

## *Tragopogon abbreviatus* (Asteraceae): a little-known species inferred from morphological and molecular analysis

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**Abstract:** *Tragopogon porrifolius* occurs in Turkey with 3 taxonomically confused subspecies: *T. porrifolius* subsp. *eriospermus*, *T. porrifolius* subsp. *longirostris*, and *T. porrifolius* subsp. *abbreviatus*. In the present paper, *T. porrifolius* subsp. *abbreviatus* endemic to Turkey is raised at specific level based on morphological and molecular analysis. After detailed assessment of original herbarium specimens and literature studies, we found that this name is not typified yet. Thus, a lectotype is provided together with an emended diagnosis; synonym, distribution map, and conservation status for the first time. Additionally, a preliminary phylogenetic position of this little-known taxon is given on several newly sequenced data.

**Key words:** Cichorieae, lectotypification, nuclear sequence data, *Tragopogon longirostris*, *T. porrifolius*, Turkey

### 1. Introduction

*Tragopogon* L. (Asteraceae) includes about 150 species native to Eurasia and known as salsify worldwide (Bremer, 1994; Soltis et al., 2004) and 22 species (25 taxa) in Turkey (Coşkunçelebi et al., 2017). Members of this genus are known as Yemlik or Tekesakalı in Turkish (Güner et al., 2012) and consumed by local people as a source of food (Baytop, 2000). According to Borisova (1964), Blanca and Diaz De La Guardia (1997), and Sukhorukov and Nilova (2015), the members of the *Tragopogon* are almost impossible to be identified without mature achenes, phyllaries, and ligules colours. However, most of the Turkish taxa including *T. porrifolius* L. and *T. longirostris* Sch. Bip. were identified on incomplete specimens in the Flora of Turkey (Matthews, 1975).

*Tragopogon longirostris* was treated under *T. longirostris* var. *abbreviatus* Boiss. and *T. longirostris* var. *brachyphyllum* Boiss. by Boissier (1875). Although Boissier (1875) did not give a detailed description in the protologue of *T. longirostris* var. *abbreviatus*, he reported that it differs from *T. longirostris* var. *brachyphyllum* of achene features. Boissier (1875) also listed *T. dshimilensis* K.Koch as a synonym under the *T. longirostris* var. *abbreviatus* in the protologue of *T. longirostris* var. *abbreviatus*. Later Coşkunçelebi et al. (2017) reported that *T. dshimilensis* is an accepted taxon endemic to Turkey due to differences in

the ligule colour, presence of the leaf remains at the base of the stem and plant habit. Although Matthews (1975) followed Boissier's view in the Flora of Turkey during the preparation of the Turkish *Tragopogon* account, this account does not always coincide with current published accounts of the genus *Tragopogon* (Feinbrun-Dothan, 1978; Dimopoulos et al., 2016). Greuter (2003) transferred *T. longirostris* under *T. porrifolius* as subspecies (*T. porrifolius* subsp. *longirostris* (Sch. Bip.) Greuter), however he ignored the names *T. longirostris* var. *abbreviatus* in his paper about the Euro+Med treatment of Cichorieae (Compositae).

During a taxonomic revision of the Turkish *Tragopogon*, the authors collected several specimens easily keying out *T. longirostris* var. *abbreviatus* according to the Flora of Turkey (Matthews, 1975). Further comparisons based on several morphological features that are important for the genus *Tragopogon* (Blanca and Diaz De La Guardia, 1997; Sukhorukov and Nilova, 2015) revealed that these samples distinctly differ from *T. porrifolius* subsp. *longirostris* (= *T. longirostris* var. *longirostris*) and *T. porrifolius* subsp. *eriospermus* (Ten.) Greuter (= *T. porrifolius* var. *brachyphyllum* Boiss.). Although *T. longirostris* and *T. porrifolius* (= *T. porrifolius* var. *brachyphyllum* Boiss.) were treated as separate species by Matthews (1975) in the Flora of Turkey, Coşkunçelebi and Gültepe (2012)

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transferred *T. longirostris* var. *abbreviatus* under the *T. porrifolius* as a subspecies (*T. porrifolius* subsp. *abbreviatus* (Boiss.) Coşkunç and M.Gultepe) contrary to Greuter (2003). Besides Gültepe et al. (2016) reported, contrary to Greuter (2003), that *T. porrifolius* and *T. longirostris* should be treated as separate species based on molecular data. Correspondingly, the aim of the present study is to identify the authentic material of the name *T. longirostris* var. *abbreviatus* and ascertain its taxonomy and provide a preliminary phylogenetic position of this little-known species.

## 2. Materials and methods

### 2.1. Morphological studies

The current study was mainly performed on authors' own specimens preserved in Herbarium of Biology Department at Karadeniz Technical University (KTUB) as well as herbarium specimens from the following herbaria (ANK, B, E, EGE, G, GAZI, HUB, ISTE, ISTF, ISTO, KATO, KNYA, LE, TBI, VANF). Detailed locality information of the examined specimens is given in the Appendix. Herbarium acronyms are given according to Index Herbariorum (Thiers, 2019).

All specimens were identified according to the Flora of Turkey (Matthews, 1975), and nomenclature is given according to Coşkunçelebi and Gültepe (2012). Morphological characters were measured from specimens according to Boisser (1875), Matthews (1975), Gültepe (2014), and relevant literature (Borisova, 1964; Richardson, 1976; Rechinger, 1977). All measurements and observations were performed from at least 3 specimens. Outer mature achenes, phyllaries, fruiting, and flowering capitula obtained from herbarium specimens stored at KTUB were drawn and/or photographed under the stereo microscope.

### 2.2. Red list assessment studies

The threat category has been assessed according to the red list criteria of IUCN (2012) using area of occupancy (AOO), the extent of occurrence (EOO), population numbers, and field observations. A distribution map, calculation of the EOO (km<sup>2</sup>), and AOO (km<sup>2</sup>) were carried out by using Geo-Cat (Bachman et al., 2011).

### 2.3. Molecular studies

Genomic DNAs were extracted from silica-dried leaves following the modified extraction procedure of Doyle and Doyle (1987). Amplification and sequence of nrDNA ITS regions were carried out according to Gültepe et al. (2010). Phylogenetic analyses were performed on the ITS data set consisting of 87 accessions (Table 1), of which 15 were newly generated sequences, 72 sequences were obtained from GenBank and 10 were used as an outgroup provided from Gültepe et al. (2016). For each taxon,

multiple samples were used whenever possible to observe the infra-specific DNA sequence variation and construct a robust phylogenetic analysis. All sequences (85 accessions) were aligned with Bioedit v. 7.0 (Hall, 1999). Phylogenetic relationships were reconstructed using Maximum Parsimony (MP) and Bayesian Inference (BI) analyses. MP analyses were run in PAUP\* version 4.0b10 (Swofford, 2003) using heuristic search with the following parameters: all characters have equal weight, gaps are regarded as 'missing', simple addition of sequences, TBR branching swapping, maxtrees setting to 100 and auto-increased by 100, one nonbinary starting tree arbitrarily dichotomized before branch swapping, only one tree was saved. A majority rule consensus tree was calculated from the most parsimonious trees. Jackknife (JK) support values for the nodes found in the MP analysis were calculated in PAUP\* applying the optimal jackknife parameters according to Farris et al. (1996) and Müller (2005) with the following parameters: 10,000 jackknife replicates using the TBR branch swapping algorithm with 36.788% of characters deleted and one tree held during each replicate. Prior to BI analyses, the nucleotide substitution model that best fits the datasets was determined for ITS with MrModeltest 2.3 (Nylander, 2004), following the Akaike Information Criterion (AIC). BI analyses in MrBayes 3.2 (Rounquist et al., 2012) were performed with 4 simultaneous runs of Metropolis-coupled Markov Chains Monte Carlo (MCMCMC), each with 4 parallel Markov chains. Each chain was performed for 20 million generations and, starting with a random tree, one tree was saved every 1000th generation. For other parameters, the default settings of the program were left unchanged. A conservative burn-in of 0.2 (i.e. discarding the first 20% of the trees) was applied. The remaining trees were used to generate a majority-rule consensus tree, and visualized in TreeGrap v.2 (Stöver and Müller, 2010).

## 3. Results

### 3.1. Taxonomy

**Tragopogon abbreviatus** (Boiss.) Coşkunç. & M.Gultepe, **comb.&stat. nov.** (Figure 1)

*Basionym:* *Tragopogon longirostris* var. *abbreviatus* Boiss., Fl.Orient. 3.745 (1875).

*Synonym:* *Tragopogon porrifolius* subsp. *abbreviatus* (Boiss.) Coşkunç. and M.Gultepe, Türkiye Bitkileri Listesi (Damarlı Bitkiler), 212 (2012), **syn. nov.**

*Lectotype* (designed here): Turkey/B2 Manisa: Alaşehir ("Tmoli subra Philadelphiam") *Boisser* s.n (G00330030!).

*Residual syntypes:* C1 Aydın, Aydın Dağı ("in regione subalpina montis Mesogis supra Tralles"), *Boisser* s.n. (G00330034!), B2 Manisa: Alaşehir ("Tmoli pars superior Alaşehir"), *Boisser* s.n. (G00330029!), A8 Gümüşhane,

**Table 1.** Locality information of the taxa using in phylogenetic analysis based on the present (\*) and GenBank (\*\*) accessions. MJ: majority-rule consensus tree.

Taxa	Voucher	Code used in the MJ
<i>T. afghanicus</i> Boiss.	<i>M. Ownbey</i> 274243 (WS)	**AY508175
<i>T. albinervis</i> Freyn & Sint.	<i>V. A. Matthews</i> s.n. (K)	**AY508183
<i>T. armeniacus</i> Kuth.	<i>A. Chechurov</i> s.n. (LE)	**AY645803
<i>T. aureus</i> Boiss.	<i>A. Khochrjakov</i> s. n. (MHA)	**AY645804
<i>T. balcanicus</i> Velen.	<i>A. Khochrjakov</i> s.n. (MHA)	**AY645805
<i>T. bornmuelleri</i> Ownbey & Rech. f.	<i>K. H. Rechinger</i> 1507 (K)	**AY645806
<i>T. brevirostris</i> DC.	261641	**AY508174
<i>T. coelesyriacus</i> Boiss.	USA, <i>M. Ownbey</i> 274106 (WS)	**AY645809
<i>T. collinus</i> DC.	<i>N. Tzvelev</i> s. n.	**AY645810
<i>T. coloratus</i> C.A.Mey.	<i>E. Nazarova</i> s. n. (ERE)	**AY645811
<i>T. cretaceus</i> S.A.Nikitin	<i>Tzvelev</i> N. N.	**HQ456271
<i>T. crocifolius</i> L.	<i>M. Ownbey</i> 274740 (WS)	**AY508180
<i>T. cupanii</i> DC.	Italy, <i>G. Caruso</i>	**KF050386
<i>T. cupanii</i> DC.	USA, <i>M. Ownbey</i> 274133	**EF374138
<i>T. dasyrhynchus</i> Artemczuk	Russia, <i>E. Mavrodiev</i> field collection,	**AY645812
<i>T. dshimilensis</i> K.Koch	Turkey, <i>Coşkunçelebi &amp; Gültepe</i> 301	*CG301
<i>T. dubjanskyi</i> Krasch. & S. A. Nikitin	South Russia, <i>E. Mavrodiev</i>	**AY645814
<i>T. dubius</i> Scop.	<i>M. Ownbey</i> 274197 (WS)	**AY645813
<i>T. elongates</i> S.A.Nikitin	<i>V. Bochkin &amp; I. Rusanovich</i> s. n. (MHA)	**AY645815
<i>T. fibrosus</i> Freyn & Sint.	<i>A. Khochrjakov</i> s.n. (MHA)	**AY645816
<i>T. filifolius</i> Boiss.	<i>A. Grosshejm</i> s. n. (LE)	**AY645817
<i>T. graminifolius</i> DC.	<i>I.A. Gubanov and P. Meshherjakov</i> (LE 381)	**KF050411
<i>T. hayekii</i> (Soó) I. Richardson	<i>I. B. K.Richardson</i> 175685 (WS)	**AY645818
<i>T. heterospermus</i> Schweigg.	<i>A. Skvortzov</i> s. n. (MHA)	**AY508168
<i>T. jesdianus</i> Boiss. & Buhse	<i>I. Gubanov &amp; V. Pavlov</i> s. n. (MW)	**AY645819
<i>T. kemulariae</i> Kuth.	<i>E. Nazarova</i> s. n. 34564E (ERE)	**AY645820
<i>T. kindingeri</i> Adamović	<i>M. Ownbey</i> 251956 (WS)	**AY508178
<i>T. kotschyi</i> Boiss.	<i>K. H. Rechinger</i> s.n. (K)	**AY508181
<i>T. krascheninnikovii</i> S. A. Nikitin	<i>S. Kuthatheladze</i> s. n. (LE)	**AY645821
<i>T. lamottei</i> Rouy	<i>F. Valle &amp; G. Blanca</i> field collection	**AY645823
<i>T. latifolius</i> Boiss. var. <i>angustifolius</i>	Turkey, <i>Coşkunçelebi &amp; Gültepe</i> 62 (Dogan et al. 2014)	*CG62
<i>T. longifolius</i> Boiss.	<i>F. Valle &amp; G. Blanca</i> field collection	**AY645824
<i>T. longirostris</i> Sch. Bip.	USA, <i>M. Ownbey</i> 274106 (WS)	**AY508185
<i>T. longirostris</i> Sch. Bip. var. <i>longirostris</i>	Turkey, GAT-bg250	**AJ633502
<i>T. makaschwilii</i> Kuth.	<i>S. Kuthatheladze</i> s. n. (LE)	**AY645826
<i>T. marginatus</i> Boiss. & Buhse	<i>S. Kuthatheladze</i> s. n. (LE)	**AY645827
<i>T. meskheticus</i> Kuth.	<i>D. Sosnovsky</i> s. n. (LE)	**AY645828
<i>T. minor</i> Mill.	1373086 (USN)	**AY508184
<i>T. mirus</i> Ownbey	USA, 2602 Palouse, WA	**AY458587
<i>T. mirus</i>	<i>F.H. Montgomery, W. Shumovich</i>	**MG220248
<i>T. montanus</i> S. A. Nikitin	<i>K. H. Rechinger</i> s.n (K)	**AY508172
<i>T. nachitschevanicus</i> Kuth.	Azerbaijan, s.n. (LE)	**KF050432

Table 1. (Continued).

<i>T. orientalis</i> L.	M. Ownbey 274728 (WS)	**AY508170
<i>T. olympicus</i> Boiss.	Turkey, Coşkunçelebi & Gültepe 483	**AY645829
<i>T. podolicus</i> (DC.) S. A. Nikitin	V. A. Sagalaev s. n. (VOLG)	**AY645831
<i>T. porrifolius</i> L. s.l.	USA, 25954 (WS)	**EF374149
<i>T. porrifolius</i> s.l.	USA, 359086 (WS)	**EF374152
<i>T. porrifolius</i> s.l.	USA, 291688 (WS)	**EF374154
<i>T. porrifolius</i> s.l.	USA, 37281 (KANU)	**EF374158
<i>T. porrifolius</i> s.l.	USA, 152714 (KANU)	**EF374161
<i>T. porrifolius</i> s.l.	United Kingdom, Cultivated. Mammoth. Unwins Seeds Ltd.	**EF374168
<i>T. porrifolius</i> s.l.	Spain, J. G. A. Reader, Botanical Museum (O)	**EF374172
<i>T. porrifolius</i> s.l.	Sweden, A. Nordstrom s.n.	**EF374178
<i>T. porrifolius</i> s.l.	Turkey, G. Bocquet 2341	**EF374184
<i>T. porrifolius</i> s.l.	USA, Soltis and Soltis collections 2611-2	**EF374209
<i>T. porrifolius</i> s.l.	Canary Islands, M. Ownbey 427 (WS)	**EF374210
<i>T. porrifolius</i> L. subsp. <i>abbreviatus</i> (Boiss.) Coşkunç. & M. Gültepe	Turkey, Coşkunçelebi & Gültepe 184	*CG184
<i>T. porrifolius</i> subsp. <i>abbreviatus</i>	Turkey, Coşkunçelebi & Gültepe 188	*CG188
<i>T. porrifolius</i> subsp. <i>abbreviatus</i>	Turkey, Coşkunçelebi & Gültepe 302	*CG302
<i>T. porrifolius</i> subsp. <i>abbreviatus</i>	Turkey, Coşkunçelebi & Gültepe 337	*CG337
<i>T. porrifolius</i> subsp. <i>abbreviatus</i>	Turkey, Coşkunçelebi & Gültepe 345	*CG345
<i>T. porrifolius</i> L. subsp. <i>australis</i>	Cyprus, Jurg Rothlisberger s.n	**EF374213
<i>T. porrifolius</i> L. subsp. <i>eriospermus</i> (Ten.) Greuter	Turkey, Coşkunçelebi & Gültepe 178	*CG345
<i>T. porrifolius</i> subsp. <i>eriospermus</i>	Turkey, Coşkunçelebi & Gültepe 438	*CG438
<i>T. porrifolius</i> subsp. <i>eriospermus</i>	Turkey, Coşkunçelebi & Gültepe 436 (Gültepe et al. 2015)	*CG436
<i>T. porrifolius</i> L. subsp. <i>longirostris</i> (Sch.Bip.) Greuter	Turkey, Coşkunçelebi & Gültepe 168 (Dogan et al. 2014)	*CG168
<i>T. porrifolius</i> subsp. <i>longirostris</i>	Turkey, Coşkunçelebi & Gültepe 69	*CG69
<i>T. porrifolius</i> subsp. <i>longirostris</i>	Turkey, Coşkunçelebi & Gültepe 122	*CG122
<i>T. porrifolius</i> subsp. <i>longirostris</i>	Turkey, Coşkunçelebi & Gültepe 179	*CG179
<i>T. pratensis</i> L.	USA, M. Ownbey 208347 (WS)	**AY508167
<i>T. pterocarpus</i> DC.	Azerbaijan, E. Nazarova (LE)	**EU124006
<i>T. pterodes</i> Petrović	Turkey, Coşkunçelebi & Gültepe 52 (Gültepe et al. 2015)	*CG52
<i>T. pusillus</i> M. Bieb.	S. Lipshitz s. N. (LE)	**AY645830
<i>T. rechingeri</i> Ownbey	Iran, P. Wendelbo 15553 (W)	**EU391835
<i>T. reticulatus</i> Boiss. & Huet.	E. Nazarova 907 (ERE)	**AY645832
<i>T. ruber</i> S. G. Gmel.	Russia, E. Mavrodiev Field Collection	**AY645833
<i>T. ruthenicus</i> Krasch. & S. A. Nikitin	Russia, E. Mavrodiev Field Collection	**AY645834
<i>T. samaritanii</i> Boiss.	M. Ownbey 274420 (WS)	**AY645835
<i>T. segetus</i> Kuth.	T. Popova s. n. (LE)	**AY645836
<i>T. serotinus</i> Sosn.	S. Kuthatheladze s. n. (LE)	**AY645837
<i>T. sinuatus</i> Avé-Lall.	USA, M. Ownbey 274232 (WS)	**EF374224
<i>T. sinuatus</i>	M. Ownbey 274442 (WS)	**EF374221
<i>T. sinuatus</i>	M. Ownbey 274133 (WS)	**AY645838
<i>T. sosnowskyi</i> Kuth.	Caucasus 1830 det S. Kuthatheladze s.n. (LE)	**AY645839
<i>T. tommasinii</i> Sch. Bip.	M. Ownbey 274702 (WS)	**AY645842
<i>T. trachycarpus</i> S.A. Nikitin	I. A. Gubanov s.n. (MW)	**AY508177
<i>T. undulatus</i> Jacq.	N. K. Schvedchikova s. n (MW)	**AY508171



**Figure 1.** *Tragopogon abbreviatus* (= *Tragopogon porrifolius* subsp. *abbreviatus*) (Coşkunçelebi & M. Gültepe 337). a. Achene drawing. b. Fruiting capitula. c. Flowering capitula d. Phyllaries e. Achene.

uncultivated areas (“champs incultes à Gumusch-khané”), Bourgeau 403 (G00330032!).

#### Emended description

Sparsely floccose to glabrous, biennial 24–92 cm tall, stem branched, base of stem without fibrous leaf remains. Cauline leaves 3.5–33 × 0.25–1.0 cm, linear or linear to lanceolate with flat margin; basal leaves 3.5–35 × 0.20–0.5 cm, linear with flat margin. Peduncles thickened below capitula, involucre sparsely floccose or not. Phyllaries 8, 20–35 × 1.8–4.0 mm in flower and 38–60 × 3.0–8 mm in fruit, lanceolate, acute, longer than flowers. Ligules purple, 19–24 mm long. Achenes (with beak) 19–35 mm long, with 5 longitudinal rows of separate scales and 5 rows of shorter scales between; beak sulcate and 9–19 mm long, equally or longer than achene body and clavate at apex. Pappus 20–30 mm long, pale greyish-brown or straw colour, annulus hairy.

**Phenology:** Flowering in April–July, fruiting in May–July

**Habitat:** *T. abbreviatus* grows in cultivated fields, roadside, graveyards, hill side, and under *Pinus brutia* Ten. Forest between 170 and 1150 m above sea level.

**Chorotype:** Endemic to Turkey

**Distribution:** North, west and south-west of Turkey (Figure 2).

**Vernacular name:** Çayır yemliği (Güner et al., 2012)

#### Lectotypification

After critical examinations on specimens and literature study, we found that the name *T. longirostris* var.

*abbreviatus* has not been typified up to now according to ICN, Article 9.2 (McNeill et al., 2012). Although Boissier (1875) included 7 specimens in the protologue, further examination revealed that 4 of them belong to *T. longirostris* var. *abbreviatus*, 1 specimen belongs to *T. dshimilensis* and 1 specimen to *T. longirostris* var. *brachyphyllum*. In the present study, the sheets stored at G are being taken into account while typifying *T. longirostris* var. *abbreviatus* (= *T. abbreviatus*). Authentic specimens stored at G are now available online via JSTOR Global Plants (JSTOR, 2019). All characteristics of Boissier’s specimens (G00330029!, G00330030!, G00330032!, G00330034!) coincide with the description in the protologue. Also, there are special labels on the sheets written by either collectors or Boissier (1875). Thus, all these samples can be considered as authentic materials according to ICN, Article 9.3 (McNeill et al., 2012). However, for the specimen (G00330030!) collected from B2 Manisa: Alaşehir (“Tmoli subra Philadelphiam”), Boisser s.n is more complete and in a better conservation status. Therefore, it has been selected as the lectotype in the present study (Figure 3).

#### Key to *Tragopogon abbreviatus* and related species

*T. abbreviatus* and related taxa may be inserted in the key adapted from the Flora of Turkey and the East Aegean Islands (Matthews, 1975).

4. Peduncles thickened below flowering capitula

6. Capitula 3–5 cm length; pappus purplish .... *T. coloratus*

6. Capitula (5-) 6–11 cm length; pappus greyish-brown

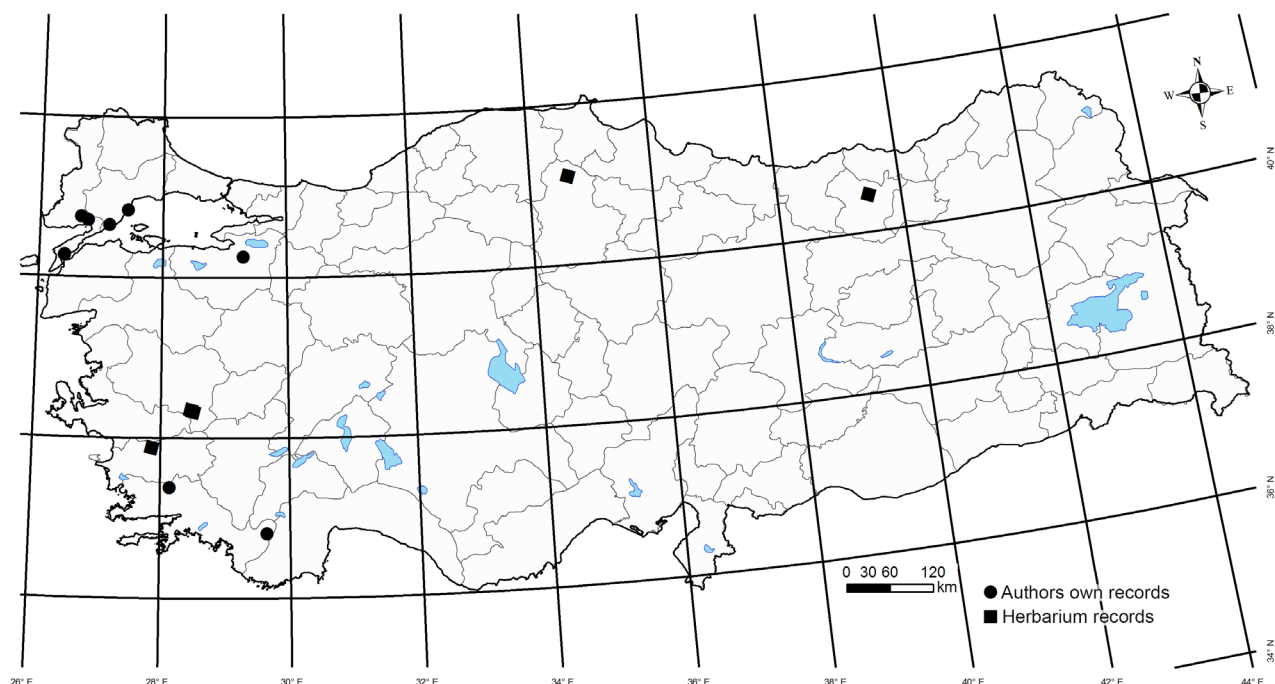


Figure 2. Distribution map of the *Tragopogon abbreviatus* in Turkey.

- 7. Plant perennial, less than 12 cm ..... *T. subacaulis*
- 7. Plant annual or biennial, more than 12 cm
- 8. Achene beak not clavate at apex ..... *T. porrifolius*
- 8. Achene beak clavate at apex
- 9. Phyllaries 8, achene with 5 longitudinal rows of separate scales and 5 rows of shorter scales between .....
- ..... *T. abbreviatus*
- 9. Phyllaries 5–8, achene with ten longitudinal rows of short separate scales .....
- ..... *T. longirostris*

### 3.2. Conservation status

*T. abbreviatus* was recorded from more than 14 localities in Turkey (Figure 2). Each population consists of sufficient number of mature plant individuals. There is no specific threat in the habitat; the habitat is qualitatively good and far from human activities. Additionally, the AOO and EOO are 27,500 km<sup>2</sup> and 290,157 km<sup>2</sup>, respectively. Thus, it should be assessed as the least concern (LC) in the present paper.

### 3.3. Molecular analysis

The aligned data matrix of the ITS region of rDNA (ITS1, 5.8S, ITS2) consists of 687 characters, of which 332 are constant and 205 are parsimony-informative sites including outgroups. Specimens belonging to *T. abbreviatus* have C and A at the position of 512 and 516, respectively. However, the rest examined *Tragopogon* taxa including *T. porrifolius* and *T. coelesyriacus* clades consisting of nucleotides A and G at the same sites. Bayesian phylogram (majority rule consensus tree) of *Tragopogon* based on ITS with JK

support values is presented in Figure 4. According to this phylogram, members of *Tragopogon* were separated from out-group (PP = 1, JK = 100) and fell in 4 distinct subgroups (PP = 1.00, JK = 100). The examined specimens treated under *T. porrifolius* before this study were grouped in the same clade in Subgroup I with good supports (PP = 1.00, JK = 64). However, individuals belonging to *T. porrifolius* subsp. *eriospermus*, *T. abbreviatus* and *T. porrifolius* subsp. *longirostris* were discriminated from each other in the phylogenetic tree.

### 4. Discussion

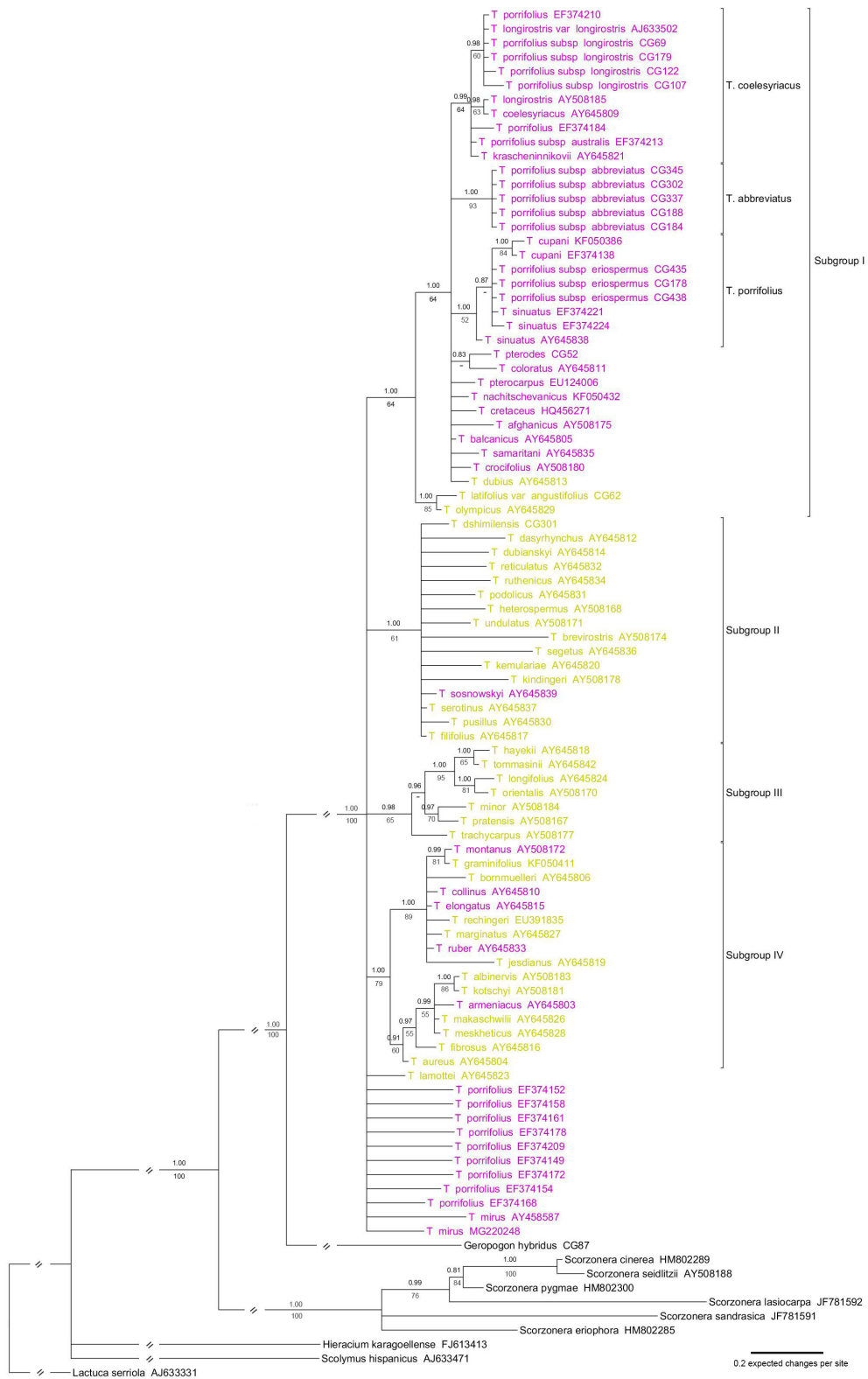
*T. abbreviatus* was firstly described as a variety of *T. longirostris* based on specimens of Boissier, Bourgeau, Calvert, and Koch collected from different parts of Turkey. Although Boissier (1875) did not specify collection details, i.e. collection date, collector number and herbarium, in the protologue, he noted that the beak of *T. longirostris* var. *abbreviatus* was scarcely longer (“rostrum achenio vix longius”), not well 2 times longer (“vel duplo longius”) as in the *T. longirostris* var. *longirostris*. The authentic material of the name is currently stored at G, but a critical examination of these specimens revealed that 4 of them (G 00330029!, G 00330030!, G 00330032!, G 00330034!) clearly belong to *T. abbreviatus* due to achene traits and general habitus. However, specimen collected from A8 Erzurum, Tortum (“in Armenia circa Turtum”, Calvert s.n., G [G00330031!]) differs from the rest of the cited specimens due to unbranched stem and the number of



Figure 3. Lectotype of *T. abbreviatus* stored at G.

phyllaries (6 digit), so it was identified as *T. longirostris* var. *longirostris* (= *T. porrifolius* subsp. *longirostris*) in the present study. The specimens stored at P (P 00720169

photo!) and B (B 100093737!) collected from A8 Rize: Cimil (Ponto Lazico) listed under name of *T. longirostris* var. *abbreviatus* by Matthews (1975) were identified as

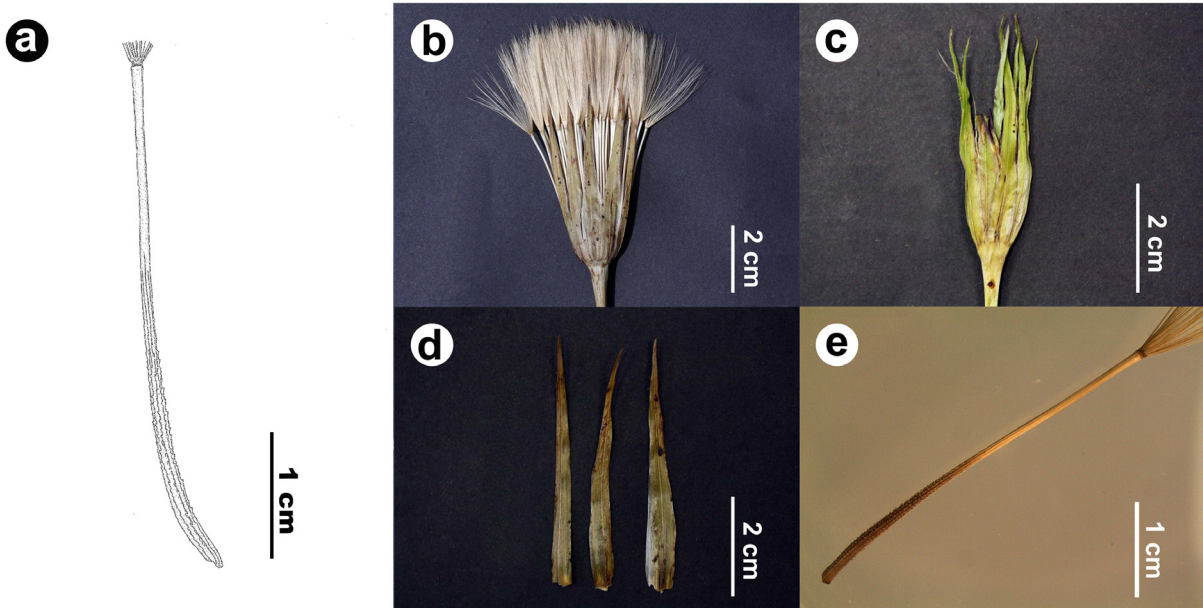


**Figure 4.** Bayesian phylogram (majority rule consensus tree) of *Tragopogon* taxa based on ITS dataset. Support values: Bayesian posterior probability (PP) above branches maximum parsimony jackknife (JK) below branches, dashes (-) designate no supports. Purple and yellow indicate flower colours.

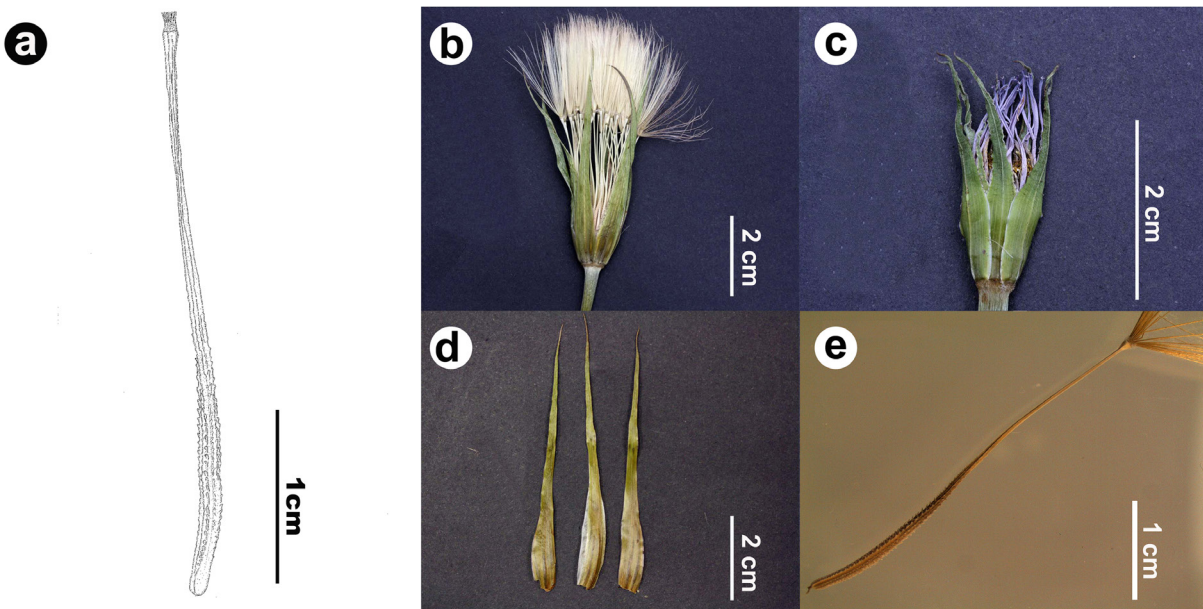


*T. dshimilensis* K.Koch by Coşkunçelebi et al. (2017). Additional specimens of P.H. Davis (*D.* 44523 (E!)) and Trelawny (*Trelawny* 1003 (E!)) listed under the name of *T. longirostris* var. *abbreviatus* by Matthews (1975) in the Flora of Turkey were also identified in the present study as *T. reticulatus* Boiss. & Huet and *T. pterocarpus* DC, respectively.

*Tragopogon abbreviatus* is morphologically related to *T. longirostris* var. *longirostris* and *T. porrifolius* subsp. *eriospermus*. Although the length of achene beak of *T. abbreviatus* is shorter than the closely related taxa, achene beak of *T. abbreviatus* (Figure 1) and *T. porrifolius* subsp. *eriospermus* (Figure 5) is straight and stout contrary to *T. porrifolius* subsp. *longirostris* (Figure 6) characterized



**Figure 5.** *Tragopogon porrifolius* subsp. *eriospermus* (Coşkunçelebi & Gültepe 178) a. Achene drawing. b. Fruiting capitula. c. Flowering capitula d. Phyllaries e. Achene.



**Figure 6.** *Tragopogon porrifolius* subsp. *longirostris* (Coşkunçelebi & M. Gültepe 112) a. Achene drawing. b. Fruiting capitula. c. Flowering capitula d. Phyllaries e. Achene.

**Table 2.** Character comparison of *Tragopogon abbreviatus* with related species.

Traits	<i>T. abbreviatus</i>	<i>T. porrifolius</i> subsp. <i>longirostris</i>	<i>T. porrifolius</i> subsp. <i>eriospermus</i>	<i>T. dshimilensis</i>
<b>Habit</b>	Biennial	Biennial	Annual or biennial	Perennial
<b>Stem</b>	24–92 cm, branched	12–120 cm, branched	24–76 cm, branched	23–80
<b>Peduncle</b>	Thickened below capitula, involucre sparsely floccose or not at base	Thickened below capitula, involucre sparsely floccose or not at base	Thickened below capitula, involucre sparsely floccose or not at base	Not or slightly thickened, involucre floccose
<b>Leaves</b>	Cauline leaves 3.5–33 × 0.25–1.0 cm, linear or linear to lanceolate with flat margin; basal leaves 3.5–35 × 0.20–0.5 cm, linear with flat margin	Cauline leaves 5–26 × 0.24–1.2 cm, linear or linear to lanceolate with flat margin; basal leaves 11–25 × 0.27–0.9 cm, linear with flat margin	Cauline leaves 4–17 × 0.65–1.8 cm, linear or linear to lanceolate with flat margin; basal leaves 14–29 × 0.4–1.0 cm, linear with flat margin	Cauline leaves 5.0–8.5 × 0.5–2.5 cm, lanceolate/ovate, margin flat, basal leaves 14–30 × 0.35–1.0 cm, lanceolate, margin flat.
<b>Phyllaries</b>	8, 20–35 × 1.8–4.0 mm in flower and 38–60 × 3.0–8 mm in fruit lanceolate, acute, longer than flowers	5–8, 22–37 × 2.5–6.0 mm in flower and 42–95 × 4.5–15 mm in fruit lanceolate, acute, longer than flowers	8–9, 20–32 × 2.3–5.5 mm in flower and 45–63 × 4.2–7.8 mm in fruit lanceolate, acute, longer than flowers	7–11, 18–30 × 2.5–4.3 mm in flower and 14–40 × 2.7–6 mm in fruit, lanceolate, acute, equal to or shorter than flowers.
<b>Ligules</b>	19–24 mm, purple	8–16 mm, purple	13–18 mm, purple	17–25 mm, yellow
<b>Achene</b>	19–35 mm, with five longitudinal rows of separate scales and five rows of shorter scales between	29–54 mm, with ten longitudinal rows of short separate scales	35–47 mm, with ten longitudinal rows of short separate scales	17–25 mm, with 10 longitudinal rows of slightly unequal scales
<b>Beak</b>	9–19 mm long, equal to or longer than achene body and clavate at apex	17–34 mm, sulcate, longer than achene body and clavate at apex	14–27 mm, not sulcate, equal, shorter or longer than achene body and not clavate at apex	5–13 mm long, equal or shorter than achene body and clavate at apex.
<b>Annulus</b>	Hairy	Hairy	Hairy	Hairy
<b>Pappus</b>	20–30 mm, pale greyish-brown or straw coloured	23–35 mm, pale greyish-brown or straw coloured	25–35 mm, pale greyish-brown or straw coloured	Pappus 15–25 mm long, fawn-coloured
<b>Achene type according to Sukhorukov &amp; Nilova (2015)</b>	Group V, but shorter achene length	Group V	Group V, but beak not angled	Group VII and Group VIII

by a thinner and sometimes curved beak as well (Table 2). Additionally, the achene beak is typically sulcate in *T. longirostris* var. *longirostris* and *T. abbreviatus* (Figure 1, Figure 6), and not sulcate in *T. porrifolius* subsp. *eriospermus* (Figure 5). More detailed morphological comparisons are given in Table 2.

According to Gültepe et al. (2015), the chromosome number of *T. abbreviatus* is  $2n = 2x = 12$  based on 4 different specimens. However, detailed morphological investigations of these specimens stored at KTUB revealed that none of them belong to *T. abbreviatus*. Pollen

grains with oblate spheroidal shape were reported in *T. abbreviatus* by Gültepe et al. (2018) based on specimens collected from Muğla: Seki, Coşkunçelebi & M. Gültepe 345! (Appendix).

The present phylogenetic analysis is a preliminary study examining a large number of *Tragopogon* accessions from Turkey. The molecular phylogenetic analysis based on the ITS data set with multiple sampling supported the monophyly of the genus *Tragopogon* as indicated in recent molecular studies (Mavrodiev et al., 2004; 2005). ITS dataset also confirmed that the genus *Tragopogon* is

distinct from the closely related genus *Gerepogon* L. and other members of Subtribe *Scorzonerinae* as stated by Mavrodiev et al. (2004). As seen in Figure 4, 4 subgroups appeared in the phylogenetic tree. All sub-groups consist of yellow and/or purple-flowered species. Similarly, both (all) sub-groups are not discriminated on features of peduncles below the capitula (all sub-groups consist of swollen peduncles). According to the phylogenetic tree, 5 accessions belonging to the *T. abbreviatus* are clustered with strong support (PP = 1.00, JK = 93). Thus, present phylogenetic tree inferred from the dataset of our own and GenBank support the status of *T. abbreviatus* as a distinct species, and also distinguish *T. longirostris* var. *longirostris* from *T. porrifolius* as previously suggested by Greuter (2003). Gültepe et al. (2016) also made similar taxonomical comment about *T. longirostris* var. *longirostris*. As seen in molecular phylogenetic tree (Fig. 4), *T. longirostris* and *T. coelesiarius* (Boissier, 1849) are sister taxa so 2 of them should be treated under the name of *T. coelesiarius* takes priority over that the names of *T. longirostris* (Feinbrun-Dothan, 1978; Dimopoulos et al., 2016). Besides, morphological examination of the holotype of *T. coelesiarius* stored at G-Boiss (G00330023 photo!) shows that it belongs to *T. longirostris* as stated by Boissier (1875). However, *T. coelesiarius* clade consists of 2 recently accepted taxa *T. porrifolius* subsp. *australis*, *T. porrifolius* subsp. *longirostris* and *T. krascheninnikovii* (Nikitin, 1933) proposed as a synonym to *T. longirostris* by

Rechinger (1977). It looks that the *T. coelesiarius* clade is a monophyletic complex including several unresolved taxa so further studies need to solve the infraspecific taxonomy of this clade (Fig. 4).

Additionally, as seen in the phylogenetic tree (Figure 4), some representatives of *T. porrifolius* were aggregated into Subgroup I and rest of accessions are appeared in polytomy. This situation coincides with the view of Mavrodiev et al. (2007), who indicated that *T. porrifolius* is a polyphyletic complex based on combined ITS and ETS datasets. Present findings also supplied additional molecular evidence for *T. dshimilensis*, previously accepted as a synonym of *T. abbreviatus* by Boissier (1875). As seen in Figure 4, *T. dshimilensis* is located in the Subgroup II with strong support (PP = 1.00, JK = 61) rather than *T. abbreviatus*. In conclusion, the present study has shown that *T. abbreviatus*, *T. porrifolius* subsp. *longirostris* and *T. coelesiarius* are not the members of *T. porrifolius* complex contrary to what stated in Greuter (2003). Besides, this complex includes in Turkey only *T. porrifolius* subsp. *eriospermus* contrary to what reported by Coşkunçelebi and Gültepe (2012).

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**Appendix.** Examined specimens in the present study.

*Tragopogon abbreviatus*: A1 Edirne: Keşan, 5 km south-east of Bahçeköy, 165 m, 20 May 2012, *Coşkunçelebi & M. Gültepe* 337 (KTUB), 40°44'N, 026°40'E; A1 Çanakkale: Gelibolu, above Yalova Village, near graveyard, 71 m, 02 Jun 2011, *Coşkunçelebi & M. Gültepe* 184 (KTUB), 40°15'N, 026° 24'E; A1 Çanakkale: Gelibolu, above Yalova Village, 110 m, 18 May 2013, *Coşkunçelebi & M. Gültepe* 338 (KTUB), 40°16'N, 026°24'E; Between Gelibolu and Keşan, Koru Mountain, 246 m, 18 May 2013, *Coşkunçelebi & M. Gültepe* 441 (KTUB), 40°42'N, 026°47'E; A1 Tekirdağ: Between Sofuköy and Şarköy, 222 m, 03 Jun 2011, *Coşkunçelebi & M. Gültepe* 188 (KTUB), N40°38'N, 027° 00'E; Between Barbaros and Kumbağ, Mürefte road, 361 m, 29 Jun 2011, *Makbul 302 & Coşkunçelebi* (KTUB) 40°50'N, 027°25'E A2 Bursa: Gürsu, between Narlıdere and Kayacık, 341 m, 01 Jun 2011, *Coşkunçelebi & M. Gültepe* 177 (KTUB), 40°15'N, 029°18'E; C2 Muğla: Between Aydın and Muğla, 458 m, *Pinus* sp. clearance, 19 May 2011, *Coşkunçelebi & M. Gültepe* 161 (KTUB), 37°22'N, 028°08'E; C2 Muğla: Seki, ski center road separation, roadsides, 1152 m, 23 May 2012, *Coşkunçelebi & M. Gültepe* 345 (KTUB), 36°48'N, 029°38'E; A5 Sinop: Kargı, under Kös Mountain, sandy, gravelly hills, 400 m, 01 Jul 1969, *Tobey 2726* (E), 41°81'N, 34°26

*Tragopogon porrifolius* subsp. *eriospermus*: A1 Çanakkale: Gökçeada, between city center and the hill of Sedef, 10 m, 5 May 1975, Ö. Seçmen 349 (EGE); Bozcaada, 1 km from the city center, main road, 5 m, 13 April 1977, Ö. Seçmen 2374 (EGE); A2 (E) İstanbul: Sarıyer, Belgrad Forest, 1951, İ. Akbaş (ISTO); A2 Bursa: Mudanya, southern of Mudanya, 237 m, 02 Jun 2011, 40°21'N, 028°52'E, *Coşkunçelebi & M. Gültepe* 178 (KTUB); Mudanya, above Mudanya, clearance of *Olea europae* L. 326 m, 18 May 2012, 40°21'N, 028°50'E, *Coşkunçelebi & M. Gültepe* 328 (KTUB); Mudanya, between Mudanya and Zeytinbağı (Trilye), roadsides, 50 m, 17 May 2013, 40°22'N, 028°49'E, *Coşkunçelebi & M. Gültepe* 435 (KTUB); Mudanya, Zeytinbağı (Trilye), 72 m, 17 May 2013, 40°22'N, 028°47'E, *Coşkunçelebi & M. Gültepe* 436 (KTUB); Mudanya, above Çepni Village, meadows, 484 m, 17 May 2013, 40°20'N, 028°49'E, *Coşkunçelebi & M. Gültepe* 438 (KTUB); B1 Balıkesir: Ayvalık, Alibey island, Patriça, Ayışığı Monastery, 10 m, 17 April 1998, K. Alpınar 75065 (ISTE), Ayvalık, Pınar island, 5 m, 10 May 1996, K. Alpınar 71778 (ISTE); B1 İzmir: Bergama, 400 m Dudley (D.34839) (E); Italy: In pascuis = Agnano, 1830, Gay, J. s.n. (K000797303 photo).

*Tragopogon porrifolius* subsp. *longirostris* (= *T. longirostris* var. *longirostris*): A1 Çanakkale: between Biga and Lapseki, Lapseki, roadsides, 74 m, 02 Jun 2011, 40° 21'N, 028° 52'E, *Coşkunçelebi & M. Gültepe* 181 (KTUB); Gelibolu to İstanbul, 55 m, 03 Jun 2011, 40°32'N, 026°47'E,

*Coşkunçelebi & M. Gültepe* 187 (KTUB); A1 Tekirdağ: Mürefte, Ganos Mountain, 920 m, 03 Jun 2011, 40°47'N, 027° 17'E, *Coşkunçelebi & M. Gültepe* 191 (KTUB); A1 Balıkesir: Marmara Island, 0–10 m, 11 May 1978, E. Tuzlacı 39354 (ISTE); A2 Bursa: Between Yenişehir and İznik, roadsides, clearances of *Quercus* sp. and *Robinia* sp., 332 m, 18 May 2012, 40°18'N, 029°40'E, *Coşkunçelebi & M. Gültepe* 325 (KTUB); A2 İstanbul: Beykoz, Karlitepe, 223 m, 16 May 2012, 41°07'N, 029°07'E, *Coşkunçelebi & M. Gültepe* 367 (KTUB); A3 Bilecik: nr Bilecik in Karasu valley, 300-400 m, Bornm. 14359; A4 Ankara: Kızılcahamam, Soğuksu National Park, Çakmaklı, Doruk Tepe location, stony places, 1663 m, Ö. Eyüboğlu 1663 (GAZİ); A4 Kırıkkale: Between Kırıkkale and Ankara, Elmadağ, Gürlevik valley, 968 m, 07 Jun 2010, N39°56', 033°16'E, *Coşkunçelebi & M. Gültepe* 122 (KTUB); A5 Çorum: Kargı, between Hacıhamza-Abdullah plateau, 600 m, 16 May 1975, M. Kılınç 2079 (ANK); A5 Amasya: Taşova, between Uluköy and Alparslan, 395 m, 11 May 2012, 40°47'N, 036°20'E, *Coşkunçelebi & M. Gültepe* 320 (KTUB); Manisa: SpilDağı, place of At Alanı, roadsides, 1000 m, 22 May 2011, 38°35'N, 027°25'E, *Coşkunçelebi & M. Gültepe* 168 (KTUB); A8 Gümüşhane: Gümüşhane, 3 km south of Bayburt, 1620 m, 21 June 1968, F. Meyer, G. Oğuz (EGE); B1 İzmir: Çamaltı saltern, Çilazmak kiddle, rocky places, 15 May 1994, N. Keyikçi 89 (EGE); Bornova, Çimentaş, roadside, 15 May 1966, H. Peşmen 1044 (EGE); between Çeşme and Ilıca, 8 May 1966, İ. Regel (EGE); B2 Uşak: Between Uşak and Gediz, roadsides, under *Pinus* sp. forest 698 m, 12 Jul 2012, 38°50'N, 029°16'E, *Coşkunçelebi & M. Gültepe* 385a (KTUB); B3 Eskişehir: Sündiken mountain, Kalolmak stream, 1400–1600 m, 12 June 1971, T. Ekim 25 (ANK); Sündiken Mountain, Karaöz stream, 1100 m, 23 May 1971 T. Ekim 25 (ANK); B3 Afyon: Boyat, east slopes of Asan Tepe, 1340 m, 29 June 1975, M. Vural 263 (ANK); B3 Isparta: Eğridir, 940 m, 20 May 1966, C. Regel, H. Peşmen (EGE); B3 Afyon: Dazkırı, Maymun Mountain, Çatal burun, sandy places, 1150 m, 10 May 1984, Z. Aytaç 1232 (GAZİ); B4 Ankara: Between Ankara and Şereflikoçhisar, 10 km to Şereflikoçhisar, slopes, 908 m, 24 May 2010, 39° 00'N, 033° 27'E, *Coşkunçelebi & M. Gültepe* 107 (KTUB); B5 Yozgat: Akdağmadeni, northwest of Tekkegüney village, cultivated areas, 1388 m, 06 Jun 2010, 39° 40'N, 035°48'E, *Coşkunçelebi & M. Gültepe* 121 (KTUB); B5 Nevşehir: between Nevşehir and Ortahisar, volcanic tuff, roadside, under trees, 1250 m, 21 May 1989, N. Adıgüzel (GAZİ); B6 Kahramanmaraş: Göksun, Ericcek, near Kınikkoz, 1952 m, 22 Jul 2011, 38° 01'N, 036°49'E, *Coşkunçelebi & M. Gültepe* 283 (KTUB); B6 Kayseri: Between Sarız and Yeşilkent, Binboğa Mountains, on the way of the Tekke Kayası, 1734 m, 15 Jul 2010, 38° 17' N, 036°28'E, *Coşkunçelebi & M. Gültepe* 153 (KTUB); B7 Erzincan: Kemaliye, between Sıra Konak and Sarı

Çiçek Mountain, 1738, 15 Jun 2011, 39°12' N, 038°28'E, Coşkunçelebi & M. Gültepe 214 (KTUB); B7 Elazığ: Haroğlu village, stony places, north slope, 1400 m, 7 July 1980, H. Evren 398 (ANK); B9 Van: Between Gevaş and İşkirt Village, roadsides, 1677 m, 09 Jun 2011, 38°18'N, 043°06'N, Coşkunçelebi & M. Gültepe 210 (KTUB); B9 Bitlis: Around Tanrıyar village, forest clearance, 1600, 04 May 2003, AA 2962 (VANF); C1 Aydın: Söke, ruins of Priene, 19 June 1971, İ. Akbaş 25343 (ISTF); C1/C2 Muğla: Road of Marmarisa to Ağlan, roadsides, 10 m, 21 May 2011, Coşkunçelebi & M. Gültepe 166 (KTUB); C2 Aydın: Çine, Mandıra Hill, 1650 m, 11 July 1992, Melahat Evcin 10059 (KATO); C2 Denizli: Babadağ, between Sarayköy and Acidere, roadside, 1100 m, 08 May 1996, S. Oluk, Ö. Seçmen, Y. Gemici (EGE); C3 Burdur: Between Burdur and Çeltikçi, 1204 m, 26 May 2010, 37°37'N, 030°22'E. 493, Coşkunçelebi & M. Gültepe 112 (KTUB); C3 Konya: Road of Seydişehir to Akseki, 28 May 2010, 37°19'N, 031°51'E, Coşkunçelebi & M. Gültepe 115 (KTUB); C3 Antalya: Kemer, Kuzdere plateau on Tahtali mountain, 900 m, D. 15159; Manavgat, Çolaklı village, dune of Petrokent buildings, 0–10 m, 15 April 1991, T. Ekim 9355 (GAZİ); C4 İçel: Anamur, between Anamur and Kazancı, Kızıllalan location, 1300 m, 18 May 1985, H. Sümbül 3285 (ANK); C5 Konya: Ereğli, Aydos mountain, protected area of Ayrancı Damp, steppe, limestone bedrock, 1300 m, 19 May 1973, S. Erik 979 (HUB); C5 Adana: Road of Adana to Pozantı, roadsides, 1236 m, 10 Jun 2009, 37°19'N, 034°48'E, Coşkunçelebi & M. Gültepe 60 (KTUB); C6 Gaziantep: Between Nurdağı and Gaziantep, before coming to Akyokuş Pass, roadsides, 1065 m, 16 May 2010, 37°10'N, 036°58'E, Coşkunçelebi & M. Gültepe 91 (KTUB); C6 Hatay: Road of Antakya to İskenderun, road separation of Kırıkhan, 5 km to İskenderun, 385 m, 16 May 2010, 36°28'N, 036°17'E, Coşkunçelebi & M. Gültepe 90 (KTUB); C9 Siirt: between Şirvan and Pervari, 28 km to Pervari, ocher area, calcareous rocky land, 1350-1400 m, 14 June 1980, A. Güner 2424- M. Koyuncu (HUB); Syrian Arab Republic: Syrie, 22.5.1841, Kotschy, K. G. T. 245a (G00330026 photo); Lebanon: Liban, Apr.-Mai 1846, Boissier, A. s.n., (G00330023 photo); Egypt: Egypte, 0.6.1832, Bové, N. 115 (G00473996 photo)

*Tragopogon dshimilensis*: A4 Kastamonu: N side of Ilgaz Da., 1700 m, Davis & O. Polunin, D. 25073 (E); Ilgaz

Mountains, 1600 m, 18.09.1981, Y. Akman, E. Yurdakulol & M. Demiriz (ANK); A7 Trabzon: Maçka, Zigana, Old Gümüşhane road, under *Pinus sylvestris* forest, 1870 m, 26.05.2012, 40° 38' N, 039° 23' E, Coşkunçelebi & M. Gültepe 355 (KTUB); Between Trabzon and Gümüşhane, entrance of Zigana tunnel from Gümüşhane side, under the forest near roads, 11.07.2013, 40° 38' 16" N, 039° 22' 57" E, Coşkunçelebi & M. Gültepe 450 (KTUB); A7 Gümüşhane: Kürtün, between Sögüteli and Kazıkbeli, pastures, 1965 m, 30.06.2010, 40° 53' N, 039° 00' E, Coşkunçelebi & M. Gültepe 137 (KTUB); Kürtün, Sarı Baba village, 1775 m, 04.08.2011, 40° 03' 13" N, 039° 01' 32" E, Coşkunçelebi & M. Gültepe 297 (KTUB); A8 Trabzon: Uzungöl, Demirkapı, alpine, 2100 m, 25.07.2009, Coşkunçelebi & M. Gültepe 82 (KTUB); A8 Rize: İkizdere, Cimil, Ortaköy, road sides, 1900 m, 23.07.2009, 40° 45' N, 040° 45' E, Coşkunçelebi & M. Gültepe 81 (KTUB); Cimil, 1848 m, 28.07.2011, 40° 44' N, 040° 44' E, Coşkunçelebi & M. Gültepe 301 (KTUB); İkizdere, Anzer, between down and up Anzer, 1982 m, 28.07.2011, 40° 37' N, 040° 31' E, Coşkunçelebi & M. Gültepe 302 (KTUB); İkizdere, Anzer, 1715 m 19.06.2012, 40° 37' N, 040° 32' E, Coşkunçelebi & M. Gültepe 359 (KTUB); Çamlıhemşin, between Hisarcık Köy and Sıraköy, alpine zone; 1600–2000 m, A. Güner 4013 (ANK); İkizdere, Ballıköy (Anzer), meadows, 2150 m, 19.07.1984, M. Vural 3079 (ANK); İkizdere, Ballıköy, 1950 m, 27.07.1991, A. Güner, T. Ekim, M. Koyuncu & H. Karaca (ANK); İkizdere, Cimil, Yetimhoca Village, roadsides, 1850 m, 24.08.1985, A.Güner & M. Vural (AG 6932) (ANK); İkizdere, Cimil, Cermanimen Plateau, 2800 m, 23.07.1984 A. Güner 6029 (ANK) A9 Artvin: Şavşat, Yavuz Village, pastures, 1449 m, 10.07.2008, 41° 13' N, 42° 23' E, Coşkunçelebi & M. Gültepe 35 (KTUB); Şavşat, Kocabey, Sulanak area, 1616 m, 10.07.2008, 41° 14' N, 42° 25' E, Coşkunçelebi & M. Gültepe 37 (KTUB); Şavşat, Meşeli village, 1591 m, 18.07.2012, 41° 18' N, 042° 28' E, Coşkunçelebi & M. Gültepe 417 (KTUB); A9 Kars: Susuz, 8 km from Kars, fallow field, 05.07.1957 Davis & Hedge (D.30585) (ANK); Kars: Sarıkamış, 2100 m, 07.07.1997, Davis & Hedge (D.30779) (ANK); Ziyaret Dağı, above Yalnızçam, igneous rocky slopes, 29.06.1957, Davis & Hedge (D.30324) (ANK); Yalnızçam, very stony volcanic slopes, 1900 m, 16.06.1957, Davis & Hedge (D.29615) (ANK).