean element.

Reassessed threatened category: VU: B2ab (iii, iv) (VU, according to Parolly and Kilian, 2003). This local endemic was recollected from Karabel Geçidi (type locality), and according to Parolly and Killian (2003) its distribution reaches the upper slopes of Akdümen Tepe (1742 m) in the greater Boncuk mountain range. The habitat quality and the number of mature individuals lead us to treat this taxa under VU according to IUCN (2012).

This stenoendemic taxon was previously treated under subg. *Scorzonera* sect. *Nervosae* Lipsch. by Parolly and Kilian (2003). According to Lipschitz (1935, 1964), sect. *Nervosae* is characterized by large perennials with densely leafy stems and tomentose indumentums, but *S. karabelensis* is a scapigerous to subscapigerous perennial herb with sericeous appressed indumentums. Hence, it is more proper to place *S. karabelensis* under the sect. *Anatolia* based on the gross morphological characters given above.

3.1.3. *Scorzonera longiana* Sümbül, Edinburgh J. Bot. 48: 35 (1991).

Type: Turkey, C4 Antalya: Gazipaşa, from Çobanlar village plateau to Oyuklu plateau, 1900–2000 m, 11.07.1983, Sümbül 2239 (holo.: HUB!, iso.: E! K photo!).

Chromosome number: 2n = 14 (first report in this study) (Makbul & Coşkunçelebi, 255).

Flowering/fruiting period: July/July–August.

Habitat: Alpine, stony meadows.

Distribution**:** Endemic, South Anatolia, Mediterranean element.

Reassessed threatened category: EN: B2ab (ii, iii) (EN, according to Ekim et al., 2000).

Scorzonera longiana was not previously placed into any infrageneric group. The phenetic features support its placement in *S.* sect. *Anatolia* of *S.* subg. *Scorzonera*.

3.1.4. *Scorzonera sandrasica* Hartvig & Strid, Bot. Jahrb. Syst. 108: 311 (1987).

Type: Turkey, C2 Muğla: Sandras mountain, W of the summit, slightly sloping stony flat (snowbed) near a small creek close to timberline, serpentine, 1970 m, 07.07.1984, N 37 04-E 028 50, P. Hartvig, Ö. Seçmen & A. Strid 23342 (holo.: C; iso.: E!).

Chromosome number: 2n = 12 (first report in this study) (Makbul & Coşkunçelebi, 232).

Flowering/fruiting period: June–July/July–August.

Habitat: Above forest boundaries, alpine hills, rocky grasslands.

Distribution: Endemic, Southwest Anatolia, Mediterranean element.

Reassessed threatened category: EN: B2ab (i, ii) (EN, according to Ekim et al., 2000).

This endemic taxon was not previously placed into any infrageneric group. It is only known from the type locality, and its morphological features suggest its placement in the newly described *S.* sect. *Anatolia*.

3.1.5. *Scorzonera ulrichii* Parolly & N. Kilian, Willdenowia 32: 198 (2002).

= *Scorzonera gokcheoglui* Ünal & Göktürk, Bot. J. Linn. Soc. 142: 465 (2003).

Type: Turkey, C4 Antalya: Distr. Alanya, Mahmutlar–Hadim road, c. 35 km NE of Mahmutlar and 15 km S of Çayarası, 1 km N of Elmalısu, gravely, rocky slopes with clearance of *Pinus nigra* var. *caramanica* forest, W-exp., limestone, 1250 m, 11.06.2002, Robert Ulrich (Tubingen) 2/12 (holo.: B photo!; iso.: E! ISTE!).

Chromosome number: 2n = 12 (first report in this study) (Makbul & Coşkunçelebi, 237).

Flowering/fruiting period: June–July/July.

Habitat: Slopes, clearance of *Pinus*, calcareous and stony areas.

Distribution: Endemic, South Anatolia, Mediterranean element.

Reassessed threatened category: VU: B2ab (ii, iv) (EN, according to Parolly and Kilian, 2002).

This endemic species was previously placed under the *S.* subg. *Scorzonera* sect. *Nervosae.* The section is recognized for its large perennials with densely leafy stems and tomentose indumentum as stated by Parolly and Kilian (2003). However, *S. ulrichii* is a scapigerous to subscapigerous caespitose perennial herb with lanate indumentum. Therefore, it is more appropriate to place it under the sect. *Anatolia*.

3.1.6. *Scorzonera zorkunensis* Coskunç. & Makbul, Turk. J. Bot. 36 (4): 302 (2012).

Type: Turkey, C6 Osmaniye: Amanos mountains, 5 km after Zorkun plateau, Keldaz hill, Halepgören area, 2075 m, 05.07.2010, Makbul & Coskuncelebi, 242 (holo.: KTUB!; iso.: RUB! ANK!).

Chromosome number: 2n = 4x = 28 (first report in this study) (Makbul & Coşkunçelebi, 242).

Flowering/fruiting period: July/July–August.

Habitat: Serpentine steppe.

Distribution: Endemic, South-East Anatolia, Mediterranean element.

Reassessed threatened category: EN: B2a (ii, iii) (EN, according to Coskuncelebi et al., 2012).

Scorzonera zorkunensis was previously treated under the subg. *Scorzonera* sect. *Nervosae* as stated by Coskuncelebi et al. (2012). *Scorzonera zorkunensis* is a scapigerous and mostly caespitose perennial herb with lanate indumentum. Thus, we decided that it is more suitable to treat it under the sect. *Anatolia*.

3.2. New synonyms

3.2.1. *Scorzonera davisii* Lipsch., Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR, 22: 291 (1963).

Type: Turkey, C9 Hakkari: Zap gorge, 48 km S of Başkale, 03.08.1954, Davis 23848 & Polumin (holo.: E!; iso.: K photo!).

= *Scorzonera tenax* Rech. f., Fl. Iranica 122:59 (1977), **syn. nov.**

Type: Distr. Mosul (Kurdistan), 10.07.1957, Rechinger 11572 (holo.: B photo!); ad confines Turciae prov. Hakkari, inter Dohuk et Amadiya; in quercetis saxosis supra Suwara Tuka.

After a detailed examination of the specimens stored in E (E00385297! for *S. davisii* Lipsch. and E00476936!-E00224242!-E00224241! for *S. tenax* Rech. f.) and comparison of the specimens described in the original papers (Lipschitz, 1964; Rechinger, 1977), we determined that the 2 taxa are very similar in terms of some morphological features such as entire leaves and glabrous and verrucose achenes and that they fall within the variation of *S. davisii*. Based on all available evidence, we conclude that *S. tenax* is conspecific of *S. davisii*.

3.2.2. *Scorzonera rigida* DC., Prodr. 7: 123 (1838).

Type: Turkey, B7 Nevşehir: the high mountains of Cappadocia and the Euphrates, Aucher 3309 (holo.: G DC photo!; iso.: K!).

= *Scorzonera adilii* A.Duran, Pakistan J. Bot. 34: 385 (2002), **syn. nov.**

Type: C5 Konya**:** Ereğli, Aydos mountain, Kayasaray village, Düğünlük stream, 1770 m, crevices of marble rocks, 07.07.2001, N 3722.04-E 3416.33, A. Duran 5798 & Sağıroğlu (holo.: ADO; iso.: GAZI! ANK! HUB!), ibid., 18.07.2002, A.Duran 5960 (ADO).

= *Scorzonera aytatchii* A.Duran & Sağiroğlu, Nordic J. Bot. 22: 333 (2003).

Type: C5 Konya: Ereğli, Aydos mountain, Kayasaray village, Düğünlük stream, 1750 m, crevices of marble rocks, 07.07.2001, N 3722-E 3416, A. Duran 5797 & Sağıroğlu (holo.: ADO, iso.: GAZI! ANK! HUB!); ibid. Sayıntaş area, 15.07.1977, S. Erik 2602 (para.: HUB).

S. adilii is described from Aydos mountain, Konya, Turkey (Duran, 2002). The features of *S. adilii* reported by Duran (2002) are not sufficiently clear to separate this taxon from *S. rigida*. Entirely barbellate pappus hairs are also seen in some specimens of *S. adilii*, as in *S. rigida*. These 2 taxa are morphologically very similar. Both taxa are subscapigerous perennial herbs with caespitose habitus and have short-pilose achene indumentums. According to Chamberlain (1975) and Parolly and Kilian (2003), *S. rigida* is a highly variable taxon distributed mainly throughout SE and E Anatolia, but it also appeared in Aydos mountain (Konya). *S. adilii* was discovered from the adjacent area of the type locality of *S. aytatchii* A.Duran & Sağıroğlu (2002), which Parolly and Kilian (2003) named *S. rigida*. The range of variation observed in both quantitative and qualitative characters of *S. adilii* fall fully within *S. rigida*. Thus, *S. adilii* was considered a synonym of *S. rigida*.

3.2.3. *Scorzonera hieraciifolia* Hayek, Ann. K. K. Naturhist. Hofmus. 20: 426 (1907).

Type: Turkey, B5 Kayseri: Erciyes mountain, in der Salzsteppe bei Soisaly, c. 1100 m, v 1902, Zederbauer (holo.: W photo!).

= *Scorzonera kurtii* Yıldırımlı, Ot Sistematik Botanik Dergisi 18 (2): 12 (2011), **syn. nov.**

Type: Turkey, B4 Konya: Kulu, Tuzyaka (Sütkanlı), Bozan village, Kaldırım road, Tuzgölü coast, salty places, 945 m, 04.05.2007, Ş.Yıldırımlı 33661 (holo.: Yıldırımlı otluk; iso.: HUB!).

Scorzonera hieraciifolia is highly variable taxon distributed mainly in salty habitats around Tuzgölü (Konya). *Scorzonera hieraciifolia* shows a range of variation observed in the leaves and stem. *Scorzonera kurtii* is separated from *S. hieraciifolia* (Yıldırımlı, 2012) mainly by leaf and stem features that are in the range of variation observed in the subpopulation of *S. hieraciifolia*

distributed around Tuzgölü. In particular, pinnatisect leaves, achene characteristics, and salty habitus of the *S. kurtii* are very similar to some specimens of *S. hieraciifolia* stored in RUB (Makbul 127!, 138!). Additionally, the range of variation observed in both quantitative and qualitative characters of *S. kurtii* fall fully within *S. hieraciifolia*. Thus *S. kurtii* was considered a synonym of *S. hieraciifolia*.

3.2.4. *Scorzonera pygmaea* Sibth. & Sm., Fl. Graec. Prodr. 2: 122 (1813).

Type: Turkey, A2 (A) Bursa, Olympo Bithyno (Uludağ), cacumine, Sibthorp.

Lectotype (designated here): Turkey, A2 Bursa, Uludağ, 2380–2580 m, 13 ix 1949, D. 14846 (E!).

= *S. pygmaea* Sibth. & Sm. subsp. *nutans* (Czeczott) Chamberlain, Notes R.B.G.: Edinb. 33:433 (1975) ≡ *S. pygmaea* Sibth. & Sm. var. *nutans* (Czeczott) O.Koyuncu & Yaylacı, Pakistan Journal of Botany, 45, 5 (2013) ≡ *Scorzonera nutans* Czeczott in Repert. Spec. Nov. Regni Veg. Beih. 107: 202. 1938, **syn. nov.**

Further examinations of many recent samples from type localities of *S. pygmaea* subsp. *pygmaea* and *S. pygmaea* subsp. *nutans* and type specimens stored in E herbarium did not support the separation of these 2 taxa as indicated by Chamberlain (1975). Many samples including the types and recent collections share similar ranges in stem and leaf size. In addition, detailed gross morphological examination of specimens belonging to *S. pygmaea* subsp. *pygmaea* and *S. pygmaea* subsp. *nutans* revealed that these 2 taxa are very similar in terms of character combination of general habitus, phyllary, and achene shape and size. Additionally, our phylogenetic analysis based on unpublished molecular data (submitted to GenBank) belongs to several populations of both *S. pygmaea* subsp. *pygmaea* (GenBank accession no.: KF925533) and *S. pygmaea* subsp. *nutans* (GenBank accession no.: KF925532) and supports the integration of subspecies under *S. pygmaea*. Parolly and Kilian (2003) reported that it is not possible to separate these 2 taxa based on the traits referred to by Chamberlain (1975). Recently, Koyuncu et al. (2013) suggested that these 2 subspecies should be described as varieties because of the similarity in traits and the overlapping distribution range. However, Koyuncu et al. (2013) did not give enough evidence for separating these taxa. Additionally, Koyuncu et al. (2013) reported that there are no distinct differences among the examined specimens based on anatomical, palynological, and ecological features. Hence, we decided that *S. pygmaea* var. *pygmaea*, and *S. pygmaea* var. *nutans* should be combined under the name of *S. pygmaea*.

3.3. New suggestions for the subgeneric level

After detailed examination of several specimens of *Scorzonera hieraciifolia*, which is treated under subg. *Podospermum* (DC.) Lipsch. sect. *Pseudopodospermum* Lipsch. (Kamelin and Tagaev, 1986), we decided that *S. hieraciifolia* should be placed in subg. *Podospermum* (DC.) Lipsch. because of the stipitate achene, corniculate phyllaries, and cylindrical roots. Although Mavrodiev et al. (2004) and Owen et al. (2006) proposed that the genus *Podospermum* be recognized as separate genera, they did not supply sufficient molecular data. The present authors follow Lipschitz (1935, 1939) and Kamelin and Tagaev (1986). Additionally, some unpublished data obtained from achene ultrastructure, basic chromosome number, and pollen lacuna types, according to Blackmore (1982), suggest *S. hieraciifolia* be placed under subg. *Podospermum*. *Scorzonera hieraciifolia* has lanata type pollen which is the common pollen type of subg. *Podospermum* (Blackmore, 1982). All examined members of *Podospermum* were characterized by a pericarp, which consisted of only sclerenchymatic cells (homogenous pericarp). It was determined that S. *hieraciifolia* has a homogenous pericarp structure as in subg. *Podospermum*. Additionally, the chromosome number of *S. hieraciifolia* is 2n = 14 (Makbul & Coşkunçelebi, 127). According to Nazarova (1997), the basic chromosome number is x = 7 in all *Podospermum* members. Therefore, *S. hieraciifolia* was transferred to subg. *Podospermum*.

Scorzonera elata Boiss. and *S. inaequiscapa* Boiss. treated under subg. *Scorzonera* sect. *Foliosae* (Boiss.) Lipsch. and sect. *Papposae* Lipsch. et Krasch. (Kamelin and Tagaev, 1986), respectively, were moved to subg. *Pseudopodospermum* based on examination of the gross morphology of several samples. According to Lipschitz (1935), *Pseudopodospermum* is characterized by stipitate achene, non-corniculate phyllaries, and simple leaves. These characteristics were observed in all specimens of *S. elata* and *S. inaequiscapa*. Corroborating these results, our further micro-/macromorphological observation showed that both taxa should be moved to subg. *Pseudopodospermum*.

Additionally, *S. tomentosa* L., treated under *S.* subg. *Scorzonera* sect. *Gelasia* (Caas.) Less. by Kamelin and Tagaev (1986), should be moved to subg. *Scorzonera* sect. *Nervosae* Lipsch. Section *Gelasia* consists of height and pubescent and caulescent plants with smooth achenes, but *S. tomentosa* has densely pubescent caulescent plants with distinctly ridged achene. Consequently, *S. tomentosa* shared specific features with sect. *Nervosae*, and because of this it should be moved from sect. *Gelasia* to sect. *Nervosae*.

Makbul et al. (2011a, 2011b) reported that stem and leaf anatomical and palynological properties (Türkmen et al., 2010) also supported the conventional taxonomic

treatment suggested by Kamelin and Tagaev (1986). According to detailed examination of our own and type specimens (E, RUB, and KTUB), as well as unpublished cytological, anatomical, palynological data, the taxonomic rank of *S. phaeopappa* and *S. semicana* DC., traditionally treated under subg. *S.* sect. *Pseudopodospermum* (Kamelin and Tagaev, 1986), was evaluated as *S.* subg. *Pseudopodospermum* (Lipsch. et Krasch.) Lipsch.

Duran et al. (2013) and Güzel et al. (2013) recently published 2 *Scorzonera* taxa, *S. aksekiensis* A.Duran & M.Öztürk and *S. pacis* Guzel, Kayikci & S.Yildiz, respectively, from Turkey. However, they did not suggest any subgeneric or sectional groups for these 2 taxa. According to the description appearing in the original paper, *S. aksekiensis* should be treated under subgenus *Pseudopodospermum* based on stipitate achene, tuberous root, and entire leaves, and this has been carried out for the first time in the present study. Similarly, *S. pacis* should be treated under subgenus *Scorzonera* sect. *Foliosae* due to the high foliated stem and distinct toothed and winged achenes. Other infrageneric and sectional changes suggested here are given in Table 3.

3.4. Excluded and included taxa from the list of *Scorzonera* recorded from Turkey

Scorzonera hispanica was recorded for Turkey based on samples from vegetable sellers at Pera (İstanbul); however, information about the origin of these samples is missing from both national and international herbariums. For this reason we thought that the samples sold by local sellers belong to *S. mollis* subsp. *mollis*. During this review, intense field work was conducted around Tekirdağ and Mürefte districts where *S. hispanica* is possibly distributed and/or recorded from. We were not able collect or observe *S. hispanica*. Nevertheless, populations of *S. mollis* subsp. *mollis* are abundant in the cited area. The individuals of *S. mollis* subsp. *mollis* appear similar, at first glance, to *S. hispanica*. Because we thought that *S. hispanica* may have been confused with *S. mollis* or recorded by mistake, this taxon was excluded from the list of *Scorzonera* distributed in Turkey.

Scorzonera cretica Willd. naturally distributed on Crete (Greek island) was excluded from the list of Turkish *Scorzonera.* Intensive field work was carried out to find this species in Turkey, but all efforts resulted in nothing.

Scorzonera woronowii Krasch recorded from Turkey by Erik (1990) was based on samples stored in HUB (31446!, 31447!). However, detail examination of these samples showed that they belong to *S. ketzkhovelii* Grossh, recorded from Turkey by Hamzaoğlu et al. (2010). Thus *S. woronowii* was also excluded from the list presented in the following key.

Scorzonera bella Lipsch. was first described by Lipschitz (1963) based on the specimens of P.H. Davis & O.V. Polunin, 23925 (holo LE!, iso E!) collected from Turkey, Hakkari, Cilo mountain, Diz stream in 1954. However, later it was verified by Chamberlain (1975) under *S. veratrifolia* Fenzl in the *Flora of Turkey*. A detailed examination of both types of *S. veratrifolia* stored in K (K000797281!) and types of *S. bella* stored in LE! (holo) and E! (iso) shows that *S. bella* is a separate/distinct species. Thus, *S. bella* was added to the list of *Scorzonera* taxa by the authors in the present study.

3.5. A new identification key to *Scorzonera* taxa distributed in Turkey

This key is mainly based on field observations and the examination of samples collected by the authors and specimens stored in the national and international herbaria listed in materials and methods. Chamberlain (1975) gave a key in his account, without infrageneric grouping, for 39 species, and Parolly and Kilian (2003) gave a key for the only subscapigerous taxa (23 taxa). In the present study, we provided a revised and updated identification key including 52 (59 taxa) species, 31 of them endemic to Turkey. The distinctive characters used in the identification key are given in Figures 2 and 3.

1- Achene at base with hollow swollen stipe (stipitate achene), involucral bracts at apex with or without corniculate appendages.....2
– Achene characters not as above (1. Subg. *Scorzonera*)...12
2- Rootstock cylindrical, all leaves (stem and basal leaves) or at least some leaves pinnatisect or deeply lobed, involucral bracts at apex with corniculate appendages (2. Subg. *Podospermum*) 3
– Rootstock tuberous, all leaves entire, involucral bracts at apex without corniculate appendages (3. Subg. *Pseudopodospermum*) 6
3- Achene lanate; at least mature achene lanate 4
– Achene glabrous 5
4- Some of basal leaves pinnatisect, entire leaves ovate or elliptic, inner phyllaries 12–15 mm in length, achene 4–7 mm in length.....**18. S. hieraciifolia**
– Basal leaves pinnatisect, segments linear-lanceolate, inner phyllaries 15–25 mm in length, achene 9–13 mm in length.....**7. S. armeniaca**
5- (3) Plants annual or biennial, not crowned by leaf remains at base, ligules as long as inner phyllaries.....**25. S. laciniata**
– Plants perennial, crowned by leaf remains, ligules at least 1.5 times as long as inner phyllaries.....**11. S. cana**
6- (2) Flowers purple or violet 7
– Flowers yellow 8
7- Plants subscapigerous, achene (16–)18–21 mm, pappus hairs barbellate .....**44. S. suberosa**

Figure 2. Types of roots and leaves observed in *Scorzonera.* a- tuberous root, b- cylindrical root, c- pinnatifid leaf, d- lanceolate leaf, e- ovate leaf, f- linear leaf, g- plane leaf margin, h- undulate leaf margin.

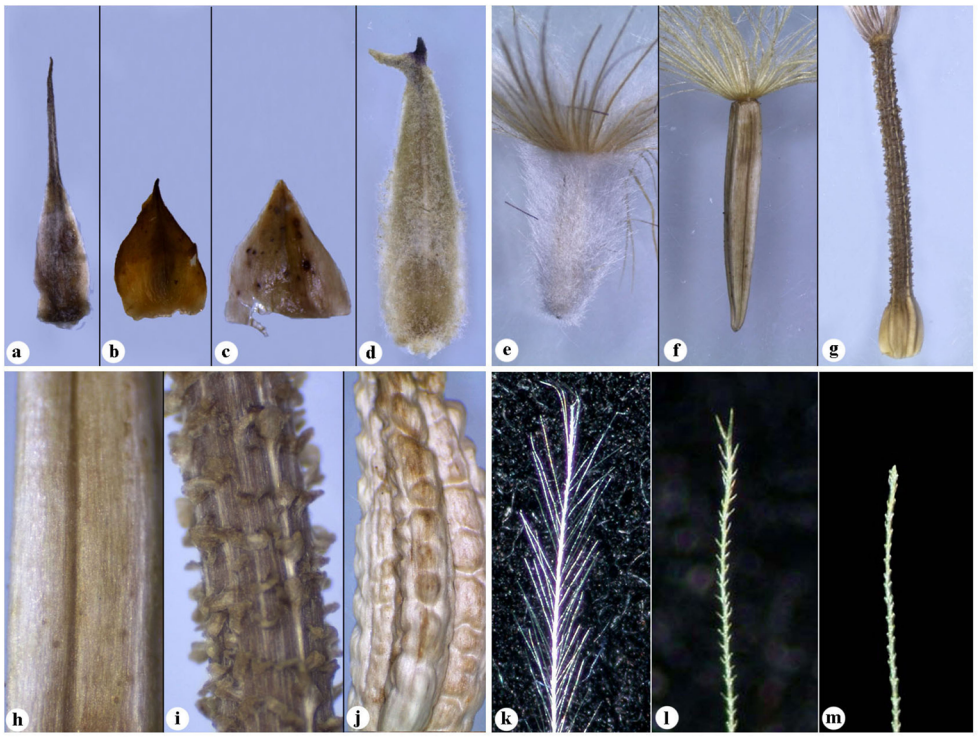

Figure 3. Valuable characters used in the key of the Turkish *Scorzonera*. Phyllary (a- aristate, b- acuminate, c- acute, d- corniculate appendage); achene (e- lanate, f- glabrous and nonstipitate, g- stipitate, h- smooth, i- lamellate, j- verrucose); pappus (k- plumose, l- barbellate, m- scabrid).

– Plants subscapigerous or caulescent, achene 14–16(–18) mm, end of the pappus hairs scabrid.....**34. S. phaeopappa**
8- (6) Plants clearly caulescent, branched, leaves slightly undulate or not, achene 8–12 mm in length 9
– Plants subscapigerous or subcaulescent, rarely branched or not, leaves densely undulate, achene 15–30 mm in length 10
9- Plants 30–95 cm length, glabrous, branches erect, leaves linear, 1–2(–3)-mm wide, outer and inner phyllaries acute, achene lamellate .....**16. S. elata**
– Plants 15–30(–35) cm in length, glabrous or crisped-pubescent below, branches ascending to erect, leaves lanceolate to oblong-lanceolate, 8–12(–15)-mm wide, outer phyllaries acute to acuminate, inner phyllaries acuminate, achene muricate ..... **4. S. aksekiensis**
10- (8) Tuber slightly elongated ellipsoid, outer phyllaries acuminate.....**42. S. semicana**
– Tuber spherical, outer phyllaries acute.....11
11- Leaves 2–5-mm wide, flowering capitula 22–45 mm in length, outer phyllaries 13–19 mm, achene lamellate, 15–21 mm.....**30. S. mollis**
– Leaves 3–14-mm wide, flowering capitula 18–20(25) mm in length, outer phyllaries 7–12 mm, achene 7–15(17) mm, tuberculate.....**19. S. inaequiscapa**
12- (1) At least some basal leaves deeply lobed to pinnatifid or pinnatisect 13
- All leaves entire 15
13- Capitula (35–)40–50 mm, flowers yellow with purple tube or with purple stripes lower surface of ligules, achenes (12–)15–23 mm, pappus hairs barbellate above, plumose below.....**20. S. incisa**
- Capitula 30–40 mm, flowers purple to violet, achenes 8–15 mm, some of the pappus hairs barbellate, others barbellate above, plumose below 14
14- Plants 15–40 cm, leaves herbaceous, outer phyllaries 14–16 mm, achenes 8–10 mm, surface lamellate ....**24. S. lacera**
- Plants 6–15 cm, leaves coriaceous, outer phyllaries 7–8 mm, achenes 10–15 mm, surface verrucose ....**50. S. violacea**
15- (12) Leaves ovate, elliptic or elliptic-lanceolate, leaves 5 times as long as broad 16
– Leaves linear or linear-lanceolate, leaves more than 5 times as long as broad 25
16- Achene glabrous 17
– Achene lanate 22
17- Leaves villous or pannose 18
– Leaves tomentose, canescent-pannose or crisped-lanate 20
18- Plants <15 cm, ascending, densely pannose, leaves ovate or obovate, rarely elliptic .....**6. S. argyrea**
– Plants 15–50 cm, erect, villous, leaves lanceolate or elliptic-lanceolate 19
19- Achene 10–12 mm, inner phyllaries (14–)15–20 mm in length.....**12. S. cinerea**
– Achene <10 mm, inner phyllaries 12–15 mm in length .....**29. S. mirabilis**
20- (17) Plant subscapigerous, achene 14–17 mm, verrucose.....**10. S. boissieri**
– Plant caulescent, achene 9–14 mm, smooth 21
21- Plants tomentose, outer phyllaries aristate, pappus red-brown, barbellate .....**46. S. tomentosa**
- Plants canescent-pannose, outer phyllaries obtuse or acute, pappus yellowish-cream, plumose-barbellate .. ..**22. S. ketzkhowelii**
22- (16) Plants greenish, glabrous or sparsely villous.....**27. S. latifolia**
- Plants gray or grayish, canascent-lanate, pannose or lanate.....23
23- Stem erect, c. 1–10 capitulate, fruiting capitula 30–40 mm in length .....**15. S. dzhawakhetica**
- Stem ascending to erect, capitula number more than 10, fruiting capitula <30 mm in length 24
24- Stem distinctly branched especially above, inflorescence racemose, capitula 18–25 mm in length .....**49. S. veratrifolia**
– Stem unbranched, inflorescence panicula, capitula <18 mm in length .....**9. S. bella**
25- (15) Plants suffruticose at base.....**1. S. acantholimon**
– Plants herbaceous.....26
26- Plants scapigerous, subscapigerous, or subcaulescent 27
- Plants caulescent, clearly branched.....43
27- Caespitose plants, leaves linear with a plane margin 28
- Plant not caespitose, leaves linear-lanceolate or lanceolate, sometimes with undulate margin.....33
28- Plants gray, densely sericeous.....**42. S. sericea**
- Plants green, crisped pubescent or lanate.....29
29- Plants (10–)15–30 cm, erect .....**39. S. rigida**
- Plants 5–10(–15) cm, at least some stems ascending 30
30- Achene lanate.....**26. S. lasiocarpa**
- Achene glabrous.....31
31- All leaves (stem and basal leaves) toward the base densely lanate, outer phyllaries (6.5–)7–9 mm, lanate .....**41. S. seidlitzii**
- All leaves (stem and basal leaves) glabrous, sparsely lanate or crisped, outer phyllaries 3–7 mm, glabrous or crisped pubescent 32
32- Outer phyllaries glabrous, aristate .....**51. S. yildirimlii**
- Outer phyllaries crisped pubescent, acute ....**37. S. pygmaea**
33- (27) Rootstock creeping. Stems hollow ....**33. S. parviflora**
- Characters not as above 34

34- Rootstock tuberous 35
- Rootstock cylindrical 36
35- Scape 12–25 mm, leaves 2–5(–6)-mm wide, plane or undulate .....**45. S. sublanata**
- Scape 5–12 mm, leaves 5–15-mm wide, undulate ....**36. S. pseudolanata**
36- (34) Leaves coriaceous, achene 16–22 mm ....**13. S. coriacea**
- Leaves not coriaceous, achene shorter than 16 mm ...37
37- Achene lanate 38
- Achene glabrous.....41
38- Outer phyllaries grayish-white, densely lanate-pannose, pappus whitish-cream .....**21. S. karabelensis**
- Outer phyllaries greenish, lanate, crisped pubescent or sericeous, pappus purple.....39
39- Plants 5–15 cm, leaves lanate, hairs 3–7 mm in length, inner phyllaries 14–18 mm, achene 6–9 mm in length .....**48. S. ulrichii**
- Plants 2–5(–6) cm, leaves crisped-lanate or sericeous, hairs shorter than 2 mm, inner phyllaries 10–14 mm, achene 3–6(–7) mm.....40
40- Leaves 3–5(–6) × 0.2–0.3 cm, densely undulate, sparsely crisped-lanate, outer phyllaries acuminate ... .**40. S. sandrasica**
- Leaves 1–3 × 0.3–0.9 cm, slightly undulate, sericeous, outer phyllaries acute.....**28. S. longiana**
41- (37) Capitula 25–35 mm in length, outer phyllaries winged, 11–14 mm in length .....**3. S. ahmet-duranii**
- Capitula 15–25 mm in length, outer phyllaries not winged, 4–11(–12) mm in length.....42
42- Leaves lanate-pannose, veins prominent, inner phyllaries 20–22 mm, achene 8–13 mm in length ....**35. S. pisidica**
- Leaves lanate, veins not prominent, inner phyllaries 9–20 mm, achene 15–21 mm in length ....**51. S. zorkunensis**
43- (26) Flowers purple .....**32. S. papposa**
- Flowersyellow.....44
44- Achene lanate 45
- Achene glabrous.....47
45- Plants lanate-pannose, leaves 10–35-mm wide, capitula 25–40 mm in length, outer phyllaries 5–10 mm, achene 8–10 mm in length.....**17. S. eriophora**
- Plants sparsely lanate, leaves 2–10-mm wide, capitula 8–25 mm in length, outer phyllaries 3–5(–6) mm, achene 4–6 mm in length 45
46- Plants ascending, leaves 2–4-mm wide, outer phyllaries obtuse-acute.....**23. S. kotschyi**
- Plants erect, leaves 5–8-mm wide, outer phyllaries acuminate.....**8. S. aucherana**
47- (44) Leaves subcoriaceous, 10–18-mm wide ....**2. S. acuminata**
- Leaves not as above, 1–10-mm wide.....48
48- Achene 17–20 mm in length.....**14. S. davisii**
- Achene shorter than 15 mm.....49
49- Caespitose plants branched at base, villous, mature capitula 15–20(–21) mm in length, inner phyllaries 12–15 mm in length.....**5. S. amasiana**
– Plants not caespitose, glabrous, mature capitula 20–40 mm in length, inner phyllaries (14–)15–30(–38) mm in length 50
50- Achene surface distinctly toothed and winged, pappus brownish .....**31. S. pacis**
– Achene surface smooth, pappus cream or dirty white 51
51- Leaves herbaceous, phyllaries glabrous, achene 9–11 mm in length, pappus plumose below and scabrid above .....**46. S. tuzgoluensis**
– Leaves not as above, inner phyllaries sparsely crisped pubescent, achene 12–15 mm in length, some pappus plumose, others scabrid.....**38. S. renzii**

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Appendix. List of examined taxa.

***Scorzonera ahmet-duranii*:** C2 Muğla: Köyceğiz, Sandras mountain, Topuklu-fire tower, *Pinus* clearance, 1655 m, 23.06.2010, Makbul & Coşkunçelebi 230 (RUB, KTUB). ***Scorzonera bella*:** C10 Hakkâri: Cilo mountain in Diz stream, 1730 m, 06.08.1954, Davis & Polunin 23925 (LE). ***Scorzonera boissieri*:** B6 Kayseri: Sarız, Yeşilkent, Binboğa mountains, Tekke rock, mountain steppe, 1879 m, 15.07.2010, Makbul & Coşkunçelebi 250 (RUB, KTUB); Maraş: Göksun, Berit mountain, above Çavdar, rocky slopes, 2203 m, 14.07.2010, Makbul & Coşkunçelebi 247 (RUB, KTUB). B6 Kayseri: Sarız, Yalak, Binboğa mountains, Tekke rocky places, steppe, 2000–2200 m, 09.07.1992, Aytaç & Duman 5157 (HUB); Kayseri: Sarız, Keklikoluk rock, Işık mountain, Binboğa mountain, mountain steppe, 2400 m, 12.09.1991, Aytaç 4451 (HUB); Kayseri: Binboğa mountain, Körkuyu-Sıcak plateau, stony steppe, 2400–2600 m, 21.07.1992, Aytaç & Duman 5444 (GAZI); Maraş: Göksun, Ericek, Berit mountain, above Çavdar plateau, 2200–2250 m, 29.06.1992, Aytaç & Duman 5004 (GAZI). ***Scorzonera coriacea*:** B3 Isparta: Şarkikaraağaç, Kızıldağ National Park, 1600–1700 m, 25.06.1994, B.Mutlu 579-928 (HUB); C3 Konya: Derebucak, Çamlık, Kızıldağ, serpentine places, 1400 m, 12.06.2009, N 37 21 869 E 031 40 501, A. Duran 8349 & B. Doğan (holo.: KNYA; iso.: GAZI, ANK, HUB, Selçuk Univ., Herbarium of the Faculty of Education); 1445 m, N 37 21 028-E 031 39 082, 30.05.2005, E.Hamzaoğlu 3707 & Aksoy (KNYA); Suluin road, serpentine places, 1300 m, N 37 21 299 E 031 36 467, 11.06.2008, A. Duran 8042 (KNYA); Konya: Derebucak, Çamlık road, opposite the fountain, *Pinus* clearance, 1401 m, 12.06.2009, Makbul & Coşkunçelebi 144 (RUB, KTUB); C3 Isparta: Şarkikaraağaç, Kızıldağ National Park, around the hill, subalpine, alpine, 1599 m, 14.07.2012, Makbul & Coşkunçelebi 354 (RUB, KTUB). ***Scorzonera davisii*:** C10 Hakkari: 30 km from Hakkari to Başkale, stony slopes, 1430 m, 19.07.2011, Makbul & Coşkunçelebi 320 (RUB, KTUB); Van: Başkale–Hakkari road, 20–25 km from Hakkari, Zap gorge, roadside, slopes, 1533 m, 19.07.2011, Makbul & Coşkunçelebi 315 (RUB, KTUB). ***Scorzonera elata*:** A2 (A) İstanbul: Kartal, Cevizli, Dragos mountain, hill, *Pinus* forest, 28.04.1968, A. Çır. and O. Sut. (ISTF); İstanbul: Büyük island, 0–100 m, Sibthorp; Bursa: Bursa surroundings, Sibthorp; A4 Kastamonu: Daday, *Juniperus* forest, 700 m, 26.06.1980, Ketenoğlu 792 (ANK); A5 Kastamonu: Tosya, Kavakçeşme, Sint. 1892: 4918b; Tokat: Zile, Akçakeçeli village, *Quercus* forest, calcareous stones, 850–950 m, 24.07.1993, Dönmez 3789 (HUB); B1 Balıkesir: Ayvalık, Pınar island, 10 m, 10.05.1996, K. Akpınar (ISTE); İzmir: İzmir surroundings, Montbret; İzmir: Bornova–Manisa 15 km, hill 430 m, 08.07.1993, Ö. Seçmen 4291 (EGE); İzmir: Bayraklı, meadows, 200–300 m 02.06.1933, O. Schwarz (EGE); İzmir: Selçuk–Kuşadası, Samsun mountain, 24.06.1965, Regel (EGE); Manisa: 20 km S of Manisa, Gediz, 500 m, 26.07.1962, M. & D. Zohary; B3 Eskişehir: Türkmen mountain, Arban stream, Üçsaray, *P. sylvestris* clearance, 16.06.1976, T. Ekim, (ISTE); Konya: Akşehir, above Atakent, 1080–1200 m, 28.05.1974, G. Dökmeci and Y. Doğantaş (ISTE); B4 Ankara: Mamak, Kıbrıs village valley, Cehrelik, grassland, 1300–1350 m, 04.07.2005, Aslan 2419 (GAZI); Ankara: Ayaş Beli, Gazi Mustafa Kemal Forest, forest clearance, 1100–1200 m, 09.07.1986, Aytaç 2179 (GAZI); B6 Sivas: 12 km N of Sivas, 1600 m, Sorger 60-18-17; B7 Sivas: Divriği, 1000 m, Bornm 1893: 242a; Erzincan: Salihli, 1250–1300 m, Hub.-Mor. 9117; C1 Aydın: Priene residues, 250 m, 25.05.1962, D. 34975 (E); Aydın: Samsun mountain, Regel (EGE 8296); İzmir: Selçuk, 300 m, Sorger 63-13-4; Muğla: Bodrum, S of Turgut Reis, W foot of Doru mountain, 16.05.1984, E. Tuzlacı (ISTE); C2 Aydın: from Aydın to Muğla 72 km, 330 m, Hub.-Mor. 13193; Antalya: Akdağ, 1400 m, Sorger 67-22-75; Burdur: 3 km N of Dirmil, 1250–1300 m, Hub.-Mor. 9115; Denizli: Denizli–Kaçık Beli road, Karatepe, Gökkaya plantation area, 750 m, 07.06.1973, A.Baytop and T.Tuzlacı (ISTE); Denizli: Babadağ, Antalya–Tavas junction, roadside, 500 m, 20.07.1997, S. Oluk 2656 (EGE); Muğla: Küçük Kargı, from Fethiye to Köyceğiz, Bozakman & Fitz 344; Muğla: Ortaca, Tepearası, Eskiköy, *Pinus brutia* forest, 60–80 m, 25.05.1991, Vural 5873, (HUB); Muğla: Köyceğiz, Kavakarası village, maquis, 20 m, 18.05.1991, Güner 9047 (HUB, GAZI); Muğla: Köyceğiz, Hamitköy, Domuzdireği hill, maquis, 10–30 m, 21.05.1991, Güner 9169 (HUB); Muğla: Köyceğiz, Ekincik village, Sandallı hill, 400–600 m, 16.06.1991, Güner 9394 (HUB); Muğla: Köyceğiz, Beybası village, Süpürgelik hill, maquis, 150 m, 21.04.1991, Güner 8994, (HUB); Muğla: Dalaman, from Dalaman to Köyceğiz 10 km before, *P. brutia* forest, roadside, 152 m, 25.05.2010, Makbul & Coşkunçelebi 204 (RUB, KTUB); C3 Antalya: Tahtalı mountain, Tekirova, 30 m, Hub.-Mor. 9983; Antalya: Adrasan, Çavuş village, Sazak road, 15 m, 15.05.2009, Eustace Ann 118 (E); Antalya: Akseki–Güzelsu, Serebil area, *Pinus brutia* forest, 1100 m, 08.07.1996, Duran 4136, (GAZI); C4 Antalya: Alanya, Çetik 124; Antalya: Alanya, Mahmutlar, Kuşkayası, *Pinus nigra* forest, 1371 m, 04.07.2010, Makbul & Coşkunçelebi 236 (RUB, KTUB); C6 Maraş: 3 km S of Süleymanlı, shrubs, 900 m, 16.06.1981, Yıldız 2811 (HUB!). ***Scorzonera hieraciifolia*:** B4 Konya: Gölyazı plateau, salty places, 912 m, 11.06.2009, Makbul & Coşkunçelebi 138 (RUB, KTUB); B4 Aksaray: Tuz lake, Aksaray, Eskil-lake, swamp, *Juncus* community, 940 m, 02.06.1998, Aydoğdu (GAZI); Konya: Cihanbeyli, 800 m, Hub.-Mor. 14690; B5 Kayseri: İncesu-Develi, 1200 m, salty swamp, 29.08.1957, D. 32766 (Typus) (E); Kayseri: İncesu-Develi, 1200 m, D. 32766; Kayseri: Sultan reeds, Yahyalı, Ovaçiftliği village, Kuş museum,

protected area, 1071 m, 10.07.1993, Yıldırımlı 16171 (HUB); Kayseri: Yahyalı, Sultan reeds, Tuzla, 03.07.1982, Sümbül 1475 (HUB); Kayseri: Yahyalı-Sultan reeds, Tuzla, 03.07.1982, Demirkuş 1913 (HUB); Niğde: Aksaray, Birand & M.Zohary 2819; B6 Sivas: Tödürge lake, Zara-Hafik, 1350 m, Hub.-Mor. 13204; B6 Sivas: Tödürge lake, S of Zara-Hafik, salty places, 1301 m, 06.06.2009, Makbul & Coşkunçelebi 127 (RUB, KTUB). ***Scorzonera inaequiscapa***: A7 Giresun: 10–15 km from Alucra to Şiran, Hacıhasan village, grassy and rocky area, 1670 m, 13.06.2005, Makbul 79 (RUB, KTUB); Giresun: Alucra–Şiran, Hacıhasan village, grassland, sandy and rocky area, 1661 m, 27.06.2011, Makbul & Coşkunçelebi, 298 (RUB, KTUB); A8 Bayburt: 2.5 km from Bayburt to İspir, roadside, 1506 m, 30.05.2005, Makbul 68 (RUB, KTUB); B5 Yozgat: Akdağmadeni forest station, 06.06.1960, Curtis 177; B7 Tunceli: Ovacık, Karagöl valley, Munzur mountain, 1400 m, 05.05.1979, Yıldırımlı 1347 (HUB). ***Scorzonera karabelensis*:** C2 Muğla: Fethiye, Fethiye–Korkuteli road, clearance of *Pinus* forest, rocky chalky slopes, 1114 m, 22.05.2012, Makbul & Coşkunçelebi 346 (RUB, KTUB). ***Scorzonera longiana*:** C4 Antalya: Gazipaşa, Çayıryakası plateau, 1700 m, 14.07.1983, Sümbül 2290 (HUB); Antalya: Gazipaşa, from Çobanlar village, plateau to Oyuklu plateau, 1800–2000 m, 11.07.1983, Sümbül 2239 (types HUB, E). ***Scorzonera longiana*:** C3 Antalya: Gazipaşa, Çayıryaka plateau, stony meadows, 1727 m, 25.07.2010, Makbul & Coşkunçelebi 255 (RUB, KTUB). ***Scorzonera pacis*:** C6 Hatay: Antakya, Karaali, maquis, 410 m, 10.04.2011, S. Yıldız 551 & S. Kayıkçı (holo.: GAZI, iso.: HUB, MKU). ***Scorzonera phaeopappa*:** C3 Antalya: Akseki, Yaylacık hill, 1900 m, Quezel et al.; C5 Adana: Adana–Ceyhan, 6 km E of Ceyhan stream, Coode & Jones 3571; Adana: Mısır–Ceyhan, 25 m, 14.04.1956, D. 26069 (ANK); Adana: Mısır, 11.04.1934, Balls 717 (ANK); Adana: 8 km from Adana to Kozan, calcareous soils, 150 m, 12.04.1957, D. 26628 (E); Niğde: Ala mountain, Çukurbağ–Narpız, 1900–2050 m, Parry 72; C6 Gaziantep: Dülük Baba, 7 km N of Gaziantep, 1100 m, 12.05.1957, D. 27879 (ANK, E); Gaziantep: Dülük Baba, Gaziantep, 1250 m, Haradj. 1217; Gaziantep: Dülük Baba, picnic area, *Pinus* forest, 1135 m, 15.05.2010, Makbul & Coşkunçelebi 174 (RUB, KTUB); Hatay: Kırıkhan, Antalya–İskenderun, 5 km from Kırıkhan junction, roadside, 385 m, 16.05.2010, Makbul & Coşkunçelebi 177 (RUB, KTUB); Maraş: Ahır mountain, Yalnız Ardıç backs, 1300–1500 m, 22.05.1992, Aytaç & Duman 4668 (HUB); Maraş: Engizek mountain, Aksu, *Juniperus excelsa* clearance, 1000–1200 m, 24.05.1987, Duman 2919 (GAZI); Maraş: Ahır mountain, Akdere, 1300–1600 m, 03.05.1991, Aytaç 3564 (GAZI); C7 Urfa: Ceylanpınar, Sorkah, 470–490 m, 14.04.1995, Adıgüzel 1895 (GAZI); C8 Batman: Bismil, 5 km from steppe area to hill, 610 m, 25.04.2009, K 37 81 06-D 40 72 53, Aslan et al. 3210 (GAZI); Mardin: 24 km from Diyarbakır to Mardin, 1000 m, D. 28735; Urfa: Ceylanpınar, Hausskn. ***Scorzonera pisidica*:** C2 Burdur: Tefenni, *Quercus coccifera*, 3 km from Altınyayla, 1200–1270 m, 27.06.1948, Hub.-Mor. 8485 & Reese (holo Hb. Hub. Mor.); Burdur: 6 km S of Dirmil, 1600–1650 m, Hub.-Mor. 8486 & Reese; Burdur: Gölhisar-Dirmil, 1270 m, 17.06.1981, Nydegger 16244 (tip) (E); Burdur: Yeşilova, S of Salda lake, *P. nigra* and *Quercus* clearance, 1170–1200 m, 11.07.1993, Duman 5080 (GAZI); C2 Denizli: Honaz, roadside, stony field, *Juniperus* clearance, 1743 m, 13.07.2012, Makbul & Coşkunçelebi 353 (RUB, KTUB); Muğla: Köyceğiz, Sandras mountain, climbing from Beyağaç to Sandras mountain, Yumaklı area, *Pinus* sp. forest, 1282 m, 23.06.2010, Makbul & Coşkunçelebi 229 (RUB, KTUB); Muğla: Köyceğiz, Sandras mountain, Topuklu–Yangın fire tower, *Pinus* sp. forest, 1655 m, 23.06.2010, Makbul & Coşkunçelebi 231 (RUB, KTUB); Muğla: Beyağaç–Sandras mountain, *P. nigra* forest, 1320 m, 16.06.2001, Varol 3895 (GAZI). ***Scorzonera pygmaea*:** A2 Bursa: Uludağ, *Juniperus* clearance, 2159 m, 24.07.2010, Makbul & Coşkunçelebi 271 (RUB, KTUB); A4 Kastamonu: Ilgaz mountain, around TV transmitter, alpine, 2055 m, 02.08.2009, Makbul 165 (RUB, KTUB); A5 Kastamonu: Ilgaz mountain, back hills of the TV transmitter, steppe, 1998 m, 20.08.2011, Makbul & Coşkunçelebi 339 (RUB, KTUB). A2(A) Bursa: Uludağ, 19.08.1850, Clementi; 2400 m, Sorger 68-54-23; Bursa: Uludağ, Karagöl road, 24.08.1971, A. & T. Baytop (ISTE); Bursa: Uludağ, alpine, 13.08.1953, A. & T. Baytop (ISTE); 29.08.1950, A. & T. Baytop (ISTE); A2 Bursa: Uludağ, 2380–2580 m, 13.09.1949, D. 14846-14862a (E); Bursa: Uludağ, 29.07.1968, Pamukçuoğlu (HUB); Bursa: Uludağ, NW of hill, calcareous stones, 2300–2500 m, 05.08.1993, Y. Gemici 8284 (EGE); Bursa: Uludağ, around the hill, stream bed, 1950 m, 27.07.1984, Ö. Seçmen 11 (EGE); Karabük: peak of Keltepe, 1950 m, 12.07.1984, Demirörs 1263 (ANK); Kastamonu: Ilgaz mountain, limy stones, 2200 m, 28.07.1962, D. 21577-38376 (E); Kastamonu: Ilgaz mountain, *Pinus* forest, 2000 m, 19.06.1969, Darrah 28 (E); Kastamonu: Ilgaz mountain, K. Hacet mountain, S slopes of alpine, limy, 2400 m, 29.02.1982, Akman et al. 12178 (ANK, EGE); A4 Zonguldak: Karabük-Keltepe, 1950 m, calcareous hills, 03.08.1962, D. 39814 (E); B2 Kütahya: Gediz, Şaphane mountain, calcareous stones, 1700–1900 m, 17.06.1993, Y.Gemici 7695 (EGE); C3 Isparta: Dedegöl Mountain, 1600–2400 m, Sorger 70-46-24. ***Scorzonera rigida*:** B7 Erzincan: above Ahmediye, NW slopes, alpine, stony places, 2306 m, 11.07.2009, Makbul 156 (RUB, KTUB); C4 Konya: Ereğli, Kayasaray village, Düğünlük stream, calcareous stones, 1910 m, 05.07.2010, Makbul 240 (RUB, KTUB). B7 Erzincan: Sipikör mountain, 1990 m, Hub.-Mor. 13194; B9 Bitlis/Van: 10 km SE of Pelli, calcareous

slopes, 2600 m, 08.07.1954, D. 22544 (ANK, E); Van: Başkale, İspiriz mountain, stony slopes, 3200 m, 31.07.1954, D. 23763 (ANK, E); Van: 8 km from Van to Erçek, stony slopes, 2100 m, 06.06.1966, D. 44424 (ISTO, E); Van: Çatak, Kavussahap mountain, 3100 m, 23.07.1954, D. 23122 (E); Van: Gevaş, Artos mountain, rocky slopes, 2134 m, 14.07.1954, D. 22681 (E); Van: 36 km from Başkale to Hoşap, Güzel Dere pass, rocky-steppe slopes, 2750 m, 03.07.1966, D. 45989 (E); Van: Başkale, Işıklı village, 13.06.1984, T. Baytop (ISTE); Van: Erek mountain, 07.07.1988, Özçelik & Ay (EGE); Van: Erek mountain, 3100 m, Kronenburg 130; B10 Ağrı: 3 km E of Doğubeyazıt, calcareous stones, 1750 m, 31.05.1966, D. 43945 (ISTO, E); C5 Adana: Gülek, 2000 m, Sorger 62-71-23; C5 Mersin: Yıldız hill, SE slopes, 2700–3000 m, 17.07.1989, Y. Gemici 4860 (EGE); C5 Niğde/İçel: Bolkar mountain, W of Mededsiz hill, stony slopes, 2500–2600 m, 26.07.1984, Strid et al.. 24036 (EGE); C6 Maraş: Berit mountain, 1700–2500 m, Hausskn.; C9 Van: Harefta mountain, Başkale–Koçanis, 2700–2800 m, Nábělek 3737; C10 Hakkari: Cilo mountain, 10 km W of Cilo hill, 3700 m, 09.08.1954, D. 24216 (ANK). ***Scorzonera sandrasica*:** C2 Muğla: Köyceğiz, Sandras mountain, Beşparmak hill, around fire tower, steppe areas, 1970 m, 13.04.2004, Varol 5634 (GAZI); Muğla: Sandras mountain, W of the summit, 1970 m, 13.04.2004, N 37 04 E 028 50, Hartvig (izo. EGE); C2 Muğla: Köyceğiz, Beşparmak hill, around fire tower, rocky slopes, forest boundaries, 2025 m, 23.06.2010, Makbul & Coşkunçelebi 232 (RUB, KTUB). ***Scorzonera sublanata*:** A1 Çanakkale: Eceabat, Yalova village, *Cistus* shrubs, hill, 110 m, 02.06.2011, Makbul & Coşkunçelebi 288 (RUB, KTUB); A1(E) Çanakkale: S of Eceabat, 300 m, Sorger 63-7-14; Çanakkale: Gökçeada, Tuzburnu–Hacıahmet, 70 m, 15.04.1976, Ö. Seçmen 1575-1588 (EGE); 60 m, 05.05.1975, Ö. Seşmen 428 (EGE); A1(A) Çanakkale: Kemerdere, Sint. 1883: 325; A4 Ankara: Çubuk, Ovacık, Saraycık village, Atcameydan hill, shrubby slopes, 1250–1380 m, 20.05.1992, Dündar 495 (GAZI); B1 Balıkesir: Ayvalık, Cunda island, above Patriçe, 10 m, 07.05.1996, K.Alpınar (ISTE); Balıkesir: Ayvalık, Armutçu–Sakarya, 20.04.1997, K.Alpınar (ISTE); Balıkesir: Ayvalık, Dolap island–Mitralyöz, 5 m, 23.05.1997, K.Alpınar (ISTE); Balıkesir: Ayvalık, Hakkıbey S of island, 15.04.1998, K.Alpınar (ISTE); İzmir: Gümüldür, W of Değirmendere, 15.04.1969, Fitz & Spitz.; İzmir: Karaburun, Balıkova–Gerence, 05.04.1980, L.Bekat 240 (EGE); İzmir: Değirmendere–Gümüldür, 15.04.1969, K.Fitz (EGE); Manisa: Spil mountain, rocky and grassy, *Juniperus* clearance, 1224 m, 22.05.2011, Makbul & Coşkunçelebi 280 (RUB, KTUB); Manisa: Spil mountain, steppe, 1196 m, 21.06.2010, Makbul & Coşkunçelebi 228 (RUB, KTUB); B2 Uşak: Uşak surroundings, 900 m, Bal.; B4 Ankara: Ankara, 1100 m, Balls 1933: 221; Ankara: Şereflikoçhisar–Aksaray road, 10 km from Şereflikoçhisar, steppe, 935 m, 24.05.2010, N 38 49 760 E 033 35 921, Makbul & Coşkunçelebi 199 (RUB, KTUB); C2 Aydın; below Karacasu, 400–500 m, maquis, 23.04.1965, D 41633 (E); Aydın: Aydın–Muğla, *Pinus* clearance, 458 m, 19.05.2011, Makbul & Coşkunçelebi 275 (RUB, KTUB); Muğla: Yılanlı mountain, rocky area, 1369 m, 19.05.2011, Makbul & Coşkunçelebi 276 (RUB, KTUB); Denizli: Pamukkale, 07.05.1969, Fitz & Spitz.; Denizli: Babadağ, Karacasu, above Yenice, *P. brutia* forest, 200 m, 24.04.1998, S.Oluk (EGE); Antalya: Elmalı, Bourgeau 169; C3 Antalya: Bük forest, Kayran, Bozakman & Fitz 149; Antalya: Kumluca, W of Adrasan village, serpentine slopes, *P. brutia* forest, 10–50 m, 29.04.1980, Peşmen 4881 (HUB); Antalya: Kumluca, Adrasan village, Musa mountain, Kızıl area, serpentine slopes, *P. brutia* forest, 0–150 m, 23.03.1979, Peşmen 4243 (HUB); Antalya: Kemer, Olimpos, 50 m, 23.03.1979, Peşmen 4229 (HUB). ***Scorzonera tomentosa*:** A4 Ankara: Kalecik, 1 km W of the village, serpentine, 12.07.1998, Adıgüzel 1899 (E); Ankara: Çubuk, Karagöl, Yaşmağın hill, 1500 m, 05.08.1974, Erik 683 (HUB); Çankırı: Çankırı, 800 m, Bornm. 1929: 14326; A5 Amasya: Direkli village, Çetinkaya, 1550 m, 03.10.1976, K.Akpınar (ISTE); Kastamonu: Tosya, Sint. 1892: 4721; A6 Sivas: Yıldız mountain, Cırcır, steppe, 1400 m, 14.08.1967, Tobey 2312 (E); A7 Gümüşhane: Kop village, rocky slopes, 1300 m, 19.06.1967, Tobey 2043 (E); A8 Artvin: Artvin, Barevan, Woronow 6153; Bayburt: Kop mountain, roadside, 2148 m, 05.07.2007, Makbul 10 (RUB, KTUB); Bayburt: Bayburt–Aşkale, Kop pass, 2350 m, 16.08.1984, Leblebici (EGE); Erzurum: 4 km W of Kuzgun village, rocky slopes, 2250–2350 m, 19.07.1977, Tatlı 5857 (HUB); Gümüşhane: near Bayburt, Bourgeau 147; A9 Kars: E of Kağızman mountain, 17 km from Akçay to Cumaçay, 2070 m, 17.07.1966, D. 46720 (ISTO, E); Kars: Demirkapı, Woronow 12686; B2 Uşak: Bulkas mountain, 1250 m, Bal.; B3 Konya: Sultan mountain, 28.06.1953, Birand & M. Zohary; B4 Ankara: near Ankara, Liston; Ankara: Mamak, Kıbrıs village valley, stony slopes, 1000–1100 m, 01.07.2004, Aslan 1592 (GAZI); Ankara: Beynam, 400 m, 05.09.1949, D. 13101; B5 Yozgat: Yıldızlı–Akdağmadeni, 10 km to Akdağmadeni, stony area, 1113 m, 06.06.2010, Makbul & Coşkunçelebi 211 (RUB, KTUB); B6 Adana: Binboğa mountain, Yalak, 2000 m, 14.07.1952, D. 19938 (ANK); Kayseri: Sarız, Yalak, Binboğa mountain, above Yalak, rocky field, 1700–2000 m, 08.07.1992, Aytaç & Duman 5242 (GAZI); Kayseri: Akkışla, above Ganişeyk, Hınzır mountain, 1900 m, 20.08.1979, Çelik 771 (HUB); Kayseri, Sarız, Yalak, Binboğa mountain, stream side, stony field, 1500–1700 m, 04.08.1991, Aytaç 4349 (GAZI); Kayseri: Pınarbaşı, Kaynar, S slopes of Hınzır mountain, above Kara Ahmed, slopes, 2000 m, 18.07.1975, Çelik 531 (ANK); Kayseri: Sarız, Yeşilkent, Binboğa mountain, climbing to Tekke stone, calcareous stones, 1734 m,

15.07.2010, Makbul & Coşkunçelebi 249 (RUB, KTUB); Malatya: Doğanşehir, Eskiköy, Çobanderesi-İhtiyarcave, *Juniperus excelsa–Quercus* forest, 1600–1800 m, 25.07.1971, Peşmen 2635 (HUB); Malatya: Doğanşehir, Dedeyazı village, Keşiş mountain, alpine steppe, 1800–2200 m, 28.07.1971, Peşmen 2580, (HUB); Malatya: Akçadağ, Kürecik, Aksüt village, 1443 m, 18.07.2005, Y. Yeşil (ISTE); Maraş: Göksun, Kınıkköz village, Gözpınarı mountain, 1700 m, 22.08.1977, Yıldız 1532 (HUB); Maraş: Göksun–Değirmendere, Koruyaz mountain–Meryemçil protected area, 1750–2000 m, 05.07.1993, Ekici 1577 (GAZI); Maraş: Göksun, Binboğa mountain pass, 1500 m, 14.07.1952 (E); Sivas: Ak mountain, near Sivas, 2200 m, Siehe 1911: 308; Sivas: Şarkışla, 1500 m, D. 32720 (E); Sivas: Hekimhan–Kangal, hillside, 1800 m, 02.09.1954, D. 24844 (E); Sivas: 8 km from Sivas to Ulaş, 1300–1450 m, 06.08.1982, D. 68628 (HUB); Sivas: Hafik, Koşutdere–Bakışecik, stony places, 1250 m, 30.06.1991, Aydoğdu 3245 (GAZI); Sivas: Şarkışla, Evcidere Kale–Alaman, calcareous stones, 1400–1500 m, 19.07.1979, Ekim & Düzenli 4022 (ANK); Sivas: Ulaş, Tecer village, Tecer mountain, 1600 m, 21.07.1978, A.Baytop et al. (ISTE); Sivas: Çelebiler, Okatan farmer sulfated soils, 1500 m, 03.08.1972, Y.Okatan (ISTF); Sivas/Tokat: Çamlıbel pass, 1650 m, 21.07.1978, A.Baytop et al. (ISTE); B7 Elazığ: Kop mountain, Sarık village, steppe, 1700 m, 18.07.1984, Evren 2108 (GAZI); Erzincan: Kemaliye (Eğin), Sırakonaklar village, calcareous stones, 1600 m, 10.07.1982, Tanker 10516 (ANK); Erzincan: Sipikör, Sint. 1890: 3309; Erzincan: Keşiş mountain, volcanic slopes, 2600 m, 28.07.1957, D. 31759 (E); Erzincan: Erzincan–Refahiye, 25 km E of Refahiye, near Sakallutan pass, serpentine area, 1960–2020 m, 15.08.2001, N 39 52 146 E 039 04 054, Adıgüzel 4156 (GAZI, E); Erzurum: W of Erzurum, Erzurum–Kandilli, Ağaver–Kandilli, Tapi stream, limy slopes, 1960 m, 17.07.1969, O.Özbay (ISTF); Malatya: Kırlangıç village, Eğri Dere, back of the cave, 1500 m, 15.07.1993, N.Gören (ISTE); Malatya: Doğanşehir, Eskiköy, above İhtiyar cave, alpine steppe, 1900–2000 m, 14.07.1971, Peşmen 2331 (EGE); Tunceli: Ovacık, Munzur mountain, Karagöl valley, 1500 m, 09.09.1979, Yıldırımlı 2463 (HUB); Tunceli: Munzur mountain, above Ovacık, Aksu stream, stony places, 1800 m, 21.07.1957, D. 31470 (E); 2100 m, 19.07.1957, D. 31313 (E); Tunceli: N pass of Pülümür, near Küçü Dere, rocky slopes, 03.08.1974, Rix 2388 (E); Tunceli/Erzincan: Pülümür pass, grassland, 1950 m, 23.07.197, F. Holtz (EGE); B8 Erzurum: Palandöken mountain, Kırkdeğirmenler, 1950–2100 m, 22.07.1984, Demirkuş 2028 (HUB); Erzurum: Tercan–Selepur, 1400 m, 11.07.1957, D. 30954 (E); Erzurum: 66 km from Hınıs to Erzurum, Aras pass, 1650 m, 12.07.1966, D. 46437 (ISTO, E); C3 Antalya: Gazipaşa–Çayıryaka plateau road, rocky-stony places, 1714 m, 25.07.2010, Makbul & Coşkunçelebi 254 (RUB, KTUB); Konya: Beyşehir, Kurucuova, Radar-Karagöl, calcareous stones, alpine, 2000–2500 m, 24.07.1975, Güner 2290 (HUB); Konya: Kuru tepe, 1400 m, Sorger 66-44-105; C4 İçel: Anamur, Anamur–Kazancı road, Kızıl Alan, 1300 m, 24.06.1984, Sümbül 3103 (HUB); Konya: 19 km from Konya to Beyşehir, 1210 m, Hub.-Mor. 8694; C5 Konya: Ereğli, Aydos mountain, Berendi, Boğaz, calcareous stones, 1600 m, 28.06.1976, Erik 1705 (HUB); C6 Osmaniye: Zorkun, Amanos mountain, Keldaz Hill, calcareous stones, 2020 m, 05.07.2010, Makbul & Coşkunçelebi 241 (RUB, KTUB); C7 Malatya: 74 km SW of Malatya, 1550 m, Sorger 71-45-12. ***Scorzonera tuzgoluensis*:** B4 Konya: Cihanbeyli, Gölyazı–Tuzgölü, 908 m, 11.06.2009, N 38 32 552 E 033 21 188, A. Duran 8368 (holo.: KNYA, iso.: GAZI, ANK, HUB, MR); 12.07.2006, A. Duran 7241 (KNYA, MR); 29.06.2009, B. Doğan 2100 (KNYA, GAZI, MR); Konya: Cihanbeyli, climbing to Gölyazı plateau, Dumanağlı plateau, salty swamp, 908 m, 06.07.2011, Makbul & Coşkunçelebi 313 (RUB, KTUB). ***Scorzonera ulrichii*:** C4 Antalya: Alanya, Çökele–Gökbel, calcareous area, near *Pinus* forest, 1425 m, 05.07.2003, Göktürk 5107 (HUB, GAZI); Antalya: Alanya, Mahmutlar–Hadim road, c. 35 km NE of Mahmutlar and 15 km S Çayarası, 1 km N Elmalısu, gravely, rocky slopes with *Pinus nigra* var. *caraminaca* forest clearance, W-exp., limestone, 1250 m, 11.06.2002, Robert Ulrich (Tubingen) 2/12 (holo.:B, iso.: E, ISTE); C4 Antalya: Alanya, Mahmutlar, Elmalısu–Hadim road, after Kuşkaya, calcareous rocks, under *Pinus nigra*, 1336 m, 05.07.2010, Makbul & Coşkunçelebi 237 (RUB, KTUB); Antalya: Alanya, Mahmutlar–Hadim road, Elmalısu, junction of Gökbel plateau road, calcareous rocks, under *Pinus nigra*, 1336 m, 05.07.2010, Makbul & Coşkunçelebi 238 (RUB, KTUB). ***Scorzonera veratrifolia*:** B9 Bitlis: Kambos mountain, above Hurmuz, 1830 m, 31.06.1954, D. 23494 (E)!; Van: Pelli mountain, 54 km SW of Van 2500 m, 09.07.1971, Edmondson 618 (E)!; Van: Van lake, 20 km SE of Tatvan, 1960 m, Frodin 1939, 1971 and 1972; C9 Hakkari: between Beytuşşebap and Uludere, W of Tanin mountain, 2500 m, 25.07.1974, Rix 2338 (E)!; Hakkari: Cilo mountain, Diz stream, 1740 m, 06.08.1954, D. 23926 (E)!; Van: Çatak, Dalbastı village, 1350–1600 m, 20.07.2002, Bani 1259 (GAZI)!; C10 Hakkari: Sat mountain, 2000–2100 m, 30.06.1966, D. 45812 (ISTO, E)!; Hakkari Cilo mountain, 2500 m, 25.08.2011, MF 27719!; Hakkari: Koçanis, 2500 m, 21.07.2011, MF 27566!; Hakkari: Esendere, Mor mountain, 2700 m, 24.07.2011, MF 27194!; Hakkari: Diz stream, 2200 m, 23.07.2011, MF 27168!. ***Scorzonera yildirimlii*:** C6 Osmaniye: Amanos mountain, Zorkun plateau, Keldaz hill, 1950 m, 05.07.2001, N 36 58 95 E 036 24 22, Duran 5765-6824 (iso.: HUB, GAZI; para.: E); Osmaniye: Zorkun, Amanos mountain, Keldaz hill, Halep Gösteren, calcareous rocky hills, 2073 m, 05.07.2010, Makbul & Coşkunçelebi 243 (RUB, KTUB).