
TAXONOMIC REVISION OF
TRisetum SECT. *TRisetum*
(POACEAE: POOIDEAE:
AVENINAE) FROM EURASIA AND
NORTH AFRICA¹

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ABSTRACT

A taxonomic revision of *Trisetum* Pers. sect. *Trisetum* is presented. We include descriptions and synonyms of each taxon from a study of 894 vouchers from 45 herbaria. Detailed morphometric descriptions, illustrations, distribution maps, an identification key, and habitat data are given for each taxon. Morphometric variation of the main characters is shown by box plots. Thirty-one names are lectotypified. Two neotypes are designated. We recognize eight species of *Trisetum* in the section: *T. alpestre* (Host) P. Beauv., *T. altaicum* Stephan ex Roshev., *T. bertolonii* Jonsell, *T. flavescens* (L.) P. Beauv., *T. fuscum* Schult., *T. glaciale* (Bory) Boiss., *T. gracile* (Moris) Boiss., and *T. laconicum* Boiss. & Orph. Two infraspecific taxa of *T. flavescens* are recognized (*T. flavescens* subsp. *flavescens* and *T. flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard). Six of the eight species of *Trisetum* sect. *Trisetum* are endemic to the different European mountain ranges, while *T. altaicum* grows in the Altai and Tian Shan Mountains, and in the mountains of northern Mongolia and southern Russia, and *T. flavescens* is widespread in temperate regions of Europe, western Asia, and northern Africa. Vegetative propagation by pseudoviviparism is observed for the first time in specimens of *T. flavescens* subsp. *flavescens*.

Key words: Aveninae, Europe, lectotypification, neotype, northern Africa, taxonomy, *Trisetum*.

Trisetum Pers. is one of the 18 genera of perennial grasses classified in the Aveninae J. Presl subtribe (Poeae tribe, subfamily Pooideae Benth.; cf. Tzvelev, 1989; GPWG, 2001; Soreng et al., 2003, 2007, 2015, 2017). This genus includes about 50 species that often form a significant part of the temperate and cold grasslands of the Northern Hemisphere, although they are also found in South America, Australia, and New Zealand. Their habitat varies according to their wide distributional range, and its species are found in open grasslands to shady areas of forests, high mountain meadows, and even the tundra (Hultén, 1959; Chrtek, 1965; Clayton & Renvoize, 1986; Randall & Hilu, 1986; Watson & Dallwitz, 1992; Finot et al., 2004, 2005a, 2005b; Barberá et al., 2017a, 2017b). *Trisetum flavescens* (L.) P. Beauv., one of the species included in the section studied here, is of great economic interest as a fodder plant for both wild and domestic livestock.

To date, detailed taxonomic revisions of only the American and New Zealand species of this genus have been carried out (Edgar, 1998; Finot et al., 2004, 2005a, 2005b), in addition to those recently published by us on two Eurasian sections, *Trisetum* sect. *Acrospelion* (Besser) Pfeiff. and *Trisetum* sect. *Sibirica* (Chrtek) Barberá (Barberá et al., 2017a, 2017b). Six of the species of the section to which we dedicate the present work, *Trisetum* sect. *Trisetum*, are endemic to Europe, while both *T. altaicum* and the most ubiquitous *T. flavescens* reach eastern Asia.

Traditionally, *Trisetum* has been divided into two sections: *Trisetum* sect. *Trisetum* and *Trisetum* sect. *Trisetaera* Asch. & Graebn. A review of the history of the genus can be found in Finot et al. (2005a) and Barberá et al. (2017a). Chrtek (1965, 1967a, 1968) carefully studied the European species of *Trisetum*, proposing new infrageneric divisions of the genus.

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Chrtek (1965) divided the European species into four subgenera (*Trisetum* subg. *Trisetum*, *Trisetum* subg. *Distichotrisetum* Chrtek, *Trisetum* subg. *Glaciotrisetum* Chrtek, and *Trisetum* subg. *Graciliotrisetum* Chrtek), based mainly on the variation in vernation (conduplicate or convolute) and on anatomical characters of leaves and roots. At the same time, Chrtek (1965) divided the subgenus *Trisetum* into five sections (sections *Trisetum*, *Trisetaera*, *Rigida* Chrtek, *Hispanica* Chrtek, and *Carpativa* Chrtek). Apart from the anatomical characters, *Trisetum* sect. *Trisetum* was separated by its lax panicles and short ligules and included *T. flavescens*, *T. alpestre* (Host) P. Beauv., *T. sibiricum* Rupr., *T. agrostideum* (Laest.) Fr., and *T. baregense* Laffitte & Miégev. The monotypic *Trisetum* sect. *Carpativa*, established for *T. fuscum* Schult. of the Carpathian Mountains, was characterized by its longer ligules and by the hairiness of the lemmas, palea keels, and awns.

Tzvelev (1976) simplified the classification of *Trisetum* by not addressing the anatomical characters used by Chrtek. Tzvelev (1976) recognized three sections (*Rigida*, *Trisetaria*, and *Trisetum*) in his treatment of *Trisetum* for Russia. He characterized the different sections by the type of growth of underground and vegetative shoots, leaf disposition, panicle density, and rachilla and callus hair length. He included seven species within *Trisetum* sect. *Trisetum*: *T. ciliare* (Kit. ex Schult.) Domin, *T. turcicum* Chrtek, *T. sibiricum*, *T. flavescens*, *T. alpestre*, *T. altaicum* Stephan ex Roshev., and *T. agrostideum*.

Later, Probatova (1979), in her study of the genus from the Caucasus, arranged *Trisetum* sect. *Trisetum* into four subsections: the monotypic *Trisetum* subsect. *Carpativa* (Chrtek) Prob. (including *T. ciliare*); subsection *Trisetum* (including *T. flavescens* s.l., *T. parvispiculatum* (Tzvelev) Prob., and *T. alpestre*); subsection *Sibirica* (Chrtek) Prob. (including *T. sibiricum* and *T. turcicum*); and subsection *Agrostidea* Prob. (including *T. altaicum* and *T. agrostideum*). The subsections were characterized by the type of growth of underground and vegetative shoots, lemma apex, callus, awn and palea keel hair length, and anther length.

Another relevant floristic study, which covers most of the species of *Trisetum* sect. *Trisetum*, is the Flora Europaea treatment by Jonsell (1980). However, he did not recognize any sections.

After studying *Trisetum* sect. *Acrospelion* and *Trisetum* sect. *Sibirica* (Barberá et al., 2017a, 2017b), we present here the taxonomic revision of *Trisetum* sect. *Trisetum*, which is the third of our ongoing monograph on the genus *Trisetum* in Eurasia and northern Africa. *Trisetum* sect. *Trisetum* is here characterized by having panicles lax to somewhat dense or compact, spikelets usually greenish or purplish, callus with short hairs, awns geniculate or bent, rarely straight, and ovaries

usually hairy apically. The most serious taxonomic problems of the group have been the delimitation of the section and the treatment given to *T. flavescens*, a very variable species that historically has been split into many taxa. Our final classification is also based on our current studies on molecular data, which will be published in the near future. This study, based on a thorough review of herbarium material and living plants, is the first to provide a detailed taxonomic scheme of the whole section *Trisetum* as we currently understand it based on our morphological and molecular surveys of the whole subtribe Aveninae.

MATERIALS AND METHODS

This revision is based on the study of 894 herbarium specimens from the following herbaria: AAH, ARAN, B, BC, BCN, BM, BOLO, C, F, FI, G, GB, GDA, GH, GOET, H, HBG, JE, K, KRAM, L, LE, LW, M, MA, MW, MO, MPU, NY, O, P, PE, PH, PR, PRC, RO, S, SEV, UPS, US, W, and WU (acronyms according to Thiers, 2017). Photos of specimens from HNWP were also examined on the website of Chinese Virtual Herbarium (<www.cvh.ac.cn>), and specimens from CAI, DAO, FR, and KFTA on the website of Global Plants (JSTOR, <<https://plants.jstor.org/>>). An index of numbered collections is presented in Appendix 1.

One hundred-seventy specimens were used for the morphometric analyses, as operational taxonomic units, selected to represent, as far as possible, the geographic range and morphological variability of the taxa. Fifty-nine quantitative characters were recorded using a Mitutoyo CD-15DCX digital vernier caliper (Mitutoyo, Kawasaki, Japan) on 20 specimens of each species when available. Spikelet measurements were taken on the distal spikelet from the longest branch of the second node of the panicle; floret measurements were taken from the basal floret of the selected spikelet. Leaf blade width was measured 1 cm above the ligule insertion. The rachilla internode between the first and second flowers is also referred to as “rachilla.” Each character was analyzed for its minimum, maximum, and lower and upper quartiles using the Statistica package. Quantitative and qualitative characters are also used in the identification key and descriptions. Minimum and maximum values are noted in brackets, and the lower and upper quartile values (between the 25th and 75th percentiles) are noted outside. Transverse sections of leaf blades were prepared by hand using the uppermost caulinar leaf; they were stained with FASGA (fucsina, alcian blue, safranina, glicerina, agua) (Tolivia & Tolivia, 1987) and photographed with a Nikon SMZ1000 optical microscope (Nikon, Tokyo, Japan). For leaf anatomy, the terminology of Ellis (1976, 1979) was used.

Additional data on the habitat, distribution, and chromosome numbers were checked from literature and collection labels. Species distribution maps were made using ArcGis v.9.3 (ESRI). The material studied is listed under each species in the taxonomic treatment below. The geographic coordinates were derived, in almost all cases, using the GeoNames database (<www.geonames.org>).

RESULTS

MORPHOLOGY OF *TRisetum* SECT. *TRisetum*

Habit and stem

These are perennial grasses commonly with a loose habit, with short to long rhizomes and thus well-isolated shoots, sometimes densely tufted as in *Trisetum glaciale* and *T. gracile*.

The stems are straight in most of the species, except in *Trisetum gracile*, which has stems often bent at its blackish nodes, and *T. bertolonii*, which sometimes has the upper part of the stems curved. The stems are usually shorter than 60 cm, except those in *T. laconicum*, which can reach more than 80 cm, and *T. flavescens* subsp. *flavescens*, which can rarely exceed these sizes. Furthermore, *T. glaciale* and *T. gracile* are the shortest species ([3–]8.8–14.4[–19.5] cm and [4.5–]8.9–12.5[–18.2] cm, respectively).

Most of the species of the section produce extravaginal tillers, being intravaginal in *Trisetum bertolonii* and *T. laconicum*, rarely in *T. fuscum*. *Trisetum glaciale* is the only species that always presents intravaginal branching. The culms are always glabrous in *T. altaicum*, *T. fuscum*, and *T. laconicum*, sometimes puberulous in some parts in *T. alpestre*, *T. gracile*, and *T. glaciale*, rarely so in *T. flavescens*. *Trisetum bertolonii* always has pubescent culms. The number of nodes varies between two and six (seven). The culm internodes are mostly concentrated in the lower part of the culm in most species, although *T. flavescens*, *T. fuscum*, and *T. laconicum* have relatively elongated lower internodes and nodes well separated along the culm.

Leaves

In *Trisetum* sect. *Trisetum*, as in the rest of the genus, the different characters of the leaf sheaths and leaf blades are variable in the same plant, depending on whether they are the basal or top culm leaf blades, or if they are young or mature (Barberá et al., 2017a, 2017b).

Leaf sheaths

Basal leaf sheaths are sparsely to densely pubescent, sometimes glabrous in *Trisetum bertolonii* and *T. gracile*, rarely in *T. alpestre* and *T. flavescens*. The oldest basal leaf sheaths usually decay into fibers in most of the

species, forming a dense layer of decomposed sheaths in *T. glaciale* and *T. gracile*. The latter two species have the leaf sheaths distinctly veined and are somewhat inflated in *T. gracile*.

Top culm leaf sheaths are always glabrous in *Trisetum bertolonii*, *T. gracile*, and *T. laconicum*, sometimes with hairs on the upper part in *T. fuscum* and sometimes pubescent in *T. alpestre* and *T. altaicum*, rarely in *T. flavescens*. *Trisetum glaciale* always has pubescent top culm leaf sheaths.

Sheath margins are glabrous in *Trisetum bertolonii*, *T. glaciale*, and *T. gracile* and always ciliate in *T. altaicum* and *T. laconicum*. Ciliate margins also sometimes develop in *T. alpestre* and *T. fuscum* and rarely in *T. flavescens*.

Leaf blades

The species of *Trisetum* sect. *Trisetum* have flat leaf blades in most of the species, although those of *T. flavescens* sometimes have convolute to revolute or conduplicate ones, rarely filiform. Most of the species of the section have non-rigid leaf blades, but *T. glaciale* and *T. gracile* have rigid ones with a thickened midrib, as well as the shortest blades (Fig. 1A), with the margins thickened and cartilaginous in *T. glaciale*. The indumentum of the leaf blades has traditionally been used as a distinctive character for taxa delimitation (Tzvelev, 1976; Jonsell, 1980). However, for *Trisetum* sect. *Acrospelion* and *Trisetum* sect. *Sibirica*, the leaf blade features have been considered less important than those of the spikelet morphology for the taxonomy of the widespread species, due to the high variability of leaf blade traits (Barberá et al., 2017a, 2017b). The species of *Trisetum* sect. *Trisetum* have leaves varying from glabrous to pubescent adaxially and abaxially, usually with ciliate margins.

The species of *Trisetum* sect. *Trisetum*, as the rest of the genus, are mesophytic or xerophytic grasses. While the abaxial surface of the leaf blade often has a flat surface, the adaxial surface has ribs of varying depth (Metcalf, 1960; Watson & Dallwitz, 1992). The xerophytic species of the section have deeper intercostal zones and associated ribs than the mesophytic ones, and the sclerenchyma girders and strands are well developed (Barberá et al., 2017a, 2017b). As indicated before, the midrib is not particularly marked in most of the species of the section but is strongly marked only in *T. glaciale* and *T. gracile*. Chrtek (1965) made the first detailed study of the histology of European *Trisetum*, including some of the species included in our work of section *Trisetum* (*T. fuscum*, *T. glaciale*, and *T. gracile*). The vascular bundles of the species of *Trisetum* sect. *Trisetum* can be accompanied or not by more or less developed sclerenchyma girders or strands that attach to the abaxial or adaxial sides of the leaf blade,

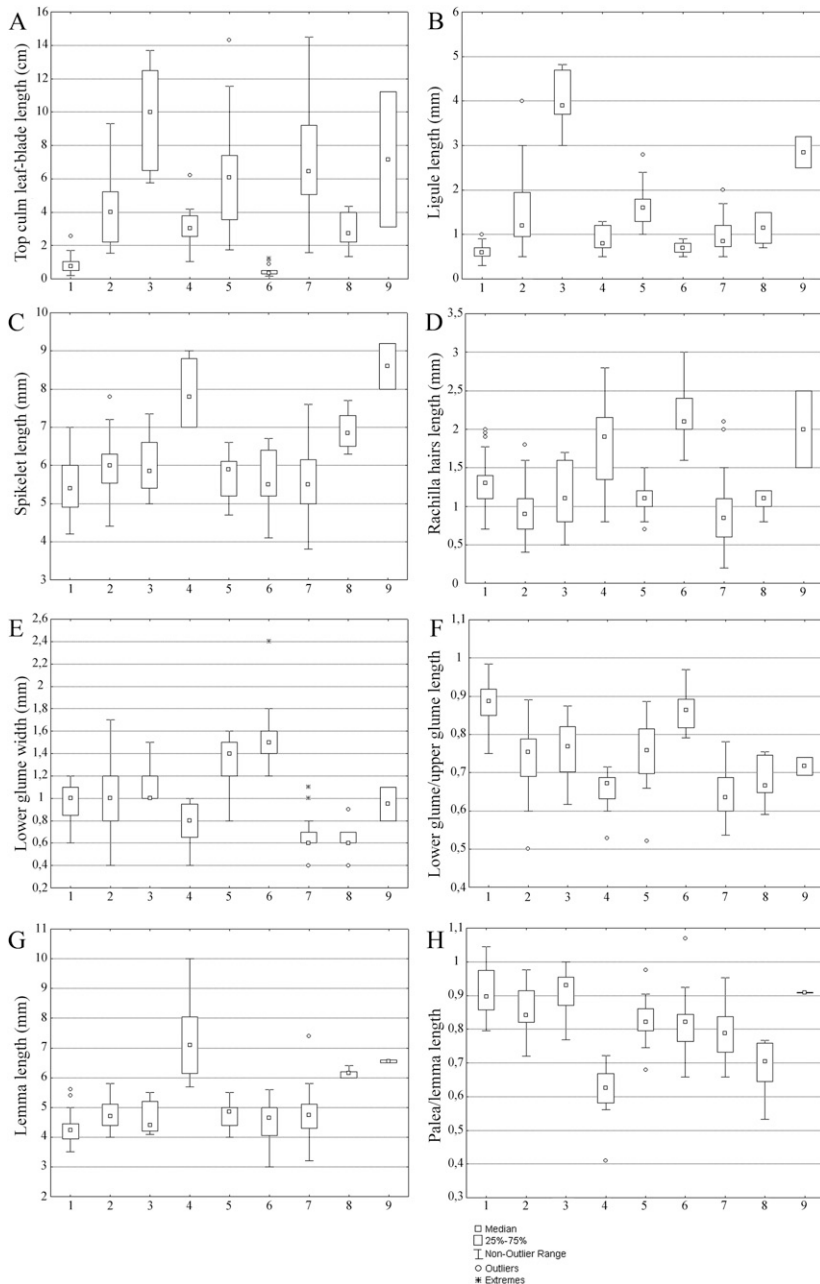


Figure 1. Box plots of a selection of studied variables. —A. Top culm leaf blade length. —B. Ligule length. —C. Spikelet length. —D. Rachilla hair length. —E. Lower glume width. —F. Lower glume/upper glume length. —G. Lemma length. —H. Palea/lemma length. Numbers along x-axis correspond to the studied taxa: 1. *Trisetum glaciale* (Bory) Boiss. 2. *Trisetum alpestre* (Host) P. Beauv. 3. *Trisetum fuscum* Schult. 4. *Trisetum bertolonii* Jonsell. 5. *Trisetum altaicum* Stephan ex Roshev. 6. *Trisetum gracile* (Moris) Boiss. 7. *Trisetum flavescens* (L.) P. Beauv. subsp. *flavescens*. 8. *Trisetum flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard. 9. *Trisetum laonicum* Boiss. & Orph.

or to both sides. No transversal section of *T. laonicum* has been done because of the few specimens available. All of the species of the section have a cap of sclerenchyma at the margins. *Trisetum altaicum* and *T. fuscum* are mesophytic grasses, which explains their shallow

intercostal zones or ribs, and the vascular bundles with no strands and with narrow girders adaxially and abaxially. *Trisetum flavescens* subsp. *flavescens* has vascular bundles with girders as deep as wide in both surfaces, alternating with bundles with only small girders

adaxially. The rest of the species of the section are more or less xerophytic grasses. *Trisetum glaciale* has girders only on the midrib, which are abaxially well developed, while *T. gracile* has no girders and presents well-developed strands in every vascular bundle in both surfaces. *Trisetum alpestre*, *T. bertolonii*, and *T. flavescens* subsp. *griseovirens* present both, girders and strands, more or less developed.

Ligules

The ligule measurements used in this study were taken from the top culm leaf blades, which are usually longer than those of the basal leaves. *Trisetum fuscum* has the longest ligules ([3–]3.7–4.7[–4.8] mm), followed by *T. laconicum* (2.5–3.2 mm). The ligules are membranous, truncate or acute, dentate to lacinate, always glabrous in *T. bertolonii* and *T. fuscum*, and usually more or less hairy along the upper edge in the rest of the species (Fig. 1B).

Inflorescences

Inflorescences are panicle, lax to somewhat dense or compact, narrowly elliptic to elliptic or lanceolate in outline, sometimes oblong, and always ovate in *Trisetum glaciale* and *T. gracile*. *Trisetum laconicum* has the longest panicles (8–19 cm), followed by *T. flavescens* and *T. fuscum* ([3.5–]6–10.5[–16.2] cm and [6.8–]7.9–11.2[–13] cm, respectively), whereas *T. glaciale* and *T. gracile* have the shortest ones ([2.3–]3–4.2[–4.8] cm and [1.3–]1.6–2.5[–3.1] cm, respectively).

Trisetum fuscum is characterized by having the longest basal branches ([1–]2.2–3.8[–5] cm), while *T. glaciale* and *T. gracile* have the shortest ones ([0.3–]0.4–0.9[–1.1] cm and [0.2–]0.3–0.9[–1.1] cm, respectively).

The inflorescence rachis is glabrous to sparsely pubescent or always pubescent in *Trisetum bertolonii*, with hairs up to 0.5 mm long.

Spikelets

Spikelet length in *Trisetum* sect. *Trisetum*, as in the rest of the genus, varies according to the lemma length and the number of florets. *Trisetum laconicum* and *T. bertolonii* have the longest spikelets, followed by *T. flavescens* subsp. *griseovirens* (8–9.2 mm, 7–9 mm, and [6.3–]6.5–7.3[–7.7] mm, respectively) (Fig. 1C). The awn is not included in the length of the spikelet. Furthermore, *T. laconicum* has the longest pedicels (5–6.3 mm).

Rachilla segments are always pubescent; *Trisetum laconicum*, *T. gracile*, and *T. bertolonii* have the longest hairs (1.5–2.5 mm, [1.6–]2–2.4[–3] mm, and [0.8–]1.3–2.2[–2.8] mm, respectively). Therefore, it is a useful diagnostic character for those three species (Fig. 1D).

The number of florets is usually two to three per spikelet, except in *Trisetum laconicum*, which has three

to four florets, rarely four in *T. flavescens*, and rarely one in *T. glaciale*.

Vegetative propagation by pseudoviviparism was observed in a specimen of *Trisetum flavescens* for the first time.

Glumes

In section *Trisetum*, the glumes are unequal, except in *T. glaciale* and *T. gracile*, which have subequal glumes (lower glume length:upper glume length ratio of [0.75–]0.85–0.92[–0.98] and [0.79–]0.82–0.89[–0.97], respectively) (Fig. 1F). *Trisetum altaicum*, *T. gracile*, and usually *T. alpestre*, *T. fuscum*, and *T. glaciale* have elliptic to oblong or lanceolate lower glumes, these wider than those of the rest of the species of the section, which have usually narrower ones, sometimes linear in *T. bertolonii*. Lower and upper glumes are acuminate to long-acuminate, sometimes acute, rarely with the upper one aristulate in *T. alpestre*, with some short hairs from the middle part to the top of the main nerve and along the margins. The lower glume in *T. bertolonii* and *T. laconicum* always has one nerve; other species rarely have one (*T. gracile*) or two lateral nerves (*T. alpestre*, *T. altaicum*, *T. flavescens*, and *T. fuscum*) (Fig. 1E). *Trisetum glaciale* has lower glumes with three nerves, sometimes two. The upper glume has always three nerves, the central one reaching the tip, the lateral ones extending to the middle or the upper half.

Lemma

The lemma structure, as in the rest of the genus, is characterized by having a dorsal awn and a bifid apex with two apical teeth normally ending in two aristules separated by a more or less deep sinus. Aristules are the intermediate nerves protruding beyond each tooth apex (Nicora, 1978; Koch, 1979; Finot et al., 2006; Barberá et al., 2017a, 2017b). Aristule length is a variable character at the species level, being longer in *Trisetum bertolonii* than in the rest of the species (1.2–2.3[–4] mm), followed by *T. flavescens* subsp. *griseovirens* ([0.9–]1–1.4[–1.8] mm) (Fig. 2B). The length of the lemma, which includes the aristule length without taking the awn into account, is longer in *T. bertolonii*, *T. laconicum*, and *T. flavescens* subsp. *griseovirens* ([5.7–]6–8[–10] mm, 6.5–6.6 mm, and 6–6.2[–6.4] mm, respectively). However, the length of the lemma does not differ greatly among the rest of the species of the section (Fig. 1C). The lemma is laterally compressed, from narrowly or broadly lanceolate to elliptic or oblong, greenish to yellowish at maturity in the central part, surrounded by purplish tinges, except in *T. bertolonii*, which has hyaline (colorless) margins. Most of the species of *Trisetum* sect. *Trisetum* have glabrous lemmas with very short, adpressed hairs up to 0.1 mm long, except *T. fuscum*, which sometimes has longer hairs at the awn insertion, and *T. gracile*, which can have pubescent

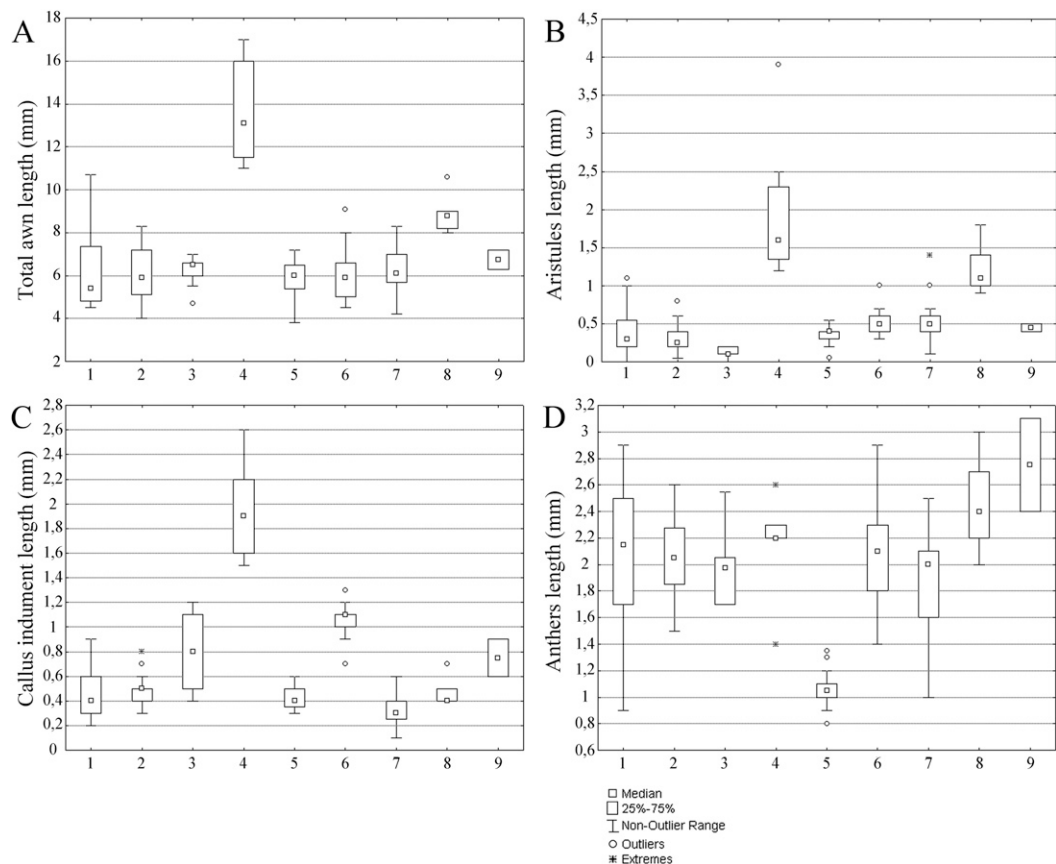


Figure 2. Box plots of a selection of studied variables. —A. Total awn length. —B. Aristule length. —C. Callus indument length. —D. Anther length. Numbers along x-axis correspond to the studied taxa: 1. *Trisetum glaciale* (Bory) Boiss. 2. *Trisetum alpestre* (Host) P. Beauv. 3. *Trisetum fuscum* Schult. 4. *Trisetum bertolonii* Jonsell. 5. *Trisetum altaicum* Stephan ex Roshev. 6. *Trisetum gracile* (Moris) Boiss. 7. *Trisetum flavescens* (L.) P. Beauv. subsp. *flavescens*. 8. *Trisetum flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard. 9. *Trisetum laconicum* Boiss. & Orph.

lemmas with hairs (0.05–)0.6–1.4(–2) mm long between its base and the awn insertion.

Awn

The length and shape of the awn are important taxonomic characters for the classification of the species of this section. *Trisetum bertolonii* has the awn significantly longer than the rest of the species of the section ([11–]11.5–16 [–17] mm), but the length does not differ greatly in the rest of the species. At subspecific rank, the length of the awn is also a good character to differentiate *T. flavescens* subsp. *griseovirens*, with longer awns than *T. flavescens* subsp. *flavescens* ([8–]8.2–9[–10.6] mm and [4.2–]5.6–7[–8.3] mm, respectively) (Fig. 2A). The awn shape is slightly geniculate to geniculate, and with a twisted column up to the geniculation in *T. flavescens*, *T. glaciale*, and *T. gracile*. *Trisetum altaicum*, *T. fuscum*, and *T. laconicum* have more or less bent awns at the base, while *T. alpestre* and *T. bertolonii* have awns straight or bent at the middle. The awn

is dorsal, inserted above or at the middle of the lemma, except in *T. gracile*, where the awn is inserted slightly below the middle (awn insertion from the base length: lemma length ratio of [0.34–]0.41–0.49[–0.51]).

Callus

The callus is elliptic to orbicular or sometimes oblong and always has short hairs. *Trisetum bertolonii* has the longest callus hairs (1.5–2.2[–2.6] mm), while the rest of species have hairs always shorter than 1.4 mm (Fig. 2C).

Palea

The palea disposition and shape are the same as in the other sections. The surfaces are hyaline. The two keels extend into two fine teeth (Barberá et al., 2017a, 2017b). In this section, the palea of *Trisetum laconicum* is longer than that in the rest of species (5.8–6 mm). The upper part of the flange edges and keels of the palea normally have very short hairs, which can reach to 0.4 mm long in

T. fuscum. The length of both the palea and the lemma is always markedly unequal in *T. bertolonii* (palea length: lemma length ratio of [0.4–]0.58–0.67[–0.7]), followed by *T. flavescens* subsp. *griseovirens* (palea length: lemma length ratio of [0.53–]0.65–0.76[–0.77]) (Fig. 1H). In the rest of the species, the difference between the palea and the lemma is more or less subequal to equal.

Lodicules

As in the rest of the sections of *Trisetum*, the two lodicules flank the dorsal sides of the ovary or caryopsis, and have a more or less oblanceolate shape (Barberá et al., 2017a, 2017b). The apices are irregularly dentate to lacinate or with (one) two to three teeth or lobules of equal or different depth, except in *T. gracile*, in which the apices are usually entire.

Stamens

The length of the anthers does not vary much among the species of this section, except in *Trisetum altaicum*, which has the shortest anthers ([0.8–]1–1.35 mm) (Fig. 2D).

Ovary and caryopsis

In this section, most of the species have a glabrous ovary. However, *Trisetum glaciale* has ovaries that range from sparsely to more densely puberulous on the upper part, rarely glabrous, and *T. alpestre* usually has an apical tuft of hairs or scattered hairs at the apex. *Trisetum altaicum* rarely has a single hair on the upper part of the ovary.

The shape of the mature caryopsis is similar in all species, being narrowly elliptic to oblong, while *Trisetum glaciale* has a more or less fusiform one. The transversal section is narrowly elliptic to elliptic and the caryopsis is not sulcate, with a punctiform hilum. The endosperm is semi-liquid.

TAXONOMIC TREATMENT

Trisetum Pers., Syn. Pl. 1: 97. 1805. TYPE: *Avena flavescens* L. (current name *T. flavescens* (L.) P. Beauv.) (lectotype, designated by Hitchcock [1920: 108]).

Trisetum Pers. sect. **Trisetum**.

Trisetum sect. *Gracilia* Chrtek & V. Jirásek, Webbia 17: 573. 1963. TYPE: *Trisetum gracile* (Moris) Boiss.

Trisetum sect. *Carpatica* Chrtek, Bot. Not. 118(2): 222. 1965. *Trisetum* subsect. *Carpatica* (Chrtek) Prob., Novosti Sist. Vyssh. Rast. 15: 19. 1979. TYPE: *Trisetum fuscum* Schult.

Trisetum subg. *Glaciotrisetum* Chrtek, Bot. Not. 118(2): 223. 1965. TYPE: *Trisetum glaciale* (Bory) Boiss.

Trisetum ser. *Laconica* Chrtek, Acta Univ. Carol., Biol. 1966: 94. 1967. TYPE: *Trisetum laconicum* Boiss. & Orph.

Herbs with or without tufted habit, rhizomatous, sometimes shortly stooling; panicles lax to somewhat dense or compact; spikelets greenish or purplish, never goldish brown; callus with short hairs, rarely longer than 1.4 mm; awns distinctly geniculate or slightly bent at middle or base, rarely straight; ovaries glabrous, sometimes sparsely to densely pubescent apically.

Distribution and habitat. *Trisetum* sect. *Trisetum* occurs from western Europe and the Maghrebian Mountains to western Asia, extending eastward into the mountains of Altai and Tian Shan and northern Mongolia and adjacent Russia, eastern Kyrgyz Republic, and Kazakhstan; it is introduced in North and South America and New Zealand. The richest areas are the different European mountain ranges. It grows on mountain meadows and floodplains, in rock fissures and forests, at elevations from sea level to more than 3000 m.

KEY TO THE TAXA OF *TRISETUM* SECT. *TRISETUM*

1. Callus hairs 1.5–2.2(–2.6) mm long; awns (11–)11.5–16(–17) mm long *T. bertolonii* Jonsell
- 1'. Callus hairs (0.1–)0.3–0.5(–1.3) mm long; awns (3.8–)5.3–7(–10.7) mm long 2
2. Plants (3–)8.9–14.1(–19.5) cm tall; top culm leaf blades (0.2–)0.3–1.5(–2.6) cm long; panicles (1.3–)2.2–3.8(–4.8) cm long, ovate in outline 3
3. Nodes enfolded by sheaths; basal leaf sheaths not inflated, densely pubescent; basal leaf blades with margins thickened, cartilaginous; callus hairs (0.2–)0.3–0.6(–0.9) mm long *T. glaciale* (Bory) Boiss.
- 3'. Nodes not enfolded by sheaths, rarely enfolded; basal leaf sheaths somewhat inflated, glabrous to sparsely pubescent; basal leaf blades with margins not thickened; callus hairs (0.7–)1–1.3 mm long *T. gracile* (Moris) Boiss.
- 2'. Plants (14.4–)28–47(–141.5) cm tall; top culm leaf blades (1.3–)2.2–12.5(–14.5) cm long; panicles (3.4–)6–9.4(–19) cm long, not or very rarely ovate 4
4. Spikelets 8–9.2 mm long; paleae 5.8–6 mm long *T. laconicum* Boiss. & Orph.
- 4'. Spikelets (3.8–)5.3–6.3(–7.8) mm long; paleae (2.2–)3.6–4.3(–5.6) mm long 5
5. Ligules (3–)3.7–4.7(–4.8) mm long *T. fuscum* Schult.
- 5'. Ligules (0.5–)0.8–1.7(–4) mm long 6
6. Lower glumes (0.8–)1.2–1.6 mm wide; anthers (0.8–)1–1.3 mm long *T. altaicum* Stephan ex Roshev.
- 6'. Lower glumes (0.4–)0.6–1(–1.7) mm wide; anthers (1–)1.8–2.2(–3) mm long 7
7. Awns straight or bent, very slightly twisted at base; ovaries usually with apical tuft of hairs 0.1–0.2(–0.3) mm long or with scattered hairs at apex *T. alpestre* (Host) P. Beauv.
- 7'. Awns geniculate to slightly geniculate, more or less twisted at base, rarely not twisted; ovaries always glabrous *T. flavescens* (L.) P. Beauv.

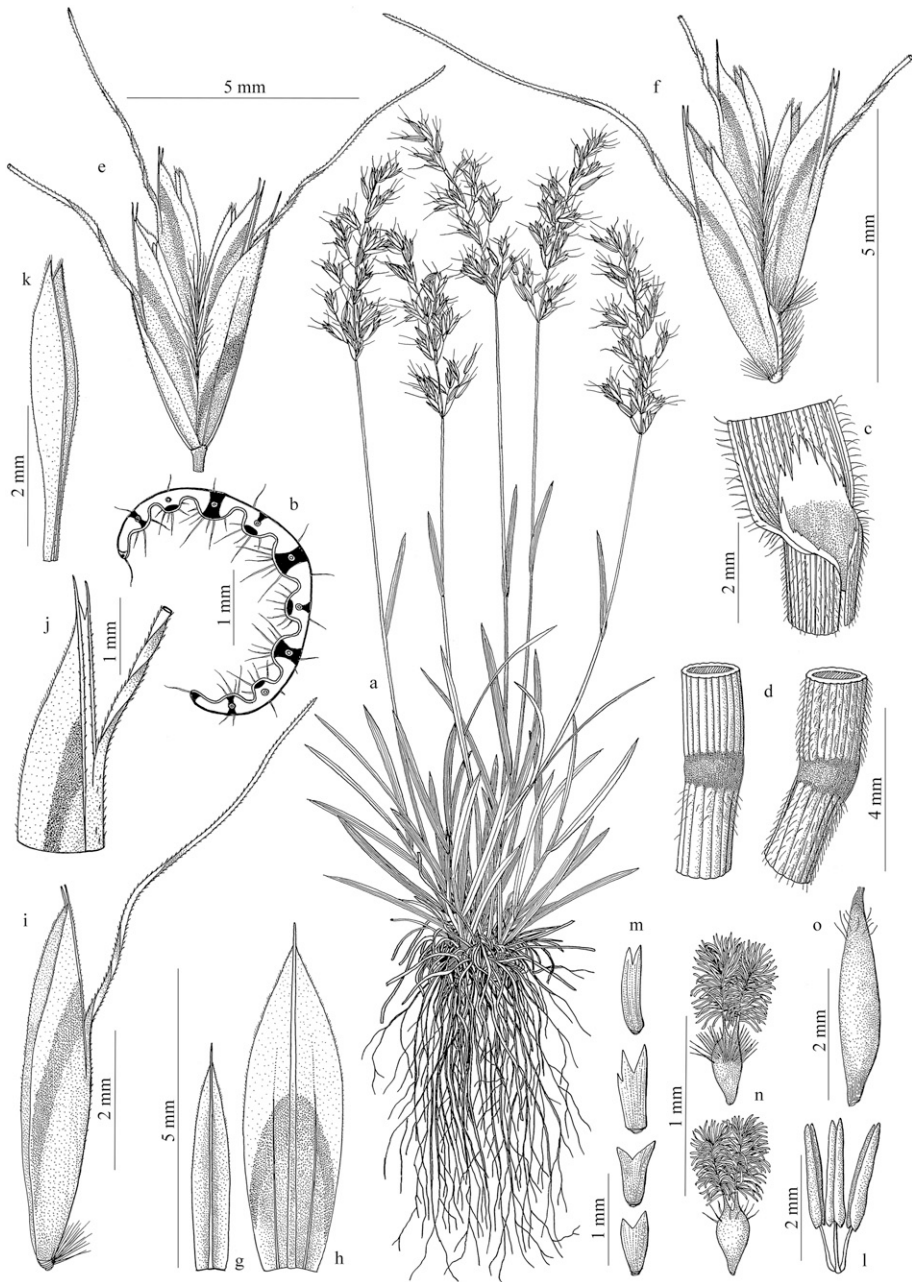


Figure 3. *Trisetum alpestre* (Host) P. Beauv. —A. Habit. —B. Transverse section of leaf blade. —C. Portion of sheath, ligule, and blade. —D. Portions of culm and node. —E. Spikelet. —F. Florets. —G. Lower glume, dorsal view. —H. Upper glume, dorsal view. —I. Floret. —J. Lemma, upper part, lateral view. —K. Palea, lateral view. —L. Stamens. —M. Lodicules. —N. Pistil. —O. Caryopsis. A, C–L based on *Du Rietz s.n.* (UPS-V-644660); B based on *Bornmüller s.n.* (B-10_0526398); N based on *Du Rietz s.n.* (UPS-V-644660) and *Barberá et al. 953PB* (MA-872340); M based on *Du Rietz s.n.* (UPS-V-644660), *Barberá et al. 953PB* (MA-872340), *Barberá & Quintanar 1062PB* (MA-876682), and *Vestergren s.n.* (S); O based on *Neyraut s.n.* (JE).

1. *Trisetum alpestre* (Host) P. Beauv., Ess. Agrostogr.: 88. 1812. *Avena alpestris* Host, Icon. Descr. Gram. Austriac. 3: 27, tab. 39. 1805. *Trisetaria alpestris* (Host) Baumg., Enum. Stirp. Transsilv. 3:

264. 1816. *Avena flavescens* var. *alpestris* (Host) Duby, Bot. Gall. 1: 512. 1828. *Trisetum flavescens* var. *alpestris* (Host) Schrad., Linnaea 12: 443. 1838. *Trisetum flavescens* subsp. *alpestre* (Host)

Hack., *Magyar Bot. Lapok* 2: 106. 1903. TYPE: Austria. *N. T. Host s.n.* (lectotype, designated here, W-1885-0002400!; isolectotype, W-0024994!) Figure 3.

Trisetum alpestre var. *argentoideum* Schur, *Oesterr. Bot. Z.* 10: 74. 1860. TYPE: Romania. Harghita, Őcsem Teteje Mtn., 46°39'N, 25°48'E, July, *P. J. F. Schur s.n.* (lectotype, designated here, W!).

Trisetum alpestre var. *purpurascens* Schur, *Oesterr. Bot. Z.* 10: 74. 1860. TYPE: Romania. Harghita, Őcsem Teteje Mtn., 46°39'N, 25°48'E, 28 July 1853, *P. J. F. Schur s.n.* (lectotype, designated here, W!).

Trisetum alpestre var. *glabrescens* Schur, *Enum. Pl. Transsilv.*: 759. 1866. *Trisetum alpestre* subsp. *glabrescens* (Schur) Tzvelev, *Novosti Sist. Vyssh. Rast.* 7: 64. 1971. TYPE: Romania. Königstein Mtn. (Piatra Craiului), 45°38'N, 25°36'E, Aug., *P. J. F. Schur s.n.* (lectotype, designated here, LW-213277 image!).

Trisetum alpestre var. *macranthum* Schur, *Enum. Pl. Transsilv.*: 759. 1866. TYPE: Romania. Harghita, Őcsem Teteje Mtn., 46°39'N, 25°48'E, 28 July 1853, *P. J. F. Schur s.n.* (lectotype, designated here, LW-213278 image!).

Trisetum baregense Laffitte & Miégev., *Bull. Soc. Bot. France* 21: 46. 1874. *Avena subalpestris* subsp. *baregense* [baregensis] (Laffitte & Miégev.) Nyman, *Consp. Fl. Eur.*: 813. 1882. *Trisetum agrostideum* subsp. *baregense* (Laffitte & Miégev.) Chouard, *Bull. Soc. Bot. France* 72: 340. 1925. *Trisetum flavescens* subsp. *baregense* (Laffitte & Miégev. ex Miégev.) O. Bolos, *Masalles & Vigo, Collect. Bot. (Barcelona)* 17: 96. 1988. *Trisetaria baregense* (Laffitte & Miégev.) Banfi & Soldano, *Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano* 135: 382. 1996. TYPE: France. Haut-Pyrénées, Héas valley, Gabiéou peak, 42°42'N, 0°5'E, 13 July 1862, *J. Miégevill s.n.* (lectotype, designated here, P-2217672!).

Trisetum alpestre f. *calvescens* Hack., *Magyar Bot. Lapok* 2: 108. 1903. TYPE: Romania. Harghita Distr., Nagy Hagymás Mtn., 46°42'N, 25°48'E, 21 June 1901, *A. de Degen, Gram. Hung.* 121 (lectotype, designated here, JE!).

Trisetum flavescens f. *tirolense* Hack., *Allg. Bot. Z. Syst.* 9: 189. 1904. TYPE: Italy. Trentino-Alto Adige, South Tyrol, Carbonin [Schluderbach], 46°37'N, 12°13'E, 21 Aug. 1903, *A. Kneucker, Gram. Exsicc.* 442 (lectotype, designated here, B-10_0366348!; isolectotypes, B-10_0366347!, C!, G-00443036!, G-00443093!, KFTA-0000478 image!, L-0050287!, L-1346752!, MA-292728, MO-2879843!, MO-3057065!, NY!, O-V2126570!, O-V2126668!, PR-9070!, SI, US-557059!, WU!).

Trisetum alpestre f. *anomalum* Zapał., *Rozpr. Wydz. Mat.-Przyr. Akad. Umiejtn., Dzia B, Nauki Biol.* 4: 111. 1904. TYPE: Tatra Mtns., *A. Rehman s.n.* (LW?, herbarium number 69/276, original material not located).

Trisetum alpestre var. *aurum* Zapał., *Rozpr. Wydz. Mat.-Przyr. Akad. Umiejtn., Dzia B, Nauki Biol.* 4: 111. 1904. TYPE: Poland. Lesser Poland, Tatra Mtns., Jaworzynka valley, 49°16'N, 19°59'E, 1856, [*F. I. Berdau*] *s.n.* (lectotype, designated here, KRAM-74425, the specimen mounted lower left hand of the sheet, with yellowish spikelets, of the two marked with "L.", image!).

Trisetum alpestre f. *majus* Zapał., *Rozpr. Wydz. Mat.-Przyr. Akad. Umiejtn., Dzia B, Nauki Biol.* 4: 111. 1904. TYPE: Poland. Lesser Poland, Tatra Mtns., Dolina

Kościeliska valley, 49°16'N, 19°52'E, *B. Kotula s.n.* (KRAM?, original material not located).

Trisetum alpestre var. *pulchrum* Zapał., *Rozpr. Wydz. Mat.-Przyr. Akad. Umiejtn., Dzia B, Nauki Biol.* 4: 110. 1904. SYNTYPES: Tatra Mtns., *B. Kotula s.n.* (KRAM?, original material not located); Ukraine. Chyvychn Mtn., 47°51'N, 24°42'E, *E. Woloszczak s.n.* (W?, original material not located); Romania. Suhard Mtns., Bucovina, 47°30'N, 25°21'E, *A. Rehman s.n.* (LW?, original material not located).

Trisetum alpestre var. *tatrense* Zapał., *Rozpr. Wydz. Mat.-Przyr. Akad. Umiejtn., Dzia B, Nauki Biol.* 4: 111. 1904. TYPE: Poland. Lesser Poland, Tatra Mtns., Mt. Lysanki, 49°16'N, 19°55'E, 20 July 1887, [*B. Kotula*] *s.n.* (lectotype, designated here, KRAM-74418 image!).

Herbs (14.4–)21.5–35.7(–53.5) cm tall, slightly caespitose to caespitose, shortly rhizomatous, culm 0.3–0.8 mm diam., straight, glabrous, sometimes puberulous at middle part or around nodes, with hairs up to 1.5 mm; nodes (2 to)3 to 4(to 5), mostly concentrated in lower part of culm, not included in sheaths, sometimes included, glabrous, yellowish to dark brownish. Basal leaf sheath surfaces and margins pubescent, rarely glabrous, with hairs (0.05–)0.3–0.6 mm, sometimes decaying into fibers, yellowish, sometimes greenish or brownish; basal leaf blades (1.9–)3–7.5(–12) cm × (1.1–)1.6–2.3(–4) mm, flat, slightly inrolled when dried, from sparsely to densely pubescent abaxially and adaxially, with hairs (0.05–)0.1–0.9(–1.2) mm, sometimes glabrous, margins also with hairs, yellowish or brownish to greenish; top culm leaf sheaths (5–)6.3–9.6(–16) cm, glabrous to pubescent, with or without cilia; top culm leaf blades (1.5–)2.2–5.2(–9.3) cm × (1–)1.6–3(–4.1) mm, flat, sometimes with margins inrolled, parallel to culm, glabrous to pubescent adaxially and abaxially, with hairs (0.05–)0.1–0.8(–1.7) mm, with cilia, greenish to grayish, sometimes yellowish or brownish; inner collar region glabrous to pubescent on margins, with hairs (0.05–)0.4–0.7(–1.1) mm; ligules (0.5–)0.9–2(–4) mm, irregularly dentate, sometimes lacinate, glabrous, sometimes with scattered hairs 0.05–0.3 mm on apex. Basal node of panicle glabrous. Panicles (3.4–)5.4–7.5(–11.5) × (1.2–)1.8–2.5(–3.6) cm, lanceolate in outline, sometimes oblong to elliptic, rather lax; rachis internodes glabrous to sparsely pubescent, mostly on upper part, with hairs up to 0.2 mm; longest basal branches (0.4–)0.8–2(–3.3) cm. Spikelets (4.4–)5.5–6.3(–7.8) × (1.2–)2.2–3.2(–5) mm, 2- or 3-flowered; pedicels (1.5–)2.4–4.1(–5.2) mm, glabrous to sparsely pubescent, mostly apically, with hairs up to 0.2 mm. Glumes unequal (lower glume length:upper glume length ratio of [0.5–]0.69–0.79[–0.9]); lower glume (2.5–)3.4–4.4(–5.3) × (0.4–)0.8–1.2(–1.7) mm, narrowly to broadly lanceolate, rarely elliptic to oblong (lower glume width: lower glume length ratio of [0.15–]0.19–0.31[–0.4]), acuminate to long-acuminate, 1(to 3)-nerved, glabrous,

usually with scattered hairs up to 0.1 mm on upper part of midrib, greenish, surrounded by purplish or hyaline margins; upper glume (3.6–)4.7–5.8(–7.5) × (1.5–)1.8–2(–2.3) mm, elliptic to broadly lanceolate or oblong, rarely oblanceolate (upper glume width:upper glume length ratio of [0.28–]0.31–0.38[–0.5]), acuminate to long-acuminate, rarely acute or aristulate, 3-nerved, glabrous, usually with very short, scattered hairs up to 0.1 mm from middle to upper part of central nerve, greenish, rarely purplish, surrounded by yellow or purple; rachilla segment between first and second florets (0.7–)1–1.3(–1.7) mm, with hairs (0.4–)0.7–1.1(–1.8) mm; rachilla segment to sterile floret (1–)1.2–1.6(–2.2) mm, with hairs (0.2–)0.4–0.9(–1.3) mm. Lemmas (4–)4.4–5.1(–5.8) × (0.4–)0.8–1.2(–1.7) mm, oblong to elliptic, sometimes narrowly to broadly lanceolate (lemma width:lemma length ratio of [0.21–]0.29–0.35[–0.5]), scabridulous, with very short hairs up to 0.1 mm on midrib, rarely glabrous, greenish to yellowish, sometimes surrounded by purplish flush; apical teeth (0.05–)0.2–0.45(–0.7) mm, with aristules (0.05–)0.2–0.4(–0.8) mm; awn (4–)5–7.2(–8.3) mm, inserted (2–)2.4–3(–3.5) mm from base (awn insertion from base length:lemma length ratio of [0.52–]0.55–0.62[–0.65]), straight or bent, very slightly twisted at base, with very short, adpressed hairs up to 0.05 mm; callus 0.2–0.3 mm, elliptic to orbicular, rarely oblong, with hairs (0.3–)0.4–0.5(–0.8) mm. Paleae (3.3–)3.8–4.5(–5.6) × (0.8–)1–1.4(–1.6) mm (palea length: lemma length ratio of [0.72–]0.82–0.91[–1]), oblong to oblanceolate or elliptic, margins glabrous or with scattered hairs; teeth (0.01–)0.1–0.3 mm, with short, antrorse hairs. Lodicules (0.4–)0.5–0.7(–0.9) mm, with 2 lobules of the same or different lengths. Anthers (1.5–)1.8–2.3(–2.6) mm. Ovaries (0.4–)0.5–0.8(–1.3) mm, usually densely pubescent with apical tuft of hairs 0.1–0.2(–0.3) mm, sometimes glabrous or with scattered hairs at apex. Caryopses 2.7–2.8 × 0.6 mm, broadly lanceolate to narrowly elliptic or oblong. Chromosome number: $2n = 14$ (Frey, 1992).

Additional illustrations. Chrték (1967b: 4, 5, sub *Trisetum baregense*); Săvulescu (1972: 289, Plansa 56, 1a–e); Frey (1992: 459, fig. 9).

Phenology. *Trisetum alpestre* has been collected in flower and fruit from June to September.

Distribution and habitat. *Trisetum alpestre* is distributed in the mountains from northern Spain (the westernmost in Burgos Province), the Pyrenees, and the Alps, up to the Carpathians. It grows on limestone slopes and rock fissures from subalpine to alpine meadows, at 500–2800 m. Figure 4.

Discussion. *Trisetum alpestre* has been recognized by some authors as a subspecies or variety of *T.*

flavescens. *Trisetum alpestre* is clearly separated from *T. flavescens* by its habit, which is usually more densely tufted and usually with fewer nodes ([two to] three to four [to five] and [three to] four to five [to seven], respectively) that are mostly concentrated in the lower part of the culm and sometimes included in the sheaths, and with top culm leaf blades shorter than ([1.5–]2.2–5.2[–9.3] cm, and [1.3–]4–9[–14.5] cm, respectively) and parallel to the culm. Apart from those characters, *T. alpestre* is differentiated from *T. flavescens* by its longer ligules ([0.5–]0.9–2[–4] mm and [0.5–]0.7–1.2[–2] mm, respectively), wider and usually purplish lower and upper glumes (lower glumes [0.4–]0.8–1.2[–1.7] mm and [0.4–]0.6–0.7[–1.1] mm, respectively; upper glumes [1.5–]1.8–2[–2.3] mm and [1.1–]1.5–1.8[–2.2] mm, respectively), straight or bent awns, and ovaries usually with an apical tuft or scattered hairs at the apex.

Trisetum baregense was described in 1874 from the Pyrenees. Chrték (1967b) was the first who wrote about the similarity between *T. baregense* and *T. alpestre*. He stated that these species differ by their awn length, glume width, and mostly by the ovary indumentum being glabrous in *T. baregense* and hairy in *T. alpestre*. Chrték (1967b) also recorded the existence of intermediate specimens between both species in the Carpathians and in the French Alps. Schur (1866) recognized some Carpathian varieties, one of which is variety *glabrescens*, which is differentiated by glabrous upper leaf surfaces, leaf sheaths, and ovaries. Tzvelev (1971) raised it to subspecific rank. Küpfer (1974), in his work about the relationships between the Alpine and Pyrenean floras, considered *T. alpestre* and *T. baregense* as schizoendemics, being the two diploid species ($2n = 14$). He affirmed also that ovary indumentum is not a useful character to separate these taxa. Küpfer (1974) added the lemma apex as another character to differentiate both, *T. alpestre* having the lateral nerves slightly excurrent and those of *T. baregense* slightly or not excurrent, with a mucro of 0–0.3 mm. However, in the studied material, no difference in the lemma apex has been found. Alejandre et al. (2012) identified the western specimens of *T. alpestre* as “*T. cf. baregense*,” and they indicated the morphological similarities between *T. alpestre* and *T. baregense* as, for example, the ovary indumentum. We agree with Chrték (1967b) and Küpfer (1974) that the ovary indumentum is a variable character. Most of the specimens from the eastern Alps and Carpathians have a crown of hairs at the ovary apex, but there are also glabrous specimens or those with scattered hairs at the apex, as in specimens from the Pyrenees. The same kind of variability, not taxonomically correlated with named taxa, has been observed in leaf and sheath indumentum. However, the awn length is slightly longer in *T. alpestre* than in *T. baregense*, and the glume width slightly wider in *T. alpestre*. Apart from

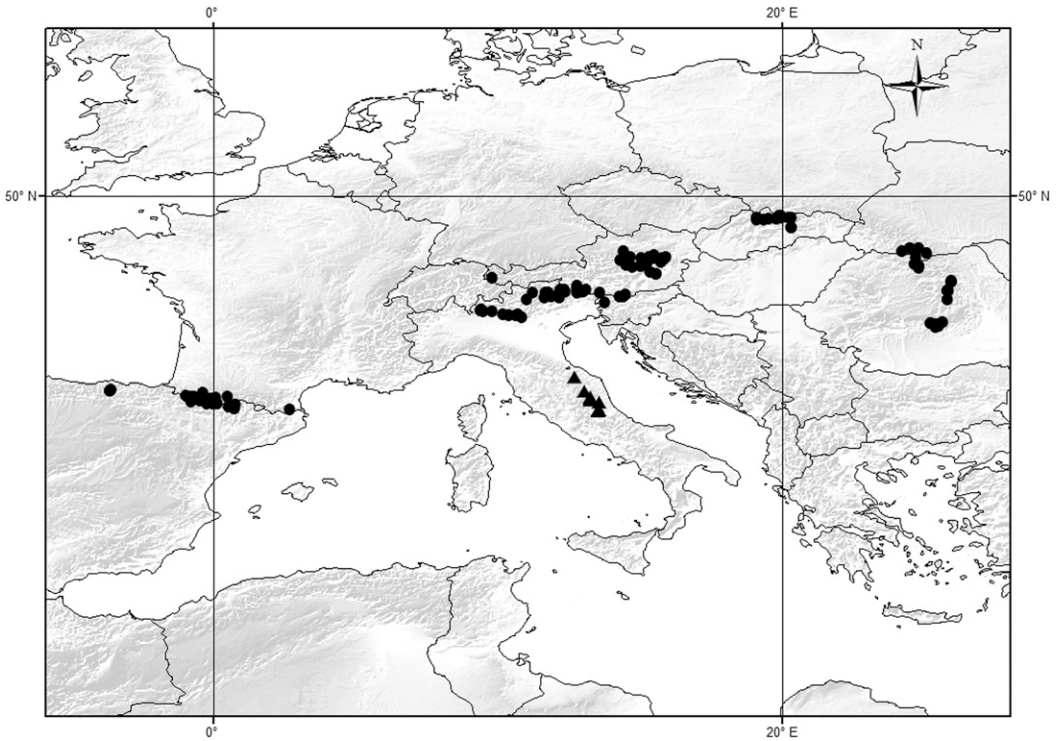


Figure 4. Distribution of *Trisetum alpestre* (Host) P. Beauv. (stars) and *T. bertolonii* Jonsell (triangles).

those characters, no other important differences have been found to differentiate these two species, so we consider *T. baregense* to be a synonym of *T. alpestre*.

Additional specimens examined. AUSTRIA. **Carinthia:** Loibel, 46°26'N, 14°16'E, *Fries s.n.* (UPS); Karawanken, Koschuta, 46°26'N, 14°25'E, 10 Aug. 1949, *Hepp s.n.* (M); Karawanken, Hochobir, 46°30'N, 14°29'E, 5 Aug. 1938, *Hepp s.n.* (M); 16 Aug. 1949, *Merxmüller & Wiedmann 5532* (M); Plöcken, am Gipfel des Polinigg, 46°37'N, 12°58'E, 13 Aug. 1949, *Merxmüller & Wiedmann 5549* (M); Gailtal, Karnische Alpen, auf steinigten Stellen im Sittmoosergruben bei Mauthen, 46°39'N, 12°57'E, 30 Aug. 1926, *Vierhapper s.n.* (WU); Gailtal, in Alpenmatten der Jauken bei Kötschach, 46°42'N, 13°5'E, 27 Aug. 1926, *Vierhapper s.n.* (WU). **Lower Austria:** unter alpinen region des Göllner bei St. Egid, 47°47'N, 15°29'E, 20 July 1878, *Fehlner s.n.* (FI, GH, HBG, JE, K, L, MPU, P, US, WU); Nördliche Kalkhochalpen, Rax-Alpe, zwischen den Landesgrenze westl. des Bißkogels und dem Habsburg-Haus, 47°44'N, 15°42'E, 19 July 2007, *Fischer & Fischer s.n.* (WU); Mt. Dürrenstein inter Landro et Prags, 47°47'N, 15°3'E, 2 Aug. 1870, *Huter s.n.* (GH, K); Schneeberg, Saugraben, 47°47'N, 15°47'E, 14 July 1994, *Mrkvicka 1109* (WU); Raxalpe, ca. 500 m O vom Otthaus am Jakobkogel, 47°43'N, 15°46'E, 24 Aug. 1959, *Podlech 5892* (M); in alpe Schneeberg, inter Baumgartner et Saugraben, 47°47'N, 15°47'E, 6 July 1922, *Vestergren s.n.* (GB, S); Raxalpe, oberhalb vom Otthaus, Beweideter Rasen in der Krummholzstufe, 47°43'N, 15°46'E, 25 July 1956, *Wagenitz s.n.* (GOET). **Styria:** Wienerbruck bei Mariazell, Hintere Tormaner, 47°51'N, 15°18'E, 6 June 1985, *Adler s.n.* (W); Kalbling, 47°33'N, 14°31'E, *Angeli s.n.* (K); Kalwang, am

Zeiritzkampel, 47°29'N, 14°43'E, 8 Sep. 1897, *Correns s.n.* (M); Hochschwabgebiet, Tragöss, ober dem Grüner See, 47°32'N, 15°3'E, 22 June 1950, *Eisenzopf s.n.* (H); St. Ilgen Thal am Hochschwab, Thalenge nach St. Ilgen, 47°34'N, 15°7'E, 16 July 1903, *Handel-Mazzetti s.n.* (WU); Hochschwab, Bruck, Trockene Rasenhänge der Roten Wand bei Mixnitz, 47°19'N, 15°21'E, 26 July 1952, *Merxmüller & Wiedmann 5546* (M); Weizklamm, 47°15'N, 15°34'E, 18 July 1888, *Preissmann s.n.* (B, UPS); Wegscheid bei Mariazell, 47°46'N, 15°18'E, 8 July 1885, *Preissmann s.n.* (WU); in valle Gesäuse, 47°35'N, 14°37'E, 28 June 1889, *Richter s.n.* (WU); Trenchtling, 47°32'N, 15°0'E, 11 July 1897, *Sartorius s.n.* (M); Kalbling, 47°33'N, 14°31'E, *Somerauer s.n.* (PR); Gesäuse, Hochtort, 47°33'N, 14°37'E, 15 July 1903, *Vierhapper s.n.* (WU). **Tyrol:** Lienz, Kerschbaumer Alpe, 46°46'N, 12°46'E, Aug. 1872, *Gander s.n.* (B, JE); 2 Aug. 1869, *Leresche s.n.* (L). **Upper Austria:** Haselgatterm, Windischgarsten, 47°43'N, 14°19'E, 13 July 1911, *Aust s.n.* (L); bei Steyr, 48°2'N, 14°25'E, Aug. 1892, *Dürnberger s.n.* (WU); Weyer, 47°51'N, 14°39'E, Aug. 1892, *Dürnberger s.n.* (JE). **Vorarlberg:** Eisernes Tör bei Höhlenhain, 47°6'N, 9°48'E, 12 Aug. 1909, *Vierhapper s.n.* (WU). **FRANCE. Hautes-Pyrénées:** Cirque de Gavarnie, 42°41'N, 0°0'W, Aug. 1880, *Ball s.n.* (MO); Aug. 1868, *Bordère s.n.* (H, K, MO, MPU, NY, O, PR, WU); Aug. 1874, *Bordère s.n.* (GB, JE, NY, PR, RO, WU); 2 July 1870, *Reuter s.n.* (NY); Héas valley, Pic de Gabiéudou, 42°42'N, 0°5'E, Aug. 1864, *Bordère s.n.* (O); 11 Aug. 1874, *Bordère s.n.* (NY, WU); 27 Aug. 1876, *Bordère s.n.* (GB, M, WU); 17 July 1865, *Miégeville s.n.* (P); Troumouse, 42°43'N, 0°6'E, July 1878, *Bordère s.n.* (K); Aug. 1877, *Bordère s.n.* (WU); *Lagger s.n.* (WU); près de Baréges, 42°53'N, 0°3'E, 22 Aug. 1948, *Chouard s.n.* (G); Cauterets, abords du sentier qui

monte au Pégúère par la crête qui sépare le ravin de La Laoune de celui de la Glacière, 42°52'N, 0°7'W, 29 July 1903, *Neyraut s.n.* (MPU); Cauterets, Mont Pégúère, 42°52'N, 0°7'W, 18 Aug. 1905, *Neyraut s.n.* (H, JE, MPU, PR); Marboré, 42°41'N, 0°0'E, 27 Aug. 1856, *Zetterstedt s.n.* (GB). **Pyrenées Atlantiques:** base de la Tènèbre d'Isabe, près des Eaux-Chaudes, 42°56'N, 0°29'W, 19 Aug. 1909, *Barrère s.n.* (MPU); cerca de Castet, Macizo de Jaut, 43°4'N, 0°25'W, 4 Aug. 1980, *Vivant s.n.* (ARAN). **Pyrenées-Orientales:** Amelie-les-Bains, 42°28'N, 2°40'E, *Taylor s.n.* (BM). ITALY. **Friuli Venezia Giulia:** Udine Prov., Forni Avoltri, 46°35'N, 12°46'E, Sep. 1857, *Ball s.n.* (GH). **Lombardy:** Brescia Prov., Campione sopra Lecco, 45°49'N, 10°10'E, 14 Aug. 1863, *Ball s.n.* (GH); Lecco Prov., Alpe Campei, sur Moggio, 45°55'N, 9°29'E, 5 Aug. 1912, *Braun s.n.* (G); Bergamo Prov., Bergamasker Alpen, Nordhänge des Pizzo Arera, 45°56'N, 9°48'E, 16 Aug. 1968, *Podlech & Lippert 15367* (M); Como Prov., Mt. Campione du côté du Val Sassina, 45°59'N, 9°24'E, 14 Sep. 1892, *Saint-Lager s.n.* (G, L, NY). **Trentino-Alto Adige:** Mt. Dürrenstein, 46°38'N, 12°12'E, 29 Aug. 1896, *Bornmüller s.n.* (B, JE); Mt. Piano, 46°36'N, 12°14'E, 22 Aug. 1896, *Bornmüller s.n.* (B); Mt. Cristallo, Val Fonda, 46°34'N, 12°11'E, 23 Aug. 1896, *Bornmüller s.n.* (B); Mt. Sarkkofel, 46°42'N, 12°11'E, 7 Sep. 1896, *Bornmüller s.n.* (B); North Wolkenstein, Regensburger Hütte, 46°35'N, 11°45'E, 23 July 1991, *Dersch 4487* (GOET); Sextener Dolomiten, an Weg 100 NW unterhalb des Burgstalls, 46°36'N, 11°12'E, 24 July, *Dietch 4176* (M); Prager Dolomiten, bei Landro, 46°37'N, 12°13'E, 27 July 1933, *Gross s.n.* (US); Fedaiia Pass, Fassatal, 46°27'N, 11°52'E, 15 July 1905, *Handel-Mazzetti s.n.* (WU); Sexten, Altler stein vallis Fischelein, 46°38'N, 12°21'E, 10 Aug. 1872, *Huter s.n.* (B, JE, K, M, MPU, P, RO, W, WU); Rotwandhütte, 46°25'N, 11°37'E, 30 July 1963, *Raabe s.n.* (HBC); Mt. Tombea, 45°48'N, 10°37'E, 1913, *Wettstein s.n.* (M); Valle Gröden, 46°34'N, 11°40'E, 24 Aug. 1896, *Spencer s.n.* (L). **Veneto:** Mt. Baldo, 45°43'N, 10°49'E, 29 Aug. 1858, *Ball s.n.* (GH, US); prope Cortina d'Ampezzo, 46°32'N, 12°8'E, 5 Sep. 1860, *Ball s.n.* (F); Mt. Pelmo, 46°25'N, 12°8'E, 18 Sep. 1857, *Ball s.n.* (GH); Drei Zinnen (Tre Cime di Lavaredo), 46°37'N, 12°18'E, 14 Aug. 1963, *Raabe s.n.* (HBC); Mt. Pelmo, 46°25'N, 12°8'E, 24 July 1895, *Saint-Lager s.n.* (G, L). POLAND. **Lesser Poland:** Zakopane, 49°17'N, 19°56'E, 23 July 1929, *Nilsson s.n.* (JE); 10 Aug. 1888, *Frey n.s.n.* (B, PR); Kosninarski Wierd [Kasprowy Wierch], 49°13'N, 19°58'E, 8 Aug. 1860, *Bisse s.n.* (JE); Hala Stoly, 49°13'N, 19°54'E, 27 July 1978, *Frey s.n.* (L); Gladkie Uplazianskie, 49°14'N, 19°53'E, 4 Aug. 1931, *Pawłowska et al. s.n.* (GB, GH, K, S, UPS); Koscielisko, 49°17'N, 19°53'E, July 1868, *Fritze s.n.* (B); Zakopane, Mt. Nosal, 49°16'N, 19°59'E, 12 July 1914, *Sagorski s.n.* (JE). ROMANIA. **Arges:** Montibus Birsei, montis Piatra Craiului, 45°31'N, 25°12'E, 11 July 1979, *Parascan & Danciu s.n.* (H); 3 Aug. 1979, *Parascan & Danciu s.n.* (M). **Bistrița-Năsăud:** Rodna, Mt. Korongvis [Corongisul], 47°31'N, 24°47'E, 9 Aug. 1902, *Degen s.n.* (PR); 11 Aug. 1902, *Degen s.n.* (B, WU); Rodnaborberek [Rodnei Mtn.], Saca, 47°28'N, 24°49'E, 1 Aug. 1909, *Vierhapper s.n.* (WU). **Braşov:** Gebirgsstock des Bucegiul (Bucegi Mtns.), bei Kronstadt, Bucsoiu, 45°27'N, 25°27'E, 18 Aug. 1910, *Ginzberger s.n.* (WU); Piatra mare, 45°33'N, 25°38'E, 12 July 1895, *Sagorski s.n.* (JE); Bucses Nordhang, Malajester Tal [Malaesti], 45°27'N, 25°27'E, 27 July 1909, *Vierhapper s.n.* (WU). **Dâmbovița:** Bucegi Mtns., Țigănești Grat, 45°28'N, 25°25'E, 6 Aug. 1928, *Schwarz 621* (B, JE); Bucegi Mtns., Tiganester Grat, Malajestu Hütte, 45°27'N, 25°27'E, 8 Aug. 1928, *Schwarz s.n.* (B, JE). **Harghita:** Ciuc, Bicaz, 46°21'N, 25°48'E, 6 July 1938, *Nyárády s.n.* (C, MW, O, P, RO); montis "Nagy Hagymás," ad pagum

Balánbánya, 46°39'N, 25°48'E, 21 June 1901, *Degen 120* (BM, GB, GH, JE, K, O, WU); Ócsem Teteje Mtn., 46°39'N, 25°48'E, July, *Schur s.n.* (W). **Maramures:** Rodnaer-Alpen [Rodnei Mtns.], Cisia, 47°35'N, 24°40'E, 27 July 1903, *Ade s.n.* (M). **Neamț:** Masivul Ceahlău, 46°59'N, 25°56'E, 22 July 1931, *Hayrén s.n.* (H); Ceahalu Mtns., Cabana Dochia, 46°57'N, 25°57'E, 1961, *Heinrich s.n.* (JE); Aug. 1961, *Lange s.n.* (JE). **Prahova:** Montis Bucegi, Vale Jepilor, 45°24'N, 25°29'E, 26 July 1959, *Ciocîrlan & Todor s.n.* (M). SLOVAKIA. **Košice:** Belianske Tatry, 49°14'N, 20°15'E, 15 Aug. 1968, *Beck 270* (B); Belianske Tatry, above Chata Protez, 49°13'N, 20°16'E, 31 July 1966, *Dahl & Hadac s.n.* (O); von Nesselblösse, Béla Höhlenhain, Bélaer Kalkalpen, 49°14'N, 20°15'E, 23 July 1912, *Korb s.n.* (UPS); comit. Szepes, ad pagum Sztracena [Stratená], 48°52'N, 20°20'E, 10 July 1932, *Lengyel s.n.* (M, S); 14 July 1933, *Lengyel s.n.* (P). **Prešov:** Belianske Tatry, 49°14'N, 20°15'E, 15 Aug. 1968, *Beck 271* (B); Belianske Tatry, Mt. Stierberg, 49°14'N, 20°15'E, 12 Sep. 1905, *Degen s.n.* (G, GB); Belianske Tatry, Chata Protez, 49°13'N, 20°16'E, 31 July 1966, *Dahl & Hadac s.n.* (O); Drechselhäuschen [Belianske Tatry], 49°14'N, 20°15'E, 29 Aug. 1921, *Kionka s.n.* (UPS); Belianske Tatry, Tatranská Kol, 49°13'N, 20°19'E, 14 July 1958, *Rothmaler s.n.* (JE). **Žilina:** Kváčányi völgy, 49°11'N, 19°32'E, 9 June 1908, *Degen s.n.* (C, GB); montis Velky Choc, prope oppidum Ruzomberok, 49°9'N, 19°20'E, 21 July 1959, *Deyl et al. s.n.* (C, FI, M, MA, NY, P, PH); Suchý Vrch, ubar Turz-St. Martin, 49°10'N, 19°5'E, July 1931, *Hruby s.n.* (H, O); Rozsutec, 49°13'N, 19°5'E, July 1890, *Sagorski s.n.* (JE); Kráľovan, 49°9'N, 19°7'E, July 1890, *Sagorski s.n.* (JE); Mala Fatra, montis Rosutec, 49°13'N, 19°5'E, June 1935, *Weber s.n.* (P). SLOVENIA. **Gorizia:** Tolmin, Kuk, 46°15'N, 13°45'E, 25 July 1855, *Areschoug s.n.* (UPS). SPAIN. **Burgos:** Espinosa de los Monteros, Macizo de Castro Valnera (Montes de Pas), cabecera del circo de Bernacho, 43°9'N, 3°40'W, 3 Sep. 2013, *Barberá et al. 951PB* (MA); Espinosa de los Monteros, Macizo de Castro Valnera (Montes de Pas), escarpes de la Calleja Honda, 43°9'N, 3°40'W, 3 Sep. 2013, *Barberá et al. 953PB* (MA). **Cantabria:** Soba, Parque Natural de los Collados del Asón, canal entre Mota La Fuente y Monte Primera, 43°11'N, 3°38'W, 3 Sep. 2013, *Barberá et al. 957PB* (MA); Soba, Parque Natural de los Collados del Asón, Mota La Fuente, 43°11'N, 3°38'W, 3 Sep. 2013, *Barberá et al. 958PB* (MA). **Huesca:** Valle de Bujaruelo, Torla, barranco de Lapazosa, 42°42'N, 0°4'W, 16 Sep. 2013, *Barberá & Quintanar 1062PB* (MA); Vall de Pineta, sota el Coll d'Añísolo, 42°41'N, 0°3'E, 8 Aug. 1991, *Carrillo & Ninot s.n.* (BCN); Candanchú, Torteille Alto, solana La Zapatilla, 42°47'N, 0°31'W, 12 Aug. 1965, *Montserrat 1339/65* (MA); Benasque, Valle de Astof, 42°36'N, 0°31'E, 23 July 1955, *Montserrat 761/55* (MA); Bal d'Ansó, Canaletas de Ruzkia, 42°45'N, 0°49'W, 28 July 1993, *Soriano & Gomà s.n.* (BCN); Panticosa, Sierra de Tendenera, prope debajo del ibon de los Asnos, 42°41'N, 0°16'W, 10 Aug. 1980, *Vivant s.n.* (ARAN). **Leida:** Vall de Pineta, sota el Coll d'Añísolo, 42°40'N, 0°44'E, 18 July 1997, *Carrillo s.n.* (BCN); Canaleta de Romero, Argia de Lin, Vielha e Mijaran, 42°30'N, 0°43'E, 18 Aug. 1998, *Carrillo s.n.* (BCN); Cap al Coth des Aranesi, Vielha e Mijaran, 42°30'N, 0°43'E, 18 Aug. 1998, *Ninot & Carreras s.n.* (BCN). **Navarra:** Isaba, Anielarra, 42°56'N, 0°44'W, 1 Aug. 1987, *Aizpuru & Catalán s.n.* (ARAN); Otsagabia, Cima del Orhy, 42°59'N, 1°0'W, 22 July 1987, *Aizpuru & Catalán s.n.* (ARAN); Roncal, Anielarra, Puerto de Eraice, 42°56'N, 0°43'W, 19 Aug. 1969, *Montserrat 5690/69* (MA). UKRAINE. **Chernivtsi:** Putila Distr., the ChyorniyDol Range, on rocks of Mt. Bolshoy Kamen, 47°59'N, 25°5'E, 20 July 1961, *Artemchuk s.n.* (LE). **Ivano-Frankivsk:**

Verkhovina Distr., watershed betw. the Chyorniy Cheremosh & Beliy Cheremosh rivers, 33–36 km SSW of Verkhovina, 48°9'N, 24°47'E, 25 July 1985, *Geltman et al. 2094I* (LE); Kosiv Distr., the Chivchyn Mtns., Mt. Mokrinskiy Kamen, 47°51'N, 24°42'E, 16 Sep. 1965, *Kharkevich s.n.* (LE). **Zakarpattia:** Rakhiv Distr., Mt. Bliznitsya, 48°3'N, 24°12'E, 28 June 1950, *Igoshina s.n.* (LE); Mt. Chyorna Gora, Petros, 48°7'N, 24°33'E, 21 July 1946, *Petrov s.n.* (LE); Petros Mtn., 48°7'N, 24°33'E, 25 July 1961, *Slyusarenko s.n.* (LE); in dizione alpis Howerla, 48°9'N, 24°29'E, July 1907, *Stockin s.n.* (G); Breskul, 48°9'N, 24°30'E, 1910, *Stockin s.n.* (P).

2. *Trisetum altaicum* Stephan ex Roshev., Bot. Mater. Gerb. Glavn. Bot. Sada R.S.F.S.R. 3: 85. 1922. TYPE: Russia. Siberia, Altai, “*Avena altaica* Stephan herb. Fisher,” probably *Mardovkin s.n.* (lectotype, designated here, LE-01011086). Figure 5.

Trisetum flavescens var. *serotinum* Ledeb., Fl. Altaic. 1: 91. 1829. TYPE: Altai, near Riddersk, 27 July 1826, C. F. Ledebour s.n. (lectotype, designated here, LE-01042263!).

Herbs (15.9–)26.3–38.3(–67.3) cm tall, slightly caespitose to caespitose, shortly rhizomatous, culm (0.3–)0.7–0.9(–1.2) mm diam., straight, glabrous; nodes (2 to)3 to 4(to 5), mostly concentrated in lower part of culm, not included in sheaths, glabrous, yellowish to blackish. Basal leaf sheaths pubescent, with hairs (0.1–)0.5–0.7(–1.1) mm, also on margins, sometimes decaying into fibers, yellowish to brownish; basal leaf blades (1.6–)2.3–4.7(–13.2) cm × (1.7–)2.3–3.2(–4.5) mm, flat, slightly inrolled when dried, glabrous to sparsely pubescent adaxially and abaxially, with hairs (0.05–)0.1–1(–1.3) mm also on margins, yellowish to brownish, sometimes greenish; top culm leaf sheaths (6–)8–10.3(–15.7) cm, glabrous to pubescent, with hairs up to 1 mm, margins ciliate; top culm leaf blades (1.7–)3.5–7.4(–14.3) cm × (1.8–)2.5–3.3(–4.5) mm, flat, usually parallel to culm, rarely arriving to panicle, glabrous to puberulous abaxially and adaxially, with hairs (0.05–)0.1–1(–1.3) mm on margins, greenish to grayish, rarely brownish; inner collar region glabrous, with scattered hairs (0.2–)0.6–0.9(–1.2) mm on margins; ligules (1–)1.3–1.8(–2.8) mm, irregularly lacinate or toothed, glabrous, usually with scattered hairs (0.1–)0.2–0.4(–0.8) mm on margins and upper part. Basal node of panicle glabrous. Panicles (4.9–)6–8(–13.8) × (1.1–)1.5–2(–2.4) cm, narrowly oblong to elliptic in outline, sometimes lanceolate, somewhat dense; rachis internodes glabrous, usually with scattered hairs up to 0.2 mm; longest basal branches (0.6–)0.9–1.7(–2.7) cm. Spikelets (4.7–)5.2–6.1(–6.6) × (1.5–)1.9–2.3(–3) mm, 2(or 3)-flowered; pedicels (1.4–)2.5–3.7(–5) mm, glabrous, rarely with few scattered hairs up to 0.1 mm. Glumes unequal (lower glume length:upper glume length ratio of [0.52–]0.7–0.8[–0.89]); lower glume (2.4–)3.2–3.8(–4.7) × (0.8–)1.2–1.6 mm, broadly

lanceolate to elliptic (lower glume width:lower glume length ratio of [0.3–]0.35–0.4[–0.53]), acuminate, sometimes acute or long-acuminate, 1(to 3)-nerved, glabrous, with scattered hairs up to 0.2 mm on upper part of midrib, greenish surrounded by purplish; upper glume (3.9–)4.4–5(–6) × 1.7–2(–2.2) mm, broadly lanceolate to elliptic, sometimes oblong (upper glume width:upper glume length ratio of [0.36–]0.39–0.4[–0.49]), acute to acuminate, rarely long-acuminate, 3-nerved, glabrous, with scattered hairs up to 0.15 mm on upper part of midrib, green surrounded by purple; rachilla segment between first and second florets (0.7–)1–1.2(–1.5) mm, with hairs (0.7–)1–1.2(–1.5) mm; rachilla segment to sterile floret (1.1–)1.4–1.8(–2.2) mm, with hairs 0.4–0.9(–1.3) mm. Lemmas (4–)4.4–5(–5.5) × (0.8–)1.2–1.6 mm, lanceolate or oblong, sometimes elliptic (lemma width:lemma length ratio of [0.27–]0.3–0.38[–0.4]), scabridulous, with very short hairs on midrib, up to 0.1 mm, greenish, surrounded by purplish flush; apical teeth (0.1–)0.2–0.3(–0.5) mm, with aristules (0.05–)0.3–0.4(–0.6) mm; awn (3.8–)5.4–6.5(–7.2) mm, inserted 2.3–2.8 mm from base (awn insertion from base length:lemma length ratio of 0.53–0.58[–0.67]), slightly or strongly curved at base, rarely not curved, slightly twisted, with adpressed hairs up to 0.05 mm; callus 0.2–0.3 mm, elliptic to orbicular, with hairs 0.3–0.5(–0.6) mm. Paleae (3.4–)3.7–4.3(–4.7) × (0.8–)1–1.2(–1.4) mm (palea length:lemma length ratio of [0.68–]0.8–0.9[–0.97]), elliptic to oblong, sometimes oblanceolate, margins with hairs on upper part; teeth 0.1–0.2(–0.3) mm, with short, antrorse hairs. Lodicules (0.5–)0.7–0.8(–1.1) mm, with 2 lobules of the same length, rarely lacinate. Anthers (0.8–)1–1.3 mm. Ovaries (0.4–)0.6–1.1(–2.7) mm, glabrous, rarely with 1 hair up to 0.2 mm on upper part. Caryopses (1.5–)1.9–2.5(–2.8) × (0.25–)0.4–0.5(–0.7) mm, narrowly elliptic to oblong. Chromosome number: $2n = 14$ (Sokolovskaya & Probatova, 1975; Probatova & Sokolovskaya, 1980).

Phenology. *Trisetum altaicum* has been collected in flower and fruit from June to September.

Distribution and habitat. *Trisetum altaicum* is distributed in the Tian Shan Mountains (in eastern Kyrgyz Republic and Kazakhstan, and Xinjiang Province in China), the Altai Mountains, and along the mountains in northern Mongolia and adjacent Russia (eastern part of Zabaykalsky Krai and the Buryatia Republic in Russia). This species occurs in alpine meadows and swales, rocky slopes, and coniferous forests at 1520–3020 m. Figure 6.

Discussion. Enushchenko (2011: 59) did not follow the requirements of Article 7.10 of the ICN for lectotypification. Consequently, a lectotype is formally

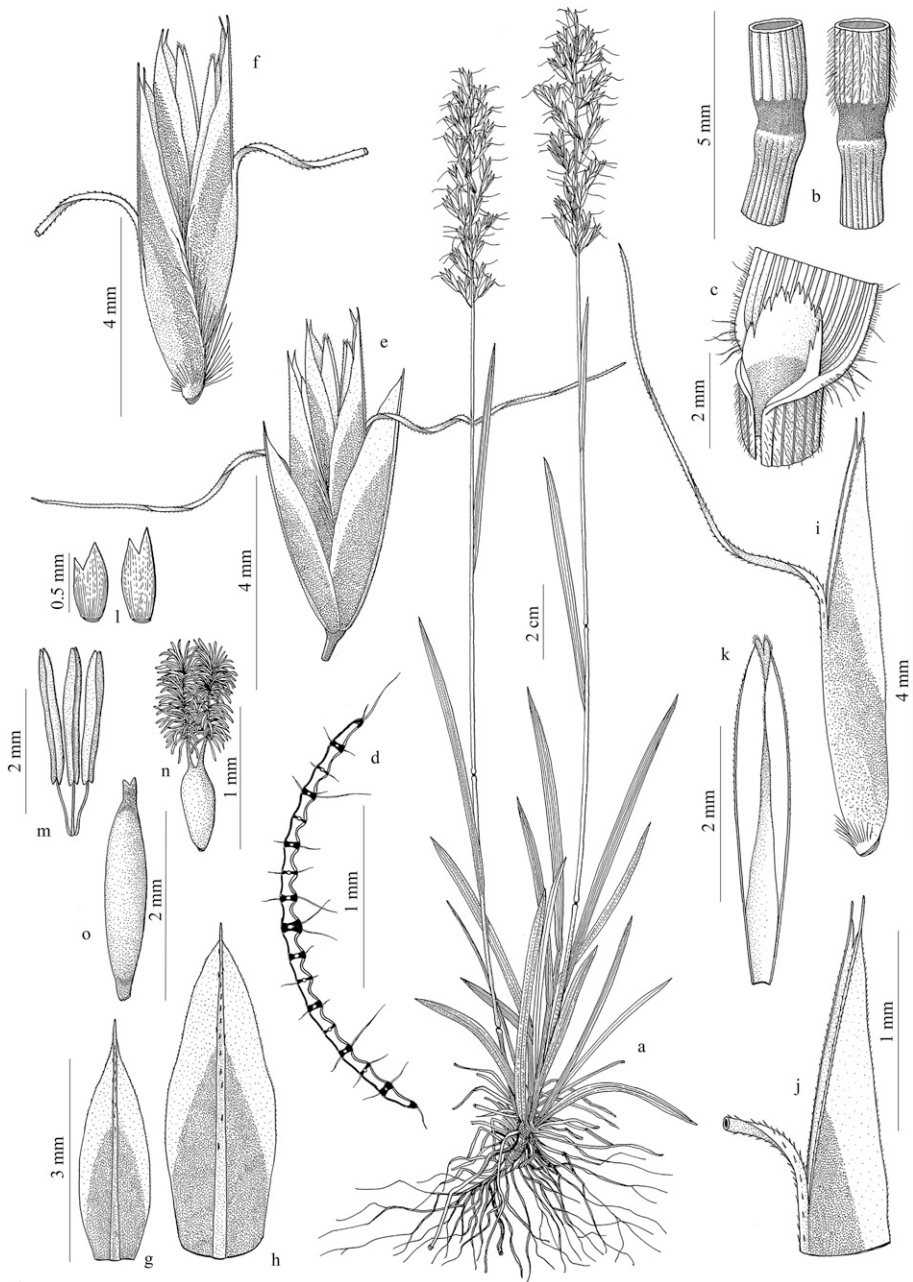


Figure 5. *Trisetum altaicum* Stephan ex Roshev. —A. Habit. —B. Portions of culm internode and node. —C. Portion of sheath, ligule, and blade. —D. Transverse section of leaf blade. —E. Spikelet. —F. Florets. —G. Lower glume, dorsal view. —H. Upper glume, dorsal view. —I. Floret. —J. Lemma, upper part, lateral view. —K. Palea, ventral view. —L. Lodicules. —M. Stamens. —N. Pistil. —O. Caryopsis. A, D based on *Albitskaia & Novoseltseba s.n.* (H-1168456); B, C, E–K, M, N based on *Kuznetsov & Iljin s.n.* (S); L based on *Kuznetsov & Iljin s.n.* (S) and *Igonnikov-Galitzky 465* (S); O based on *Maksimova s.n.* (B-10_0526146).

designated here for *Trisetum altaicum*. According to R. Ufimov and A. Grebenjuk (in litt.), the original collection was probably collected by Mardovkin, who was a collector for Fisher. The choice of this type was made by

R. Roshevitz with a label on the sheet, but it was never published.

Trisetum altaicum has the shortest anthers ([0.8–] 1–1.35 mm) of the species of the section. It is also

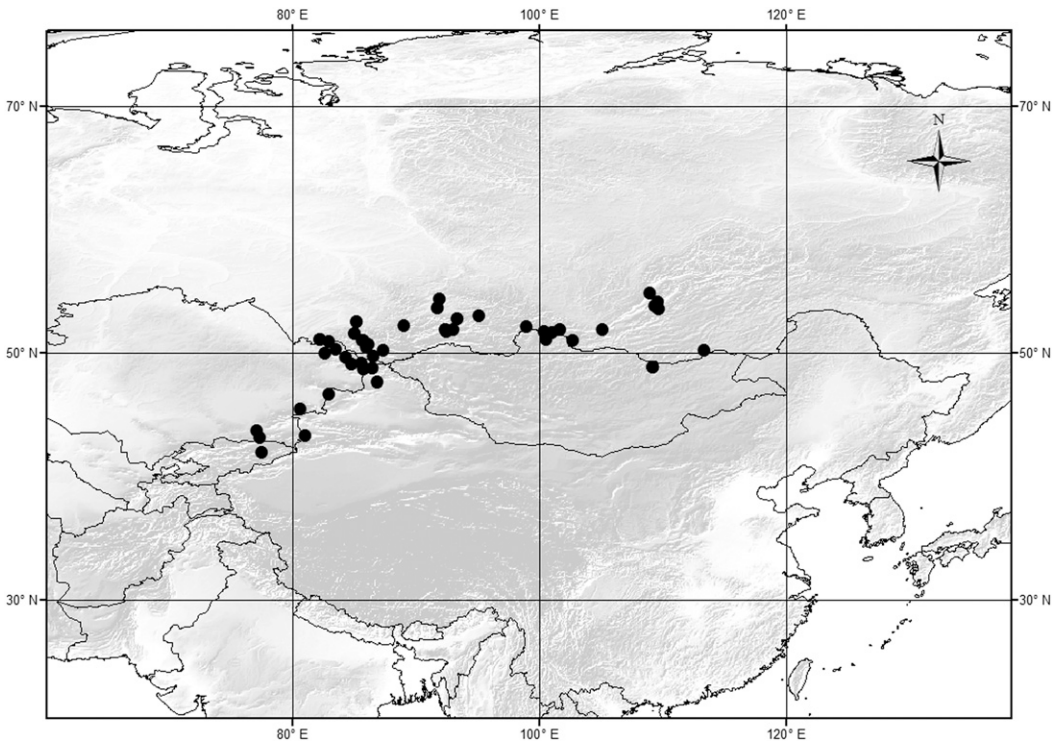


Figure 6. Distribution of *Trisetum altaicum* Stephan ex Roshev. (dots).

characterized by its caespitose habit, wider lower glumes ([0.8–]1.2–1.6 mm), usually purplish and narrower panicles, from narrowly oblong to elliptic in outline, and awns slightly or strongly curved at the base, rarely not curved.

Probatova (1979) placed *Trisetum altaicum* in subsection *Agrostidea*, together with *T. subalpestre* Neuman. These species share their caespitose habit, often spiciform panicles, and short callus hairs and anthers. Our unpublished molecular data showed that those species are not closely related, with *T. subalpestre* aligning in the *T. spicatum* complex (Barberá et al., unpublished data).

Additional specimens examined. CHINA. **Xinjiang:** N of Tacheng, 46°44'N, 82°57'E, 13 Aug. 1957, *Kejian Gua 2930* (PE); Burqin region, 47°42'N, 86°51'E, 23 July 1972, *s. coll. 2052* (HNWP). KAZAKHSTAN. **Almaty:** Talgarskoe gorge, 43°13'N, 77°17'E, 14 June 1909, *Bogolyubov 343* (LE); Trans-Ili Alatau, gorge of the Malaya Almatinska River, 43°46'N, 77°7'E, 16 July 1927, *Dubiansky & Basilevskaja s.n.* (LE); the Ketmenskiy range, upper reach of the Sumbe River, 43°20'N, 81°0'E, 12 Aug. 1931, *Rodin 1108-A* (LE); Lepsinsk uyezd, Tarbagatay range, the Say-asu pass, 45°31'N, 80°36'E, 21 June 1915, *Sapozhnikov & Tripolitova s.n.* (LE). **East Kazakhstan:** Ust-Kamenogorsk uyezd, a range along the Kuzgunda Superior River, 49°58'N, 82°36'E, 2 July 1908, *Sedelnikov s.n.* (LE); Narynshiy range, watershed betw. the basins of the Bukon & Kurchum rivers, pass from Dirat to Terekta, 49°6'N, 84°48'E, 6 Aug. 1914, *Jakowleff 40* (LE); Ridder Distr., 5 km S of Ridder, N slope of the Ivanovskiy

range, 50°20'N, 83°30'E, 5 Aug. 1936, *Matveeva s.n.* (LE); Kaby, Chegan-Daba, Arasankaba, 48°48'N, 86°28'E, Aug. 1920, *Sapozhnikova s.n.* (G, LE); montium Narymensium, pr. pagum Katon-Karagaj, 49°10'N, 85°36'E, 6 Sep. 1930, *Smirnov 10* (JE, MW); Zyryan Distr., Tatarskoe saddle, 49°43'N, 84°16'E, 15 Aug. 1936, *Temnoev 123* (LE). KYRGYZSTAN. **Issyk-Kul:** the Terskey Alatau range, northern slope, the Chimundusay pass, 42°0'N, 77°30'E, 5 July 1936, *Ovchinnikov & Usov 35* (LE). MONGOLIA. **Khentii:** western Kentey Mtns., Kerulen & Onon rivers, Kentein-khan, 48°53'N, 109°10'E, 23 July 1928, *Ikonnikov-Galitskiy & Ikonnikov-Galitskiy 465* (LE); western Kentey Mtns., Kerulen & Onon rivers, hill NNW from Kentein-khan, 48°53'N, 109°10'E, 24 July 1928, *Ikonnikov-Galitskiy & Ikonnikov-Galitskiy 478* (LE); western Kentey Mtns., upper reach of the Kerulen River, NE of Kentein-khan golets, 48°53'N, 109°10'E, 26 July 1928, *Ikonnikov-Galitskiy & Ikonnikov-Galitskiy 575* (LE); SE slope of Kentein-khan golets, 48°53'N, 109°10'E, 9 Aug. 1928, *Ikonnikov-Galitskiy & Ikonnikov-Galitskiy 922* (AAH, LE, NY). **Khövsgöl:** N slope above the saddle betw. summits of Mt. Sardyk, 51°45'N, 100°20'E, 30 July 1926, *Kuwaev 165-2* (LE, MW); Khangay upland, eastern shore of Khovsgol lake, 51°6'N, 100°30'E, 14 July 1924, *Neyburg s.n.* (LE). RUSSIA. **Altai Krai:** Zmeinogorsk uyezd, 51°9'N, 82°11'E, 15 June 1909, *Ilyin s.n.* (L, LE); Biysk uyezd, Mt. Yantyg-Khat, a pass betw. the Ak-kaya & Ayryk rivers, 52°32'N, 85°12'E, 22 June 1915, *Krylov s.n.* (LE); Biysk uyezd, Katunskie belki, upper reach of the Katun River, 49°46'N, 86°31'E, 11 June 1911, *Nekrasova s.n.* (LE); Biysk Okrug, Chernyy Anuy, snowed summits Talitskie belki, 51°34'N, 85°0'E, 8 Aug. 1929, *Pobedimova 649* (LE). **Altai Republic:** Gorno-Altayskaya oblast, Onguday area, Mt. Sarlyk, 51°5'N, 85°42'E, 18

Aug. 1985, *Alanko et al.* 53269 (H); Terektinskiy range, the Kostakhta River, 50°30'N, 86°0'E, 4 July 1931, *Shishkin et al.* s.n. (LE, NY); Kosh-Agachsky rayon, 17 km SW of Chibit, pass from Baksara to Eshtykol valley, 50°14'N, 87°19'E, 28 July 2008, *Serogin & Serogin S-443* (MW); Seminsky Pass, 51°1'N, 85°38'E, 26 July 1996, *Sukopp et al.* 1667 (NY); Zmeinogorsk uyezd, valley of the Chernovaya River, 51°9'N, 82°11'E, 5 Aug. 1910, *Tomin 313* (LE). **Buryatia Republic:** Tunkinsky Distr., near the selo of Mondy, bottom of the valley of the Khulugaysha River, 51°40'N, 100°59'E, 2 Aug. 1963, *Alyanskaya et al.* s.n. (LE); Lake Baykal, source of the Muzhinay River, 54°54'N, 108°54'E, Aug. 1967, *Egorova & Siplivinskiy* s.n. (AAH, GB, LE); Barguzin uyezd, basin of the Muya River, on top of the Kindikanskiy pass, 53°37'N, 109°38'E, 7 Aug. 1914, *Korotkiy et al.* 849 (LE); eastern Sayan, the Pogranichniy range, the Tengisim-Daban, 52°10'N, 98°56'E, 19 Aug. 1959, *Malyshev & Pezhemskaya* 56 (LE); Hangarulsky range, at the source of the Snezhnaya River, 51°5'N, 102°43'E, 20 Aug. 1912, *Smirnov 615* (LE); Lake Baikal, Chivyrskuy, upper reach of the Khozhalyvy River, 53°52'N, 109°17'E, 1 Aug. 1928, *Sukachev et al.* 1652 (LE); Barguzin uyezd, mouth of the Kudalda River, 54°9'N, 109°33'E, 25 July 1939, *Tyulina* s.n. (LE). **Irkutsk:** Lake Baykal, Kulkut, on the way up to Khamar-Daban, 51°55'N, 105°5'E, 14 July 1915, *Tsinzertling* s.n. (LE). **Khakassia Republic:** Abakan River, Mt. Saman, 52°16'N, 88°59'E, 8 Aug. 1927, *Plotnikov* s.n. (PR). **Krasnoyarsk Krai:** Western Sayan, vic. of the Olenya Rechka station, 52°48'N, 93°17'E, 21 July 1964, *Khabarov & Chayka* s.n. (LE); Western Sayan, the Monysh range, 51°54'N, 92°23'E, 25 July 1968, *Krasnoborov & Khanminchun 6812* (LE); Western Sayan, Sabinskiy range, at the upper reach of Sambyd River, 51°54'N, 92°23'E, 20 Aug. 1966, *Krasnoborov & Kuklina* s.n. (LE); Minusinsk Distr., in alpine Sajansensibus ad fl. Kazyr super, 53°42'N, 91°41'E, 12 Aug. 1913, *Kusnezov & Iljyn* s.n. (K, LE, MO, MW, PR, S); basin of the Sydy, Sisma & Many rivers (tributaries of Enisey), 54°22'N, 91°51'E, 30 July 1908, *Volkov 397* (LE). **Tuva Republic:** western slope of the Akademika Obrucheva range, basin of the Tapsa River, upper reach of its right tributary the Kara-Khem River, 53°2'N, 95°4'E, 10 July 1974, *Krasnoborov & Khanminchun 749* (LE); Western Sayan, Uyukskiy range, upper reach of the Orto-Khem River, eastern part of Mt. Bedelig, 51°47'N, 92°26'E, 18 July 1974, *Lomsonova 2590* (LE); Western Sayan, Kurtushibinskiy range, interfluvium of the Khem & Ozhu rivers, 51°55'N, 93°0'E, 11 July 1979, *Shaulo & Belskaya 1520* (LE). **Zabaykalsky Krai:** Khentey-Chikoyskoe upland, the Borshechovochniy range, 51°43'N, 111°58'E, 5 Aug. 1967, *Maksimova* s.n. (AAH, B, G, K, LE, M, S); Aksha uyezd, basin of the Onon River, near the source of the Balidzhi River, 50°16'N, 113°17'E, 1 Aug. 1913, *Smirnov 1433* (LE).

3. *Trisetum bertolonii* Jonsell, Bot. J. Linn. Soc. 76 (4): 320. 1978. *Avena villosa* Bertol., Excerpta Re Bot.: 6. 1820 [Opusc. Sci. 4: 222. 1820, n.v.]. *Trisetum villosum* (Bertol.) Schult., Mant. 2: 368. 1824, nom. illeg., non *Trisetum villosum* Pers., Syn. Pl. 1: 97. 1805. *Trisetaria villosa* (Bertol.) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 386. 1996. TYPE: Italy. Teramo Prov., Monte Corno, Arapietra, 42°29'N, 13°34'E, 1818, *A. Orsini* s.n. (lectotype, designated by Jonsell [1978: 320], BOLO image!). Figure 7.

Trisetum villosum var. *glaberrimum* Ces., Comp. Fl. Ital. 1(3): 64. 1869. *Trisetum villosum* subsp. *glaberrimum* (Ces.)

Arcang., Comp. Fl. Ital.: 779. 1882. TYPE: Italy, Chiarino, *C. Gussone* s.n. (original material not located).

Herbs (16.5–)17.7–27.8(–38) cm tall, caespitose, shortly rhizomatous, culm 0.4–0.7 mm diam., straight, sometimes curved at upper part, pubescent, with hairs 0.2–0.8 mm; nodes 2 to 3(to 4), mostly concentrated in lower part of culm, included or not in sheaths, glabrous, brownish. Basal leaf sheaths glabrous to pubescent, with hairs 0.1–0.3 mm, decaying into fibers, yellowish; basal leaf blades (2–)4.2–7.8(–12) cm × 1.2–1.5(–2) mm, inrolled, glabrous abaxially and pubescent adaxially, with hairs up to 0.2 mm, also on margins, grayish to greenish; top culm leaf sheaths (3.6–)5.3–8.5(–11) cm, glabrous, without cilia on margins; top culm leaf blades (1–)2.5–3.8(–6.2) cm × 1.4–2(–2.4) mm, conduplicate or flat, with margins inrolled, parallel to culm, pubescent abaxially, glabrous adaxially, with scattered hairs on margins, with hairs (0.05–)0.2–0.4 mm, greenish; inner collar region glabrous; ligules 0.5–1.3 mm, slightly irregularly dentate, glabrous. Basal node of panicle glabrous to pubescent, with hairs up to 0.5 mm. Panicles (3.5–)4.6–7.4(–8) × 1.6–3 cm, narrowly elliptic, sometimes ovate to broadly lanceolate in outline, rather lax; rachis internodes pubescent, rarely sparsely puberulous, with hairs up to 0.5 mm; longest basal branches (0.7–)0.9–1.6(–1.7) cm. Spikelets 7–9 × 2.5–4(–5) mm, 2- to 3-flowered; pedicels 3.7–4.7(–8.4) mm, pubescent, sometimes very sparsely pubescent, with hairs up to 0.2 mm. Glumes unequal (lower glume length:upper glume length ratio of [0.53–]0.63–0.7); lower glume (3.8–)4.6–5.3(–6) × (0.4–)0.6–1 mm, narrowly lanceolate, rarely linear (lower glume width:lower glume length ratio of [0.11–]0.14–0.17[–0.2]), long-acuminate to acuminate, 1-nerved, glabrous, usually with scattered hairs up to 0.1 mm on upper part of central nerve, greenish margins hyaline, rarely surrounded by purplish; upper glume 6.8–8(–9) × 1.4–2(–2.4) mm, broadly lanceolate to oblong or elliptic, rarely narrowly lanceolate (upper glume width:upper glume length ratio of [0.19–]0.22–0.28[–0.3]), acuminate to long-acuminate, 3-nerved, glabrous, sometimes with scattered hairs up to 0.1 mm on upper part of midrib, greenish, sometimes yellowish, with hyaline margins; rachilla segment between first and second florets 1–1.8 mm, with hairs (0.8–)1.3–2.2(–2.8) mm; rachilla segment to sterile floret 1.4–2(–2.3) mm, with hairs 1–1.5 mm. Lemmas (5.7–)6–8(–10) × (0.4–)0.6–1 mm, oblong to narrowly lanceolate (lemma width:lemma length ratio of 0.13–0.23[–0.3]), glabrous, sometimes scabridulous, yellowish or greenish, with hyaline margins, sometimes surrounded by purplish flush; apical teeth 0.3–0.5(–0.8) mm, with aristules 1.2–2.3(–4) mm; awn (11–)11.5–16(–17) mm, inserted 2.8–4 mm from base (awn



Figure 7. *Trisetum bertolonii* Jonsell. —A. Habit. —B. Portion of culm internode and node. —C. Portion of sheath, ligule, and blade. —D. Transverse section of leaf blade. —E. Spikelet. —F. Florets. —G. Lower glume, dorsal view. —H. Upper glume, dorsal view. —I. Floret. —J. Lemma, upper part, lateral view. —K. Palea, lateral view. —L. Lodicules. —M. Stamens. —N. Pistil. —O. Caryopsis. A based on *Bertoloni s.n.* (P-03365075); B, C, E–K, M, N based on *Merxmüller & Wiedmann 19570* (M-0223256); D based on *Navarro et al. CN4234* (MA-699433); L based on *Bertoloni s.n.* (P-03365075) and *Navarro et al. CN4234* (MA-699433); O based on *Orsini s.n.* (P-02320457).

insertion from base length:lemma length ratio of [0.56–] 0.6–0.68[–0.75]), straight or slightly curved at middle, twisted, with short, adpressed hairs up to 0.05 mm; callus 0.2–0.3 mm, elliptic, rarely orbicular, with hairs

1.5–2.2(–2.6) mm. Paleae (3.2–)3.8–5.2 × 0.8–1.2 mm (palea length:lemma length ratio of [0.4–]0.58–0.67 [–0.7]), oblong to oblanceolate, margins glabrous or with scattered hairs; teeth 0.2–0.4(–0.6) mm, with short,

antrorse hairs. Lodicules 0.4–0.7(–0.8) mm, with 2 lobules of the same length, rarely with 3 shallow ones. Anthers (1.4–)2.2–2.3(–2.6) mm. Ovaries 0.5–0.9(–1.1) mm, glabrous. Caryopses ca. 3.2 × 0.9 mm, oblong. Chromosome number: 2n = 14 (Favarger, 1973).

Additional illustrations. Chrték & Jirásek (1963: 577, fig. 3, 3, sub *Trisetum villosum*); Chrték (1967c: 176, tab. I, 2; 178, tab. II, 3–4, sub *Trisetum villosum*); Fiori & Paoletti (1895: 27, 231, sub *Trisetum villosum*).

Phenology. *Trisetum bertolonii* has been collected in flower and fruit from May to August.

Distribution and habitat. This species is endemic to the Apennines. It is found in limestone rocks on mountain cliffs at 170–1630 m. Figure 4.

Discussion. *Trisetum bertolonii* is easily differentiated from the rest of the species of the section by its habit, with long and convolute leaves or with margins inrolled, and a combination of different characters of the spikelets. This species has the longest callus hairs (1.5–2.2[–2.6] mm), upper glumes (6.8–8[–9] mm), and awns ([11–]11.5–16[–17] mm), which are straight or slightly curved at the middle, and lemmas with hyaline margins.

Chrték (1967c) considered *Trisetum bertolonii* to be closely related to *T. griseovirens*, from the High Atlas Mountains in Morocco, because of their similar habits, shape and anatomy of the leaves, and awn length. Later, Jonsell (1978) agreed that *T. bertolonii* is close to, but not conspecific with, *T. griseovirens*. We consider *T. griseovirens* to be a subspecies of *T. flavescens*. The material studied of both species shows some similarities in habit and other characters of the spikelets, which are more pronounced in *T. bertolonii*. *Trisetum bertolonii* and *T. flavescens* subsp. *griseovirens* have narrow leaves (convolute or filiform and inrolled, respectively), longer aristules (1.2–2.3[–4] mm and [0.9–]1.1–1.4[–1.8] mm, respectively), longer awns ([11–]11.5–16[–17] mm and [8–]8.2–9[–10.6] mm, respectively), and a more marked difference between the palea and the lemma length (palea length:lemma length ratio of [0.4–]0.58–0.67 [–0.7] and [0.53–]0.65–0.76[–0.77], respectively). However, both taxa are easy to differentiate, because *T. bertolonii* has longer callus hairs (1.5–2.2[–2.6] mm and 0.4–0.5[–0.7] mm, respectively) and straight or slightly curved awns, whereas *T. flavescens* subsp. *griseovirens* has geniculate ones. Additionally, our molecular data (Barberá et al., unpublished) show that both taxa are not closely related. Thus, we do not agree with Jonsell (1978) who states that *T. bertolonii* and *T. griseovirens* may constitute an isolated pair of species with an interesting phylogeographical disjunction.

Due to the long aristules of *Trisetum bertolonii*, the aristules were not taken into account for calculating the

ratio of the awn insertion from the base length/lemma length.

Additional specimens examined. ITALY. **Ascoli Piceno:** Monte Vettore, 42°49'N, 13°16'E, 21 July 1886, *Orsini 863* (L); Monte Volubrio, 42°55'N, 13°16'E, 1847, *Bertoloni s.n.* (P); Furca del Cristo sub Monte Vettore, 42°49'N, 13°16'E, 6 July 1856, *Caruel s.n.* (K); Monte della Sibilla, 42°54'N, 13°15'E, 1843, *Marzialetti s.n.* (FI); Monte Vettore, 42°49'N, 13°16'E, July 1856, *Rostan s.n.* (BM). **L'Aquila:** Gran Sasso, Campo Imperatore, Observatory, 42°26'N, 13°33'E, 3 Aug. 1960, *Segelberg s.n.* (GB, S). **Macerata:** in montibus di Camerino, 43°8'N, 13°4'E, 1831, *Bertoloni s.n.* (B). **Pesaro and Urbino:** Gola die Furlo an der Via Flaminia, zw. Fossombrone und Acqualagna, 43°38'N, 12°42'E, 16 May 1964, *Mexmüller & Wiedmann 18/64* (M). **Pescara:** Vado di Sole, 42°23'N, 13°47'E, 2 July 2002, *Navarro et al. 4234* (MA). **Teramo:** Monte dei Fiori, 42°46'N, 13°35'E, s. coll. s.n. (H); Monte Corno, 42°28'N, 13°33'E, *Orsini s.n.* (FI, P); 1833, *Orsini s.n.* (P); Monte Corno ad Arapietra, 42°29'N, 13°34'E, *Orsini s.n.* (FI).

4. *Trisetum flavescens* (L.) P. Beauv., Ess. Agrostogr. 88. 1812. *Avena flavescens* L., Sp. Pl.: 80. 1753. *Trisetum pratense* Pers., Syn. Pl. 1: 97. 1805, nom. illeg. *Trisetaria flavescens* (L.) Baumg., Enum. Stirp. Transsilv. 3: 263. 1816. *Avena flavescens* var. *pratensis* Neilr., Fl. Nieder.-Oesterreich: 56. 1859, nom. illeg. *Avenastrum flavescens* (L.) Jess., Deutschl. Gräser: 215. 1863. *Trisetum flavescens* subsp. *pratense* Asch. & Graebn., Syn. Mitteleur. Fl. 2: 265. 1899. TYPE: Herb. A. van Royen N° 913. 7-458 (lectotype, designated by Cope in Cafferty et al. [2000: 247], L-221378 image!).

Herbs (20.2–)30.9–58.1(–141.5) cm tall, not to slightly caespitose or caespitose, rhizomatous or with stoloniferous rhizome, culm (0.3–)0.6–0.8(–1.2) mm diam., straight, glabrous, rarely sparsely pubescent, with hairs 0.1–0.5 mm; nodes (3 to)4 to 5(to 7), separated along culm, not included in sheaths, glabrous, yellowish to brownish. Basal leaf sheaths sparsely pubescent to pubescent, rarely glabrous, with hairs (0.1–)0.4–1(–1.7) mm, decaying into fibers, yellowish to brownish, sometimes greenish; basal leaf blades (1.4–)3.9–7(–18) cm × (0.6–)1.5–2.7(–5.6) mm, flat, sometimes convolute, rarely filiform, inrolled when dried, from glabrous to pubescent abaxially, pubescent, rarely glabrous adaxially, with hairs (0.05–)0.1–0.8(–1) mm, usually with cilia, brownish to yellowish, sometimes greenish or grayish; top culm leaf sheaths (4.5–)7.5–11(–20) cm, glabrous, rarely pubescent, rarely with cilia, usually with hyaline margins; top culm leaf blades (1.3–)4–9(–14.5) cm × (1–)1.8–3.4(–6) mm, from flat to convolute or filiform, rarely parallel to culm, glabrous to pubescent abaxially, pubescent to densely pubescent adaxially, rarely glabrous, with hairs (0.05–)0.2–1(–1.5) mm, sometimes with cilia, greenish to grayish; inner collar region glabrous, rarely with scattered hairs or

sparingly pubescent, with hairs 0.05–1 mm; ligules (0.5–)0.7–1.2(–2) mm, irregularly dentate to lacinate, rarely entire, glabrous, sometimes with adpressed hairs on surface, glabrous or with hairs (0.05–)0.2–0.4 (–0.6) mm on upper part. Basal node of panicle glabrous, rarely sparsely puberulous, with hairs 0.05–0.2 mm. Panicles (3.5–)6–10.5(–16.2) × (0.9–)1.5–2.8(–5) cm, narrowly elliptic or elliptic to narrowly lanceolate or lanceolate in outline, rarely oblong or ovate, lax to somewhat dense; rachis internodes glabrous to sparsely pubescent, mostly on upper part and branches, rarely pubescent, with hairs up to 0.2(–0.3) mm; longest basal branches (0.5–)1.1–2.1(–4) cm. Spikelets (3.8–)5.2–6.3(–7.7) × (0.8–)1.8–3(–3.8) mm, 2- to 3(4)-flowered; pedicels (1.5–)2.6–3.7(–5) mm, sparsely pubescent, sometimes glabrous or pubescent, with hairs 0.05–0.1(–0.3) mm. Glumes unequal (lower glume length:upper glume length ratio of [0.54–]0.6–0.7[–0.78]); lower glume (2–)3–3.7(–4.6) × (0.4–)0.6–0.7(–1.1) mm, narrowly lanceolate, sometimes broadly lanceolate (lower glume width:lower glume length ratio of [0.1–]0.17–0.22[–0.37]), acuminate, sometimes long-acuminate, rarely acute, 1(3)-nerved, glabrous, usually with short hairs from center to upper part of main nerve, up to 0.1 mm, greenish, rarely purplish or brownish, with hyaline margins; upper glume (3.2–)4.6–5.3(–7.4) × (1.1–)1.5–1.8(–2.2) mm, elliptic, usually oblong or broadly lanceolate, sometimes slightly oblanceolate (upper glume width:upper glume length ratio of [0.25–]0.3–0.36[–0.47]), acuminate to long-acuminate, 3-nerved, glabrous, usually with short hairs from center to upper part of central

nerve, with hairs up to 0.1 mm, greenish, rarely purplish, usually with hyaline margins; rachilla segment between first and second florets (0.6–)0.8–1.1(–1.3) mm, with hairs (0.2–)0.6–1.1(–2.1) mm; rachilla segment to sterile floret (0.7–)1–1.2(–1.5) mm, with hairs (0.2–)0.4–0.7(–1.2) mm. Lemmas (3.2–)4.4–5.4 (–7.4) × (0.4–)0.6–0.7(–1.1) mm, narrowly to broadly lanceolate, sometimes oblong or elliptic, rarely oblanceolate (lemma width:lemma length ratio of [0.19–]0.23–0.3[–0.43]), glabrous to scabridulous, with short hairs up to 0.1 mm on upper part and along midrib, greenish to yellowish on central part, sometimes with purple; apical teeth (0–)0.2–0.3(–0.6) mm, with aristules (0.1–)0.4–0.7(–1.8) mm; awn (4.2–)5.7–7.2 (–10.6) mm, inserted (1.5–)2.4–3.3(–4) mm from base (awn insertion from base length:lemma length ratio of [0.45–]0.54–0.59[–0.67]), geniculate to slightly geniculate, ± twisted at base, rarely not twisted, with hairs up to 0.05 mm; callus (0.1–)0.2 mm, orbicular, sometimes rounded or elliptic, with hairs (0.1–)0.2–0.4(–0.7) mm. Paleae (2.2–)3.4–4.2(–5.5) × (0.6–)0.8–1(–1.3) mm (palea length:lemma length ratio of [0.53–]0.72–0.82 [–0.95]), elliptic to narrowly elliptic, sometimes slightly oblanceolate, margins with hairs on upper part, sometimes glabrous; teeth (0.05–)0.2–0.3(–0.6) mm, with short, antrorse hairs mostly on upper part, rarely glabrous. Lodicules (0.3–)0.4–0.6(–0.9) mm, with (1 to) 2 to 3 teeth or lobules of equal or different depths, sometimes entire. Anthers (1–)1.7–2.2(–3) mm. Ovaries (0.3–)0.4–0.7(–1.1) mm, glabrous. Caryopses (2.3–)2.4–2.9(–3.7) × 0.3–0.5 mm, narrowly elliptic, sometimes linear.

KEY TO THE SUBSPECIES OF *TRisetum FLAVESCENS*

1. Lemmas (3.2–)4.3–5.1(–7.4) mm long; aristules (0.1–)0.3–0.6(–1.4) mm long; awns (4.2–)5.6–7(–8.3) mm long . . .
..... *T. flavescens* (L.) P. Beauv. subsp. *flavescens*
- 1'. Lemmas 6–6.2(–6.4) mm long; aristules (0.9–)1–1.4(–1.8) mm long; awns (8–)8.2–9(–10.6) mm long
..... *T. flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard

4a. *Trisetum flavescens* subsp. *flavescens*.

Avena purpurascens DC., Cat. Pl. Horti Monsp.: 82. 1813. *Trisetum flavescens* subsp. *purpurascens* (DC.) Arcang., Comp. Fl. Ital.: 779. 1882. *Trisetum flavescens* subvar. *purpurascens* (DC.) J. Zimm. in Hegi, Ill. Fl. Mitt.-Eur. 1, ed. 2: 337. 1936. *Trisetum flavescens* f. *purpurascens* (DC.) Borza, Consp. Fl. Roman. 1: 24. 1947. *Trisetaria flavescens* subsp. *purpurascens* (DC.) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 383. 1996. TYPE: France. Savoie, Cenis Mtn., 45°15'N, 6°54'E, 1809, *J. L. Bonjean s.n.* (lectotype, designated here, G-DC-00418509 image!).

Trisetum splendens C. Presl, Cyper. Gramin. Sicul.: 30. 1820. *Avena splendens* (C. Presl) Guss., Fl. Sic. Prodr. 1: 126. 1827. *Trisetum flavescens* var. *splendens* (C. Presl) Parl., Fl. Ital. 1: 261. 1848. *Trisetum flavescens* subsp. *splendens* (C. Presl) Arcang., Comp. Fl. Ital.: 779. 1882. *Trisetaria flavescens* subsp. *splendens* (C. Presl) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat.

Milano 135: 383. 1996. TYPE: Italy, Sicily, San Martino, 37°59'N, 15°9'E, June 1817, *C. Presl s.n.* (lectotype, designated here, PRC-450870 image!; possible isolectotypes, PRC-450868 image!, W-1889-0242136!).

Trisetum flavescens var. *biflorum* Gray, Nat. Arr. Brit. Pl. 2: 129. 1821. TYPE: Great Britain. *S. F. Gray s.n.* (no original material found).

Avena flavescens var. *depauperata* Mert. & W. D. J. Koch, Deutschl. Fl., ed. 3, 1: 563. 1823. *Trisetum flavescens* var. *depauperatum* (Mert. & W. D. J. Koch) R. Uechtr., Fl. Schlesien: 512. 1881. TYPE: Germany, Alps, *F. K. Mertens & W. D. J. Koch s.n.* (LE?) (no original material found).

Avena flavescens var. *variegata* Gaudin ex Mert. & W. D. J. Koch in Röhl., Deutschl. Fl. 1, ed. 3, 1: 562. 1823. *Trisetum flavescens* var. *alpinum* Parl., Fl. Ital. 1: 261. 1850, nom. illeg. *Trisetum flavescens* var. *variegatum* (Gaudin ex Mert. & W. D. J. Koch) Schur, Enum. Pl. Transsilv.: 758. 1866. *Trisetum flavescens* [b] *variegatum* (Gaudin ex Mert. & W. D. J. Koch) Asch. & Graebn., Syn.

- Mitteleur. Fl. 2: 266. 1899. *Trisetum flavescens* f. *variegatum* (Gaudin ex Mert. & W. D. J. Koch) Beetle, Phytologia 38(3): 176. 1978. TYPE: Switzerland. *J. F. Gaudin* s.n. (lectotype, designated here, L-1346419!).
- Avena flavescens* var. *major* Spenn., Fl. Friburg. 1: 108. 1825. TYPE: Germany. Friburg, *F. C. L. Spenner* s.n. (FB?, original material not located).
- Avena flavescens* var. *capillacea* Gaudin, Fl. Helv. 1: 337. 1828. *Trisetum flavescens* var. *capillaceum* (Gaudin) Ducommun, Taschenb. Schweiz. Bot.: 857. 1869. TYPE: Switzerland. Vaud, Châteaux d'Oex, June & July, *J. F. Gaudin* s.n. (original material not located).
- Avena flavescens* var. *maior* Gaudin, Fl. Helv. 1: 337. 1828, nom. illeg., non Spenn., Fl. Friburg. 1: 108. 1825. *Trisetum flavescens* var. *latifolium* Schur, Enum. Pl. Transsilv.: 758. 1866, nom. illeg. TYPE: Switzerland. *J. F. Gaudin* s.n. (original material not located).
- Avena flavescens* var. *lutescens* Rchb., Fl. Germ. Excurs. 1: 51. 1830. *Trisetum flavescens* var. *lutescens* (Rchb.) Druce, Fl. Oxfordshire, ed. 2: 478. 1927. *Trisetum flavescens* subvar. *lutescens* (Rchb.) Maire, Cat. Maroc.: 48. 1931. *Trisetum flavescens* f. *lutescens* (Rchb.) Buia & Morariu, Fl. Republ. Socialiste România 12: 292. 1972. TYPE: (lectotype, designated here, Rchb., Icon. Fl. Germ. Helv. 1, tab. XCIX, fig. 1695. 1834).
- Trisetum burnoufii* Req. ex Parl., Fl. Ital. 1: 263. 1850. *Avena burnoufii* (Req. ex Parl.) Nyman, Syll. Fl. Eur.: 413. 1855. *Trisetum flavescens* var. *burnoufii* (Req. ex Parl.) Hack in Briq., Prodr. Fl. Corse 1: 104. 1910. *Trisetum flavescens* subsp. *burnoufii* (Req. ex Parl.) P. Fourn., Quatre Fl. France, ed. 2: 60. 1946. *Trisetaria burnoufii* (Req. ex Parl.) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 382. 1996. TYPE: France. Corse, Haute-Corse, Corte, 42°18'N, 9°8'E, 7 Oct. 1847, *E. Requièn* s.n. (lectotype, designated by Signorini & Ricceri [1996: 215], FI not seen; isolectotypes, G-00100184!, P-03365150!).
- Avena candollei* M. Serres, Bull. Soc. Bot. France 4: 440. 1857. *Trisetum candollei* (M. Serres) B. Verl., Cat. Pl. Vasc. Dauphiné: 365. 1872. TYPE: France. Hautes-Alpes, Gap, 44°34'N, 6°5'E, *B. Blanc* s.n. (original material not located).
- Trisetum flavescens* var. *glabratum* Asch., Fl. Brandenburg 1: 830. 1864. TYPE: Germany. Brandenburg, *s. coll.* (original material not located).
- Trisetum flavescens* var. *biflorum* Schur, Enum. Pl. Transsilv.: 757. 1866, nom. illeg., non *Trisetum flavescens* var. *biflorum* Gray, Nat. Arr. Brit. Pl. 2: 189. 1821. TYPE: Romania. Kronstadt [Braşov], *P. J. F. Schur* s.n. (original material not located).
- Trisetum flavescens* var. *triflorum* Schur, Enum. Pl. Transsilv.: 758. 1866. TYPE: Romania. Sibiu [Hermannstadt], 45°48'N, 24°9'E, June 1852, *P. J. F. Schur* s.n. (lectotype, designated here, LW-213271 image!).
- Trisetum bungei* Boiss., Fl. Orient. 5: 535. 1884. TYPE: Iran. Golestan, Ziarat, 36°41'N, 54°31'E, 13 May 1858, *A. A. v. Bunge* 68 (lectotype, designated here, P-03644568!; isolectotypes, B not seen, K image!).
- Trisetum pratense* var. *villosum* Čelak., Sitzungsber. Königl. Böhm. Ges. Wiss. Prag., Math.-Naturwiss. Cl. 1887: 180. 1887. *Trisetum flavescens* var. *villosum* (Čelak.) Fiek, Jahresber. Schles. Ges. Vaterl. Cult. 67: 167. 1889. TYPE: Czech Republic. Ptáčekovna, Písek, 49°19'N, 14°10'E, *H. Ciboch* s.n. (original material not located).
- Trisetum flavescens* var. *nodosum* Chabert, Bull. Soc. Bot. France 36: 31. 1889. TYPE: Algeria. Nador supra Medeah, 36°15'N, 2°45'E, 1871–1875, *A. C. Chabert* s.n. (FI?, original material not located).
- Trisetum flavescens* var. *tenue* Hack. ex Formánek, Verh. Naturf. Vereins Brünn 35: 155. 1897. *Trisetum tenue* (Hack. ex Formánek) Chrtek, Acta Univ. Carol., Biol. 1971: 228. 1973, nom. illeg., non *Trisetum tenue* Roem. & Schult., Syst. Veg. (ed. 15 bis) 2: 657. 1817. *Trisetum tenuiforme* Jonsell, Bot. J. Linn. Soc. 76: 320. 1978. *Trisetum flavescens* subsp. *tenue* (Hack. ex Formánek) Strid, Mount. Fl. Greece 2: 808. 1991. *Trisetaria tenuiformis* (Jonsell) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 385. 1996. TYPE: Greece. Thessalia, Agrapha, Monoster Korona, 39°8'N, 21°38'E, 1 Aug. 1896, *E. Formánek* s.n. (lectotype, designated by Jonsell [1978: 320], W-1916-0031810!).
- Trisetum flavescens* var. *ponticum* Velen., Fl. Bulg., Suppl. 1: 295. 1898. TYPE: Bulgaria. Burgas, 42°30'N, 27°28'E, 1893, *S. Jablonowsky* s.n. (lectotype, designated here, PRC-451827 image!).
- Trisetum flavescens* var. *serbicum* Velen., Fl. Bulg., Suppl. 1: 295. 1898. *Trisetum flavescens* subsp. *serbicum* (Velen.) Hayek, Repert. Spec. Nov. Regni Veg. Beih. 30(2): 312. 1933. TYPE: Serbia. Vranja, 42°33'N, 21°54'E, 1898, *L. L. Adamović* s.n. (lectotype, designated here, PRC-451825 image!).
- Avena flavescens* f. *major* Hausskn., Mitth. Thüring. Bot. Vereins 13: 42. 1899, nom. illeg., non *Avena flavescens* var. *major* Spenn., Fl. Friburg. 1: 108. 1825. TYPE: Greece. Thessaly, Pharsalus, 39°17'N, 22°23'E, June 1885, *C. Haussknecht* s.n. (lectotype, designated here, JE-18858!).
- Avena flavescens* var. *pingica* Hausskn., Mitth. Thüring. Bot. Vereins 13: 43. 1899. TYPE: Greece. Monte Karava, 39°18'N, 21°33'E, July 1885, *C. Haussknecht* s.n. (lectotype, designated here, JE-00018850!; isolectotype, JE-00018851!).
- Trisetum corsicum* Rouy, Rev. Bot. Syst. Géogr. Bot. 1: 139. 1904. *Trisetum flavescens* var. *corsicum* (Rouy) Briq., Prodr. Fl. Corse 1: 103. 1910. *Trisetum flavescens* subsp. *corsicum* (Rouy) Cif. & Giacom., Nomencl. Fl. Ital., 1: 30. 1950. TYPE: France. Corse, Corte, 42°18'N, 9°9'E, July 1898, *J. Foucaud* 924 (lectotype, designated by Signorini & Ricceri [1996: 216], LY not seen; isolectotypes, G-00100185!, P-319106!, P-2217837!, P-2221569!).
- Trisetum flavescens* var. *paczoskii* Zapał., Bull. Int. Acad. Sci. Cracovie, Cl. Sci. Math. 3: 167. 1904. TYPE: Tatra Mtns., *J. K. Paczosi* s.n. (KRAM?; original material not located).
- Trisetum flavescens* f. *scabriusculum* Zapał., Rozpr. Wydz. Mat.-Przyr. Akad. Umiejtn., Dzia B, Nauki Biol. 4: 107. 1904. TYPE: Ukraine. Dublyani, 49°55'N, 24°9'E, *J. K. Paczosi* s.n. (KRAM?; original material not located).
- Trisetum flavescens* f. *subpilosum* Zapał., Rozpr. Wydz. Mat.-Przyr. Akad. Umiejtn., Dzia B, Nauki Biol. 4: 107. 1904. TYPE: Poland. Lesser Poland, Wola Batorska, 50°03'N, 20°15'E, *J. Krupa* s.n. (KRAM?, original material not located).
- Trisetum flavescens* var. *barcinonense* Sennen, Bull. Géogr. Bot. 23: 50. 1913. TYPE: Spain. Barcelona Prov., Tibidabo Mtns., Santa Cruz de Olorde, 41°25'N, 2°06'E, June 1911, *F. Sennen* 1238 (lectotype, designated here, MA-7940!; isolectotypes, B-10_0470051!, BCN-82824!, DAO-000465368 image!, FR-0036078 image!, JE-00021246!, JE-00021247!, JE-00021248!, JE-00021249!, MPU!, NY!, SEV-6701!, W-19120005494 image!, W-19230017014 image!, W-20080017999 image!, WU!).

Trisetum handelii Vierh., Oesterr. Bot. Z. 73: 128. 1924. TYPE: Italy. Veneto, Ampezzo, 46°25'N, 12°47'E, 1905–1907, *F. K. M. Vierhapper s.n.* (lectotype, selected by W. Till in sched., designated here, WU-0073386 image!).

Trisetum flavescens var. *africanum* H. Lindb., Acta Soc. Sci. Fenn., Ser. B, Opera Biol. 1(2): 25. 1932. *Trisetum flavescens* subsp. *africanum* (H. Lindb.) Dobignard, J. Bot. Soc. Bot. France 28: 44. 2004. TYPE: Morocco. Marrakesh-Safi, Amizmiz, 31°13'N, 8°13'W, 24 May 1926, *H. Lindberg 2719* (lectotype, designated by Väre [2012: 89], H-1168497!; isolecotypes, CAI-000243 image!, H-1168500!).

Trisetum flavescens var. *clausonii* Maire, Bull. Soc. Hist. Nat. Afrique N. 23: 219. 1932. TYPE: Algeria. Djelfa Prov., Kef Roumia, 34°23'N, 3°10'E, 30 May 1855, *Th. Clauson s.n.* (lectotype, designated here, MPU-3030!; isolecotype, P-83440!).

Trisetum flavescens f. *hirticulme* H. Lindb., Acta Soc. Sci. Fenn., Ser. B, Opera Biol. 1(2): 25. 1932. TYPE: Morocco. Marrakesh-Safi, Asni, Reraïa River valley, 31°10'N, 7°54'W, 2 June 1926, *H. Lindberg 3483* (lectotype, designated by Väre [2012: 89], H-1168498!).

Trisetum macratherum Maire & Trab., Bull. Soc. Hist. Nat. Afrique N. 23: 218. 1932. *Trisetum flavescens* var. *macratherum* (Maire & Trab.) Maire & Weiller, Fl. Afrique N. 2: 247. 1953. *Trisetum flavescens* subsp. *macratherum* (Maire & Trab.) Dobignard, J. Bot. Soc. Bot. France 28: 44. 2004. TYPE: Algeria. Near Oran, 35°41'N, 0°37'W, *L. C. Trabut s.n.* (lectotype, designated here, MPU-3029!).

Trisetum flavescens subsp. *taticum* Chrtek, Čas. Nár. Mus., Odd. Přír. 35(2): 81. 1966. TYPE: Slovakia. Belanské Tatry, Bujaci, 49°13'N, 20°16'E, 15 Aug. 1933, *K. Domin s.n.* (holotype, PRC-454454 image!).

Trisetum flavescens subsp. *parvispiculatum* Tzvelev, Spisok Rast. Gerb. Fl. S.S.S.R. Bot. Inst. Vsesojuzn. Akad. Nauk 18: 6. 1970. *Trisetum parvispiculatum* (Tzvelev) Prob., Bot. Zhurn. (Moscow & Leningrad) 60: 674. 1975. TYPE: Russia. Dagestan Republic, Makhachkala, Tarkitau Mtn., 42°56'N, 47°27'E, 17 May 1953, *J. I. Prokhanov 407* (holotype, LE-01042366!).

Herbs (20.2–)36.4–63.1(–141.50) cm tall. Basal leaf blades (1.5–)4.2–7(–18) cm × (0.6–)1.5–2.8(–5.6) mm, flat, sometimes convolute, inrolled when dried. Top culm leaf blades (1.6–)4.9–9.2(–14.5) cm × (1–)2–3.5(–6) mm, from flat to convolute, rarely filiform or parallel to culm. Panicles (3.6–)6.9–10.6(–16.2) × (0.9–)1.6–2.9(–5) cm. Spikelets (3.8–)5–6.1(–7.6) mm. Lemmas (3.2–)4.3–5.1(–7.4) mm; aristules (0.1–)0.3–0.6(–1.4) mm; awn (4.2–)5.6–7(–8.3) mm. Palea length:lemma length ratio of (0.66–)0.73–0.83(–0.95). Anthers (1–)1.6–2.1(–2.5) mm. Chromosome numbers: $2n = 12$ (Sokolovskaya & Probatova, 1975), 24 (Frey, 1992), 28 (Sorokin, 1990), 36 (Strid & Andersson, 1985). Figures 8A, 9A, 10A, and 11A.

Additional illustrations. Fiori & Paoletti (1895: 28, 234 sub *Trisetum burnouffii*, 235, sub *T. flavescens*); Chrtek & Jirásek (1963: 577, figs. 3, 4); Săvulescu (1972: 289, Plansa 56, 2a–c); Frey (1992: 453, fig. 6);

Signorini & Ricceri (1996: 219, fig. 1, sub *Trisetum corsicum*); Gabrielian (2010: 176, tab. 44, 1, 1a).

Phenology. *Trisetum flavescens* subsp. *flavescens* has been collected in flower and fruit from May to October.

Distribution and habitat. *Trisetum flavescens* subsp. *flavescens* is widespread throughout Europe, extending to western Asia and northern Africa, and it has been introduced in many other temperate zones in Asia, North and South America, and New Zealand; on meadows, forest clearings, among shrubs, or on stony places, growing from sea level to 2900 m. Figure 12.

Discussion. *Trisetum flavescens* is one of the most polymorphic and widespread taxa of the genus. The morphology and hairiness of leaves, as well as the shape and color of the panicles, are highly variable.

This species is characterized as having short ligules ([0.5–]0.7–1.2[–2] mm) and short callus hairs ([0.1–]0.2–0.4[–0.7] mm), narrow lower glumes ([0.4–]0.6–0.7[–1.1] mm), and always geniculate awns and glabrous ovaries. Barberá et al. (2017b) pointed out that it frequently has been confused with *T. sibiricum*, which belongs to *Trisetum* sect. *Sibirica*.

Due to the polymorphism of *Trisetum flavescens*, many subspecies and varieties have been described by different authors to classify its morphological variation. Presl (1820) described *T. splendens*, with flat leaves and contracted golden panicles, which was later reduced to the rank of subspecies by Arcangeli (1882); this was also accepted as such by many authors (Jonsell, 1980; Pignatti, 1982; Signorini & Ricceri, 1996). In the same way, *T. purpurascens*, with wider leaves, slightly longer ligules, and dense, purplish spikelets, was described by de Candolle (1813) from the Alps and then reduced to subspecies by Arcangeli (1882) and, at that rank, accepted by Jonsell (1980), Frey (1992; subvariety *purpurascens*), and Tison and de Foucault (2014). Strid and Tan (1991) indicated that the differences between *T. flavescens* subsp. *splendens* and *T. flavescens* subsp. *flavescens* are rather obscure. Chrtek (1966) described *T. flavescens* subsp. *taticum* specimens from the Carpathian Mountains, but these are hardly distinguishable from *T. flavescens* subsp. *purpurascens*. Three additional species have been described because of their more or less pubescent and convolute leaves and culm hairiness, namely *T. tenuiforme*, *T. burnouffi*, and *T. corsicum*. *Trisetum burnouffi* and *T. corsicum* are endemic to Corsica, the latter with intermediate characters between *T. burnouffi* and *T. flavescens*. Signorini and Ricceri (1996) studied these species, including *T. splendens*, and accepted all these taxa at the species rank. Later, Jeanmonod and Gamisans (2007)

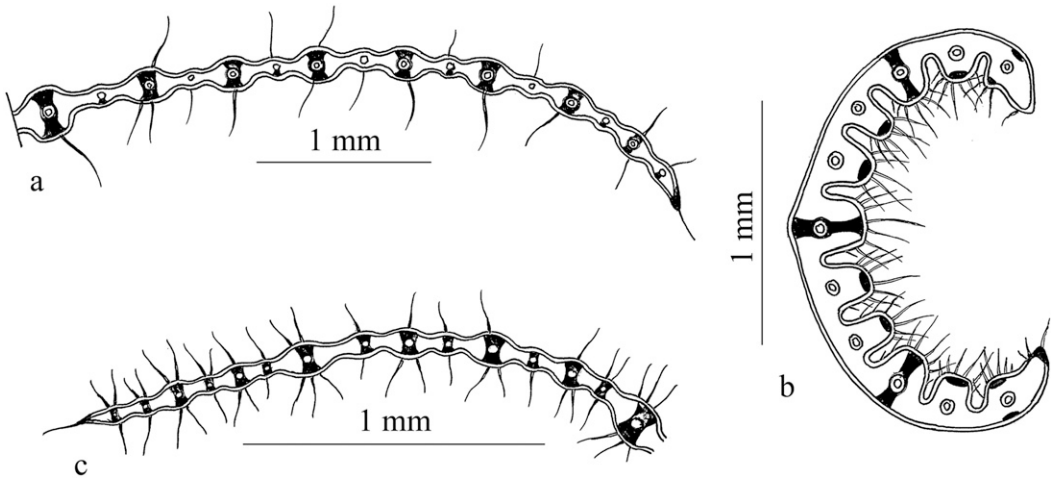


Figure 8. Transverse section of leaf blade. —A. *Trisetum flavescens* (L.) P. Beauv. subsp. *flavescens*. —B. *Trisetum flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard. —C. *Trisetum fuscum* Schult. A based on *Aedo et al.* 8571 (MA-700192); B based on *Jury et al.* 8847 (MA-391300); C based on *Rechinger s.n.* (S).

recognized *T. corsicum* as a subspecies of *T. flavescens*, and *T. burnouffi* as a variety of this subspecies. Apart from these taxa from the Mediterranean region and Europe, other taxa were described from Africa and Asia. Tzvelev (1970) published *T. flavescens* subsp. *parvispiculatum*, with small spikelets and lemmas, from the Caucasus and mountain ranges of Iran and Turkmenistan. The detailed study of the morphology of the specimens belonging to this taxon indicates that these supposed diagnostic characters are not exclusive to them, and that they also occur indiscriminately in other specimens from Europe and the Mediterranean region.

Maire and Trabut (Maire, 1932) and Lindberg (1932) described other species and varieties from northern

Africa, namely *Trisetum macratherum*, *T. flavescens* var. *africanum*, and *T. griseovirens*. Chrtek (1967c) considered that *T. griseovirens* was the only one well characterized, mainly by the characters of the spikelet (length of spikelet, lemma, and awn). However, Dobignard (2004) treated these three taxa as subspecies, making clear that he did so only to reflect intraspecific variability of *T. flavescens* and awaiting a more rigorous taxonomic revision in the future.

As has already been mentioned, the leaf blade traits of *Trisetum flavescens* and its associated taxa are highly variable, much more so than the characters of the spikelets and, therefore, we recommend giving them a secondary diagnostic value. Consequently, we

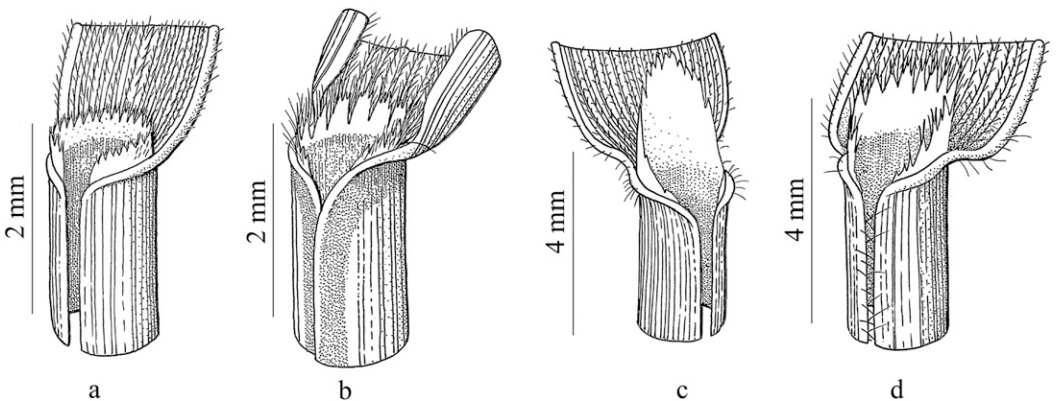


Figure 9. Portion of sheath, ligule, and blade. —A. *Trisetum flavescens* (L.) P. Beauv. subsp. *flavescens*. —B. *Trisetum flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard. —C. *Trisetum fuscum* Roem. & Schult. —D. *Trisetum laconicum* Boiss. & Orph. A based on *Döring & Holtz s.n.* (GOET); B based on *Cabezas et al.* FJC419 (MA-746349); C based on *Nyárady s.n.* (L-1346389); D based on *Orphanides 2890* (B-10_0508993).

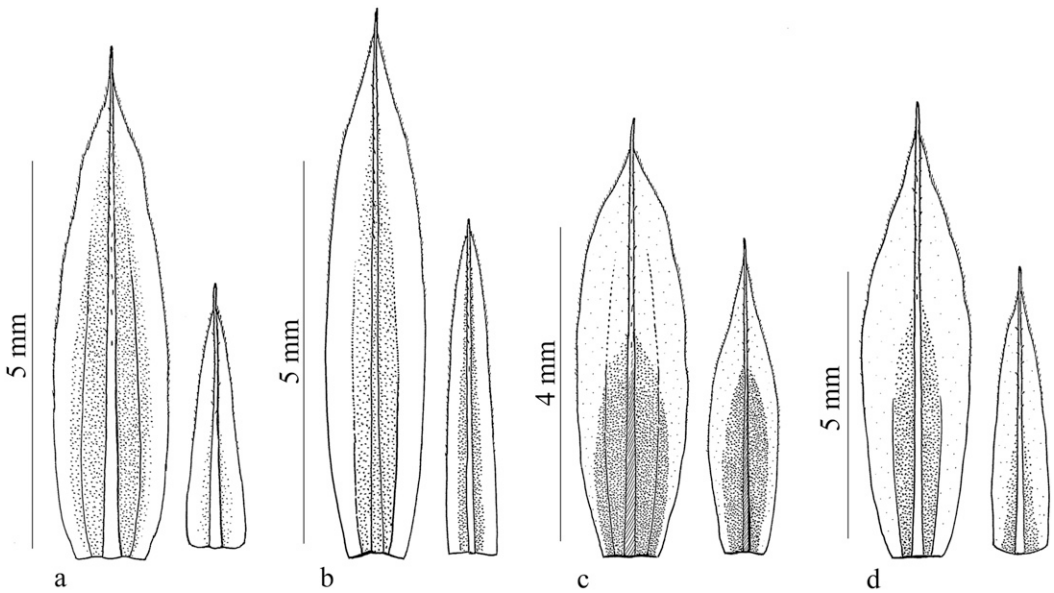


Figure 10. Upper and lower glume, dorsal view. —A. *Trisetum flavescens* (L.) P. Beauv. subsp. *flavescens*. —B. *Trisetum flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard. —C. *Trisetum fuscum* Schult. —D. *Trisetum laconicum* Boiss. & Orph. A based on Barberá & Quintanar 897PB (MA-871565); B based on Cabezas et al. FJCA19 (MA-746349); C based on Nyárády s.n. (L-1346389); D based on Orphanides 2890 (B-10_0508993).

decided to synonymize all these taxa with more labile foliar morphology, and to maintain only two subspecies in *T. flavescens*, *T. flavescens* subsp. *griseovirens* and the typical subspecies.

Vegetative propagation by pseudoviviparism has been noted in a specimen of *Trisetum flavescens* subsp. *flavescens* collected by de Wilde (*de Wilde s.n.*, L-1346507) (Fig. 13). Until now, this type of propagation has been observed only in *T. rigidum* (M. Bieb.) Roem. & Schult., *T. tamonanteae* Marrero Rodr. & S. Scholz, and *T. velutinum* Boiss., all belonging to *Trisetum* sect. *Acrospelion* (Marrero Rodríguez & Scholz, 2013; Barberá et al., 2017a).

Additional specimens examined. ALBANIA. **Gjirokastrë:** Mali Lunxheris, N-Hänge, 40°4'N, 20°8'E, 13 July 1980, *Krendl s.n.* (C); Nemerçka, über Permet, südwestlich vom Qafa e Dhembelit, 40°12'N, 20°20'E, 12 July 1959, *Meyer s.n.* (JE). **Korçë:** near Ersekë, 40°20'N, 20°40'E, 29 June 1933, *Alston & Sandwith 1994* (K). **Vlorë:** Mali i Gjer (Mali Gjinez), Delvina, zwischen Qafa Gradishtit und Qafa Piloit, 40°0'N, 20°5'E, 26 June 1959, *Meyer s.n.* (JE). ALGERIA. **Algiers:** à Maison Carrée, près d'Alger, 36°43'N, 3°8'E, 31 May 1930, *Faurel s.n.* (P). **Batna:** Pic des Cédres, 35°33'N, 6°2'E, 6 July 1935, *Faurel s.n.* (P). **Blida:** à Chrea, 36°25'N, 2°52'E, 5 July 1930, *Faurel s.n.* (P). **Bouïra:** environs de Tala Rana, versant meridional du Lalla Khelidja, 36°25'N, 4°13'E, 30 June 1875, *Duhamel s.n.* (G). **Constantine:** Djebel Cougour près de Batna, 35°33'N, 6°10'E, 22 May 1899, *Cosson s.n.* (L). **Oran:** pente sud du Djebel-Santo, 35°44'N, 0°43'W, 11 June 1852, *Balansa s.n.* (L). **Sétif:** Massif de Bou-Talef, près de Charène, 35°45'N, 5°19'E, 21 May 1937, *Faurel s.n.* (P). **Tiaret:** Massif de Bélezma, de Bocdem, 35°13'N, 0°45'E, 16 June 1937,

Faurel s.n. (P). **Tizi Ouzou:** Grande Kabylie, National Park Djurdjura, bei Tala Guilef, 36°27'N, 4°13'E, 30 June 1983, *Scholz & Baillargeon s.n.* (B). **Tlemcen:** au-dessus de Tlemcen, 34°52'N, 1°18'W, 19 June 1856, *Bourgeau s.n.* (UPS). ANDORRA. Pr. Soldeu, 42°34'N, 1°40'E, 29 Aug. 2002, *Aedo et al. 8571* (MA). ARMENIA. **Aragatsotn:** monte Aragat, Ghazaravan, carretera de subida al lago Kari, 40°23'N, 44°15'E, 30 June 2005, *Medina et al. 2606* (MA); Ashtarak Distr., in declivibus montis Arailer, in vicinitate pagi Egvart, 40°24'N, 44°28'E, 15 July 1975, *Vasak s.n.* (B, G). **Gegharkunik:** pr. Sevan, 40°35'N, 44°57'E, 19 June 2005, *Aedo et al. 11722* (MA); Vardenis Distr., montis Vardenisskij Khrebet, in declivibus montis Kungukh-tar, 40°10'N, 45°43'E, 29 July 1975, *Vasak s.n.* (B, G, MA, NY). **Kotayk:** pr. Tsahkadzor village, Tehenis Mtn., 40°32'N, 44°41'E, 22 June 2005, *Castroviejo et al. 17687* (MA). **Lori:** Akhtala, above village Ghochkan (Tchotchkan), 41°11'N, 44°49'E, 24 June 2009, *Vitek et al. 09-1870* (B). **Shirak:** Akhuryan Distr., Shirak range, N of the Dzhadzhur pass, 40°51'N, 43°59'E, 23 June 1960, *Tsvelev & Cherepanov 215* (LE). **Syunik:** Meghri Distr., on a slope to a right tributary of the Mergiget River, near Vardanadzor, 38°58'N, 46°12'E, 29 June 1956, *Egorova et al. 1512* (LE); Pirdaudan, 39°15'N, 46°8'E, 23 June 1893, *Lipshiy s.n.* (LE). **Tavush:** Haghartsin monastery, 40°49'N, 44°53'E, 21 June 2005, *Castroviejo et al. 17555* (MA). **Vayots Dzor:** pr. Ger-Ger, 39°47'N, 45°32'E, 24 June 2005, *Herrero et al. 2841* (MA). AUSTRIA. **Carinthia:** Mauthen im Gailthal, 46°39'N, 12°59'E, 22 June 1934, *Ronninger s.n.* (NY). **Lower Austria:** St. Poelten, 48°12'N, 15°38'E, June 1879, *Hackel s.n.* (B, PR); Gloggnitz, 47°40'N, 15°56'E, 28 June 1861, *Halácsy s.n.* (WU); Semmering ad stationem in prato, 47°38'N, 15°49'E, 29 June 1922, *Vestergren s.n.* (NY, S). **Salzburg:** Gaisberg, 47°48'N, 13°6'E, 22 May 1922, *Petterson s.n.* (H). **Styria:** in ruderalis prope urbem Graz, 47°4'N, 15°27'E, June 1808, *Fritsch s.n.* (H, L, MA, O, WU). **Tyrol:** Obergurgl, 46°52'N, 11°1'E, 3 Aug. 1992, *Emanuelsson 1319* (S); im

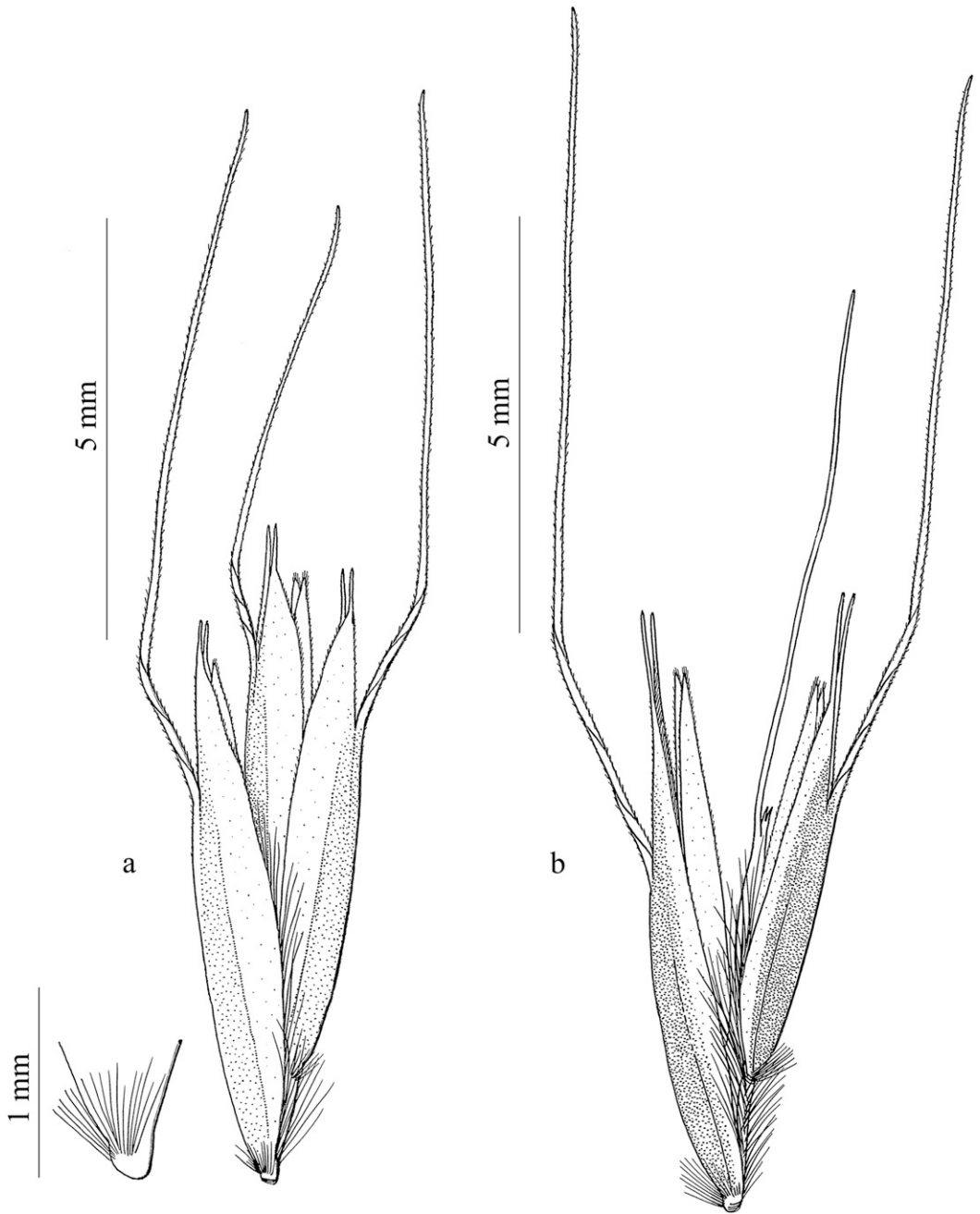


Figure 11. Florets. —A. *Trisetum flavescens* (L.) P. Beauv. subsp. *flavescens*. —B. *Trisetum flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard. A based on Barberá & Quintanar 897PB (MA-871565); B based on Cabezas et al. FJC419 (MA-746349).

Paznauntal bei Galtür am Eingang des Jamtales, 46°58'N, 10°11'E, 27 July 1978, *Holtz 03.892* (GOET). **Upper Austria:** ca. Aistersheim, 48°11'N, 13°44'E, June 1875, *Keck s.n.* (B, F, G, GOET, H, MO, MW, NY, WU); Lichtenberg, N v. Ort bei Kaiserberg 5, 48°22'N, 14°15'E, 18 June 1995, *Kleesadl 178* (W, WU). **Vienna:** Neuwaldegg, 48°14'N, 16°17'E, 27 July 1921, *Fiedler s.n.* (B). **Vorarlberg:** Illufer unter Feldkirch,

47°13'N, 9°36'E, 3 Aug. 1869, *Boetz s.n.* (W). **AZERBAIJAN. Daglig-Shirvan:** rd. Shemakha–Aksu, 40°34'N, 48°24'E, 1 June 1949, *Beydeman s.n.* (LE). **Ganja-Gazakh:** Dashkasan Distr., Khachbulag, 40°28'N, 46°0'E, 16 July 1970, *Lyatifova 24* (LE). **Lankaran:** a pass betw. Lerik & the village of Bozuchar, 38°46'N, 48°24'E, 3 July 1931, *Shipchinskiy 565* (LE). **BELGIUM. East Flanders:** Gent, “Snepkai,” 51°3'N,

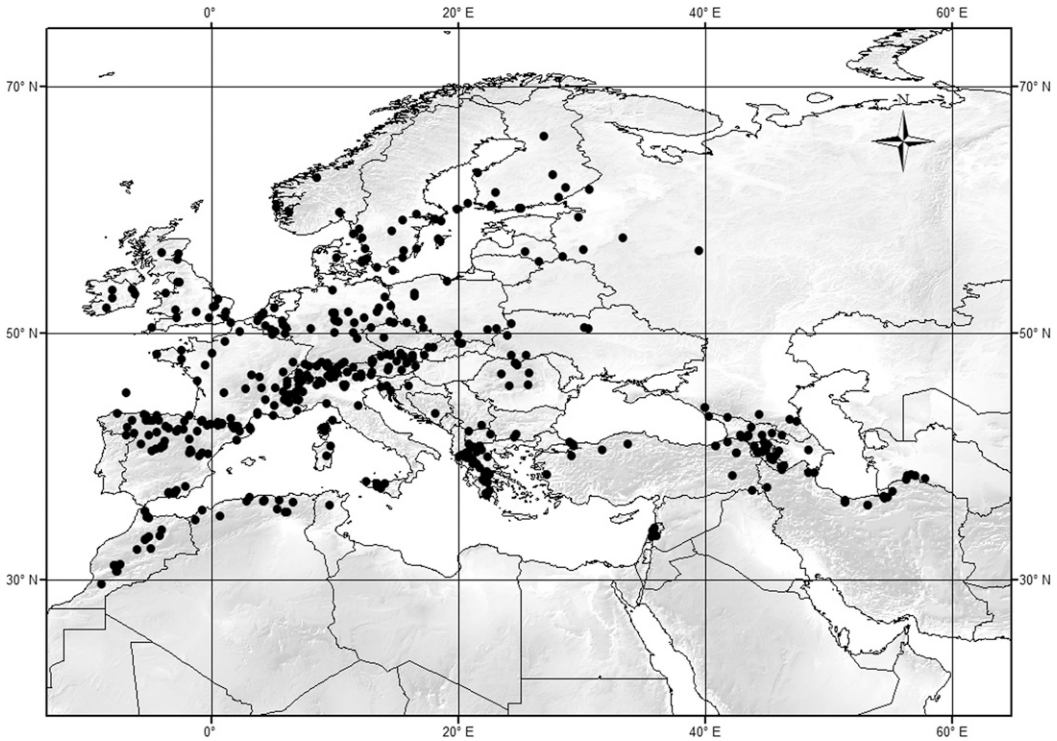


Figure 12. Distribution of *Trisetum flavescens* (L.) P. Beauv. subsp. *flavescens* (dots) in Eurasia and North Africa.

3°43'E, 14 June 1957, *Michiels s.n.* (C). **Liège:** Ardennen, tussen Eupen en Baraque Michel, 50°31'N, 6°3'E, June 1950, *Borssum Waalkes 5114* (L). **Limburg:** prairies à Maeseeyck, 51°5'N, 5°47'E, 24 June 1871, *Cogniaux s.n.* (NY). **Namur:** Rochefort, Croise St. Jean, 50°9'N, 5°14'E, 15 June 1934, *Mosseray-Staner s.n.* (C). **Walloon Brabant:** Waterloo, 50°42'N, 4°23'E, 1 July 1923, *Lambert s.n.* (US). BOSNIA AND HERZEGOVINA: Homami do pr. cast. Jablan, 43°32'N, 18°8'E, Sep. 1910, *Vandas s.n.* (PR). BULGARIA. **Plovdiv:** Central Rhodopes Mtns., pr. Kosovo, 41°54'N, 24°42'E, 29 June 2004, *Aedo et al. 10371* (MA). **Smolyan:** Central Rhodope Mtns., Smolyan Distr., Gela village, 41°39'N, 24°33'E, 28 June 2004, *Aedo et al. 10141* (MA). CROATIA. **Zagreb Co.:** Zagreb, 24 km E of Zagreb, by the rd. Zagreb–Beograd, 45°48'N, 15°58'E, 13 June 1971, *Suominen 472* (H). CZECH REPUBLIC. **Central Bohemian:** Příbram Distr., na lukách pred Novou Hospodou [Nová Hospoda], 49°41'N, 14°2'E, June 1904, *Toel s.n.* (G, H). **South Moravian:** Strážnice, Velká, locis “na Kukách,” supra Vápenky, 48°52'N, 17°37'E, 20 June 1930, *Podpera et al. s.n.* (C, G, H, K, MO, S, UPS, US, WU). **Ústí nad Labem:** Děčín Distr., Šluknov, 51°0'N, 14°27'E, 16 June 1964, *Chrtěk & Pistulková s.n.* (G, H, K, L, MA, MO, S, UPS). DENMARK. **Capital Region:** Bornholm, Rønne Åvangskolen, 55°6'N, 14°42'E, 17 June 1978, *Lütken s.n.* (MO). **Central Jutland:** Aabyhøj, Ruderat ved Frichs fabrikker, 56°9'N, 10°9'E, 21 June 1964, *Øllgaard s.n.* (MO). **Region Zealand:** Bastrup, 55°49'N, 12°16'E, 25 June 1944, *Lange s.n.* (US). FINLAND. **Åland Islands:** Maarianhamina, Badhusberget, 60°6'N, 19°55'E, 21 Sep. 1984, *Hægström 5224* (H). **Lapland:** Männikkö prope opp. Willmanstrand, 66°3'N, 26°55'E, 12 July 1887, *Sælan s.n.* (H). **Northern Savonia:** Kuopio, Vanhan tulitikkentehaan puisto, 62°53'N,

27°40'E, 25 July 1931, *Toivanen s.n.* (H). **Ostrobothnia:** Vaasa, Vasklot, 63°5'N, 21°34'E, 28 June 1954, *Malmberg s.n.* (H). **Pirkanmaa:** Satakunta, Karkku, 61°26'N, 23°2'E, 2 Sep. 1870, *Hjelt s.n.* (H). **South Karelia:** Lappeenranta, Linnoitus, 61°3'N, 28°10'E, 20 June 1948, *Eurola s.n.* (H). **Southern Savonia:** Savonlinna, Saaminki, Aholahti, 61°53'N, 28°45'E, 27 June 1920, *Linkola s.n.* (H). **Southwest Finland:** Turku, Paimio, Juntola, E bank of Paimio River at the bridge above the power station, 60°27'N, 22°41'E, 3 July 1982, *Kukkonen 11193* (H). **Uusimaa:** Helsinki, Nordsjö, Rastila, 60°12'N, 25°7'E, 3 July 1964, *Ruotsalo s.n.* (H). FRANCE. **Allier:** Arouer, Les Damariats, 46°41'N, 3°17'E, June 1894, *Lassimonne s.n.* (C). **Alpes-de-Haute-Provence:** Lautaret, 44°26'N, 6°21'E, July 1905, *Jeanpert s.n.* (F). **Alpes-Maritimes:** Cipières village, 43°46'N, 6°57'E, 1 July 1992, *Hepper 9464* (B). **Ardèche:** Saint-Julien-du-Serre, 44°39'N, 4°24'E, 5 June 1902, *Girod s.n.* (G). **Ariège:** Haies à Pamiers, 43°7'N, 1°36'E, 12 June 1877, *Huet s.n.* (UPS). **Bouches-du-Rhône:** Martigues, 43°24'N, 5°3'E, May 1871, *Autheman s.n.* (UPS). **Charente-Maritime:** La Rochelle, 46°10'N, 1°9'W, 6 June 1955, *Galiano s.n.* (SEV). **Corse:** Upper Corsica, Massif du San Petrone, a l'WNW d'Aïti, 42°23'N, 9°14'E, 30 June 1990, *Gamisans 14681* (G); Corte, au dessus de Casanova, ravin de Taola, 42°15'N, 9°10'E, 8 July 1979, *Gamisans s.n.* (G); Upper Corsica, Calacuccia, 42°20'N, 9°0'E, 8 July 1911, *Petry s.n.* (BM, H, O, PR). **Côtes d'Armor:** Côte du Nord, Pléhérel, 48°39'N, 2°22'W, 11 June 1967, *Bakker & Beglel s.n.* (L). **Dordogne:** Sainte-Orse, 45°12'N, 1°4'E, 16 June 1891, *Mouillefarine s.n.* (US). **Haute-Garonne:** Bagnères-de-Luchon, 42°47'N, 0°35'E, 6 July 1885, *Peyron s.n.* (G). **Haute-Saône:** Champagny, 47°42'N, 6°40'E, 6 June 1868, *Vendrelly s.n.* (JE). **Haute-Savoie:** Mt. Veyrier, Col

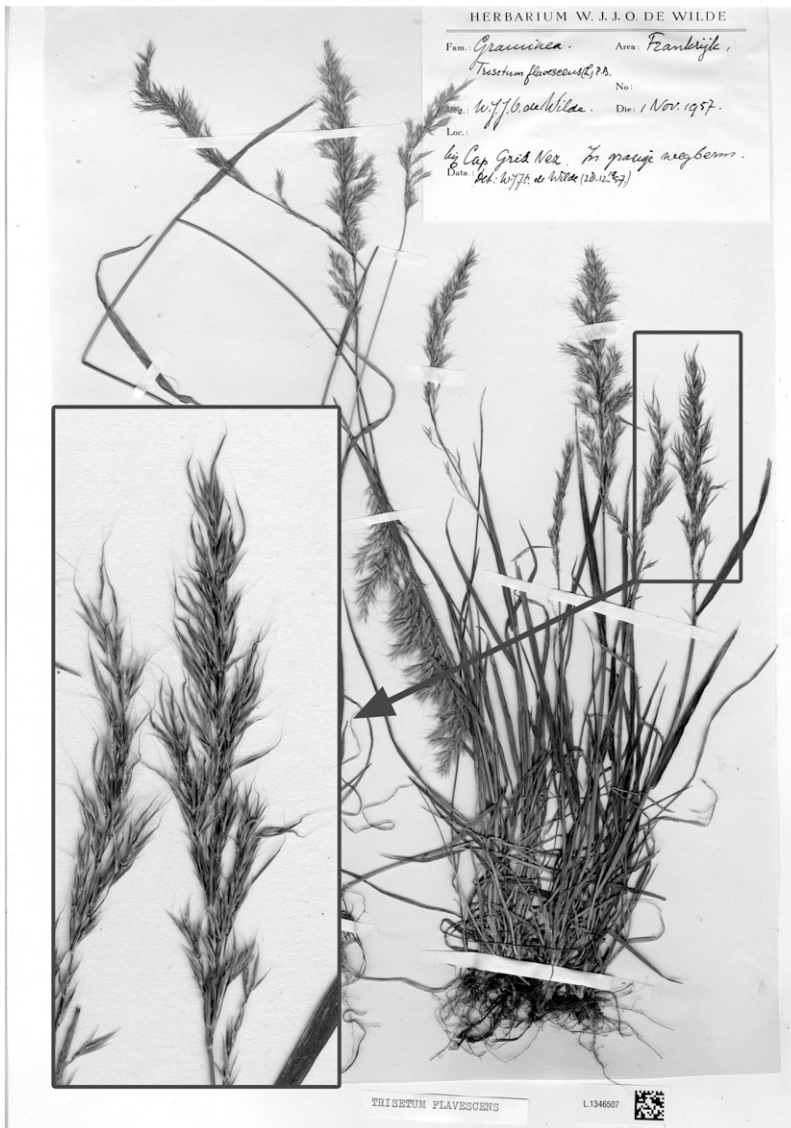


Figure 13. *Trisetum flavescens* (L.) P. Beauv. subsp. *flavescens*. Specimen with proliferating spikelets based on *de Wilde* s.n. (L-1346507).

des Contrebandiers, E of Annecy, 45°54'N, 6°10'E, 20 July 1967, *Ib Olsen* 578 (C). **Hautes-Alpes:** La Monta près Abriès, Chemin de la Traversette, 44°46'N, 6°59'E, 9 Aug. 1913, *Jeanpert* s.n. (F); Tal der Aigue Blanche (Seidental des Val Queyras), SE von St. Veran, 44°42'N, 6°52'E, 14 July 1970, *Matthi* s.n. (B). **Hautes-Pyrénées:** Gèdre, 42°41'N, 0°0'W, June 1884, *Bordère* s.n. (JE, L). **Hérault:** St. Felix du Monceau bei Gigean, 43°29'N, 3°43'E, 24 May 1972, *Döring & Holtz* s.n. (GOET). **Isère:** Dauphiné, Saint-Pierre-de-Chartreuse, La Scia, 45°20'N, 5°51'E, 28 July 1959, *Segelberg* s.n. (S). **Jura:** près secs à Salins, 46°56'N, 5°52'E, June 1851, *Garnier* s.n. (B, F, JE). **Loire:** Montbrison, 45°36'N, 4°3'E, June 1887, *Giroud* s.n. (G). **Maine-et-Loire:** St. Barthélemy, 47°28'N, 0°29'W, June 1914, *Bioret* s.n. (S). **Morbihan:** près secs à Saint-Antoine en-Plôermel, 47°55'N, 2°23'W, 20 May 1953,

Arsène 2317 (G). **Orne:** prope Alençon, 48°26'N, 0°5'E, 22 June 1886, *Beaudouin* s.n. (FI, S). **Puy-de-Dôme:** Torr ängsmark i St. Nectaire, 14 km öster om Mont-Dore, 45°34'N, 2°49'E, 4 July 1955, *Een* s.n. (S). **Pyrénées-Orientales:** Angostrine, 42°28'N, 1°57'E, 7 July 1927, *Sennen* s.n. (BM, PH, US). **Saône-et-Loire:** chemin des bois de La Motte-Saint-Jean, 46°29'N, 3°57'E, May 1959, *Charpin* s.n. (G). **Savoie:** Col du Petit Mont Cenis, 45°12'N, 6°52'W, 22 Aug. 2013, *Aedo* 20920 (MA). **Seine-Maritime:** Bonsecours, 49°25'N, 1°7'E, 19 June 1934, *Tidestrom* s.n. (NY). **Somme:** Doullens, 50°9'N, 2°20'E, 12 July 1887, *Copineau* s.n. (US). **Vaucluse:** Malaucène, 44°10'N, 5°7'E, 8 June 1876, *Delacour* s.n. (K). **GEORGIA. Abkhazia:** Gagra massif, on Mamdzyshkha Mtn., 43°18'N, 40°20'E, 27 July 1905, *Voronov* s.n. (LE). **Imereti:** Adzhar-Imereti range, Zekari pass, 41°49'N,

42°51'E, 29 July 1970, *Menitskiy s.n.* (LE). **Kakheti**: Lagodekhi gorge, in vic. of a meteorological station, 41°49'N, 46°16'E, 16 Sep. 1949, *Golubkova & Pojarkova 1256* (LE). **Samtskhe-Javakheti**: western part of mtn. range of Trialeti, surroundings of Azvreti, 41°36'N, 43°23'E, 15 July 2002, *Schnee Weiss s.n.* (B). **Shida Kartli**: above the selo of Kham-palgom on Alkhashenda Mtn., 42°27'N, 43°45'E, 23 July 1928, *Bush & Bush s.n.* (LE). **Tbilisi**: Trialeti, Didgori, 41°47'N, 44°39'E, 8 July 1997, *Gagnidze et al. 2799* (MO). GERMANY. **Baden-Württemberg**: Freiburg, Radolfzell am Bodensee, 47°44'N, 8°58'E, 5 Oct. 1975, *Fritze s.n.* (K). **Bavaria**: Weilheim-Schongau, 47°40'N, 10°48'E, 24 July 2001, *Willing & Willing 13363* (B). **Brandenburg**: Kreis Eisenhüttenstadt, Fiederzwenkenhang an den Lossower Bergen, 52°18'N, 14°33'E, 14 June 1974, *Benkert s.n.* (B). **Hamburg**: ad Blankenese, 53°33'N, 9°48'E, June 1840, *Sonder s.n.* (UPS). **Hesse**: Eichenberg, 1 km südöst. Netra, 51°5'N, 10°5'E, 18 Aug. 1988, *Böhle 13551* (B). **Lower Saxony**: Mesobrometum bei Göttingen-Nikolausberg, 51°33'N, 9°58'E, 10 June 1952, *Trautmann s.n.* (GOET). **Saxony**: Erzgebirge, Neudorf, Kretscham, 50°28'N, 12°59'E, 28 Aug. 1965, *Fröhner 3911* (B). **Saxony-Anhalt**: Kreis Quedlinburg, Altenburg bei Quedlinburg, 51°47'N, 11°9'E, 20 June 1952, *Dähnn s.n.* (B). **Thuringia**: Jena, 50°55'N, 11°35'E, 16 June 1927, *Huysman s.n.* (L). GREAT BRITAIN. **East of England**: Cambridgeshire, in fruticetis apud Gog Magog Golf Course, 52°9'N, 0°11'E, 28 June 1961, *Sell 61/299* (H, O, UPS). **North West**: Cumbria, Westmorland, Burton-in-Kendal, Dalton, 54°11'N, 2°43'W, 4 July 1976, *Halliday 36/79* (C). **Scotland**: East Lothian, East Links, near North Berwick, 56°3'N, 2°43'W, 8 Aug. 1956, *Green 18* (H, MO, S, UPS); Angus, East Haven, al sur de Arboath, 56°31'N, 2°40'W, 14 July 1984, *Valdés s.n.* (SEV); Perthshire, Kenmore, grounds of Taymouth Castle, 56°36'N, 3°59'W, 7 July 1953, *Welch 5200* (C, F). **South East**: Surrey, Chipstead valley near Coulsdon, 51°19'N, 0°8'W, 1 July 1954, *Cannon & Cannon 2735* (L). **South West**: Somerset, Cheddar Gorge, pr. Weston, 51°18'N, 2°48'W, 14 July 1996, *Aedo & Gama CA3874* (MA). **West Midlands**: Herefordshire, Kentchurch, 51°55'N, 2°51'W, 13 June 1937, *Hubbard s.n.* (C). GREECE. **Central Greece**: Evrytania, Agrafa area, 5 km WNW of the village of Petralona, 39°10'N, 21°43'E, 11 Aug. 1981, *Franzén & Andersson 640* (C). **Central Macedonia**: Florina, Pellis, Mt. Voras, 1 km NE of marshy area known as Dobro Pole, 40°55'N, 21°47'E, 17 July 1981, *Strid et al. 19163* (C, G). **Epirus**: Central Pindus range, pr. Mount Smolikas, Lake Drakolimni, 40°5'N, 20°54'E, 28 June 2007, *Gonzalo et al. RG789* (MA); Ioannina Distr., Montes Pindus, in monte Tsuka Rossa ditionis pagi Vovousa (Viosa), 39°56'N, 21°2'E, 2 Aug. 1956, *Rechinger 18583* (B, MA, MO, S). **Peloponnese**: Lakonia, Taigetos Mtns., pr. Aghia Marina, 37°3'N, 22°15'E, 24 June 2007, *Aedo et al. 14339* (MA); Korinthia, Kilini, 37°55'N, 22°24'E, 22 June 2007, *Herrero et al. AH3383* (MA). **Thessaly**: Lárissa, Ep. Elasonos, Mt. Olympus, S foothills, 2 km E of the village of Karya, 39°59'N, 22°23'E, 14 June 1976, *Strid & Kjellson 11406* (G). **West Greece**: von Fteri zum Klokos, 38°9'N, 22°2'E, 8 July 1991, *Burri & Krendl s.n.* (B). **West Macedonia**: Kozani, Askio, macizo Askion, monte Siniatsikon, por encima de Námata, 40°24'N, 21°32'E, 1 July 2007, *Herrero et al. AH3636* (MA); Florina, Melitti, Mt. Kajmakalan, 40°53'N, 21°46'E, 1 July 1999, *Schuler 99/746* (B). HUNGARY. **Vas**: Kőszeg, 47°23'N, 16°32'E, 29 May 1931, *Holmström s.n.* (GB, H, S). IRAN. **Golestán**: Mt. Elburs orient., in valle Zaringol, 36°44'N, 54°48'E, 30 June 1938, *Gaubas s.n.* (US); 60 km NE Gonbadghabus [Gonbad-e Kávús], 37°15'N, 55°10'E, 14 May 1966, *Pabot 7719* (G). **Mazandaran**: prope Pol-e-Zoghal, 36°30'N, 51°19'E, 31 May 1938,

Gaubas s.n. (US); au dessus de la plus haute des bergeries de Sang-Deh, 36°4'N, 53°13'E, 5 July 1973, *Klein 4832* (G). **West Azerbaijan**: Uromiyeh [Urmia], around Soluk waterfall, 7°33'N, 45°4'E, 27 May 2004, *American-Iranian Botanical Delegation 34291* (MO). IRELAND. **Leinster**: Louth Co., Thomastown Bog, 2-1/4 mi. W of Duleek, 53°39'N, 6°25'W, 26 July 1969, *Scannell s.n.* (H). **Munster**: Tipperary Co., betw. Borriskane & Cloughjordan, 52°56'N, 8°2'W, 9 July 1967, *Scannell s.n.* (H). ITALY. **Belluno**: Cortina d'Ampezzo, 46°32'N, 12°8'E, Oct. 1870, *Ball s.n.* (GH). **Cuneo**: Crissolo, 44°41'N, 7°9'E, 13 July 1890, *Bicknell s.n.* (UPS). **Forlì-Cesena**: Castrocaro, 44°10'N, 11°56'E, 29 May 1877, *Sommier s.n.* (G). **Genoa**: in Wiesen bei Cogorno nördl. Lasagna, 44°19'N, 9°22'E, 5 June 1983, *Nowak It83/319* (B). **Livorno**: Capraia Isola, Sentiero per Monte Arpagna, presso l'inizio dei due sentieri, por punta del trattaio e per Colombia, 43°1'N, 9°48'E, 18 June 1996, *Signorini & Miniati s.n.* (FI). **Sardinia**: Isola di Tavolara, 40°54'N, 9°42'E, 12 June 1988, *Arrigoni s.n.* (FI); Nuoro Prov., Gruppo del Genargentu, Nodu'E Littipori e Mte. Bruttu presso Acri Correi, 40°5'N, 9°21'E, 8 July 1972, *Arrigoni & Nardi s.n.* (FI). **Sicily**: Palermo, Riserva di Bosco della Ficuzza, Piano de la Tramontana, Rocca Busambra, 37°51'N, 13°25'E, 31 May 2000, *Castroviejo et al. 15391SC* (MA); Trapani, Mt. San Giuliano, near Erice, 38°2'N, 12°35'E, 31 May 1990, *Raimondo et al. s.n.* (B, C, SEV); Agrigento, Monte delle Rose, Garden "Acqua Bianca," 37°39'N, 13°25'E, 12 June 1964, *Segelberg s.n.* (S). **Trentino-South Tyrol**: Sellajach, Rodella, 46°29'N, 11°44'E, 30 July 1907, *Bornmüller s.n.* (B); Pustertal, prope Niederdorf, 46°44'N, 12°11'E, *Bornmüller s.n.* (C, F, G, GOET, H, L, MO, MW, PR, S, WU). **Trieste**: SW-Hang des Monte Lanaro oberhalb Rupingrande, 45°44'N, 13°46'E, 26 June 1980, *Leuschner & Sigi 17397* (B). **Turin**: Monastero di Lanzo, tra Monastero e Lanzo, ca. 1 km a S-SO di Coassolo, sul lato destro della valle del Torrente Tesso, 45°18'N, 7°26'E, 28 June 1993, *Pistarino & Gallo s.n.* (H). **Verbano-Cusio-Ossola**: prati nella compagnia di Stresa, 45°52'N, 8°32'E, 25 May 1912, *Boggiani s.n.* (B, G). **Verona**: Monte Baldo, 45°43'N, 10°49'E, July 1931, *Baschant s.n.* (B). LATVIA. **Aizkraukle**: Kokenhusen, ved Fernbaldinien, 56°39'N, 25°26'E, 30 June 1929, *Grantved s.n.* (C). **Daugavpils**: 20 km W of Daugavpils, bank of the Rauda River, 55°52'N, 26°32'E, 13 June 1930, *Birkmane 28952* (LE). LEBANON. **Beqaa**: grès entre Towmat Gezzine et Machghara, 33°31'N, 35°39'E, 29 May 1950, *Mouterde 9853* (G). **Mount Lebanon**: Kesrouan, Chahtoul, 34°2'N, 35°43'E, 5 June 1956, *Mouterde 11697* (G). **North**: Hadet el Djoubbeh, 34°14'N, 35°55'E, 12 June 1933, *Samuelsson 2142* (S). LUXEMBOURG. Draufelt, 50°1'N, 6°0'E, June 1963, *Germain 10598* (K). MACEDONIA. **Eastern Region**: Vinica, prope Suhostre, 41°50'N, 22°39'E, 7 July 2004, *Quintanar 1408AQ* et al. (MA). **Polog Region**: Schar-dagh, in cacumine Kobelica, 42°5'N, 20°53'E, 14 Aug. 1917, *Bornmüller 2202* (B, JE, NY). **Southwestern Region**: Ochrid, in montibus Petrina, supra vicum Pestany, 41°3'N, 20°53'E, 19 June 1968, *Weber s.n.* (PR). MOROCCO. **Béni Mellal-Khénifra**: region de El Ksiba, 32°30'N, 6°0'W, 5 July 2006, *Quintanar et al. 2040AQ* (MA). **Drâa-Tafilalet**: Collado de Tamrouit, circo de Jaffar, 32°33'N, 4°53'W, 7 July 2006, *Castroviejo et al. SC17882* (MA). **Fès-Meknès**: refugio de Taffert, Atlas Medio, 33°38'N, 4°9'W, 23 June 1997, *Aedo et al. CA4165* (MA); carretera entre Imouzzèr e Ifrane, pr. Ifrane, 33°33'N, 5°5'W, 24 June 2008, *Andrés Sánchez et al. SA233* (MA). **Marrakech-Safi**: sous Tizi-n'Tichkat, 31°17'N, 7°22'W, 20 June 1985, *Dobignard 3861* (G); Oukaïmeden, pista por encima de la estación de esquí, 31°13'N, 7°52'W, 11 July 1984, *López & Muñoz Garmendia 8979GL* (MA). **Souss-Massa-Drâa**: Col

Tizi-Melloul, 30°46'N, 7°36'W, 27 June 1997, *Aedo et al.* 4381 (MA); proximidades de la pista que une Askaun y Ansal, 30°46'N, 7°39'W, 10 June 2009, *Quintanar et al.* 3630AQ (MA). **Tanger-Tetouan-Al Hoceima:** Chefchaouen, Jbel Talamssemtane, ca. 38 km from Chefchaouen, 14 km above Bab Taza on track to Jbel Talamssemtane, 35°9'N, 5°12'W, 26 June 1992, *Achhal et al. s.n.* (FI); montis Dj. Dersa, supra Tetauen, 35°35'N, 5°23'W, 20 June 1930, *Maire s.n.* (P). NETHERLANDS. **Limburg:** Slenaken, 50°46'N, 5°51'E, 10 July 1951, *Larsen s.n.* (C). **South Holland:** shoulders of rd. near Oude Tonge, island Goeree-Overflakkee, 51°41'N, 4°12'E, 10 June 1958, *Florschütz et al. s.n.* (K). **Utrecht:** western vic. of Utrecht, near Amsterdam-Rhine-canal, 52°5'N, 5°7'E, 11 June 1954, *Leeuwenberg s.n.* (H, K, MA, MO, NY). **Zeeland:** Zd. Beveland, Perkpolder, på vallen vid färjeläget, 51°24'N, 4°1'E, 7 June 1959, *Een s.n.* (S). NORWAY. **Akershus:** Asker, 59°50'N, 10°26'E, 20 June 1896, *Weren-skiold s.n.* (GH). **Hordaland:** Hardanger, Odda, Lindenes, 59°52'N, 6°21'E, 29 June 1906, *Selland s.n.* (O, S, WU). **Møre og Romsdal:** Sunddal, 62°40'N, 8°33'E, 19 Sep. 1981, *Berg s.n.* (O). POLAND. **Greater Poland:** Schönlanke, 53°2'N, 16°27'E, June 1906, *Bothe s.n.* (B). **Lesser Poland:** Wieliczka, 49°58'N, 19°58'E, 9 June 2004, *Zelazny s.n.* (B). **Lower Silesia:** Liegnitz, Boberau [Bobrów], 50°52'N, 15°50'E, 28 Aug. 1889, *Figers s.n.* (G, JE, S, WU). **Lublin:** inter vicos Na Garbie et Hamernia, 50°27'N, 23°7'E, 19 June 1976, *Palkowa & Sidzina s.n.* (B, G, H, MA, MO, NY, PH). **Opole:** Laki k. Otmuchowa pow. Grodków, 50°28'N, 17°10'E, 19 June 1952, *Nikosiewicz s.n.* (B, H). **Pomeranian:** Tiegenghof, am Damm in Petershagen, 54°14'N, 19°8'E, June 1902, *Gross s.n.* (B). **Subcarpathian:** Lazów near Lezajsk, 50°20'N, 22°23'E, 30 July 2005, *Nobis & Nobis s.n.* (B, H). **West Pomeranian:** [illegible], Krone, 53°16'N, 16°28'E, 13 June 1877, *Ruhmer s.n.* (JE). PORTUGAL. **Trás-os-Montes e Alto Douro:** Bragança, inter Castrelos et Conlelas, 41°49'N, 6°54'W, 27 June 1968, *Silva & Teles 8348* (US). ROMANIA. **Bistrița-Năsăud:** in pratis montis Cisia ad Rodnam, 47°27'N, 24°49'E, 24 Aug. 1902, *von Degen 119* (BM, K, O, US, WU). **Cluj:** valle "Valea Seaca," prope opp. Cluj, 46°43'N, 23°32'E, 26 June 1970, *Gergely s.n.* (C, G, H, MA, MW, US). **Covasna:** sub colle "Forbic" prope pag. Viclele, 45°51'N, 25°41'E, 19 July 1971, *Morariu s.n.* (C, G, H, JE, K, MA, MW, O, US). **Harghita:** Muntele Surdecc, am Lacu Rosu, 46°47'N, 25°47'E, 3 July 1979, *Lippold s.n.* (JE). **Maramures:** auf Alpentriften des Berges Cisia in den Rodnaer Karpathen in Siebenbürgen, 47°35'N, 24°40'E, 24 Aug. 1902, *von Degen s.n.* (B, C, G, H, L, MA, MO, PR, S, US, WU). **Sibiu:** Hermannstadt [Sibiu], 45°48'N, 24°9'E, 16 June 1912, *Barth s.n.* (JE). RUSSIA. **Kabardino-Balkar Republic:** Sunzhenskiy range, northern slope, 3 verstas SE of the margin on the selo of Verkhniy Kurp, 43°28'N, 44°22'E, 6 Oct. 1924, *Knorring s.n.* (LE). **Karachay-Cherkess Republic:** Teberda Distr., Dombai village, Musatcheri Mtn., along rd. S & E from jct. of second & third chairlifts, 44°3'N, 40°1'E, 31 July 2010, *Soreng et al.* 8024 (US). **Leningrad Oblast:** Gatchina Distr., vic. of Elizavetino station, near the selo of Malye Bornitsy, 59°29'N, 29°46'E, 28 June 1984, *Tsvelev 24* (LE). **Novgorod Oblast:** Valdayskiy Distr., the village of Niva (former Nebylitsy), 20 km SE of Valday, 57°46'N, 33°20'E, 27 July 2003, *Sennikov s.n.* (LE). **Pskov Oblast:** 4–5 km SE of Sebez & 2–2.5 km W of the selo of Cherneya, 56°17'N, 28°28'E, 5 June 2002, *Tsvelev 154* (LE). **Republic of Adygea:** Lago-Naky Nature Reserve, 8.5 km by rd. S of Bolsahys Azishskaya (cave), 44°3'N, 40°1'E, 6 Aug. 2010, *Soreng et al.* 8041 (US). **Republic of Dagestan:** Makhachkala Distr., NE slope of Tarkitau Mtn., 42°55'N, 47°25'E, 8 June 1925, *Bodanovskaya-Gienef s.n.* (LE). **Republic of Karelia:** Sortavala, 61°42'N,

30°40'E, 21 June 1895, *Mustonen s.n.* (H). **Vladimir Oblast:** Yuryev-Polskiy Distr., 31 km N of Yuryev-Polskiy, 1.5 km downstream of the selo of Luchki, right side of the floodplain of the Nerl River, 56°46'N, 39°32'E, 1 Aug. 2010, *Seregin 4697* (LE). SERBIA. Vranja, 42°33'N, 21°54'E, June 1896, *Dimi-trijevitz s.n.* (WU). SLOVAKIA. **Bratislava:** Bazini [Pezinok], 48°17'N, 17°16'E, 4 June 1917, *Holuby s.n.* (PR). **Prešov:** Belanske Tatry, Kotlina siedmich praménov, Lawinental, 49°13'N, 20°19'E, 17 Aug. 1965, *Fröhner 3868* (B). **Trenčín:** montanis Bosacá, 48°53'N, 18°2'E, June 1887, *Holuby s.n.* (JE). SLOVENIA. **Gorizia:** Bovec, Jusliche Alpen, Predilpass, 46°25'N, 13°34'E, 21 July 1913, *Ronniger s.n.* (G). **Littoral-Inner Carniola:** Postojna, 8 km NW of Postojna, Bukove, Predjamski grad., 45°46'N, 14°12'E, 12 June 1971, *Hämet-Ahti 2440* (H). SPAIN. **Almería:** Sierra Nevada, La Ragua, Bayárcal, 37°3'N, 2°59'W, 6 July 1981, *Segura Zubizarreta s.n.* (MA). **Asturias:** Valles, San Román de Villa, Piloña, 43°21'N, 5°19'W, 24 June 2002, *San Miguel s.n.* (MA). **Ávila:** sierra de Ojos Albos, Los Regajales, 40°42'N, 4°31'W, 3 July 1984, *Burgaz et al. s.n.* (MA). **Barcelona:** Turó d'en Corts, Collserola, 41°25'N, 2°6'E, 11 June 1989, *Garcta Pausas s.n.* (BCN). **Burgos:** San Martín de Ubierna, 42°30'N, 3°42'W, 7 July 1984, *Galán Cela & Martín 591* (MA). **Cantabria:** San Vicente de la Barquera, 43°22'N, 4°23'W, 29 June 1986, *Aedo s.n.* (MA). **Castellón:** Vistabella del Maestrat, Al Forí, 40°17'N, 0°17'W, 19 June 1980, *Soriano s.n.* (BCN). **Cuenca:** Mogorrita, Montes Universales, 40°20'N, 1°46'W, 22 July 1979, *López 2085GF* (MA). **Gerona:** prop de Vidrà, Ripollés, 42°7'N, 2°18'E, 23 June 1981, *Papiró s.n.* (BCN). **Granada:** Sierra Nevada, carril del Puerto de la Ragua a Jerez del Marquesado, barranco de los Pasillos, 37°7'N, 3°4'W, 26 June 1997, *Morales & Baena s.n.* (MA). **Guadalajara:** entre Alustante y Alcorcho, Los Horcajos, 40°36'N, 1°39'W, 13 July 1965, *Paunero & Rivas s.n.* (MA). **Guipúzcoa:** Hondarribia, 43°21'N, 1°48'W, 27 June 1984, *Catalán & Aizpuru s.n.* (MA). **Huesca:** Valle de Bujaruelo, Torla, barranco de Lapazosa, 42°41'N, 0°6'W, 16 Sep. 2013, *Barberá et al.* 1059PB (MA); Benasque, prados sobre Cerler, 42°35'N, 0°32'E, 20 July 1955, *Montserrat 702/55* (MA). **León:** Redipollos, 43°0'N, 5°15'W, 3 July 1983, *Andrés s.n.* (BCN). **Lérida:** valle de Arán, pr. Baguerque, 42°43'N, 0°54'E, 8 Oct. 2006, *Aedo et al.* 13498 (MA). **Logroño:** Torrecilla de Cameros, 42°15'N, 2°37'W, 15 June 1966, *Segura Zubizarreta s.n.* (MA). **Lugo:** Orol, 43°33'N, 7°38'W, *Merino s.n.* (MA). **Madrid:** Puerto de Rascafría, 40°54'N, 3°52'W, 27 June 1973, *López & Valdés Bermejo s.n.* (MA). **Navarra:** Valle del Roncal, Puerto de Arlas, 42°58'N, 0°45'W, 27 July 1969, *Galiano et al. s.n.* (GDA, SEV). **Orense:** Vilardesilva, Serra da Enciña da Lastra, 42°27'N, 6°50'W, 16 June 2017, *Aedo et al.* 25040 (MA). **Palencia:** Velilla del Río Carrión, proximidades del Espigüete, por carretera que va a Cardaño de Arriba, 42°57'N, 4°45'W, 15 July 2013, *Barberá & Quintanar 897PB* (MA). **Salamanca:** Castellanos de Villiquera, 41°3'N, 5°41'W, 4 June 1979, *Amich s.n.* (MA). **Segovia:** Sepúlveda, Hoz del río Duratón, 41°17'N, 3°45'W, 9 July 1981, *Cebolla et al. s.n.* (MA). **Soria:** Montenegro de Cameros, La Cuerva, 42°6'N, 2°46'W, 22 June 2005, *Molina & Montamarta s.n.* (MA). **Teruel:** entre Orihuela y Noguera, 40°27'N, 1°35'W, 14 July 1965, *Paunero & Rivas s.n.* (MA). **Valladolid:** Castromonte, 41°46'N, 5°2'W, 28 June 1906, *Sennen s.n.* (MA). **Zamora:** Villardeciervos, 41°56'N, 6°17'W, July 1947, *Bernis s.n.* (MA). **Zaragoza:** Egea de los Caballeros, Erla, orillas del río Arba de Biel, 42°7'N, 1°8'W, 19 June 1955, *Paunero s.n.* (MA). SWEDEN. **Blekinge:** Nätraby par., Agdatorp, 56°12'N, 15°31'E, 5 Aug. 1927, *Arrhenius s.n.* (S). **Bohuslän:** Nösund, 58°6'N, 11°31'E, 21 July 1936, *Fries s.n.* (S). **Dalsland:** Ödeborg, Kyrkskolan, 58°32'N, 11°58'E, 19 June 1925,

Johansson s.n. (S). **Gotland:** Dalhem, 57°33'N, 18°32'E, 22 June 1974, *Karlsson s.n.* (S). **Halland:** Falkenberg, 56°54'N, 12°29'E, 24 June 1912, *Svenson s.n.* (S). **Jämtland:** Friso, 63°11'N, 14°32'E, 22 Oct. 1933, *Lange s.n.* (S). **Närke:** Stora Mellösa sn, Göksholm, 59°12'N, 15°30'E, 29 June 1929, *Broddezon s.n.* (S). **Öland:** Borgholm, 56°52'N, 16°39'E, 23 June 1911, *Erdmann s.n.* (S). **Östergötland:** Västra Tollstad, 4.5 km NNW of Alvastra, W side of Omberg by reserve Bokskogen, 58°18'N, 14°38'E, 3 July 1957, *Ahti B426* (H). **Skåne:** Hälsingborg, Sofiero, 56°5'N, 12°40'E, 11 July 1942, *Pettersson s.n.* (S). **Småland:** Algtutsboda par., Boda, 56°43'N, 15°34'E, 13 June 1987, *Karlsson 87031* (S). **Södermanland:** Nändö par., Bunkvik, 59°10'N, 18°40'E, 4 Aug. 1988, *Sundin 57* (S). **Uppland:** Stockholm, Laduvikens NO-hörn, 59°19'N, 18°3'E, 28 May 1998, *Blom & Thorán 4497* (S). **Västergötland:** Lerum, Hulan's park, 57°46'N, 12°16'E, 10 July 1946, *Ohlsén s.n.* (S). **Västmanland:** Tillberga, Hedensberg, 59°41'N, 16°38'E, 29 June 1950, *Almqvist s.n.* (S). SWITZERLAND. **Basel-Stadt:** S part of Riehen, Lange Erlen, 47°34'N, 7°36'E, 8 May 1948, *Ruotsalo s.n.* (H). **Bern:** Ganterland beim Haus Schopen, Ringoldswil ob Gunten am Thunersee, 46°41'N, 7°43'E, 11 Aug. 1954, *Keller s.n.* (G). **Geneva:** environs de Genève, à Carouge, 46°10'N, 6°8'E, June 1871, *Brown s.n.* (UPS). **Graubünden:** Engiadina Bassa, Guarda, 46°46'N, 10°9'E, 17 July 1990, *Castroviejo et al. 11464SC* (MA). **Solothurn:** bei Frohburg, 47°22'N, 7°53'E, 25 July 1905, *Fisher-Sigwart s.n.* (B, H, K, L, MA, MO, PR, S, US, WU). **St. Gallen:** St. Gallen-Nest, 47°25'N, 9°22'E, 15 June 1969, *Leenhouts 2037* (L). **Ticino:** Lugano, 46°0'N, 8°57'E, 1 June 1967, *Leenhouts 1518* (L). **Valais:** La Fouly, pr. Orsieres, 45°54'N, 7°6'E, 17 Aug. 2013, *Aedo 20819* (MA). **Vaud:** Les Plans-sur-Bex, 46°15'N, 7°5'E, 29 July 1972, *Scholz s.n.* (B). **Zürich:** prés sur le Zürichberg, 47°23'N, 8°34'E, 18 July 1890, *Stebler & Schröter 31* (S, US). SYRIA. **Rif Dimashq:** Ouadi el Karn, 33°37'N, 36°4'E, 28 May 1953, *Pabot s.n.* (G). TUNISIA. **Siliana:** Dj. Bargou, 36°6'N, 9°36'E, 18 May 1903, *Murbeck s.n.* (H, UPS). TURKEY. **Artvin:** Salalet ad Artwin [Artvin], 41°11'N, 41°49'E, 30 June 1912, *Holmberg 1985* (S). **Bitlis:** Tarvan [Tatvan], 38°30'N, 42°16'E, 27 June 1954, *Davis & Polunin 22187* (BM, G). **Bolu:** Aladag-Kartalkaya, 40°36'N, 31°40'E, 1 July 1955, *Alpay 414* (G). **Bursa:** Ulu Dag, Yesil Konak Bölgesi Civari, 40°4'N, 29°13'E, 15 July 1955, *Alpay 112* (G). **Çankırı:** Ilgaz Distr., Kütüz Ilgaz Dag, Wiesen 1 km südlich der Passhöhe, 41°2'N, 33°44'E, 12 July 1964, *Huber-Morath 17383* (G). **Hakkâri:** Karadag, 37°20'N, 43°48'E, 16 Aug. 1954, *Davis & Polunin 24393* (BM, G). **Istanbul:** Tchataldagh, près d'Alemdagh, 41°2'N, 29°15'E, 5 June 1892, *Aznavour s.n.* (G). **İzmir:** Yamanlar Dağı, Rastplatz, 38°33'N, 27°10'E, 10 July 1978, *Kesercioglu 101* (GOET). **Kars:** prope opp. Sarıkamış, 40°19'N, 42°35'E, 1 July 1914, *Litvinov s.n.* (C, G, H, JE, K, MO, NY). **Rize:** Vallée d'Khabakhor, 40°55'N, 40°50'E, 30 Aug. 1866, *Balansa s.n.* (L). TURKMENISTAN. **Ahal:** Baharly Distr., SW Kopetdag, western part of Kecce-Yola, 38°15'N, 57°48'E, 4 June 1974, *Nikitin & Ivanov s.n.* (BM, G, H, K, L, MA). **Balkan:** Kara-Kala Distr., top of Mt. Khasar, 38°34'N, 56°44'E, 23 June 1931, *Borisova 184* (LE). UKRAINE. **Chernivtsi Oblast:** Vashkivtsi Distr., Nyzhni Stanivtsi, valley of the Brusnytsya River, 48°18'N, 25°33'E, 21 June 1952, *Gorokhova s.n.* (LE). **Kiev Oblast:** vic. of Irpen, 50°31'N, 30°15'E, 6 July 1969, *Kharkevich s.n.* (LE). **Lviv Oblast:** Shevchenkovskiy rayon, 50°26'N, 30°31'E, 24 June 1991, *Tsebryk s.n.* (B). **Volyn Oblast:** Volodymyr-Volynskyy, Ostrivok, 50°50'N, 24°20'E, 31 May 1918, *von Hayek s.n.* (WU). **Zakarpattia Oblast:** rd. Yasinya-Rakhiv, 48°16'N, 24°21'E, 2 Sep. 1968, *Bobrov et al. s.n.* (LE). WALES. Denbighshire, Tan Penmaen Head, E side of

Colwyn Bay, 53°17'N, 3°43'W, 19 June 1960, *Brummitt 60394* (MA).

4b. *Trisetum flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard, J. Bot. Soc. Bot. France 28: 44. 2004. *Trisetum griseovirens* H. Lindb., Acta Soc. Sci. Fenn., Ser. B, Opera Biol. 1(2): 25, fig. 6. 1932. *Trisetum flavescens* var. *griseovirens* (H. Lindb.) Maire, Fl. Afrique N. 2: 247. 1953. TYPE: Morocco. Marrakech, Ait Messane, betw. Fimelil & Arround, 31°07'N, 7°55'W, 10 June 1926, *H. Lindberg s.n.* (lectotype, designated by Väre [2012: 89], H-1088222!).

Herbs 20.5–30(–36.5) cm tall. Basal leaf blades (1.4–)2.3–5.5(–6.8) cm × (1.2–)1.5–1.8 mm, inrolled, sometimes filiform. Top culm leaf blades (1.3–)2.2–4(–4.4) cm × (1.2–)1.4–2 mm, flat or slightly convolute to filiform or inrolled. Panicles (5–)5.5–6.5(–8.5) × 1–2(–3) cm. Spikelets (6.3–)6.5–7.3(–7.7) mm. Lemmas 6–6.2(–6.4) mm; aristules (0.9–)1–1.4(–1.8) mm; awn (8–)8.2–9(–10.6) mm. Palea length:lemma length ratio of (0.53–)0.65–0.76(–0.77). Anthers (2–)2.2–2.7(–3) mm. Chromosome number: $2n = 12$ (Galland, 1985, 1988). Figures 8B, 9B, 10B, 11B.

Additional illustrations. Chrték (1967c: 176, tab. I, 1; 178: tab. II, 1, 2, sub *Trisetum griseovirens*).

Phenology. *Trisetum flavescens* subsp. *griseovirens* has been collected in flower and fruit from June to August.

Distribution and habitat. This subspecies is endemic to the High Atlas Mountains in Morocco at 1900–3250 m, where it grows in sandstone formations and granitic rocky grasslands. Figure 14.

Discussion. When Dobignard (2004) combined *Trisetum griseovirens* under *T. flavescens*, he misspelled the epithet as “griseovirens.” That is corrected here to the original spelling.

Trisetum flavescens subsp. *griseovirens* is separated from subspecies *flavescens* by its habit (having shorter height, usually inrolled and filiform basal and upper leaves, and smaller panicles), and by its longer spikelets, aristules, and awns. Chrték (1967c) recognized this taxon at specific rank, as did Lindberg (1932). He assigned much importance to the anatomical characters of the leaves. Some of the Moroccan specimens studied possess intermediate characters between subspecies *griseovirens* and subspecies *flavescens*. For example, the specimens *Dobignard 3861* (G-00443134) and *López & Muñoz Garmendia 8979GL* (MA-549691) have a habit similar to that of *T. flavescens* subsp. *flavescens*, but have the long lemmas, aristules, and awns as in *T. flavescens* subsp. *griseovirens*. The opposite happens with the specimen *Sánchez et al. SA233*

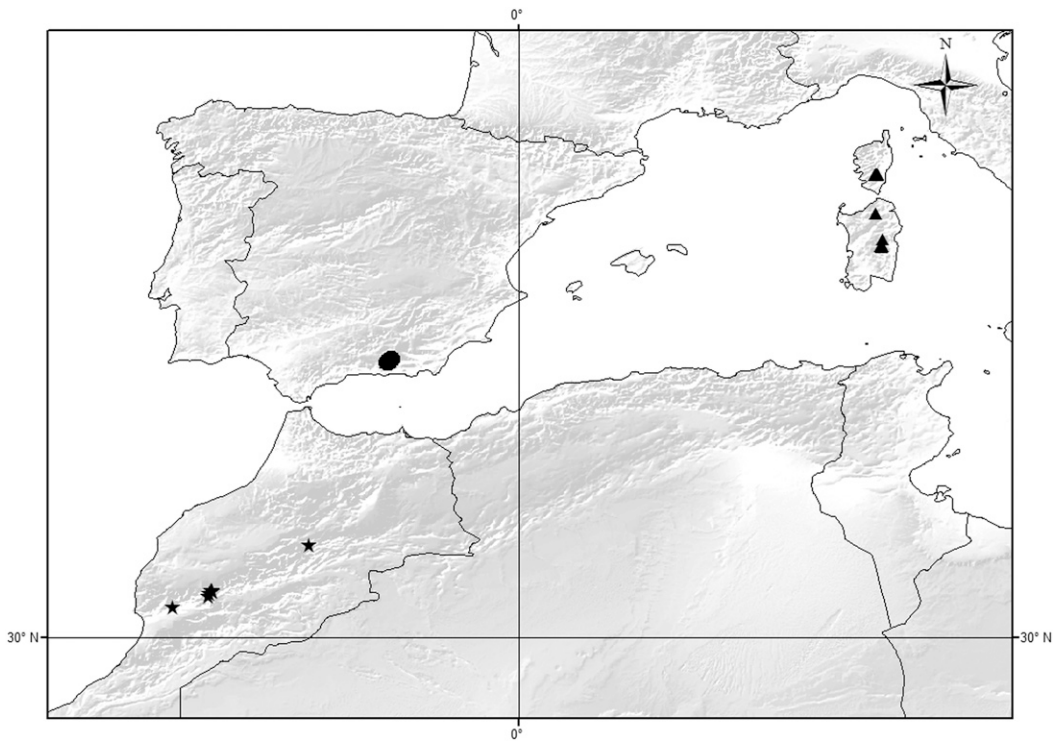


Figure 14. Distribution of *Trisetum glaciale* (Bory) Boiss. (triangles), *T. gracile* (Moris) Boiss. (dots), and *T. flavescens* subsp. *griseovirens* (H. Lindb.) Dobignard (stars).

(MA-782244) with only the habit similar to that of subspecies *griseovirens*. Moreover, the specimen *Aedo et al.* 4381 (MA-593200) has some individuals with characters of subspecies *griseovirens*, and others of subspecies *flavescens*, all of them from the same population. It seems that subspecific rank is here appropriate because of its geographic isolation and the presence of some intermediate specimens (Du Rietz, 1930).

As indicated above, Chrtek (1967c) considered that *Trisetum griseovirens* is closely related to *T. flavescens* (sub *T. burnouffi*), but even more so to *T. bertolonii*. However, our molecular data (Barberá et al., unpublished) suggest that *T. griseovirens* belongs to the *T. flavescens* complex, which is also in accordance with the morphology.

Additional specimens examined. MOROCCO. **Khénifra:** Arhbalou canyon n'Oussaka betw. Jebel Masker & Jebel Bou Ijallabene, S Assaka, 32°22'N, 5°22'W, 2 July 1989, *Lippert 24863* (M). **Marrakech:** Oukaïmeden, Adrar Tizrag, 31°12'N, 7°51'W, 1 July 2006, *Cabezas et al. FJCA19* (MA); directly above (N of) Oukaïmeden, 31°12'N, 7°52'W, 17 July 1981, *Davis 67647* (M); près d'Isougane-n-Guadouns, 31°3'N, 7°56'W, 1 Aug. 1938, *Faurel s.n.* (MPU, P); Adrar-n-Oukaïmeden, vertiente S, 31°11'N, 7°51'W, 29 June 2006, *Herrero et al. 2985* (MA, MPU); 72 km S from Marrakech, Oukaïmeden, 31°13'N, 7°52'W, 3 July 1987, *Jury et al. 8847*

(MA, SEV); surroundings of Oukaïmeden, 31°11'N, 7°51'W, 15 July 1989, *Lippert 25525* (M, W); Reraya, Arround, 31°7'N, 7°55'W, 23 July, *Litardière s.n.* (MPU); 19 July 1924, *Maire s.n.* (MPU). **Taroudant:** Adrar-n-Dern, Toubkal NP, 30°47'N, 8°52'W, 24 Aug. 1992, *Kreisch 92/0631* (B).

5. *Trisetum fuscum* Schult. in Roem. & Schult., Syst. Veg. 2: 664. 1817. *Avena fusca* Kit. ex Schult., Oestr. Fl. ed. 2, 1: 268. 1814, nom. illeg. hom., non *Avena fusca* Ard., Saggi Sci. Lett. Accad. Padova 2: t. 4. 1789. *Trisetum flavescens* subsp. *fuscum* (Schult.) Hack., Magyar Bot. Lapok 2: 111. 1903. *Trisetaria fusca* (Schult.) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 383. 1996. TYPE: Slovakia. Carpathians, *P. Kitaibel s.n.* (lectotype, selected by B. Jonsell in sched., designated here, M-0210842!; isolectotype, M-0223323!). Figures 8C, 9C, 10C, 15A.

Trisetum transylvanicum Steud., Syn. Pl. Glumac. 1: 226. 1855. TYPE: Romania. Transylvania, *J. C. G. Baumgarten s.n.* (lectotype, designated here, P-219670!).

Trisetum varium var. *violaceum* Schur, Oestr. Bot. Z. 10: 75. 1860. TYPE: Romania. Mtns. Königstein [Piatra Craiului], 45°30'N, 25°13'E, 13 Aug. 1854, *P. J. F. Schur s.n.* (neotype, designated here, LW-213275 image!).

Trisetum flavescens f. *majus* Zapal., Rozpr. Wydz. Mat.-Przyr. Akad. Umiejctn., Dział B. Nauki Biol. 4: 108. 1904.

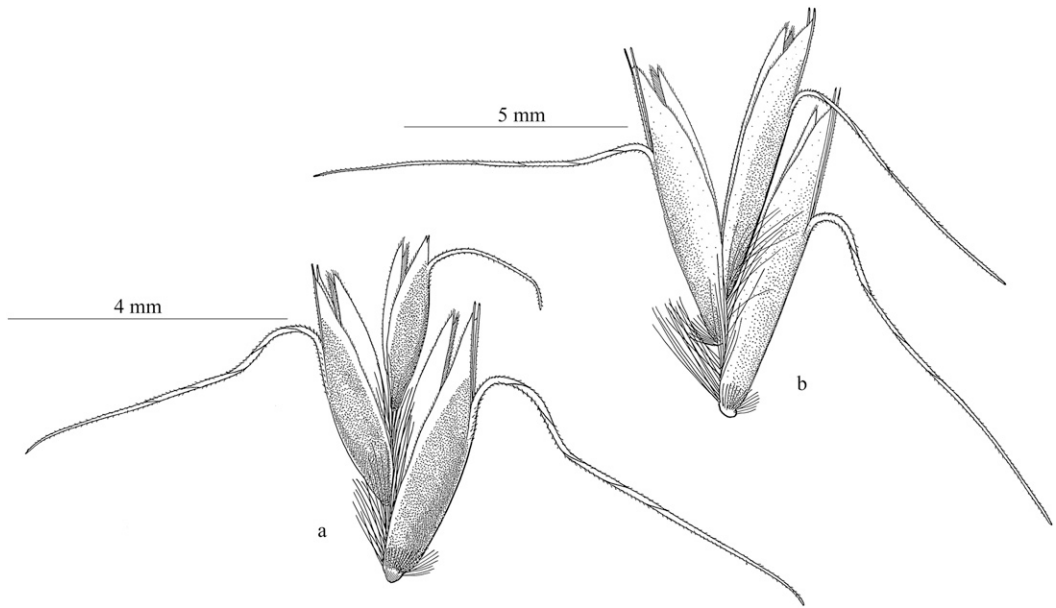


Figure 15. Florets. —A. *Trisetum fuscum* Schult. —B. *Trisetum laconicum* Boiss. & Orph. A based on *Nyárády s.n.* (L-1346389); B based on *Orphanides 2890* (B-10_0508993).

TYPE: Tatra Mtns., *J. Krupa s.n.* (KRAM?, original material not located).

Herbs (26.8–)44.9–54(–72) cm tall, not to slightly caespitose, with stoloniferous rhizome, culm (0.4–)0.6–0.9(–1.1) mm diam., straight, glabrous; nodes 4 to 5, separated along culm, not included in sheaths, rarely included, glabrous, yellowish or brownish. Basal leaf sheaths sparsely pubescent to pubescent, with hairs (0.2–)0.6–0.8 mm, decaying into fibers, brownish to yellowish; basal leaf blades (1.1–)6.1–10(–18) cm × (1.4–)2.5–3.2(–5) mm, flat, sometimes slightly inrolled when dried, sparsely to densely pubescent adaxially and abaxially, sometimes glabrous abaxially, margins with hairs (0.05–)0.3–0.9(–1.2) mm, yellowish to brownish, sometimes greenish; top culm leaf sheaths (7–)9–12(–13.7) cm, not distinctly veined, glabrous, sometimes with hairs on upper part, with or without cilia on margins; top culm leaf blades (5.7–)6.5–12.5(–13.7) cm × (2.1–)3.4–5(–6.1) mm, flat, usually parallel to culm, sometimes surpassing panicle, pubescent adaxially and abaxially, sometimes glabrous or less densely pubescent abaxially, with hairs on margins (0.05–)0.1–1(–1.2) mm, greenish to grayish; inner collar region glabrous, with scattered hairs (0.2–)0.8–1.3(–2.3) mm on margins; ligules (3–)3.7–4.7(–4.8) mm, irregularly dentate to lacinate, glabrous. Basal node of panicle glabrous. Panicles (6.8–)7.9–11.2(–13) × (1.5–)1.8–3.5(–4.5) cm, elliptic to oblong in outline, lax to somewhat dense; rachis glabrous, sometimes sparsely pubescent, up to 0.3 mm; longest basal branches (1–)

2.2–3.8(–5) cm. Spikelets (5–)5.4–6.6(–7.4) × (1.8–)2.2–3.1(–3.2) mm, 2- to 3-flowered; pedicels (1.7–)2.5–3.3(–4.4) mm, glabrous to sparsely pubescent, with hairs up to 0.2 mm. Glumes unequal (lower glume length:upper glume length ratio of [0.62–]0.7–0.82 [–0.88]); lower glume (2.9–)3.5–4.3(–4.5) × 1–1.2(–1.5) mm, broadly lanceolate, sometimes narrowly lanceolate (lower glume width:lower glume length ratio of [0.22–]0.25–0.34), acuminate, sometimes long-acuminate, 1(to 3)-nerved, glabrous, usually with hairs up to 0.05 mm on upper part and margins, greenish to purplish; upper glume (4–)4.7–5.5(–6.3) × (1.8–)2–2.4(–2.6) mm, elliptic to lanceolate, rarely oblanceolate (upper glume width:upper glume length ratio of [0.36–]0.38–0.46[–0.51]), acuminate to long-acuminate, 3-nerved, glabrous, with hairs up to 0.1(–0.3) mm from middle to upper part of midrib and margins, greenish surrounded by purplish and yellowish; rachilla segments between first and second florets 0.9–1.3 mm, with hairs (0.5–)0.8–1.7 mm; rachilla segments to sterile floret (1–)1.2–1.8 mm, with hairs (0.3–)0.7–1.2(–1.5) mm. Lemmas (4.1–)4.2–5.2(–5.5) × 1–1.2(–1.5) mm, oblong to broadly lanceolate, sometimes elliptic (lemma width: lemma length ratio of [0.33–]0.35–0.41[–0.44]), strigulose, with hairs (0.05–)0.1–0.2 mm, the longest ones at awn insertion, greenish to yellowish on central part, surrounded by purple; apical teeth (0.1–)0.2–0.4(–0.8) mm, with aristules 0.1–0.2 mm, rarely without; awn (4.7–)6–6.6(–7) mm, inserted (2.1–)2.8–3(–3.4) mm from base (awn insertion from base length:lemma

length ratio of 0.5–0.68[–0.83]), strongly curved basally, not or slightly twisted at base, with adpressed hairs 0.05–0.2 mm, the longest ones at base; callus (0.1–)0.2(–0.3) mm, elliptic to orbicular, with hairs (0.4–)0.5–1.1(–1.2) mm. Paleae (3.6–)3.9–4.5(–5.5) × 1–1.5(–1.7) mm (palea length:lemma length ratio of [0.77–]0.87–0.95[–1]), lanceolate or elliptic to slightly oblanceolate, margins with hairs from middle to upper part; teeth 0.2(–0.3) mm, with short, antrorse hairs sometimes up to 0.4 mm. Lodicules (0.4–)0.5–0.8(–0.9) mm, with 2 or 3 lobules or teeth of the same length. Anthers 1.7–2.1(–2.5) mm. Ovaries (0.4–)0.5–0.8(–1.1) mm, glabrous. Caryopses 1.6–2.8 × 0.5–0.6 mm, oblong to elliptic. Chromosome number: $2n = 28$ (Frey, 1991).

Additional illustrations. Chrtek & Jirásek (1963: 577, fig. 3, 3, sub *Trisetum ciliare*); Chrtek (1965: 213, Abb. 1, 2; 214, Abb. 3, 1; 217, Abb. 4, 1); Săvulescu (1972: 289, Plansa 56, 3a–c, sub *T. ciliare*); Frey (1992: 464, fig. 12).

Phenology. *Trisetum fuscum* has been collected in flower and fruit from June to October.

Distribution and habitat. This species is endemic to the Carpathian Mountains; it grows on scree of mountain meadows and floodplains in wet rock fissures, at 1500–2000 m. Figure 16.

Discussion. *Trisetum fuscum* is differentiated from the rest of species of the section mainly by its longer ligules ([3–]3.7–4.7[–4.8] mm). *Trisetum fuscum* is similar to *T. alpestre*, with which it frequently has been confused. Apart from the length of the ligules, *T. fuscum* is separated from *T. alpestre* by its larger size ([26.8–]44.9–54[–72] cm vs. [14.4–]21.5–35.7[–53.5] cm) and not or more loosely tufted habit, longer and wider top culm leaf blades ([5.7–]6.5–12.5[–13.7] cm × [2.1–]3.4–5[–6.1] mm vs. [1.5–]2.2–5.2[–9.3] cm × [1–]1.6–3[–4.1] mm), and longer panicles ([6.8–]7.9–11.2 [–13] mm vs. [3.4–]5.4–7.5[–11.5] mm). Concerning spikelet characters, *T. fuscum* has wider upper glumes than *T. alpestre* ([1.8–]2–2.4[–2.6] mm vs. [1.5–]1.8–2 [–2.3] mm), awns strongly curved basally and sometimes with long hairs at the base (up to 0.2 mm), paleae sometimes also with longer hairs (up to 0.4 mm apically), and glabrous ovaries.

Trisetum fuscum is easy to differentiate from *T. flavescens*, with which it sometimes has been confused. The ligules are significantly shorter in *T. flavescens* ([0.5–]0.7–1.2[–2] mm). Some authors, such as Chrtek (1968), Jonsell (1980), and Frey (1992), give much taxonomic importance to the hairiness of the lemma and the palea to differentiate *T. fuscum* from *T. alpestre* and *T. flavescens*. In particular, Chrtek (1968) published a detailed morphological study of *T. fuscum*,

comparing each of those characters among the three species. In our study of *T. fuscum*, the hairiness of both the palea and the lemma exhibited great variability in length and density, suggesting that this feature is of minor taxonomic utility.

Jonsell (1980) described the ovary of *Trisetum fuscum* as having a few apical hairs. Later, Frey (1992) also observed two to three long papillae (atypical hairs) on the top of the ovary of *T. fuscum*. However, in all the specimens of *T. fuscum* studied by us, the ovaries were glabrous.

Arduino (1789) proposed the name *Avena fusca* in an illustration (tab. 4) for his *A. hispanica*, which was described in the same publication (pp. 111–113). Thus, *A. fusca* should be considered as a valid published name (alternative name), according to Article 36.2 of the ICN (McNeill et al., 2012). Consequently, *A. fusca* Kit. ex Schult. is a later homonym (Art. 53.1), spelled exactly like Arduino's name for a taxon of the same rank, but based on a different type. We have decided to conserve the epithet “*fuscum*” as a replacement name with the same type as the illegitimate name in order to avoid disadvantageous nomenclatural changes.

Additional specimens examined. POLAND. **Lesser Poland:** Morskie Oko, 49°11'N, 20°4'E, 19 July 1929, Nilsson s.n. (S); Kociol pod Rysami, Rysy, 49°11'N, 20°4'E, 20 Aug. 1931, Pawlowski s.n. (GB, GH, K, LE, S, UPS). SLOVAKIA. **Banská Bystrica:** Djumbier [Dumbier], 48°56'N, 19°38'E, Gustav s.n. (MO). **Prešov:** Mlynica, 49°6'N, 20°18'E, 29 July 1966, Dahl & Hadac s.n. (O); Csorban, Jégtói völgy valley & Furkota völgy, 49°10'N, 20°1'E, 9 Aug. 1904, Degen s.n. (BM, GB, JE, LE, WU); Jégtói, 49°10'N, 20°1'E, July 1904, Degen s.n. (BM, GB, JE, WU); Dolina Litworowa valley, 49°10'N, 20°7'E, 29 Aug. 1988, Frey s.n. (L); Nowy, 49°15'N, 20°11'E, Aug. 1972, Frütze s.n. (K); July 1971, Frütze s.n. (JE, M, PR); pr. Jaworina, 49°35'N, 19°24'E, 11 Sep. 1865, Frütze s.n. (K); Zelene Pleso, 49°10'N, 20°7'E, 1 Aug. 1964, Hadac & Dahl s.n. (O); Omladěk-völgy valley (Trümmertal), 49°10'N, 20°4'E, 2 Aug. 1932, Lengyel s.n. (GB, HBG, M, S); Mengusovský valley, 49°10'N, 20°4'E, 18 Sep. 1910, Nyárády s.n. (L, UPS). **Žilina:** Jarzabczy Wierch, 49°11'N, 19°47'E, 10 Aug. 1922, Pawlowski s.n. (S); Arva, lacum inferiorem Roháč see, 49°12'N, 19°45'E, 25 July 1928, Reching s.n. (S); Raczkowa sjö, 49°11'N, 19°48'E, 3 Aug. 1813, Wahlberg s.n. (UPS).

6. *Trisetum glaciale* (Bory) Boiss., Elench. Pl. Nov.: 87. 1838. *Avena glacialis* Bory, Ann. Gén. Sci. Phys. 3: 6. 1820, as “*Glacialis*.” *Trisetaria glacialis* (Bory) Paunero, Anales Jard. Bot. Madrid 9: 514. 1950. TYPE: Spain. Granada, Sierra Nevada, Aug. 1837, P. E. Boissier 186 (neotype, designated here, G-00176302 image!; isoneotypes, B-10_0250162!, B-10_0347071!, BM-001134049 image!, G-00176303!, G-00176305 image!, GH!, GOET!, JE!, K!, L-1346396!, L-1346397!, L-1346398!, L-1346399!, L-1346401!, LE!, M-0210838!, MA-8022!, MO-1604193!, MPU!, MW!, NY-431723!, O-V2126600!, O-V2126602!, P-00731516!, P-02219569!,

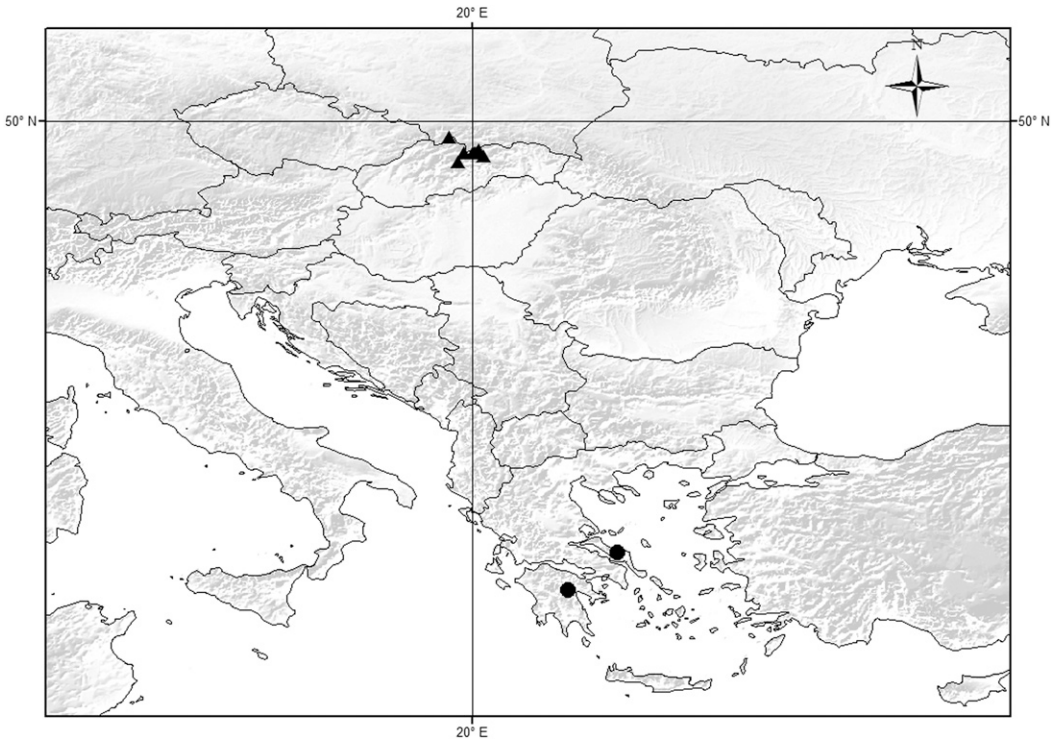


Figure 16. Distribution of *Trisetum fuscum* Schult. (triangles) and *T. laonicum* Boiss. & Orph. (dots).

P-02219574!, P-02219579!, P-03364420!, RO image!,
US!, W-0025052 image!, W-1889-0242183!). Figure 17.

Trisetum antonii-josephii Font Quer & Muñoz Med., *Anales Jard. Bot. Madrid* 6: 495. 1946, as "Antonii-Josephii." *Trisetaria antonii-josephii* (Font Quer & Muñoz Med.) Paunero, *Anales Jard. Bot. Madrid* 9: 516. 1950. TYPE: Spain. Granada, Sierra Nevada, Jerez del Marquesado, Barranco del Nacimiento del río Alhorí, 37°07'N, 3°14'W, 19 July 1923, P. Font Quer & J. M. Muñoz Medina s.n. (holotype, BC-81358!).

Herbs (3–)8.8–14.4(–19.5) cm tall, caespitose to densely caespitose, shortly rhizomatous, culm 0.3–0.7 mm diam., straight, glabrous, with some dispersed hairs mostly on upper part, sometimes puberulous, with hairs 0.1–0.6(–1.2) mm; nodes (2 to)3(to 4), concentrated in lower part of culm, included in sheaths, pubescent, yellowish. Basal leaf sheaths distinctly veined, not inflated, densely pubescent, with hairs up to 1.2 mm, with dense layer of oldest ones decomposed into fibers, yellowish to greenish; basal leaf blades (0.9–)1.4–4.2(–8.4) cm × (0.7–)1.6–2.5(–3) mm, rigid, flat, sometimes conduplicate, with central nerve and margins thickened, cartilaginous, densely pubescent, with patent hairs 0.1–0.5(–0.9) mm abaxially and adaxially, grayish to greenish; top culm leaf sheaths (1.8–)2.5–3.7(–4.6) cm, involving most of culm, distinctly veined, pubescent, with long and short hairs, without

cilia on margins; top culm leaf blades (0.2–)0.5–1.5(–2.6) cm × (0.6–)1.2–2(–2.5) mm, flat to conduplicate, densely pubescent abaxially and adaxially, with short and some scattered long hairs (0.05–)0.1–0.5(–0.6) mm, greenish to grayish, sometimes slightly yellowish; inner collar region densely pubescent, with hairs 0.1–0.3(–0.7) mm; ligules (0.3–)0.5–0.7(–1) mm, acute, lacinate, slightly strigose, puberulous on upper part, with hairs 0.2–0.4(–0.9) mm. Basal node of panicle glabrous, sometimes with dispersed hairs 0.1–0.2(–0.3) mm. Panicles (2.3–)3–4.2(–4.8) × (0.7–)1–1.4(–1.8) cm, ovate in outline, from compact to somewhat lax; rachis glabrous to sparsely pubescent, with hairs 0.1–0.3 mm; longest basal branches (0.3–)0.4–0.9(–1.1) cm. Spikelets (4.2–)4.8–6(–7) × (1–)1.6–2.4(–3.8) mm, (1)2(3)-flowered; pedicels (1–)1.5–2.2(–3.6) mm, from sparsely pubescent to pubescent, with hairs 0.1–0.3 mm. Glumes unequal to subequal (lower glume length:upper glume length ratio of [0.75–]0.85–0.92[–0.98]); lower glume (3.2–)4.2–5(–5.7) × (0.6–)0.8–1.2 mm, broadly lanceolate, sometimes narrowly lanceolate (lower glume width:lower glume length ratio of [0.1–]0.2–0.25[–0.3]), acuminate to long-acuminate, (2 to)3-nerved, glabrous, sometimes with very short hairs up to 0.06 mm on upper part of margins and central nerve, greenish on central basal part, sometimes purplish, laterals and upper part



Figure 17. *Trisetum glaciale* (Bory) Boiss. Image of an isoneotype (B-10_0250162).

purplish, sometimes yellowish; upper glume (4.2–)4.7–5.6 (–6.5) × (1–)1.2–1.6(–2.1) mm, broadly lanceolate, sometimes lanceolate (upper glume width:upper glume length ratio of [0.17–]0.24–0.33[–0.48]), acuminate to long-acuminate, 3-nerved, glabrous, sometimes with scattered and very short hairs up to 0.07 mm on midrib and upper part of margins, greenish on central basal part, sometimes purplish, margins and upper part purplish, sometimes yellowish; rachilla segments between first and second florets 1–1.5(–2.2) mm, with hairs (0.7–)1–1.4(–2) mm;

rachilla segments to sterile floret (1–)1.3–1.7(–1.9) mm, with hairs (0.5–)0.8–1.1(–1.7) mm. Lemmas (3.5–)4–4.5 (–5.6) × (0.6–)0.8–1.2 mm, broadly lanceolate (lemma width:lemma length ratio of [0.24–]0.28–0.37[–0.45]), glabrous to strigulose, greenish, sometimes yellowish, purplish on laterals and upper part; apical teeth (0.2–)0.4–1(–2) mm, with aristules 0.2–0.5(–0.9) mm, rarely without; awn (4.5–)4.8–7.4(–10.7) mm, inserted (1.9–)2.3–2.6(–3) mm from base (awn insertion from base length:lemma length ratio of [0.45–]0.54–0.63[–0.71]),

slightly geniculate, twisted at base when mature, with very short, adpressed hairs up to 0.05 mm; callus (0.15–)0.2 (–0.3) mm, elliptic, sometimes elliptic-oblong, with hairs (0.2–)0.3–0.6(–0.9) mm. Paleae (3–)3.6–4.1(–4.6) × (0.6–)0.8–1(–1.4) mm (palea length:lemma length ratio of 0.8–1.05), narrowly elliptic, margins with short, antrorse hairs; teeth (0.2–)0.3–0.6(–0.8) mm, with short, antrorse hairs less than 0.1 mm. Lodicules 0.4–0.7(–0.9) mm, irregularly dentate. Anthers (0.9–)1.7–2.6(–2.9) mm. Ovaries (0.3–)0.5–0.8(–2) mm, from sparsely puberulous to puberulous on upper part, with hairs 0.1–0.3 mm, rarely glabrous. Caryopses 2.5–3.1 × 0.5–0.8 mm, ± fusiform. Chromosome number: $2n = 14$ (Küpfer, 1968).

Illustrations. Paunero (1950: 548, lám. XII, sub *Trisetaria glacialis*; 549, lám. XIII, sub *T. glacialis*; 550, lám. XIV, sub *T. antoni-josephii*; 551, lám. XV, sub *T. antoni-josephii*; 552, lám. XVI, sub *T. antoni-josephii* and *T. glacialis*; 553, lám. XVII, sub *T. antoni-josephii* and *T. glacialis*; 554, lám. XVIII, sub *T. antoni-josephii* and *T. glacialis*); Chrték & Jirásek (1963: 575, figs. 2, 4–6); Chrték (1965: 214, Abb. 2, 1; 215, Abb. 3, 8; 217, Abb. 4, 4–5; 218, Abb. 5, 4–5).

Phenology. *Trisetum glaciale* has been collected in flower and fruit from June to September.

Distribution and habitat. *Trisetum glaciale* is endemic to the Sierra Nevada in southern Spain, at 2400–3400 m elevation, in mountain pastures and in fissures of schist soils. Figure 14.

Discussion. Burdet et al. (1981: 580) proposed *Boissier 186* as the lectotype, which seems to be a mistake as that was not original material. After searching in Bory's collection, no original material has been found. Nevertheless, the specimens collected by Boissier come from the type locality and match the current concept of *Trisetum glaciale*. Therefore, it is appropriate to consider the Burdet proposal as a neotypification (Art. 9.9 of ICN).

The IPNI website has two entries for *Avena glacialis*, one attributed to Bory (1820) and the other to Boissier (1838). However, Boissier (1838) made a combination of Bory's name in the genus *Trisetum*, not *Avena*, and explicitly referred to the basionym as "*Avena glacialis* Bor. Fl. n° 20." Consequently, the name "*Avena glacialis* Boiss." has no standing and should be disregarded.

Trisetum glaciale is characterized by its densely tufted habit and short height ([3–]8.8–14.4[–19.5] cm), and by having short and rigid leaf blades with a thickened midrib and margins, the margins also cartilaginous, pubescent top culm leaf sheaths, panicles ovate in outline, subequal glumes (lower glume length:upper glume length ratio of [0.75–]0.85–0.92 [–0.98]), palea almost or as long as the lemma (palea

length:lemma length ratio of 0.8–1.05), and ovaries from sparsely to densely puberulous apically, rarely glabrous.

Font Quer and Muñoz Medina (Font Quer, 1946) described another species from Sierra Nevada, *Trisetum antonii-josephii*. It was separated from *T. glaciale* by its narrower and 1-veined lower glumes and lanceolate lemmas with longer awns. Paunero (1950) made a more detailed study indicating the difference in the lemma apex (acute in *T. antonii-josephii* and obtuse in *T. glaciale*), noting that the leaf structure, which varies widely among the species of the genus, as well as the ovary indumentum, is identical in both species. Romero (2009) recognized both species and indicated that specimens with intermediate characters have been found, probably of hybrid origin. In the material studied, we determined that the number of nerves in the lower glumes depends on the stage of development of the specimen, and is, therefore, not a good taxonomical character state for discriminating these taxa. Awn length is also variable in specimens of the same population. Therefore, we consider *T. antonii-josephii* to be a synonym of *T. glaciale*.

Additional specimens examined. SPAIN. **Granada:** Sierra Nevada, ascensión al Veleta desde la parada del microbús, bordes del Corral del Veleta, 37°3'N, 3°22'W, 24 July 2013, Barberá et al. 937PB (MA); ascensión al Veleta, trincheras junto a la parada del microbús, 37°3'N, 3°22'W, 24 July 2013, Barberá et al. 939PB (MA); Caldera del Mulhacen, 37°3'N, 3°18'W, 25 July 1851, Bourgeau 1517 (G, GOET, K, P); Valle de Lanjarón, Peñón Elorrieta, 37°2'N, 3°23'W, 6 July 1930, Ceballos & Vicioso s.n. (MA); Monachil, inter Laguna de Las Yeguas et Pico Veleta, 37°3'N, 3°22'W, 26 July 1978, Charpin et al. 15297 (G); autour des lagunas de Río Seco, 37°3'N, 3°20'W, 15 July 1983, Deferrard 4317 (G); Monte Pelado, 37°6'N, 3°15'W, 24 Aug. 1923, Font Quer s.n. (BC, BM, GDA, JE, K, MA, S, UPS); Laguna de la Caldera, 37°3'N, 3°19'W, 8 Aug. 1924, Ginzberger s.n. (W); Picacho de Veleta, 37°3'N, 3°22'W, 1 Aug. 1879, Huter et al. 1172 (B, BM, G, GB, HBG, K, LE, M, MPU, P, PR, W, WU); Raspones de Río Seco, 37°3'N, 3°20'W, 4 Aug. 1997, Martínez Lirola & Vargas s.n. (GDA); entre 1^a y 2^a laguna del río Lanjarón, 37°2'N, 3°24'W, 28 July 1997, Martínez Lirola & Vargas s.n. (GDA); Picacho de Veleta, 37°3'N, 3°22'W, 22 Aug. 1974, Merxmüller & Lippert 29582 (M); Capileira, alrededores de la Laguna de Majano, 37°2'N, 3°19'W, 13 Aug. 1978, Molero Mesa s.n. (GDA); Pico del Veleta, 37°3'N, 3°22'W, 25 July 1947, Muñoz Medina & Serrano s.n. (ARAN, BC, F, GDA, MA); Picacho de Veleta, 37°3'N, 3°22'W, Aug. 1891, Porta & Rigo 630 (B, G, GB, JE, K, M, MA, NY, P, S, W, WU); subida al Pico Mulhacén, 37°3'N, 3°18'W, 18 June 2014, Quintanar et al. 5226 (MA); subida al Mojón Alto, entre la loma de Maitena y el Calvario, 37°7'N, 3°17'W, 21 June 2014, Quintanar et al. 5273 (MA); al pie del Collado de las Buitreras, 37°6'N, 3°16'W, 21 June 2014, Quintanar et al. 5275 (MA); bajada del Collado de las Buitreras en el camino hacia Cerro Pelao, 37°6'N, 3°15'W, 21 June 2014, Quintanar et al. 5277 (MA); Cerro Pelao, 37°6'N, 3°15'W, 21 June 2014, Quintanar et al. 5278 (MA); Barranco del Río Alhorí y Ventisquero de los Caballones, 37°6'N, 3°15'W, 21 June 2014, Quintanar et al. 5279 (MA); Laguna de la Caldera hasta la de Majano, 37°2'N,

3°19'W, 4 Aug. 1981, *Romero s.n.* (GDA); Barranco de San Juan, 37°4'N, 3°22'W, 18 July 1981, *Romero s.n.* (GDA); alrededores de la Laguna de Aguas Verdes, 37°2'N, 3°22'W, 22 July 1980, *Romero & Morales s.n.* (GDA); Refugio de Elorrieta, 37°2'N, 3°23'W, 24 July 1981, *Romero & Sánchez s.n.* (GDA); Mulhacén, Laguna La Caldera, 37°3'N, 3°22'W, 28 July 1967, *Segura Zubizarreta s.n.* (MA); Sierra Nevada, 4 Aug. 1845, *Willkomm 1281* (MPU, P); Picacho de Veleta, 37°3'N, 3°22'W, 31 July 1876, *Winkler s.n.* (B, M, MPU, P, WU).

7. *Trisetum gracile* (Moris) Boiss., *Voy. Bot. Espagne* 2: 654. 1844. *Avena gracilis* Moris, *Stirp. Sard. Elench.* 1: 50. 1827. *Trisetum morisii* Trin., *Bull. Sc. Acad. Petersb.* 1: 66. 1836, nom. illeg. superfl. TYPE: Italy, Sardinia, Nuoro Prov., Gennargentu Mtns., 40°01'N, 9°20'E, *G. G. Moris s.n.* (lectotype, designated here, LE-01042367!; possible isolectotypes, JE-00018855!, P-02222289!, P-02222295!). Figure 18.

Trisetum conradiæ Gamisans, *Candollea* 26: 322. 1971. *Trisetaria conradiæ* (Gamisans) Banfi & Soldano, *Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano* 135: 382. 1996. TYPE: France, Corsica, Incudine Massif, 41°51'N, 9°12'E, 14 July 1968, *J. Gamisans 68* (holotype, Gamisans' private herbarium; isotype, G-00100183!).

Trisetum gracile var. *morisianum* Gamisans, *Candollea* 28: 54. 1973. TYPE: Italy, Sardinia, Ogliastra Prov., Punta La Marmora Mtn., 39°59'N, 9°19'E, 24 June 1970, *J. Gamisans & M. Reille S-2399* (holotype, G-00386420!).

Herbs (4.5–)8.9–12.5(–18.2) cm tall, caespitose to densely caespitose, shortly rhizomatous, culm (0.2–)0.4–0.6 mm diam., often bent at nodes, glabrous, sometimes with hairs 0.2–0.4 mm below basal node; nodes 2 to 3(to 4), mostly concentrated in lower part of culm, not included in sheaths, rarely included, glabrous, blackish. Basal leaf sheaths distinctly veined, somewhat inflated, glabrous to sparsely pubescent, with hairs up to 0.1 mm, with dense layer of oldest ones decomposed into fibers, yellowish to brownish, rarely greenish; basal leaf blades 1–2(–4) cm × (0.6–)1.3–1.7(–2.6) mm, rigid, flat to convolute or revolute, with central nerve thickened, glabrous to sparsely puberulous adaxially, pubescent abaxially, also in margins, with hairs (0.05–)0.1–1.2(–1.8) mm, greenish to grayish; top culm leaf sheaths (1.4–)2–3.2(–4) cm, distinctly veined, somewhat inflated, glabrous, without cilia on margins; top culm leaf blades (0.2–)0.3–1(–1.8) cm × (0.6–)0.8–1.2 mm, conduplicate, rarely flat, parallel to culm, glabrous to sparsely pubescent abaxially and adaxially, with hairs up to 0.2 mm on margins, brownish to yellowish, sometimes grayish; inner collar region glabrous, sometimes with few scattered hairs up to 0.3 mm on margins; ligules 0.5–0.9 mm, lacinate to shortly irregularly toothed, with hairs 0.1–0.3 mm on upper part. Basal node of panicle glabrous. Panicles

(1.3–)1.6–2.5(–3.1) × (0.7–)1–1.5(–1.8) cm, ovate in outline, somewhat dense; rachis internodes glabrous to sparsely pubescent, with hairs 0.05–0.2 mm; longest basal branches (0.2–)0.3–0.9(–1.1) cm. Spikelets (4–)5.2–6.4(–6.7) × (1.7–)2.4–4(–5.2) mm, 2- to 3-flowered; pedicels (1.4–)1.8–3.2(–4.4) mm, sparsely puberulous, with hairs up to 0.2 mm. Glumes slightly subequal to almost equal (lower glume length:upper glume length ratio of [0.79–]0.82–0.89[–0.97]); lower glume (3.6–)4–5.6(–6.5) × 1.2–1.6(–2.4) mm, elliptic to broadly lanceolate (lower glume width:lower glume length ratio of [0.28–]0.3–0.35[–0.4]), acuminate to long-acuminate, 1(or 2)-nerved, glabrous, greenish surrounded by purple, margins hyaline; upper glume (4–)4.7–6.6(–6.8) × (1.8–)2–2.4 mm, elliptic to oblong, sometimes narrowly elliptic or narrowly lanceolate (upper glume width:upper glume length ratio of 0.33–0.43 [–0.49]), acuminate, sometimes long-acuminate, 3-nerved, glabrous, greenish surrounded by purple, margins hyaline; rachilla segment between first and second florets 0.6–1.2 mm, with hairs (1.6–)2–2.4(–3) mm; rachilla segment to sterile floret (0.8–)1–1.3 mm, with hairs (0.7–)1–1.5(–2) mm. Lemmas (3–)4–5(–5.6) × 1.2–1.6(–2.4) mm, narrowly elliptic to narrowly lanceolate, sometimes broadly lanceolate (lemma width:lemma length ratio of [0.26–]0.3–0.36[–0.47]), glabrous to pubescent, with hairs (0.05–)0.6–1.4(–2) mm between awn and base, greenish, sometimes yellowish, surrounded by purplish flush; apical teeth (0.1–)0.2–0.4 mm, with aristules 0.3–0.6(–1) mm; awn (4.5–)5–6.6(–9.1) mm, inserted (1.3–)1.8–2.2(–2.8) mm from base (awn insertion from base length:lemma length ratio of [0.34–]0.41–0.49[–0.51]), geniculate and slightly twisted at base, with very short, adpressed hairs up to 0.05 mm; callus 0.1–0.4 mm, elliptic to orbicular, with hairs (0.7–)1–1.3 mm. Paleae (2.7–)3.7–4.2(–4.6) × 0.7–1.3 mm (palea length:lemma length ratio of [0.66–]0.76–0.84 [–1.1]), elliptic or narrowly elliptic to slightly oblanceolate, margins glabrous; teeth (0.1–)0.2–0.4 mm, glabrous or with short, antrorse hairs. Lodicules (0.6–)0.9–1.2(–1.8) mm, entire, sometimes with 2 lobules or irregularly dentate. Anthers (1.4–)1.8–2.3(–3) mm. Ovaries 0.5–1(–2) mm, glabrous. Caryopses 1.5–2.6 × 0.4–0.7 mm, oblong or narrowly elliptic. Chromosome number: $2n = 14$ (Gamisans, 1973).

Additional illustrations. Fiori & Paoletti (1895: 27, 230); Chrték & Jirásek (1963: 575, fig. 2, 1–3); Chrték (1965: 214, Abb. 2, 4–5; 215, Abb. 3, 8; 217, Abb. 4, 6–7; 218, Abb. 5, 1–3); Gamisans (1971: 323, fig. 1, 1–5; 325, fig. 2, 1–3); Jeanmonod & Gamisans (2007: XXX, fig. 32, b).

Phenology. *Trisetum gracile* has been collected in flower and fruit from May to August.

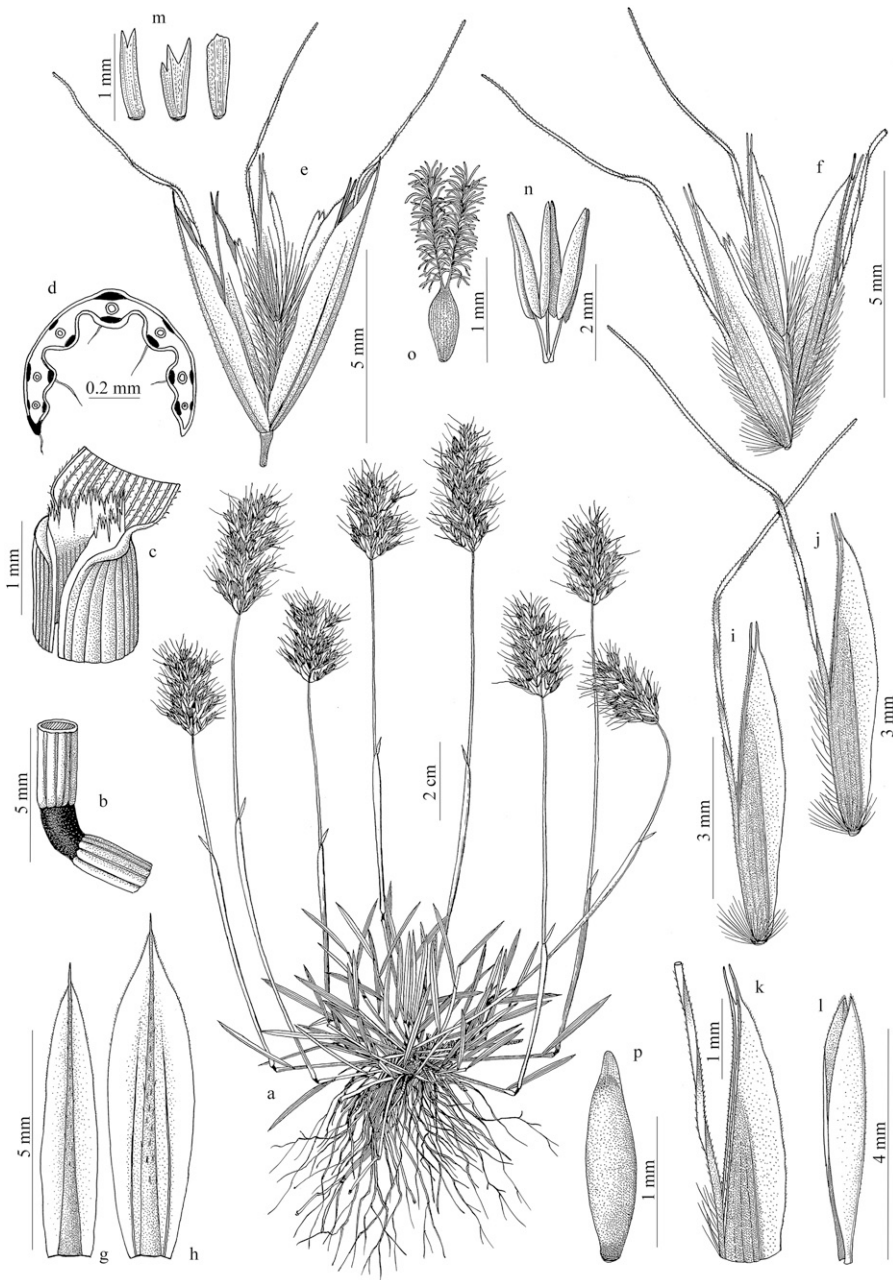


Figure 18. *Trisetum gracile* (Moris) Boiss. —A. Habit. —B. Portion of culm and node. —C. Portion of sheath, ligule, and blade. —D. Transverse section of leaf blade. —E. Spikelet. —F. Florets. —G. Lower glume, dorsal view. —H. Upper glume, dorsal view. —I, J. Floret. —K. Lemma, upper part, lateral view. —L. Palea, lateral view. —M. Lodicules. —N. Stamens. —O. Pistil. —P. Caryopsis. A based on *Gamisans 14148* (G-00220037); B–H, J–O based on *Reverchon 312* (S); I based on *Barberá & Quintanar 1441PB* (MA); P based on *Müller s.n.* (M-0223271).

Distribution and habitat. This species is endemic to the mountains of southern Corsica and Sardinia. It grows in poor soils of granitic sands at 1300–2100 m. Figure 14.

Discussion. Moris's herbarium is kept at TO, but Dr. Laura Guglielmono kindly informed us that the Moris collection was closed for security reasons.

Fortunately, we have found original material at some herbaria. There is a specimen at LE with a label handwritten by Moris and collected in the Gennargentu Mountains, one of the localities mentioned in the protologue, which has been selected as lectotype. P and JE specimens are potential isolectotypes, although their localities are less specific (the labels read only Sardinia).

Trisetum gracile and *T. glaciale* are two species of the section *Trisetum* with a similar habit, being densely tufted, having the shortest height ([4.5–]8.9–12.5 [–18.2] cm and [3–]8.8–14.4[–19.5] cm, respectively), rigid leaves with a thickened midrib, short upper leaf blades ([0.2–]0.3–1[–1.8] cm and [0.2–]0.5–1.5[–2.6] cm, respectively), panicles ovate in outline, and subequal glumes. Nevertheless, *T. gracile* is clearly differentiated from *T. glaciale* by its blackish nodes usually exerted from the sheaths, with culms often bent at the nodes and more or less glabrous, sheaths somewhat inflated, long rachilla hairs ([1.6–]2–2.4[–3] mm and [0.7–]1–1.4[–2] mm, respectively), lemmas usually hairy between the base and the awn insertion, awn inserted slightly below the middle of the lemma (awn insertion from base length:lemma length ratio of [0.34–]0.41–0.49[–0.51]), long callus hairs ([0.7–]1–1.3 mm and [0.2–]0.3–0.6[–0.9] mm, respectively), and glabrous ovaries.

Gamisans (1971) described a new species, *Trisetum conradiae*, from Corsica that was very close taxonomically to *T. gracile*, based on its glabrous lemmas, among other characters. After collecting more material, Gamisans (1973) realized that this character was the only one that separated both species. Later, Jeanmonod and Gamisans (2007) recognized *T. conradiae* at sub-specific rank. In our own observations, specimens with and without hairy lemmas have been collected in the same populations, varying in the density and the length of the hairs ([0.05–]0.6–1.4[–2] mm). In other species of the section, such as *T. flavescens* subsp. *griseovirens*, specimens with hairy lemmas have been found, hairs sometimes appearing only in the proximal lemma. Consequently, we agree with Tison and de Foucault (2014) that this character does not have any taxonomical importance here, and *T. conradiae* is considered a synonym of *T. gracile*.

Additional specimens examined. FRANCE. **South Corsica:** Monte Incudine, Plateau de Cuscione, 41°50'N, 9°10'E, 5 July 2014, Barberá & Quintanar 1439PB (MA); Barberá & Quintanar 1440PB (MA); Barberá & Quintanar 1441PB (MA); crête Monte Incudine, Tintennaga, 41°51'N, 9°13'E, 24 July 1985, Gamisans 11703 (G); Pianu di Cuscione, Fonda di Serra Longa, 41°50'N, 9°8'E, 1 July 1989, Gamisans 14148 (G); Monte Incudine, Foce Aperta, 41°52'N, 9°12'E, 6 July 1989, Gamisans 14203 (G); Massif de l'Incudine, Coscione, crête au S de la Punta Tozzarella, 41°51'N, 9°11'E, 1 Aug. 1972, Gamisans 2242 (C); Massif de l'Incudine, crête à 100 m au

SE de Bocca Chiralba, versant N, 41°50'N, 9°11'E, 1 Aug. 1972, Gamisans 2247-I (MPU); crête au S de la Punta Tozzarella, 41°51'N, 9°10'E, 25 July 1974, Gamisans 3591 (G); crête au S de Bocca Chiralba, 41°50'N, 9°11'E, 25 July 1974, Gamisans 3598 (G); Macizo del monte Incudine, meseta de Coscione, 41°50'N, 9°8'E, 6 July 2014, Quintanar & Barberá 5390AQ (MA). ITALY. **Sardinia:** Nuoro Prov., Fonnì, Gennargentu, Bronco Spina, 40°1'N, 9°18'E, 3 June 2003, Castroviejo et al. 17028 (MA); Nuoro Prov., Gennargentu, Monte di Scudo, versant SW, 40°1'N, 9°19'E, 23 June 1970, Gamisans S-2394bis (G); Nuoro Prov., Monte Gennargentu, 40°1'N, 9°19'E, July 1827, Müller s.n. (BM, H, HBG, JE, LE, M, PR, WU); Sassari Prov., Monte Limbara, lors d'un chemin près de l'extrémité de la route, 40°51'N, 9°10'E, 30 May 1983, Charpin et al. AC17871 (G); Sassari Prov., Tempio, Monte Limbaro [Limbara], 40°51'N, 9°10'E, 4 July 1882, Reverchon 312 (B, BM, G, JE, K, LE, M, MA, MO, MPU, NY, P, PR, UPS, WU); Reverchon s.n. (B, G, GB, GOET, H, HBG, JE, L, M, MPU, NY, P, PR, RO, S, UPS, US, WU).

8. *Trisetum laconicum* Boiss. & Orph. in Boiss., Diagn. Pl. Orient., ser. 2, 4: 129. 1859. *Avena laconica* (Boiss. & Orph.) Nyman, Syll. Fl. Eur. Suppl.: 71. 1865. *Trisetaria laconica* (Boiss. & Orph.) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 383. 1996. TYPE: Greece. Peloponnese: Malevós Mtn., near Vrancopigadou, 37°37'N, 22°31'E, 19 July 1850, T. G. Orphanides s.n. (lectotype, designated by Tan & Iatrou [2001: 450], G-BOIS image!; isolectotypes, B-10_0508993!, JE-18853!, P-3365069!, W-1916-0031855!, WU-0079593 image!, WU-0079594 image!). Figures 9D, 10D, 15B.

Trisetum rechingeri Chrték, Acta Univ. Carol., Biol. 1966: 92. 1967. TYPE: Greece. Central Greece: Euboea, Difi Mtn., 38°37'N, 23°50'E, 7 Aug. 1858, T. H. H. von Heldreich 3522 (holotype, P not seen; isotype, W-1916-0031796!).

Herbs 38.5–83.5 cm tall, not caespitose, rhizomatous, culm 0.5–1.1 mm diam., straight, glabrous; nodes 4 to 6, separated along culm, included or not in sheaths, glabrous, yellowish or brownish. Basal leaf sheaths pubescent, with hairs 0.5–1 mm, decaying into fibers, brownish; basal leaf blades 5–6 cm × 3.6–5 mm, flat, pubescent, with hairs 0.3–1 mm, also on margins, brownish to grayish; top culm leaf sheaths 9.7–25 cm, glabrous, ciliate; top culm leaf blades 3.1–11.2 cm × 1.3–4 mm, flat, sometimes slightly inrolled and parallel to culm, pubescent abaxially, glabrous adaxially, with hairs 0.2–0.6 mm, also on margins, greenish to grayish; inner collar region glabrous, sometimes with scattered hairs up to 0.1 mm on margins; ligules 2.5–3.2 mm, irregularly dentate to lacinate, glabrous or with scattered hairs up to 0.2 mm on surface and upper part. Basal node of panicle glabrous to sparsely pubescent with adpressed hairs up to 0.05 mm. Panicles 8–19 × 1.5–6 cm, narrowly elliptic to oblong in outline, somewhat dense; rachis internodes glabrous to sparsely pubescent, with hairs up

to 0.05 mm; longest basal branches 1.3–2.4 cm. Spikelets 8–9.2 × 2.3–4.8 mm, 3- to 4-flowered; pedicels 5–6.3 mm, sparsely pubescent, with hairs up to 0.1 mm. Glumes unequal (lower glume length:upper glume length ratio of 0.69–0.74); lower glume 4.3–5.4 × 0.8–1.1 mm, narrowly lanceolate (lower glume width: lower glume length ratio of 0.18–0.2), long-acuminate, 1-nerved, glabrous, with hairs up to 0.05 mm on upper part and margins, yellowish to greenish; upper glume 6.2–7.3 × 1.4–2.1 mm, narrowly elliptic to lanceolate (upper glume width:upper glume length ratio of 0.22–0.29), acuminate, 3-nerved, glabrous, with scattered hairs up to 0.05 mm on upper part of central nerve and margins, yellowish to greenish; rachilla segment between first and second florets 1.2–1.7 mm, with hairs 1.5–2.5 mm; rachilla segment to sterile floret 1.3–1.6 mm, with hairs 0.7–1.1 mm. Lemmas 6.5–6.6 × 0.8–1.1 mm, narrowly elliptic to narrowly lanceolate (lemma width:lemma length ratio of 0.21–0.23), scabridulous, with hairs up to 0.05 mm, greenish to yellowish, sometimes with purplish flush; apical teeth 0.2 mm, with aristules 0.4–0.5 mm; awn 6.3–7.2 mm, inserted 4.1–4.5 mm from base (awn insertion from base length:lemma length ratio of 0.62–0.65), strongly bent near base, ± twisted at base, with very short, adpressed hairs up to 0.05 mm; callus 0.3 mm, elliptic to oblong, with hairs 0.6–0.9 mm. Paleae 5.8–6 × 1.1–1.5 mm (palea length:lemma length ratio of 0.89–0.9), narrowly elliptic, ciliate on upper part; teeth 0.3–0.4 mm, with short, antrorse hairs. Lodicules 0.6 mm, with regular teeth or lacinate. Anthers 2.4–3.1 mm. Ovaries 0.8–0.9 mm, glabrous. Caryopses not seen. Chromosome number not known.

Phenology. *Trisetum laconicum* has been collected in flower from June to August.

Distribution and habitat. *Trisetum laconicum* is endemic to Greece and is known from only two collections: Malevos Mountains in the south of the Peloponnese and Dirfi Mountains in Euboea Island; on limestone rocks and cliffs. It has been found at elevations from 1220 to 1500 m. Figure 16.

Discussion. Boissier and Orphanides (Boissier, 1859) separated the Malevos Mountains species, *Trisetum laconicum*, from *T. flavescens* mainly by its densely hairy leaves, larger spikelets, and longer rachilla hairs. Apart from those characters, we have also discerned that *T. laconicum* has longer ligules (2.5–3.2 mm), pedicels (5–6.3 mm), lemmas (6.5–6.6 mm), callus indumentum (0.6–0.9 mm), and paleae (5.8–6 mm) than *T. flavescens*. Another distinguishing characteristic is the awn shape, which is strongly bent near the base in *T. laconicum* and geniculate to slightly geniculate in *T. flavescens*. We

found no or only minor overlap with *T. flavescens* in any of the previously mentioned characters. For this reason, and considering that only the type material is available, *T. laconicum* is treated as a separate species.

Chrtek (1967a) described *Trisetum rechingeri* from Euboea Island based on a single sheet (Heldreich 3522, P). He indicated that *T. laconicum* was the taxonomically closest species to *T. rechingeri*, separating them mainly by its smaller size and shorter rachilla hairs and spikelets. Chrtek (1967a) included both species in a series within *Trisetum* sect. *Rigida*, named *Trisetum* ser. *Laconica*, and characterized by its general habit and shorter rachilla hairs. Jonsell (1980) decided to consider these species as conspecific until more material is available. Furthermore, Strid (2016) indicated that no more material has been collected on Mt. Dirfis and considered that *T. rechingeri* represents individual variation within *T. laconicum*. We agree with these latter authors and therefore consider *T. rechingeri* to be a synonym of *T. laconicum*.

MISCELLANEOUS DOUBTFUL, INVALID, AND EXCLUDED (FROM *TRISETUM*) NAMES

Avena alpestris DC.

The IPNI website attributed the name *Avena alpestris* to de Candolle. De Candolle (Lamarck, 1815), however, when recording *A. alpestris*, indicated “*A. Alpestris*. Host. gram. 3, p. 27,” suggesting that he was not publishing a nomen novum. Consequently, the isonym “*Avena alpestris* DC.” should be disregarded (Art. 6, Note 2).

Avena flavescens var. *vulgaris* Alef., Landw. Fl.: 350. 1866, nom. inval. (Art. 24.3).

Alefeld (1866) divided *Avena flavescens* into three varieties, and he used the epithet “*vulgaris*” for the first, purporting to indicate the taxon containing the type of *A. flavescens*.

Avena sesquitertia Host

The IPNI website attributed the name *Avena sesquitertia* to Host (1797). Host (1797), however, when he recorded *A. sesquitertia*, repeated the polynomial of Linné (1767), “*A. paniculata*, calycibus subtrifloris, flosculis omnibus aristatis, receptaculis barbatis. *Syst. veget.* p. 122,” suggesting that he was not publishing a new taxon name. Consequently, the isonym “*Avena sesquitertia* Host” should be disregarded (Art. 6, Note 2).

Avena tenuis Moench, Methodus: 195. 1794, nom. illeg. superfl. for *Avena dubia* Leers [= *Ventenata dubia* (Leers) Coss.].

Rebentischia flavescens Opiz, Lotos 4: 104. 1854, nom. inval., syn. of *Trisetum flavescens*.

Trisetum alpestre var. *viviparum-macranthum* Schur, Oesterr. Bot. Z. 10: 74. 1860, nom. inval. (Art. 23.6).

Trisetum ciliare (Kit. ex Schult.) Domin, Preslia 13–15: 41. 1935, nom. inval. The combination proposed by Domin (1935) is based on *Avena ciliaris* Kit. ex Schult., Oestr. Fl., ed. 2, 1: 268. 1814, nom. nud.

Trisetum debile Chrték, Folia Geobot. Phytotax. 25: 334. 1990. TYPE: China. Yunnan Prov., Dschungdien, 27°49'N, 99°42'E, 22 Aug. 1915, *H. R. E. Handel-Mazzetti* 7739 (holotype, W-1940-0014741!; isotype, WU-0033964 image!).

The type is the only original material that could be located. It is a fragment that cannot be identified to species, but it may belong to one of the taxa allied to the genus *Trisetum*. Its slender habit may be due to the fact that the specimen was immature.

Trisetum flavescens subsp. *agrostideum* (Laest.) Douin in Bonnier & Douin, Fl. Ill. France 12: 19. 1934, syn. of *Trisetum subalpestre* (Hartm.) Neuman. The epithet “agrostideum” was attributed to Fries (1842), but it was previously published by Laestadius (1839).

Trisetum flavescens var. *bulbosum* Holla ex Asch., Fl. Brandenburg 1: 830. 1864. TYPE: Germany. Brandenburg, *Holla s.n.* (original material not located). Ascherson’s description seems to refer to *Arrhenatherum bulbosum* (Willd.) C. Presl.

Trisetum flavescens subsp. *copiosum* Printz, Veg. Siber.-Mongol. Front.: 124, 125, fig. 74. 1921. TYPE: Russia. Krasnoyarsk Krai, Minusinsk Distr., July 1914, *K. Printz s.n.* (lectotype, designated here, C!; syn. of *Trisetum sibiricum* Rupr. subsp. *sibiricum*). This name was not included in Barberá et al. (2017b).

Trisetum flavescens var. *dimorphantha* Maire & Weiller, Fl. Afrique N. 2: 248. 1953, nom. inval. (Art. 39.1).

Trisetum flavescens subsp. *fuscum* Domin, Preslia, 13–15: 41. 1935, nom. inval., syn. of *Trisetum ciliare* (Kit. ex Schult.) Domin.

Trisetum flavescens var. *latifolium-majus* Schur, Oesterr. Bot. Z. 10: 77. 1860, nom. inval. (Art. 23.6).

Trisetum flavescens var. *sibiricum* (Rupr.) Ostenf. ex B. Fedtsch., Izv. Imp. Bot. Sada Petra Velikago 14(2): 64. 1913, syn. of *Trisetum sibiricum* Rupr. subsp.

sibiricum. This name was not included in Barberá et al. (2017b).

Trisetum flavescens var. *subtriflorum-transsilvanicum* Schur, Oesterr. Bot. Z. 10: 76. 1860, nom. inval. (Art. 23.6).

Trisetum gracile subsp. *conradiae* (Gamisans) Gamisans, Fl. Corsica: 255. 2007, nom. inval. (Art. 41.5).

Trisetum miegevillei Duval-Jouve ex Miégev., Bull. Soc. Bot. France 21: 47. 1874, nom. nud., syn. of *Trisetum baregense* Laffitte & Miégev.

Trisetum tarnowskii Zapał., Rozpr. Wydz. Mat.-Przyr. Akad. Umiejetn., Dzia B, Nauki Biol., III, 4: 167. 1904. TYPE: Romania. Suceava, Petrile Doamnei, 47°27'N, 25°34'E, *A. Rehman s.n.* (lectotype, designated here, KRAM-074724 image!; syn. of *Trisetum macrotrichum* Hack.). This name was not typified in Barberá et al. (2017a).

Trisetum tarnowskii f. *albovirens* Zapał., Kosmos (Lviv) 34: 1176. 1909. TYPE: Romania. Suceava, Petrile Doamnei, 47°27'N, 25°34'E, 10 Aug. 1909, *H. Zapałowicz s.n.* (lectotype, here designated, KRAM-074594 image!; isolectotypes, KRAM-074450 image!, KRAM-074595 image!; syn. of *Trisetum macrotrichum* Hack.). This name was not included in Barberá et al. (2017a).

Trisetum tenue Roem. & Schult., Syst. Veg., ed. 15 bis [Roemer & Schultes] 2: 657. 1817, nom. illeg.

According to Jonsell (1978: 320), *Trisetum tenue* Roem. & Schult. is a nomen superfluum for *Avena dubia* Leers [*Ventenata dubia* (Leers) Cosson].

Trisetum transsilvanicum Schur, Oesterr. Bot. Z. 10: 77. 1860, nom. inval., syn. of *Trisetum flavescens* var. *subtriflorum-transsilvanicum* Schur, Oesterr. Bot. Z. 10: 76. 1860.

Trisetum varium Schur, Oesterr. Bot. Z. 10: 75. 1860, nom. illeg. superfl.

This forgotten name is based on *Avena varia* Schur, Sert. Fl. Transsilv.: 85. 1853, which is a superfluous name for *A. carpatica* Host, Icon. Descr. Gram. Austriac. 4: 18, tab. 31. 1809, *Trisetum carpaticum* (Host) Roem. & Schult., Syst. Veg. 2: 663. 1817, *T. flavescens* var. *carpaticum* (Host) Zapał., Rozpr. Wydz. Mat.-Przyr. Akad. Umiejetn., Dział B Nauki Biol. 4: 107. 1904. Host’s illustration clearly represents *Avenula pubescens* (Huds.) Dumort.

Trisetum yunnanense Chrték, Folia Geobot. Phytotax. 25: 335. 1990. TYPE: China. Yunnan Prov., near

Lidjiang, 26°52'N, 100°14'E, 18 July 1914, *H. R. E. Handel-Mazzetti* 4212 “(H-M Diar. Nr. 664)” (holotype, W-1926-0004138!; isotype, WU-0033963!).

Chrtěk (1990) described this species as remarkable for its robust habit, relatively short, rigid leaves, and large spikelets. Wu and Phillips (2006) included this species in the *Flora of China*, indicating that the hairy ovary is unusual in *Trisetum* and that they did not see the type. The type material has a thicker, scarious palea, a densely hairy ovary with long hairs, and an immature caryopsis with a long, linear hilum. Those characters fit well with the genus *Helictotrichon*, suggesting that this species belongs to that genus.

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- Appendix I. Index of collectors. Collections are listed alphabetically by first collector's last name. Numbers in parentheses refer to the corresponding species in the text.
- Aedo, C. 20819 (4.1), 20920 (4.1); Aedo, C. & S. Gama CA3874 (4.1); Aedo, C. et al. 4165 (4.1), 4381 (4.1), 8571 (4.1), 10141 (4.1), 10371 (4.1), 11722 (4.1), 13498 (4.1), 14173 (4.1), 14339 (4.1), 25040 (4.1); Ahti, T. B426 (4.1); Alanko, P. et al. 53269 (2); Aldén, B. 2862 (4.1); Alpay, O. 112 (4.1), 414 (4.1); Alston, H. G. & N. Y. Sandwith 1994 (4.1); American-Iranian Botanical Delegation 34291 (4.1); Andrés Sánchez, S. et al. SA233 (4.1); Arsène, L. 2317 (4.1).
- Barberá, P. & A. Quintanar 897PB (4.1), 1062PB (1), 1439PB (7), 1440PB (7), 1441PB (7); Barberá, P. et al. 937PB (6), 938PB (6), 939PB (6), 951PB (1), 953PB (1), 954PB (1), 956PB (1), 957PB (1), 958PB (1), 1059PB (4.1); Beck, C. 270 (1), 271 (1); Bécker, J. 24 (4.1); Bergmeier, E. 95-263 (4.1); Birkman, K. 28952 (4.1); Blom, L. & L. Thorán 4497 (4.1); Bogolyubov, S. N. 343 (2); Böhle 13551 (4.1); Boissier, P. E. 186 (6); Bor, N. L. 11A (4.1); Borisova, A. 184 (4.1); Bornmüller, J. 2202 (4.1); Borssum Waalkes, J. V. 5114 (4.1); Bourgeau, E. 1517 (6); Brummitt, R. K. 60394 (4.1); Bunge, A. A. 98 (4.1); Burt, B. L. B145 (4.1).
- Cabezas, F. J. et al. FJC419 (4.2), 625 (4.1); Calvo, J. JC4997 (4.1); Calvo, J. & A. Quintanar JC2558 (4.1); Cannon, J. F. & M. J. Cannon 2735 (4.1); Castroviejo, S. et al. 11464SC (4.1), 15391SC (4.1), 17028 (7), 17057 (7), 17555 (4.1), 17687 (4.1), SC17882 (4.1); Charpin, A. et al. 15297 (6), AC17871 (7).
- Davis, P. H. 67647 (4.2); Davis, P. H. & O. Polunin 22187 (4.1), 24393 (4.1); de Vogel, E. F. 329 (4.1); de Wilde, J. J. et al. 2641 (4.1); Defferrard, C. 4317 (6); Degen, A. 120 (1); Dersch, G. 4487 (1); Dietrich, W. 4176 (1); Dobignard, A. 3861 (4.1).
- Egorova, T. V. et al. 1512 (4.1); Elias, T. S. et al. 4268 (2); Emanuelsson, E. 1319 (4.1).
- Franzén, R. & J. Akeroyd 169 (4.1); Franzén, R. & A. Andersson 640 (4.1); Fröhner, S. 3868 (4.1), 3911 (4.1).
- Gagnidze, R. et al. 2799 (4.1), 2936 (4.1); Galán Cela, P. & A. Martín 591 (4.1); Gamisans, J. 68 (7), 615 (7), 2192 (7), 2242 (7), 2242-4 (7), 2242bis (7), 2242ter (7), 2245 (7), 2247-I (7), 2248bis (7), 2249ter (7), 2251bis (7), 2252 (7), 2253-3 (7), S-2394bis (7), S-2397-1 (7), 3591 (7), 3594 (7), 3596 (7), 3598 (7), 3704bis (7), 9179 (7), 11701bis (7), 11703 (7), 11715bis (7), 14148 (7), 14149bis (7), 14203 (7), 14205 (7), 14681 (4.1); Gamisans, J. & Reille S-2399 (7); García, R. 5493RG (4.1); Geltman, D. et al. 2094I (1); Germain, R. 10598 (4.1), 10711 (4.1); Golubkova, V. F. & A. I. Pojarkova 1256 (4.1); Gonzalo, R. et al. RG789 (4.1); Green, P. S. 18 (4.1); Greuter, W. 14362 (4.1); Guinea, E. 963 (4.1).
- Hæggström, C. A. 5224 (4.1), 6966 (4.1); Halliday, G. 36/79 (4.1), 90/67 (4.1); Hämet-Ahti, L. 2440 (4.1); Heldreich, T. H. 3522 (8); Hepper, F. N. 9464 (4.1); Herrero, A. et al. 2620 (4.1), 2841 (4.1), 2985 (4.2), AH3383 (4.1), AH3636 (4.1); Holmberg, O. R. 1985 (4.1); Holtz, F. 03.892 (4.1); Huber-Morath, A. 17383 (4.1); Huter, R. et al. 1172 (6).
- Ib Olsen, G. 578 (4.1); Ikonnikov-Galitskiy, N. P. & V. A. Ikonnikov-Galitskiy 465 (2), 478 (2), 575 (2), 922 (2).
- Jakowleff, D. 40 (2); Jury, S. L. et al. 8847 (4.2), 8876 (4.1), 18170 (4.1).
- Karlsson, T. 87031 (4.1); Kejian Gua 2930 (2); Kesercioglu, T. 101 (4.1); Kislev, M. E. & Melamed 166 (4.1); Kleesadl 178 (4.1); Klein, J. C. 879 (4.1), 4832 (4.1), 4967 (4.1), 5525 (4.1); Korotkiy, M. et al. 849 (2); Krasnoborov, I. & V. Khanminchum 749 (2), 6812 (2); Kreisch, W. 92/0631 (4.2); Kukkonen, I. 11193 (4.1); Kusnezow, J. W. 29 (2); Kuvae, V. 165-2 (2).
- Leavenworth, W. C. 17548 (4.1); Leenhouts, P. W. 1518 (4.1), 2037 (4.1); Leuschner, C. & M. Sigi 17397 (4.1); Lippert, W. 23598b (6), 24863 (4.2), 25525 (4.2); Lipskiy, V. I. 3411 (4.1); Lomosonova, L. 2590 (2); López, G. 2085GF (4.1); López, G. & F. Muñoz Garmendia 8979GL (4.1), 9033GL (4.1); Lyatifova, A. 24 (4.1).
- Malyshev, L. & V. Pezhemskiy 56 (2); Mateos, M. A. 64/2250 (4.1); Medina, L. et al. 2606 (4.1); Melderis, A. 19 (4.1); Merxmüller, H. & W. Lippert 29582 (6); Merxmüller, H. & W. Wiedmann 18/64 (3), 704/62 (6), 5532 (1), 5546 (1), 5548 (1), 5549 (1); Mikhelson et al. 4480 (4.1); Milne, J. I. 1 (4.1); Montserrat, P. 69/55 (4.1), 702/55 (4.1), 761/55 (1), 1339/65 (1), 3999/68 (4.1), 5222/70 (1), 5690/69 (1); Mouterde, P. 9853 (4.1), 11697 (4.1); Mrkvicka, A. C. 1109 (1); Myndel Pedersen, T. 2478 (4.1).
- Navarro, C. et al. 4234 (3); Nowak, B. H83/319 (4.1).
- Orsini, A. 863 (3); Ovchinnikov, B. N. & M. P. Usov 35 (2).
- Pabot, H. 7719 (4.1); Pobedimova, E. G. 649 (2), 706 (2); Podlech, D. 5892 (1); Podlech, D. & W. Lippert 15367 (1); Porta, P. & G. Rigo 630 (6).
- Quintanar, A. & P. Barberá 5390AQ (7); Quintanar, A. et al. 1408AQ (4.1), 2040AQ (4.1), 3630AQ (4.1), 5226 (6), 5231 (6), 5273 (6), 5275 (6), 5276 (6), 5277 (6), 5278 (6), 5279 (6).
- Rechinger, K. H. 1103 (6), 18583 (4.1); Reverchon, E. 312 (7), 607 (4.1); Rodin, L. 1108-A (2); Rothmaler, W. 16304 (6).
- Samuelsson, G. 180 (4.1), 2142 (4.1); Schuler, A. 1818 (4.1), 99/746 (4.1); Schwarz, O. 621 (1); Sell, P. D. 61/299 (4.1); Sennen, F. 3820 (4.1); Seregin, A. 4697 (4.1); Serogin, A. & I. Serogin S-443 (2); Sharif, G. 496 (4.1); Shaulo, D. & I. Belskaya 1520 (2); Shipchinskiy, N. 565 (4.1); Silva, P. & A. N. Teles 8348 (4.1); Smimow, P. 10 (2); Smimow, W. 615 (2), 1433 (2); Soreng, R. 3818 (4.1); Soreng, R. et al. 7516a (4.1), 8024 (4.1), 8041 (4.1); Starcs, K. 3350 (4.1); Stebler, F. G. & C. Schröter 31 (4.1); Strid, A. & Kjellsson 11406 (4.1); Strid, A. & K. Papanicolaou 15238 (4.1); Strid, A. et al. 18148 (4.1), 19163 (4.1); Studentenexcursie 11113 (4.1); Sukachev, V. N. et al. 1652 (2); Sukopp, U. et al. 1667 (2); Süme, U. 13790 (4.1); Summerhop, V. S. 3348 (4.1); Sundin, R. 57 (4.1); Suominen, J. 472 (4.1).
- Temnoev, N. I. 123 (2); Till, W. 100104 (4.1); Tomin, M. P. 313 (2); Tzvelev, N. 24 (4.1), 154 (4.1); Tzvelev, N. & S. Cherepanov 215 (4.1). Univ. Copenhagen Excurs. 775 (4.1); unknown 2052 (2).
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