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Taxonomic Revision of *Trisetum* section *Acrospelion* (Poaceae: Pooideae: Aveninae) from Eurasia

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Abstract—A taxonomic revision of *Trisetum* sect. *Acrospelion* is presented. We include descriptions and synonyms of each taxon from a study of 670 vouchers from 45 herbaria. Detailed morphometric descriptions, illustrations, distribution maps, identification key, and habitat data are given for each taxon. Twelve names are lectotypified: *Aira halleri* Honck., *Avena argentea* Willd., *Avena brevifolia* Host, *Avena daenensis* Boiss., *Avena distichophylla* Vill., *Trisetum argenteum* var. *parviflorum* Parl., *Trisetum cavanillesianum* Borja & Font Quer, *Trisetum distichophyllum* subsp. *delphinense* Beauverd, *Trisetum macrotrichum* Hack., *Trisetum rigidum* var. *molle* Somm. & Levier, *Trisetum rigidum* var. *ovale* Somm. & Levier, and *Trisetum teberdense* var. *brevifolium* Kharadze. We recognize seven species of *Trisetum* into the section, which is endemic to Eurasia: *T. argenteum*, *T. buschianum* Seredin, *T. distichophyllum* (Vill.) P. Beauv., *T. macrotrichum*, *T. rigidum* (M. Bieb.) Roem. & Schult., *T. tamonanteae* Marrero Rodr. & S. Scholz, and *T. velutinum* Boiss. Morphometric variation of the main characters is shown by box plots. The highest diversity is located in the Caucasian Mountains and the Alps, where two species were found in each area. Additionally, one species is endemic to the Canary Islands, a second to southeastern Spain, and a third to the Carpathian Mountains. In contrast with some regional treatments, *T. persicum* Chrtek is considered a synonym of *T. rigidum* (M. Bieb.) Roem. & Schult., and *T. cavanillesianum* Borja & Font Quer a synonym of *T. velutinum* Boiss. *Trisetum rigidum* subsp. *teberdense* (Litv.) Tzvelev and *T. buschianum* subsp. *transcaasicum* (Seredin) Mosul. are recognized as subspecies. Vegetative propagation has been observed for the first time in specimens of *T. rigidum* and *T. velutinum*.

Keywords—Asia, Europe, grasses, lectotypification, nomenclature, taxonomy.

Trisetum Pers. [Poaceae (R. Br.) Barnhart: subfamily Pooideae Benth.] is a perennial genus of grasses which belongs to the blue grass tribe Poeae R. Br. (including tribe Aveneae Dumort.; cf. Tzvelev 1989; GPWG 2001; Soreng et al. 2003, 2007; Quintanar et al. 2007), and to subtribe Aveninae J. Presl (Soreng et al. 2015).

Trisetum is comprised of approximately 70 species that inhabit temperate and cold regions, mainly in the Northern hemisphere, but are also found in South America, Australia, and New Zealand. Typically, they live in weedy places, meadows, mountain slopes, and alpine and tundra grasslands (Hultén 1959; Chrtek 1965; Clayton and Renvoize 1986; Randall and Hilu 1986; Watson and Dallwitz 1992; Finot et al. 2004, 2005a). Detailed taxonomic revisions of American taxa, as well as taxa from New Zealand, have been made (Edgar 1998; Finot et al. 2004, 2005a, b); however, only partial revisions exist for Europe and Asia. All the species of *T.* sect. *Acrospelion* are endemic to this latter area.

Prior to the publication of the genus *Trisetum* by Persoon (1805), the species included in the genus were considered to belong to the genus *Avena* L. The genus *Trisetaria* described by Forsskål (1775) (describing only one species, *Trisetaria linearis* Forssk.), was considered a synonym of *Trisetum* by some authors (e.g. Poirét (1808), Baumgarten (1817), Dumortier (1824), Ascherson and Graebner (1899), Boissier (1854)). Others realized that *Trisetaria* had priority when the two genera are united (e.g. Maire (1942), Paunero (1950), Jonsell (1980)). In this study, we continue the traditional separation of the two genera based on their perennial (*Trisetum*) vs. annual (*Trisetaria*) life-cycles (e.g. Chrtek 1965, Rechinger 1970, Tzvelev 1976, Pignatti 1982, Mosulishvili 1991, Finot et al. 2004, 2005a, b); therefore, the proposal of Quintanar and Castroviejo (2010) to conserve *Trisetum* against *Trisetaria* is followed.

Trisetum has been traditionally divided into two sections: *T.* sect. *Trisetum*, with lax, open panicles, and culms glabrous below the inflorescences, and *T.* sect. *Trisetaera* Asch. & Graebn., with dense, spiciform panicles, and culms pilose below the inflorescences. A review of the history of the genus can be found in Finot et al. (2005b).

Chrtek (1965) divided the European species of *Trisetum* into four subgenera: *T.* subg. *Distichotrisetum*, *T.* subg. *Glaciotrisetum*, *T.* subg. *Graciliotrisetum*, and *T.* subg. *Trisetum*. To divide the aforementioned subgenera, Chrtek considered the most important characters to be the variation in vernation (conduplicate or convolute), sclerenchyma disposition in transverse sections of leaf blades, and the endodermal cell disposition in transverse sections of roots. Other characters considered alongside the previous ones are the innovation leaves disposition, ligule length, and rachilla hair length. The distribution of the species was also taken into account. The wide-ranging group, *T.* subg. *Trisetum*, was primarily characterized by convolute vernation. *Trisetum flavescens* and related species, *T. fuscum*, *T. hispidum*, *T. macrotrichum*, *T. rigidum*, *T. spicatum*, and *T. velutinum* belong to this subgenus, along with *T. agrostideum* (Laest.) Fr., *T. alpestre* (Host) P. Beauv., *T. baregense* Laffitte & Miégev., *T. burnouffii* Req. ex Parl., and *T. sibiricum* Rupr. The other subgenera have fewer species and narrower distributions. *Trisetum* subg. *Distichotrisetum*, comprising *T. distichophyllum* and *T. argenteum*, was characterized by having conduplicate vernation, leaves with sclerenchyma clearly developed on young leaves, endodermal cells of roots C- and U-shaped, and young leaves distichously disposed. Another species, *T. glaciale*, endemic to the Sierra Nevada in southeastern Spain, belongs to *T.* subg. *Glaciotrisetum*, displaying the conduplicate vernation, endodermal cells of roots C- and U-shaped, and leaf blades with sclerenchyma only present on the abaxial side of the central vascular bundle as a well-developed girder, and a cap of sclerenchyma at the margin. The last group, *T.* subg. *Graciliotrisetum* is made up of one species from Corsica and Sardinia, *T. gracile*, characterized by vernation conduplicate to convolute, endodermal cells of roots O-shaped, and leaf blades with sclerenchyma adaxially and abaxially disposed in an arched well-developed strand.

Chrtek (1965) also divided the subgenus *Trisetum* in five sections: *T.* sect. *Carpatica*, *T.* sect. *Hispanica*, *T.* sect. *Rigida*, *T.* sect. *Trisetaera*, and *T.* sect. *Trisetum*.

Chrtek (1965) proposed an extremely heterogeneous section endemic to the Iberian Peninsula, *T. sect. Hispanica* (comprising the type species *T. velutinum*, and *T. hispidum*), which shares elongated, rectangular long cells with slightly sinuous lateral walls, hirsute leaves, and inconspicuous bulliform cells. The monotypic *T. sect. Carpatica*, established for *T. fuscum* of the Carpathian Mountains, has slightly longer ligules than those found in *T. sect. Hispanica*, and hairy palea keels. In *Trisetum sect. Rigida*, Chrtek (1965) included *T. macrotrichum* and *T. rigidum*, characterized by long rachilla hairs and distichous disposition of young leaves (sclerenchyma disposition and epidermal cells of abaxial side of innovation leaves as in *T. sect. Trisetum*). *Trisetum sect. Trisetaria* includes the *T. spicatum* complex with contracted panicles, and leaf blades with sclerenchyma adaxially and abaxially disposed in an arched, well-developed strand, as *T. subg. Glaciotrisetum*. *Trisetum sect. Trisetum* is separated from *T. sect. Trisetaria* by its lax panicles and leaves with the sclerenchyma clearly developed in young leaves. Chrtek (1965) noted that *T. agrostideum*, which belongs to *T. sect. Trisetum*, has a sclerenchyma disposition similar to *T. sect. Trisetaria*.

Chrtek (1967) described one new species from Greece, *Trisetum rechingeri* Chrtek, and divided *sect. Rigida* into three new series: *T. ser. Macrotricha*, *T. ser. Laconica* Chrtek, and *T. ser. Rigida*. *Trisetum ser. Macrotricha*, including only *T. macrotrichum*, was diagnosed by its long callus hairs (reaching to ½ of the lemma) and long innovation leaves, while *T. ser. Laconica* had shorter rachilla and callus hairs, and shorter innovation leaves. *Trisetum ser. Rigida*, including *T. buschianum*, *T. daenense*, *T. rigidum*, *T. teberdense*, and *T. transcaucasicum*, was characterized by its long rachilla hairs (reaching to ¾ of the lemma), short callus hairs, and short or long culm innovation leaves. Chrtek (1968) in his study of some Asian taxa, described one species (*T. persicum* Chrtek) and one subspecies (*T. rigidum* subsp. *demavandense* Chrtek), both from Iran, in *T. ser. Rigida*.

Tzvelev (1976) simplified Chrtek's classification recognizing three sections (*T. sect. Rigida*, *T. sect. Trisetaria*, and *T. sect. Trisetum*) in his treatment of *Trisetum* for the Soviet Union. He characterized the different sections by the type of growth of underground and vegetative shoots, the leaf disposition, panicle density, and the rachilla and callus hair length. He did not account for the anatomical characters used by Chrtek. Tzvelev included four species and two subspecies within *T. sect. Rigida*, and avoided discussion of the series of *T. sect. Rigida*. In the section, Tzvelev included plants with long creeping underground shoots, long vegetative shoots, with distant nodes and distinctly distichous leaves, panicles sparse or fairly dense, with somewhat scabrous (to almost smooth) branches, rachillas with hairs 2–4.2 mm long, callus hairs 0.6–3.5 mm long, and anthers 1.7–3 mm long.

Chrtek (1965, 1967) overlooked the name *Acrospelion*, coined by Roemer and Schultes (1827) for a group of *Trisetum*. This genus was later combined as a section by Pfeiffer (1871–1873) and typified based on *Trisetum distichophyllum*. Therefore, because of its earlier date, the epithet *Acrospelion* has priority over the epithet *Rigida* in the sectional rank.

This work, together with that of Chrtek, provides the most comprehensive study on this section to date. However, the complex and extremely analytical Chrtek subgeneric divisions proved unsatisfactory and impractical due to the overlap of some characters among his proposed groups. Consequently, we prefer to follow Tzvelev's outline, and recognize a broader and better characterized *T. sect. Acrospelion*, without resorting

to anatomical characters. Therefore, *T. sect. Acrospelion* includes seven species, *T. argenteum*, *T. buschianum*, *T. distichophyllum*, *T. macrotrichum*, *T. rigidum*, *T. tamonanteae*, and *T. velutinum*. *Trisetum sect. Acrospelion* is here characterized by having young shoots with distichous disposition, more or less rigid, and also loosely tufted habit, panicles from lax to slightly dense, glumes unequal to subequal, and long hairs on the rachilla segments between first and second floret and callus.

We present a taxonomic revision of *Trisetum sect. Acrospelion* based on the careful review of herbarium material, as a first installment of a monograph of *Trisetum* in Eurasia. For technical reasons, and the large number of species in the genus, the work will be presented in various articles, of which this is the first.

MATERIALS AND METHODS

This revision is based on the study of 670 herbarium specimens from the following herbaria: A, ABH, ARAN, B, BC, BCN, BERG, BM, BP, C, F, FI, G, GB, GDA, GH, GOET, H, HBG, IBF, JE, K, L, LD, LE, LPA, M, MA, MO, MPU, MW, NY, O, P, PH, PR, S, SEV, TBI, UPS, US, VAL, W, WIS, and WU (acronyms according to Thiers 2017). An index of specimens cited is provided in Appendix 1.

One hundred and twenty specimens were included for the morphometric analysis, as operational taxonomic units (OTUs), selected to represent as far as possible the geographic range and morphological variability of the taxa. Fifty-nine quantitative characters, listed in Appendix 2, were recorded using a Mitutoyo CD-15DCX digital vernier caliper on 20 specimens of each species when available. Commonly used characters in *Trisetum* taxonomy were selected, as well as those observed to be variable and diagnostic in herbarium specimens. 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 proximal branches. Leaf blade width was measured one cm above the ligule insertion. The segment between the first and second flower is also referred to as the rachilla. Each character was analyzed for its minimum, maximum, and lower and upper quartiles, using the STATISTICA package (www.statsoft.com). Quantitative and qualitative characters were used to build an identification key and descriptions. Minimum and maximum values are noted in parentheses, and the lower and upper quartile values are noted outside. A combination of morphological characters was employed to distinguish species. Transverse sections of top leaf blades were prepared by hand, stained with Fasca (Tolivia and Tolivia 1987), and photographed with a Nikon SMZ1000 optical microscope. For leaf anatomy, the terminology defined by Ellis (1976, 1979) was used.

Additional data on the habitat, distribution, and chromosome numbers was checked from literature and collection labels. Chromosome numbers were summarized from the literature, but the extant vouchers, if any, were not revised. The list of numbered collections, examined specimens, and coordinates used to produce distribution maps were generated by a Microsoft ACCESS database (Microsoft, Seattle, Washington) using ArcGis v.9.3 (ESRI 2008). The material studied is listed below each species. The data for establishing coordinates was completed in almost all cases, using the www.geonames.org database.

RESULTS

Morphology—HABIT—The species of *Trisetum sect. Acrospelion* are perennial grasses with short rhizomatous or stoloniferous rhizomes, with well-isolated shoots or loosely tufted habit (densely tufted in *T. tamonanteae*). They are also characterized by their young shoots with distinctly distichous leaf disposition, also noticeable in older leaves. Most of the species present intravaginal growth in the basal part, although occasionally extravaginal growth occurs in the upper nodes (with the exception of *T. rigidum* and sometimes *T. buschianum*, whose nodes are never enclosed by the sheaths).

VEGETATIVE BODY—The culms are straight, with (3)4–10 nodes, and usually shorter than 60 cm. The variation in size

among the species of this section is smaller in those with more limited biogeographical ranges; *T. rigidum* is the most widespread species of the section, ranging from (18.5–)37 to 57(–76.3) cm in height. Culms are glabrous in most of the species, pubescent in *T. tamonanteae*, and slightly puberulous around the nodes in *T. rigidum*, or occasionally puberulous in the upper internode below the panicle in *T. macrotrichum* and *T. velutinum*.

LEAVES—The indumentum, shape, and size of ligules, leaf sheaths, and leaf blades are variable characters in the same plant, depending on their location on the plant, whether they are basal or the top culm leaf. There is also variation according to leaf length and age. Young leaf blades are usually less hairy than mature ones. Therefore, notable heterophylly occurs between young and mature leaf blades in *T. sect. Acrospelion*, as well as in the closely related genus *Koeleria* (Quintanar and Castroviejo 2013).

LEAF SHEATHS—Basal leaf sheaths are puberulous to pubescent, and rarely glabrous (velutinous in *T. velutinum*). Top culm leaf sheaths can be shorter or longer than their respective internodes, and are always glabrous (except in *T. tamonanteae*, which has pubescent to densely pubescent sheaths, sometimes puberulous in *T. velutinum*). Sheath margins are glabrous, except for those of *T. macrotrichum*, which are ciliate (rarely ciliate in *T. distichophyllum*).

LEAF BLADES—The species of *Trisetum* sect. *Acrospelion* have flat to inrolled leaf blades. Hermann (1956) classified both *T. distichophyllum* and *T. argenteum* as a different subgenus (*T. subgen. Argentaria* Hermann), because of the presence of young conduplicate leaf blades. Chrtek (1965), using additional morphological and anatomical characters, divided those species with conduplicate or convoluted vernal leaf blades into four separate subgenera (subgen. *Trisetum*, *Distichotrisetum*, *Glaciotrisetum*, and *Graciliotrisetum*). The indumentum of leaf blades has traditionally been used as a distinctive character for taxon delimitation (Tzvelev 1976; Jonsell 1980; Pignatti 1982). However, leaf blade features (mainly indumentum and width) have been considered less important than those linked to spikelet morphology for the taxonomy of species with large distribution (i.e. *T. rigidum*) due to the high variability of leaf blade traits, which are more important at the subspecific level (i.e. *T. rigidum* and *T. buschianum*). Most of the species are abaxially and adaxially puberulous to pubescent, with hairs also found on the margin, except for *T. rigidum*, which has been separated into two subspecies mainly because of the indumentum and size of leaf blades: glabrous in *T. rigidum* subsp. *rigidum*, and with long hairs along the margin and wider leaf blades in *T. rigidum* subsp. *teberdense* (Fig. 1A–B).

All of the species of *Trisetum* sect. *Acrospelion* are C₃ (XyMS+) and mesophytic or xerophytic grasses. While the abaxial surface of the leaf blades often has a regular outline, the adaxial surface has ribs of varying depth, and the midrib is not readily distinguishable (Metcalf 1960; Watson and Dallwitz 1992). The depth of the intercostal zones and associated ribs is more pronounced in xerophytic species. Chrtek (1965) conducted the first detailed study on the histology of European *Trisetum*. He used the distribution of sclerenchyma strands or girders along the young leaf blades as a main taxonomical character in his subgeneric classification. Among the species of this section, all the vascular bundles are accompanied by more or less developed sclerenchyma girders and strands that attach to both the abaxial and adaxial sides of the leaf blade. Those

species from strongly xeric habitats have well-developed sclerenchyma strands, specifically on the abaxial side where the ribs are less developed. Thus, *T. velutinum*, *T. rigidum*, and *T. argenteum*, all from more xerophytic habitats, have wider strands of sclerenchyma, whereas *T. macrotrichum*, *T. distichophyllum* and *T. buschianum* have thinner strands. This layer is discontinuous and narrows at the adaxial surface, and it is often interrupted at the furrows.

LIGULES—The shape and size of ligules are variable, with those of basal leaves being shorter than those of top culm leaves. The ligule measurements used in this study were taken from the top culm leaf blades. *Trisetum rigidum* has the longest ligules (3.4(–4.2) mm), while *T. argenteum* has the shortest (0.3–0.5(–0.7) mm) (Fig. 1C). The ligules are membranous, with a truncate, lacinate to slightly lacinate, sometimes denticulate apex, glabrous or almost glabrous, with some hairs in most of the species (mostly pubescent in *T. argenteum*, *T. distichophyllum*, and *T. velutinum*).

INFLORESCENCES—Inflorescences are paniculate, from lax to dense in *T. tamonanteae*, oblong to elliptic or lanceolate in outline, and sometimes ovate in *T. distichophyllum* and *T. buschianum* subsp. *transcaucasicum*. *Trisetum rigidum* and *T. macrotrichum* have the longest basal branches and panicles. *Trisetum* sect. *Acrospelion* has a glabrous to slightly pubescent rachis, whereas *T. tamonanteae* has a pubescent rachis with hairs up to 0.6 mm long.

Vegetative propagation has been observed in some specimens of *Trisetum rigidum* and *T. velutinum* for the first time (Fig. 8); up until these observations, *T. tamonanteae* was the first species in the genus *Trisetum* in which this type of propagation was observed (Marrero Rodríguez and Scholz 2013).

SPIKELETS—The size of the spikelets of *Trisetum* sect. *Acrospelion* varies according to the lemma length, being slightly longer, compared to the rest of species, in *T. rigidum*, and slightly shorter in *T. argenteum* and *T. tamonanteae*. For convenience, the awn is not included in the length of the spikelet. The variation in the number of florets, usually 2–3 per spikelet, is significant. *Trisetum macrotrichum* and *T. tamonanteae* have up to 4 and 5 florets per spikelet respectively.

Rachilla segments are always pubescent, with long white hairs between the first and second floret in most of the species, whereas they are shorter in *T. tamonanteae*, *T. velutinum*, and *T. argenteum*, with hairs that are 0.1–0.3(–0.7) mm long, (0.3–)0.7–1.6(–2.4) mm long, and (1–)1.7–2.5(–3.4) mm long, respectively (Fig. 1E). The length of these hairs can be useful as a diagnostic character.

GLUMES—Glumes are always unequal in *Trisetum argenteum*, *T. macrotrichum*, and *T. rigidum*, and sometimes subequal in *T. buschianum*, *T. distichophyllum*, *T. tamonanteae*, and *T. velutinum*. Lower and upper glumes are acute to long acuminate, and glabrous, with some short hairs from the middle part to the top of the main nerve and along the margins. The lower glume is always shorter than the upper one, and usually has a main nerve reaching the tip, sometimes having one or two very short lateral nerves, extending at most to the middle part of the glume (Fig. 1D). The upper glume always has three nerves, the central one reaching the tip like the lower glume, with the lateral ones more notable and only extending to the upper half.

LEMMA—The lemma of the species of *Trisetum* sect. *Acrospelion*, as well as that of 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 main lateral nerves protruding

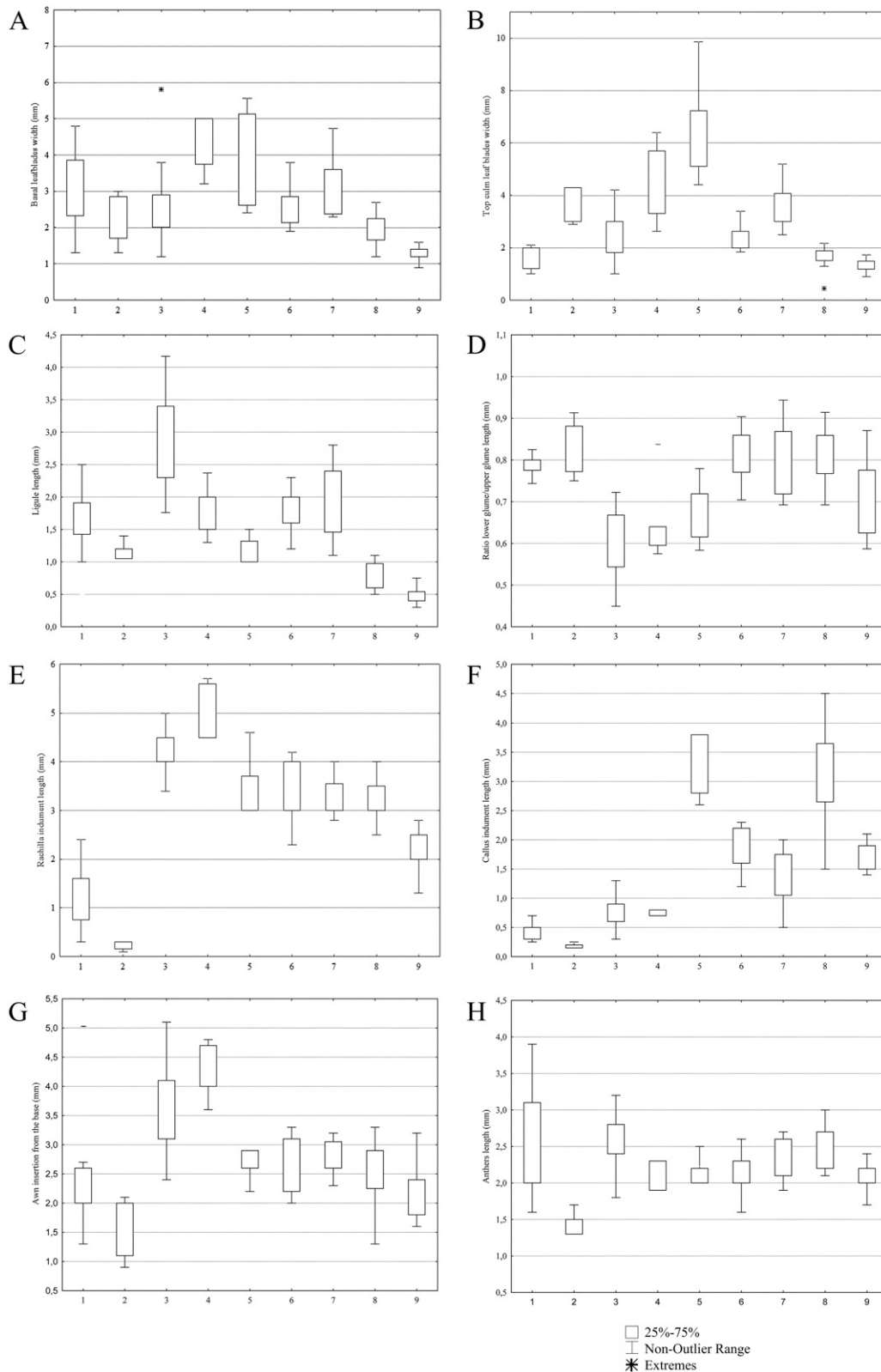


FIG. 1. Box plots of a selection of studied variables. 1) *T. velutinum*. 2) *T. tamonanteae*. 3) *T. rigidum* subsp. *rigidum*. 4) *T. rigidum* subsp. *teberdense*. 5) *T. macrotrichum*. 6) *T. buschianum* subsp. *transcaucasicum*. 7) *T. buschianum* subsp. *buschianum*. 8) *T. distichophyllum*. 9) *T. argenteum*.

through each tooth apex (Nicora 1978; Koch 1979; Finot et al. 2006). Apical teeth and aristules are variable characters at the species level. The length of the lemma, without taking the awn into account, is a good diagnostic character, being shorter in

T. tamonanteae and *T. argenteum* ((2.6–)3–4.3(–5.4) mm and (4–)4.4–5.2(–6.5) mm long, respectively) and longer in *T. rigidum* subsp. *rigidum* and *T. rigidum* subsp. *teberdense* ((5.3–)6.4–7.7(–9.3) and (6.7–)7–8.5 mm long, respectively).

The lemma is laterally compressed, from narrowly or broadly lanceolate to elliptic or oblong, with a glabrous to scabridulous or strigulous surface, having slightly longer hairs on the upper part.

CALLUS—The callus has an oblong to elliptic shape, sometimes rounded, always with hairs in the species of this section. The length of the callus indumentum is an important taxonomic character, being longer in *T. distichophyllum* and *T. macrotrichum* ((1.5–)2.2–3.7(–4.5) and (2.6–)2.8–3.8 mm long, respectively) and shorter in *T. tamonanteae* (0.1–0.3 mm long), *T. velutinum* (0.25–0.5(–0.7) mm long) and *T. rigidum* subsp. *rigidum* and *T. rigidum* subsp. *teberdense* ((0.3–)0.6–0.9(–1.4) and 0.7–0.8(–1) mm long, respectively) (Fig. 1F).

PALEA—The palea is enclosed by the margins of the lemma, opening only during anthesis. The palea is a hyaline structure, with two keels extruding into two fine teeth, with very short hairs, also present along the outer edges. The length of both the palea and the lemma is unequal to subequal, being slightly less similar in *T. tamonanteae* and *T. rigidum* (ratio palea length/lemma length (0.56–)0.63–0.74 and (0.54–)0.66–0.81(–0.87), respectively).

LODICULES—The two lodicules flank the dorsal sides of the ovary or caryopsis, having a more or less oblanceolate shape. The apex is irregular to regularly lobulate (2–4-lobate) or denticulate, and glabrous, rarely with scattered hairs in *T. velutinum*.

AWN—The most important taxonomic character of the awn is length and the point of insertion on the lemma. The awn shape depends upon the maturity of the specimen, but in general, it is more or less geniculate and twisted near the base, although almost straight in *T. tamonanteae*. This species has the shortest awn ((2.8–)3.4–5.1(–6.1) mm), but the length does not differ greatly in the rest of the species of the section. In *T. tamonanteae*, *T. velutinum*, and *T. argenteum*, the point of insertion is closer to the base of the lemma, compared to the rest of the species. *Trisetum rigidum* is the species with the most apical awn (Fig. 1G).

STAMENS—The length of the anthers is fairly constant at the species level. *Trisetum tamonanteae* is the species with the smallest anthers (0.8–1.6(–1.8) mm long) (Fig. 1H).

OVARY AND CARYOPSIS—The ovary and caryopsis are very similar in all species, being glabrous, sometimes slightly puberulous on the apex in *T. rigidum*. The mature caryopsis is oblong in shape, narrowly elliptic in transverse section, not sulcate, with punctiform hilum. The endosperm is liquid.

TAXONOMIC TREATMENT

TRisetum sect. ACROSPELION (Besser) Pfeiff., Nomencl. Bot. 1(1): 38. 1877. *Acrospelion* Besser, in Schult. & Schult. f., Mant. 3 (Add. 1): 526 [“326”]. 1827. *T.* [unranked] *Acrospelion* (Besser) Trin., Mém. Acad. Imp. Sci. St.-Petersbourg, sér. 6, Sci. Math. 1(1): 59. 1830.—LECTOTYPE: *T. distichophyllum* (Vill.) P. Beauv. (designated by Pfeiffer 1877: 38).

T. sect. *Rigida* Chrtek, Bot. Not. 118(2): 222. 1965. *T.* ser. *Rigida* Chrtek, Acta Univ. Carol., Biol. 1966(2): 94. 1967. *T.* subsect. *Rigida* (Chrtek) Mosul., Zametki Sist. Geogr. Rast. 42: 33. 1991.—TYPE: *T. rigidum* (M. Bieb.) Roem. & Schult.

T. subg. *Argentaria* F. Herm., Fl. N.-Mitt.-Eur., 120, Stuttgart. 1956. *T.* subg. *Distichotrisetum* Chrtek, Bot. Not. 118(2): 223. 1965., nom. illeg.—TYPE: *T. distichophyllum* (Vill.) P. Beauv.

T. sect. *Hispanica* Chrtek, Bot. Not. 118(2): 222. 1965.—TYPE: *T. velutinum* Boiss.

T. ser. *Macrotricha* Chrtek, Acta Univ. Carol., Biol. 1966(2): 94. 1967.—TYPE: *T. macrotrichum* Hack.

T. subsect. *Monticolae* Mosul., Zametki Sist. Geogr. Rast. 42: 33. 1991.—TYPE: *T. buschianum* Seregin.

Herbs with or without loosely tufted habit (rarely densely tufted); young shoots with distichous disposition, ± rigid; panicles from lax to slightly dense (rarely dense); glumes unequal to subequal; rachilla segments between first and second flower and callus usually with long hairs.

KEY TO THE SPECIES OF TRisetum SECT. ACROSPELION

1. Top culm leaf blades generally reaching or surpassing the panicles; rachilla segments between first and second flower with hairs 0.1–0.3(–0.7) mm long; paleas 2.3–3 mm long; anthers 0.8–1.6(–1.8) mm long *T. tamonanteae*
1. Top culm leaf blades not or rarely reaching the panicle; rachilla segments between first and second flower with hairs (0.3–)0.7–4.7(–5.7) mm long; paleas (2.4–)3.8–6(–6.6) mm long; anthers (1.5–)2–3.4(–4) mm long 2
2. Sheaths velutinous; rachilla segments between first and second flower with hairs (0.3–)0.7–1.6(–2.4) mm long *T. velutinum*
2. Sheaths glabrous or hairy but not velutinous; rachilla segments between first and second flower with hairs (1–)3–4.2(–5.7) mm long 3
3. Rachilla segments between first and second flower with hairs (3.2–)4–4.7(–5.7) mm long; callus hairs (0.3–)0.6–0.9(–1.4) mm long 4
4. Plants (47–)50–67(–72) cm tall; basal leaf blades (5–)7.5–8(–8.6) cm long, not rigid, with hairs along the margins 0.4–1 mm long; top culm leaf blades usually erect, sometimes reaching into the panicle *T. rigidum* subsp. *teberdense*
4. Plants (18.5–)34.3–56.5(–76.3) cm tall; basal leaf blades (0.8–)2.8–5.2(–7) cm long, rigid, with hairs along the margins 0.05–0.6(–1) mm long; top culm leaf blades divergent (rarely erect), not reaching into the panicle *T. rigidum* subsp. *rigidum*
3. Rachilla segments between first and second flower with hairs (1)2.5–3.5(4.8) mm long; callus hairs (0.5–)1.5–2.9(–4.5) mm long 5
5. Plants (33–)38.5–67(–77) cm tall; top culm leaf blades (4.4–)5–7.2(–10) mm wide *T. macrotrichum*
5. Plants (10.6–)18.3–30.4(–41.5) cm tall; top culm leaf blades (0.4–)1.4–2.5(–5.2) mm wide 6
6. Habit slender; basal leaf blades flat to inrolled, (0.9–)1.2–1.5(–1.7) mm wide *T. argenteum*
6. Habit more robust; basal leaf blades flat, rarely inrolled, (1.2–)1.8–2.8(–4.7) mm wide 7
7. Ligules 0.5–1 mm long, from densely to slightly pubescent on the surface and apex, sometimes glabrous; callus hairs (1.5–)2.2–3.7(–4.5) mm long *T. distichophyllum*
7. Ligules (1.2–)1.5–2.1(–3) mm long, glabrous, rarely with few hairs on the apex; callus hairs (1.2–)1.6–2.2(–2.3) mm long 8
8. Plants (17–)23.7–30.7(–35) cm tall; nodes separated along the culm; top culm leaf sheaths (6–)6.7–9(–10) cm long *T. buschianum* subsp. *buschianum*
8. Plants (10.6–)13.6–18.6(–22.6) cm tall; nodes concentrated in the lower part of the culm; top culm leaf sheaths (3–)3.6–6.2(–7.3) cm long *T. buschianum* subsp. *transcaucasicum*

1. *TRISETUMDISTICHOPHYLLUM* (Vill.) P. Beauv., Ess. Agrostogr.: 88. 1812. *Avena distichophylla* Vill., Prosp. Hist. Pl. Dauphiné: 16. 1779. *Avena disticha* Lam., Encycl. 1: 333. 1783., nom. superfl. *Trisetaria distichophylla* (Vill.) Paunero, Anales Jard. Bot. Madrid 9: 514. 1950.—TYPE: FRANCE. Dauphiné, 45°0'N, 5°15'E, *D. Villars s. n.* (lectotype, here designated, P-LA-564210!).
- Aira halleri* Honck., Verz. Gew. Teutschl.: 212. 1782.—TYPE: [unknown locality]. *V.A. Haller s. n.* (lectotype, here designated, P-Haller (image!); choice made by M. Kerguelen in sched.).
- Avena brevifolia* Host, Icon. Descr. Gram. Austriac. 3: 28, Table 40. 1805. *Trisetum brevifolium* (Host) Roem. & Schult., Syst. Veg., 2: 665. 1817. *Trisetaria brevifolia* (Host) Baumg., Enum. Stirp. Transsilv., Mant.: 80. 1846. *Trisetum distichophyllum* subsp. *brevifolium* (Host) Pignatti, Giorn. Bot. Ital. 111(1–2): 59. 1977. *Trisetaria distichophylla* subsp. *brevifolia* (Host) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 382. 1996.—TYPE: AUSTRIA. Host herbarium, without locality or collector (lectotype, here designated, W-1885–0002402!).
- Avena distichophylla* var. *gracilis* Shuttlew., Mag. Zoo. Bot. 2: 17. 1838.—TYPE: SWITZERLAND. Valais, M. Gemmi, 46°23'N, 7°36'E, 30 Aug 1836, *R.J. Shuttleworth s. n.* (no original material found).
- T. albanicum* Jáv., Magyar Bot. Lapok 18: 1. 1920. *T. distichophyllum* subsp. *albanicum* (Jáv.) Hayek, Feddes Repert., Beih. 30(3): 313. 1932.—TYPE: ALBANIA. Hekurave Mountains, Djakova, Bunjaj, cacumina Stüla Gris, 42°23'N, 19°58'E, 24 Aug 1918, *S. Jávorka s. n.* (lectotype, designated by Kováts 2000: 35, BP!).
- T. distichophyllum* subsp. *delphinense* Beauverd, Bull. Soc. Bot. Genève, sér. 2, 26: 122, Fig. 1. 1934.—TYPE: FRANCE. Hautes-Alpes, Monétier, 44°59'N, 6°32'E, 25 Jul 1933, *G. Beauverd s. n.* (lectotype, here designated, G-386040 (image!); isolectotype, G-386041 (image!)).

Herbs (14.8–)17.8–27.2(–41.5) cm tall, loosely tufted, short rhizomatous, culms (0.3–)0.4–0.6(–0.7) mm diam, glabrous; nodes 4–5(–7), concentrated in lower part of the culm, enclosed by the sheaths, sometimes the upper one exposed, glabrous. Basal leaf sheaths pubescent, sometimes with longer hairs on the upper margins up to 0.1 mm long, decaying into fibers, brownish to yellowish, sometimes greenish; basal leaf blades (1–)1.6–3.4(–7.7) cm long × (1.2–)1.6–2.2(–3.8) mm wide, markedly distichous, flat to slightly inrolled, sometimes conduplicate, from densely to slightly pubescent or scabridulous adaxially, slightly pubescent to glabrous abaxially, with hairs (0.05–)0.1–0.3(–1.3) mm long, greyish to greenish; top culm leaf sheaths (3.3–)4.3–7(–10.8) cm long, shorter than the internodes, sometimes longer or almost equal, glabrous, without cilia on the margins, or rarely with cilia; top culm leaf blades (0.5–)1.2–2.6(–6) cm long × (0.4–)1.5–1.9(–2.5) mm wide, conduplicate to inrolled, sometimes flat, adaxially pubescent to densely pubescent, abaxially pubescent to slightly pubescent, rarely almost glabrous, with hairs 0.05–0.1(–0.3) mm long along the margins, greenish to greyish; inner collar region glabrous to slightly pubescent, usually with scattered hairs on the margins 0.05–0.2(–1.5) mm long; ligules 0.5–1 mm long, lacinate to slightly lacinate, rarely slightly lobulate, from densely to slightly pubescent with hairs 0.05–0.2(–0.3) mm long on the abaxial

surface and apex, sometimes glabrous. Basal node of the panicle glabrous. Panicles (2.8–)4–6.3(–9.4) cm long × (1.2–)1.6–2.5(–4.3) cm wide, ovate to broadly lanceolate in outline, sometimes oblong-elliptic, lax, rarely dense, with most rachis internodes plainly visible; rachis glabrous to slightly puberulous (mostly on the upper part), with hairs 0.05–0.15 mm long; longest basal branches (0.5–)0.6–1.8(–3.2) cm long. Spikelets (5.5–)7–8(–8.6) mm long × (2–)2.7–4.8(–7) mm wide, 2–3-flowered; pedicels (1.8–)2.7–4.2(–5) mm long, slightly pubescent with hairs 0.05–0.2 mm long, sometimes glabrous with scattered hairs distally. Glumes unequal to subequal (ratio lower glume length/upper glume length = (0.69–)0.77–0.86(–1)); lower glume (3.6–)5–6.4(–7) mm long × (0.8–)1.1–1.6(–2) mm wide, narrowly to broadly lanceolate, sometimes elliptic or oblong (ratio lower glume width/lower glume length = (0.15–)0.22–0.26(–0.3)), acuminate to long acuminate, sometimes acute, (1–)2–3-nerved, glabrous, sometimes with short hairs up to 0.1 mm long from the center to the upper part of the main nerve, purplish to greenish, with margins hyaline; upper glume (5.2–)6.6–7.3(–8.1) mm long × (1.4–)1.8–2.2(–2.6) mm wide, elliptic to oblong, sometimes lanceolate, rarely slightly oblanceolate (ratio upper glume width/upper glume length = (0.23–)0.26–0.31(–0.4)), acuminate to long acuminate, rarely acute, 3-nerved, glabrous, usually with hairs up to 0.1 mm long, from the center to the upper part of the central nerve, purplish to greenish on the central part, margins mostly hyaline; rachilla segments between first and second floret (0.7–)1–1.3(–1.6) mm long, with hairs (2–)3–3.8(–4.8) mm long; rachilla segments to sterile floret (0.7–)1.3–2(–2.3) mm long, with hairs (1.4–)1.8–2.7(–3.5) mm long. Lemmas (4.5–)5.7–6.4(–7.5) mm long × (0.8–)1.1–1.6(–2) mm wide, elliptic to broadly lanceolate, rarely oblong (ratio lemma width/lemma length = (0.2–)0.26–0.32(–0.4)), scabridulous, with hairs 0.05–0.1(–0.8) mm long, the longest ones on the central part and on the awn insertion, greenish to yellowish on the central part, surrounded by purple; apical teeth absent or 0.2–0.4(1.2) mm long, with aristules (0.1–)0.2–0.4(–0.7) mm long; awn (4–)5.5–6.6(–8) mm long, inserted (1.3–)2.3–3(–3.3) mm from the base (ratio awn insertion from the base length/lemma length = (0.2–)0.4–0.5), geniculate and twisted near the base, sometimes straight, with very short adpressed hairs up to 0.15 mm long; callus 0.2–0.4(–0.5) mm long, oblong to elliptic, with hairs (1.5–)2.2–3.7(–4.5) mm long. Paleas (3.8–)4.5–5.4(–6.6) mm long × (0.8–)1–1.3(–1.6) mm wide (ratio palea length/lemma length = (0.7–)0.78–0.87(–1)), elliptic to narrowly elliptic or oblong, with hairs from the center to the upper part of the outer edges; keels with short hairs mostly on the apex, ending in teeth 0.1–0.3(–0.4) mm long. Lodicules (0.6–)0.7–1(–1.2) mm long, with apex regularly or irregularly lobate, sometimes with a lateral linear lobe. Anthers 2.1–2.7(–3) mm long. Ovary (0.3–)0.6–1(–1.3) mm long, glabrous. Caryopsis 1.8–3 mm long × 0.4–0.8 mm wide. Figure 2.

Chromosome Number— $2n = 28, 56$ (Beuret 1974; Lippert 2006).

Phenology—Flowering from June to September.

Distribution and Habitat—*Trisetum distichophyllum* occurs in the Alps, from west to east, reaching to the Albanian Alps between Montenegro and Albania; at 950–2,700 m elevation; around rocks and pebbles, mostly in calcareous soils, also in granites. Figure 3.

Specimens Examined—ALBANIA. Kukës County: Tropojë district, on the northern slope of mt. Maja e Ershelit, above village Peraj, 42°29'N,

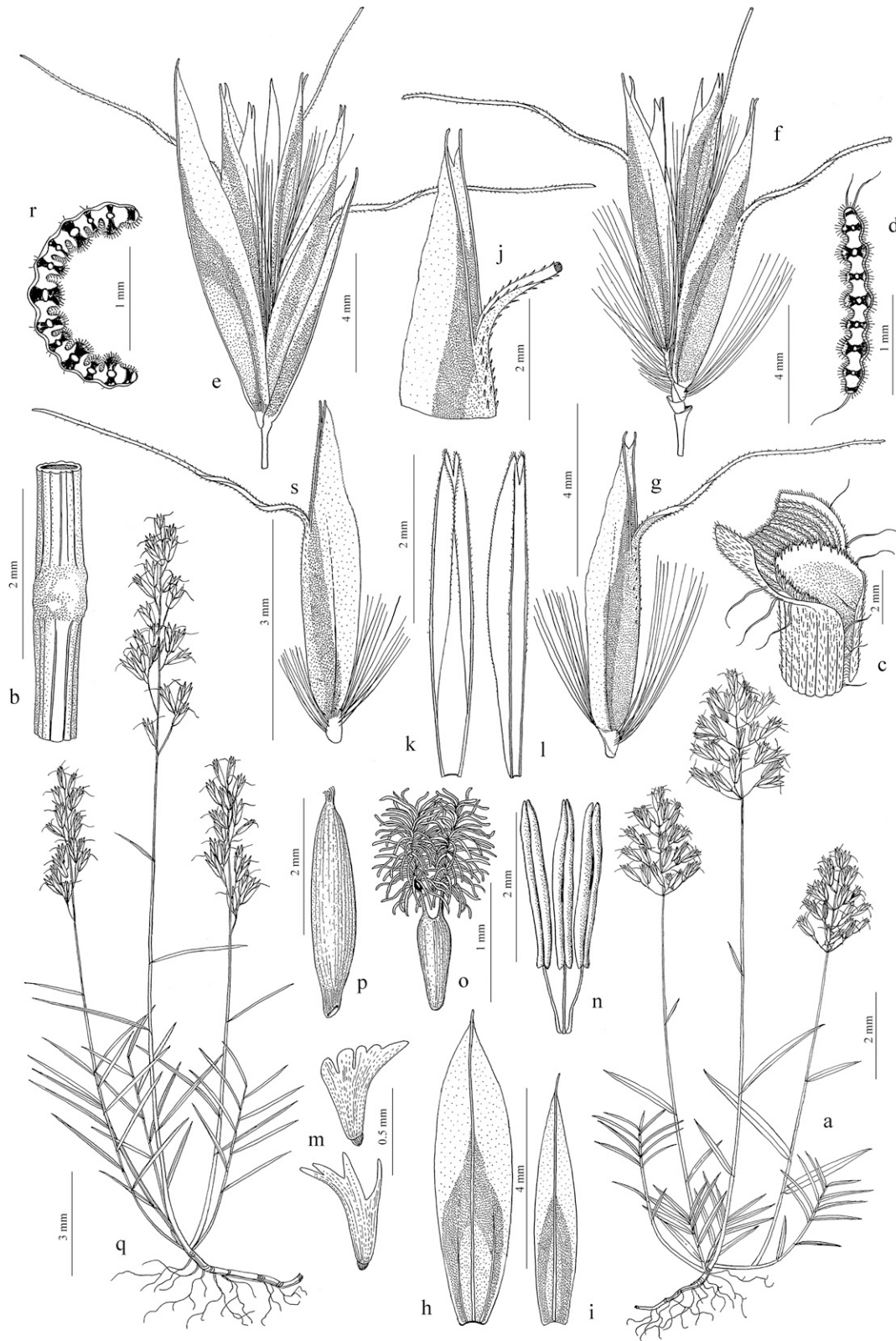


FIG. 2. A–P. *Trisetum distichophyllum*. A. Habit. B. Portions of the culm and node. C. Sheath, ligule, and portion of the blade. D. Transverse section of leaf blade. E. Spikelet. F. Florets. G. Floret. H. First glume, dorsal view. I. Second glume, dorsal view. J. Lemma, upper part, lateral view. K. Palea, ventral view. L. Palea, dorsal view. M. Lodicules. N. Stamens. O. Pistil. P. Caryopsis. Q–S. *Trisetum argenteum*. Q. Habit. R. Transverse section of leaf blade. S. Floret. (A: Reinecke s. n., JE. B–O: Huter s. n., PR-807305. P: Hellweger et Huter s. n., PR-807301. Q–S: Bornmüller s. n., B-100526133).

19°85'E, 15 Jul 2014, *Barina s. n. & al.* (BP); Qafa Valbons, inter vallem Valbona et Theti, 42°24'N, 19°48'E, 4 Jul 1955, *Jávorka s. n. & Ujhelyi* (BP); Beriscus, sub rupe Maja Drosks versus cacumin Maja Hecuravet, 42°23'N, 19°58'E, 1 Jul 1955, *Ujhelyi s. n.* (BP).

AUSTRIA. Carinthia: Heiligenblut, Heiligenblüter Cavern, 47°2'N, 12°50'E, 28 Jul 1906, *Jeanpert s. n.* (F); Val Pasterze, au-dessus d'Heiligenblut, 47°4'N, 12°46'E, 26 Jul 1869, *Leresche s. n.* (L); Alpes d'Heiligenblut, Col de Kals, versant nord, 47°2'N, 12°50'E, 31 Jul 1869, *Leresche s. n.* (G, L);

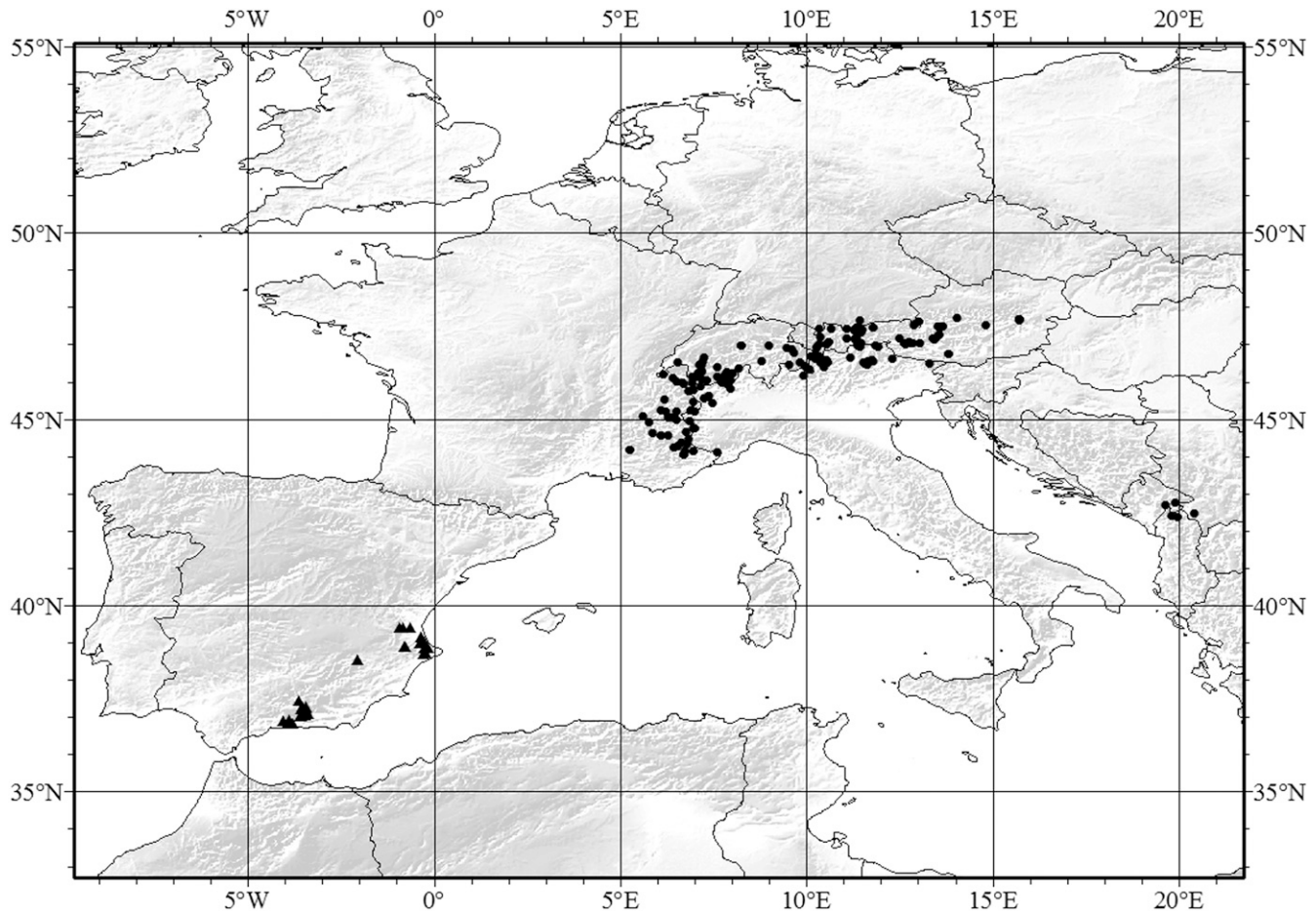


FIG. 3. Distribution of *Trisetum velutinum* (triangles) and *T. distichophyllum* (dots).

Heidelberger Hütte, 46°56'N, 10°16'E, Aug 1952, *Raabe s. n.* (HBG). Lower Austria: Raxalpe, Preiner Schütt, 47°42'N, 15°43'E, Jul 1883, *Beck s. n.* (W); Mt. Raxalpe, 47°42'N, 15°43'E, Aug 1879, *Halácsy s. n.* (B, F, JE, PR, WU); Raxalpe, auf der Schütt der Griesleiten, 47°40'N, 15°44'E, Aug 1871, *Halácsy s. n.* (PR, W, WU). Salzburg: Radstädter Tauern, Lantschfeldgraben im Taurachwinkel, 47°15'N, 13°33'E, Aug 1916, *Vierhapper s. n.* (W); Hauptkamm, Höcknerin im Lantschfeldgraben des Taurachwinkels, 47°15'N, 13°33'E, Sep 1916, *Vierhapper s. n.* (W); Dachteingebiet, nächst der Kolpinghütte, 47°29'N, 13°32'E, 17 Aug 1916, *Vetter s. n.* (UPS). Styria: Dachstein-Südwand, 47°27'N, 13°36'E, Aug 1957, *Baschant s. n.* (MA). Tyrol: Aufstieg vom Hallerangerhaus zum Sünsiger, 47°21'N, 11°28'E, 28 Aug 1950, *Bot. Exk. 740* (HBG); Dorferalpe in Praegrasen, 47°3'N, 12°37'E, 7 Aug 1865, *Gander s. n.* (JE, MO); Pettneu, in den Alpen, Weg zur Feuerspitze, 47°12'N, 10°22'E, 17 Jul 1928, *Gross s. n.* (US); vallis Gleirsch, 47°10'N, 11°5'E, *Hellweger s. n.* & *Huter* (B, C, F, GH, HBG, K, L, NY, O, PR, W, WU); Tyrol sept. ad pedem mt. Tribulaun in Oberrberg, 46°59'N, 11°22'E, Aug 1885, *Huter s. n.* (PR); Höttingergraben bei Innsbruck, 47°18'N, 11°22'E, 1868, *Kernu s. n.* (WU); Karwendel, 47°25'N, 11°28'E, Jun 1930, *Michaelis s. n.* (JE); Halltal, 47°19'N, 11°29'E, 5 Jul 1936, *Milne-Redhead 2316* (K); Häufig am Innsbruck, 47°15'N, 11°23'E, Jul 1881, *Murr s. n.* (B); Alpes de Stubai, Vallée de Gschnitz, près du sentier de Gschnitz au Innsbrucker Hütte, au sud de Kalkwand, 47°3'N, 11°22'E, 19 Aug 1985, *Podlech 42147* (B, C, H, L, MA); Stubai Alpen, Fulpmes, Aufstieg Froneben bis Schlicker Alm, 47°9'N, 11°18'E, 26 Aug 1990, *Polatschek s. n.* (B, C); West Tirol, im Gmeiertal zwischen Pfunds (Oberinntal) und Paznaun, 47°0'N, 10°20'E, 18 Aug 1906, *Handel-Mazzetti s. n.* (WU); zwischen dem Groder und der Brücke über den Ködnitz Bach, 47°0'N, 12°40'E, 19 Jul 1905, *Handel-Mazzetti s. n.* (WU); Nord-Tirol, am Gipfel der Marchreissenspitze in Stubai im Gerölle, 47°10'N, 11°18'E, 25 Sep 1902, *Handel-Mazzetti s. n.* (W); Nörd-Tirol, Sonnwendgebirge bei Jenbach, Spieljoch gegen Osten, 47°28'N, 11°47'E, 18 Aug 1904, *Handel-Mazzetti s. n.* (W); Hohe Tauern, im Kleiner Iseltale bei Trägraten, 47°10'N, 12°30'E, 7 Aug 1923, *Vetter s. n.* (UPS); Nordtirol, Sonnwendgebirge, 47°28'N, 11°47'E, Jul 1905, *Vierhapper s. n.* (W); Nordtirol, Stubai Alpen, Peilspitze nordwestl., Trins im Gschnitztal, 47°6'N, 11°23'E, 23 Aug 1971, *Wagenitz 1738* (GOET). Upper Austria: Totes Gebirge, Prielgruppe, Klinserscharte, 47°43'N,

14°3'E, 8 Aug 1989, *Hörandl 1739* (W); ad pedem meridionalem montis Dachstein, 47°28'N, 13°36'E, Sep 1905, *Hayek s. n.* (L, LE, W).

FRANCE. Auvergne-Rhône-Alpes: Isère, Col de l'Arc, près Grenoble, 45°4'N, 5°37'E, 15 Jun 1884, *Beaudouin s. n.* (JE); Isère, Mont Chamoux, 45°32'N, 6°12'E, Jul 1897, *Bernard s. n.* (HBG); Haute-Savoie, Mt. Vargy, 46°1'N, 6°30'E, 26 Jul 1880, *Bernét s. n.* (NY); Les Fiz, 45°59'N, 6°41'E, 7 Sep 1909, *Bouchard s. n.* (GB, JE, L, MA, MO, US); Savoie, Maurienne, Saint-Sorlin-d'Arves, 45°13'N, 6°14'E, 31 Jul 1852, *Didier s. n.* (BM, HBG, JE, L, LE, MPU); Savoie, near Col du Mont Cenis, just S of barrage in the Lake, 45°14'N, 6°55'E, 16 Jul 1954, *Jacobs 3893* (L); Haute-Savoie, Col d'Isoard, 44°14'N, 6°26'E, 11 Aug 1912, *Jeanpert s. n.* (F); Isère, Mont Sineipy, près de la Mure, 44°54'N, 5°47'E, 6 Jul 1890, *Moutin 475 & Bernard* (FI, MPU); Haute-Savoie, entre le Col de Gers et Col de Platé, 45°57'N, 6°43'E, 8 Aug 1908, *Palibine s. n.* (LE); Savoy, Vallée de Larocheur, en Maurienne, 45°13'N, 6°30'E, 27 Aug 1856, *Perrier de la Bathie s. n.* (GH); Savoie, Dauphiné, Le Briançonnais, Serre Chevalier, Rocher Blanc, 45°14'N, 6°6'E, 25 Jul 1959, *Segelberg s. n.* (S). Provence-Alpes-Côte d'Azur: Hautes-Alpes, Lautaret, 45°2'N, 6°24'E, 16 Aug 1923, *Chandler s. n.* (BM); Hautes-Alpes, Ceillac, près du torrent de Vallon, 44°40'N, 6°46'E, 8 Aug 1984, *Charpin 19140* (G); Alpes-Maritimes, Saint Martin d'Entraunes, 44°8'N, 6°45'E, 11 Aug 1982, *Charpin AC17607 & Salanar* (G, LE); Basses-Alpes, Barcelonnette, col de Valgelage, 44°23'N, 6°39'E, 2 Aug 1897, *Coste s. n.* (MPU); Hautes-Alpes, Montagne des Trois-Évêchés, au-dessus du village de Goleffe, comm. du Villard-d'Arène, cant. de La Grave, arr. de Briançon, 44°17'N, 6°32'E, 15 Sep 1856, *De Valon s. n.* (B, G, GB, GH, L, LE, PR); Hautes-Alpes, Savoie, crete du Galibier, 45°3'N, 6°24'E, 23 Jul 1955, *Dettmann s. n.* (B); Hautes-Alpes, Monétier-les-Bains, 44°58'N, 6°30'E, 22 Aug 1908, *Faure s. n.* (L); Alpes-Maritimes, Mont Mounier bei Beuil, 44°8'N, 6°58'E, 4 Aug 1931, *Fiedler s. n.* (B); Vaucluse, Mont Ventoux, 44°10'N, 5°16'E, 1852, *Godron s. n.* (UPS); Hautes-Alpes, Villar d'Arène, 45°2'N, 6°20'E, 1851, *Grenier s. n.* (UPS); Hautes-Alpes, Briançon, La Combe au Col d'Isoard, 44°14'N, 6°26'E, 1 Jul 1867, *Guillon s. n.* (UPS); Hautes-Alpes, La Monta près Abriès, Vallon de la Caillante, lac Eugourgeau, 44°46'N, 6°59'E, 19 Aug 1913, *Jeanpert s. n.* (F); Hautes-Alpes, La Monta près Abriès, Torrent de Bouchou, 44°46'N, 6°59'E, 18 Aug 1913, *Jeanpert s. n.* (F); Col d'Isoard, 44°14'N, 6°26'E, 15 Aug 1912, *Jeanpert s. n.* (F); Hautes-Alpes,

Col du Lautaret, western slopes of Pyramide de Laurichard, 45°2'N, 6°24'E, 22 Jul 1959, *Klimmek s. n.* (HBC); Hautes-Alpes, La Grave, 45°2'N, 6°18'E, 10 Jul 1861, *Mathonet s. n.* (JE, LE, MPU, NY, PH); Hautes-Alpes, Gap, Mont Aurouse, 44°38'N, 5°53'E, 30 Aug 1871, *Reverchon s. n.* (GH); Alpes-Maritimes, Montagne de Rio Freddo, 44°7'N, 7°36'E, 15 Jul 1886, *Reverchon s. n.* (US); Vauduse, sommet du Ventoux, 44°10'N, 5°16'E, 12 Jul 1877, *Reverchon s. n.* (JE, MPU); Basses-Alpes, Aurent, près Annot, 44°2'N, 6°42'E, 7 Jul 1887, *Reverchon 255 & Derbez* (MA); Alpes-Maritimes, Mont Mounier bei Beuil, Val Demant, 44°8'N, 6°58'E, 4 Jul 1931, *Ronniger s. n.* (NY); Alpes-Maritimes, Haute-Tinée, Hänge ober Bousiéyas an der Pass-Straße zum Col de Restefond, ca. 9 km NW St. Etienne-de-Tinée, 44°20'N, 6°48'E, 10 Jul 1998, *Schnee Weiss s. n. & al.* (WU); Hautes-Alpes, am Weg vom Col du Lautaret im obersten Romanche-Tal, 45°2'N, 6°24'E, 14 Aug 1961, *Spanovsky s. n.* (JE).

GERMANY. Bavaria: Wimbach Thal, prope Berchtesgaden, 47°37'N, 13°0'E, 29 Jul 1858, *Ball s. n.* (US); Mt. Schneeberg, 47°20'N, 13°39'E, Aug 1884, *Beck s. n.* (W); Aug 1881, *Beck s. n.* (WU); Tölz, Benediktenwand, 47°39'N, 11°27'E, 15 Aug 1894, *Bornmüller s. n.* (B, JE); Wimbachtal, W. sup. Watzmann, 47°33'N, 12°55'E, 20 Jul 1915, *Bornmüller s. n.* (B); Wetterstein Gebirge Schachenplan, 47°25'N, 11°6'E, 14 Aug 1950, *Bot. Exk. 447* (HBC); Berchtesgadener Alpen, Wimbachtal, bei der Kirche, 47°32'N, 12°53'E, 9 Aug 1963, *Lippert s. n.* (MA); Wettersteingebirge, westl. Thörlspitze, 47°25'N, 11°5'E, 14 Aug 1947, *Mückel s. n.* (HBC); Oberstdorf, am Nebelhorn, 47°25'N, 10°20'E, Jul 1890, *Schmidt s. n.* (HBC); Bayerische Alpen, Karwendel, Brunnsteinspitze, 47°24'N, 11°17'E, 24 Jul 1957, *Scholz s. n.* (B).

ITALY. Aosta Valley: Cogne, Val de Grauson, 45°38'N, 7°23'E, Aug 1878, *Buchenau s. n.* (GH); Courmayeur, salendo al Col de Checrouit, 45°47'N, 6°56'E, 20 Aug 1916, *Fiori s. n.* (FI); prope Lac de Combal, 45°46'N, 6°51'E, 11 Aug 1849, *Parlatore s. n.* (FI); Gran Paradiso, Gran Lauson nara Cogne, 45°34'N, 7°16'E, 30 Jun 1965, *Strid s. n.* (S). Friuli-Venecia Julia: Udine province, Kanantal, Pontebba-Chinsaforto, 46°30'N, 13°18'E, 18 Jul 1913, *Ronniger s. n.* (BM). Lombardy: Sondrio, Valfurva, pr. St. Catarina, 46°24'N, 10°29'E, 10 Aug 1870, *Ball s. n.* (GH, US); Monte Braulio, 46°31'N, 10°23'E, 10 Aug 1904, *Camperio s. n.* (LE); Sondrio, partie inferieure du valle Zebrù, 46°28'N, 10°27'E, 29 Jul 1887, *Cornaz s. n.* (MA). Piedmont: Val de Cogne, 45°36'N, 7°21'E, 13 Aug 1866, *Ball s. n.* (US); environs de l'hospice de Valdobbia, 45°49'N, 7°57'E, 26 Aug 1858, *Billot s. n.* (LE, MPU); Monte Rosa, 45°56'N, 7°52'E, 23 Jul 1847, *Dufft s. n.* (JE); Grasjön, 28 Jul 1862, *Hausknecht s. n.* (JE); M. Chavanisse, 27 Jul 1862, *Hausknecht s. n.* (JE); Turin, Colle Sestriere, 44°57'N, 6°52'E, Jul 1864, *Rostan s. n.* (US); Parque Nacional del Gran Paradiso, Valle del Orco, del Gran Piano de Moasca a la Bocheta del Ges, 45°25'N, 7°28'E, 9 Aug 1952, *Sappa s. n. & Galiano* (MA); Valle di Jura, Moncenisio, rupi Petro l'Ospizio, 45°12'N, 6°59'E, 6 Aug 1914, *Vignolo-Lutati s. n.* (GH). Trentino-Alto Adige/Südtirol: Bolzano, Selva di Val Gardena, Dantercepies, hauteur de Wolkenstein, 46°33'N, 11°45'E, 17 Aug 1986, *Buggenhout s. n.* (B, C, H, MA, MPU); Val Gardena, Coronella, Gruppo del Catinaccio, 46°27'N, 11°37'E, 18 Aug 1932, *Chiurugi s. n.* (FI); monte du Stelvio, 46°35'N, 10°32'E, 31 Jul 1890, *Cornaz s. n.* (JE, LE); valle Sulden, 46°31'N, 10°35'E, 1884, *Hackel s. n.* (US); Brenner, Schelleberg, 46°57'N, 11°26'E, Aug 1887, *Huter s. n.* (JE); Sulden, 46°31'N, 10°35'E, 9 Jul 1938, *Ronniger s. n.* (BM); Schlern, 46°30'N, 11°34'E, Jul 1890, *Schmidt s. n.* (HBC); Wolferkogel bei Luttach, 46°56'N, 11°55'E, 22 Aug 1894, *Treffer s. n.* (JE); Riedberg bei Gossensass [Colle Isarco], 46°56'N, 11°26'E, 22 Aug 1904, *Handel-Mazzetti s. n.* (W); Val Gardena, im Langental in Gröden, 46°34'N, 11°40'E, 3 Aug 1903, *Vetter s. n.* (UPS); Ahrntal, im Grus gegen den Gipfel des Schönberg bei Luttach, 46°58'N, 11°52'E, 29 Aug 1927, *Vierhapper s. n.* (W). Veneto: Belluno, Drei Zinnen (Tre Cime di Lavaredo), 46°37'N, 12°18'E, 16 Aug 1964, *Raabe s. n.* (HBC).

MONTENEGRO. Vasojevići: Kom Vasojevički, 42°41'N, 19°39'E, Aug 1906, *Rohlens s. n.* (HBC, PR); montium Ljubonicka planina "dict. Loco Jankova pluga" nominato, 42°45'N, 19°55'E, Aug 1914, *Vandas s. n.* (PR).

SWITZERLAND. Bern: Rauflihore spitze [Bluttlighore], 46°31'N, 7°28'E, 12 Sep 1903, *Tranzschel s. n.* (LE). Fribourg: versant N des Morteyes, 46°34'N, 7°14'E, 3 Aug 1883, *Castella s. n.* (US). Geneva: Genève, 46°12'N, 6°9'E, 1839, *Grenier s. n.* (UPS). Glarus: Glemnisch, 46°59'N, 8°59'E, 18 Aug 1846, *Dufft s. n.* (JE). Grisons: Arosa, beim Arlenwald, 46°47'N, 9°40'E, 8 Aug 1913, *Beger s. n.* (B); Puschlav auf dem Salsalbo, 46°20'N, 10°5'E, 20 Aug 1964, *Eckardt 615* (B); Samedan, Piz Padella, 46°31'N, 9°50'E, 6 Aug 1935, *Heimans s. n. & Jansen* (L); Engadin, an der Ofenpass-Strasse unter Ova Spin hinter Zernez, 46°41'N, 10°8'E, 23 Jul 1936, *Koch s. n.* (NY); Aversstal, Val Bergalga, nördl. Teil südl., Avers-Juppa, 46°27'N, 9°32'E, 26 Jul 1990, *Lewejohann s. n.* (GOET); Silvretta, Heideberg Hütte am Piz Davo Sassé, 46°54'N, 10°16'E, 12 Aug 1954, *Raabe s. n.* (HBC); Calanda über Chur (Coira), 46°54'N, 9°28'E, Sep 1917, *Schröter s. n. & Braun-Blanquet* (C, GH, O, PR, W); Alp Sesvenna und Scarl, 46°42'N, 10°20'E, 10 Aug 1949, *Simon s. n.* (GB); Passhöhe des Ofenpasses, 46°38'N, 10°17'E, 29 Jul 1966, *Simon s. n.* (C, H); Chur, Gromserkopf [Gromser Chopf], près de la Fürstenalp, près de

Coire, 46°52'N, 9°36'E, 15 Aug 1888, *Stebler 114 & Schröter* (C, LE, NY); Graubünden, Zerner, M. Buffalora, 46°37'N, 10°15'E, 27 Jul 1923, *Thaysén s. n.* (H); Lango de Spoor bij Bernina-häuser, 46°24'N, 10°0'E, Jul 1929, *Soest s. n.* (L); Val Plavna, 46°42'N, 10°13'E, Jul 1932, *Jansen s. n.* (L). Lucerne: Mt. Pilato, 46°58'N, 8°15'E, *Baching s. n.* (HBC); Obwalden, Pilatus vid Ringfluhe, 46°58'N, 8°15'E, 20 Sep 1812, *Wahlenberg s. n.* (UPS). Ticino: Lukmanierpass, Campo Solario, 46°33'N, 8°48'E, 20 Jul 1912, *Beger s. n.* (B). Tyrol: in alpebus Leontinis, 8 Aug 1954, *Duty s. n.* (JE). Valais: convalle alpina Nicolai Thal prope Zermatt, 46°11'N, 7°48'E, Aug 1845, *Ball s. n.* (GH); Gemmi, 46°23'N, 7°36'E, 1851, *Bamberger s. n.* (B, JE, L, MO, PR); Massif du Mont Rose, moraines du glacier de Gorner, 45°58'N, 7°48'E, 31 Aug 1916, *Beauverd s. n.* (NY); supra Zinal, 46°8'N, 7°37'E, 13 Aug 1887, *Bernoulli s. n.* (MA, MPU); Saastal, Wege nach Plattjen, 46°6'N, 7°55'E, 15 Jul 1945, *Bühler s. n.* (UPS); L'Érié, Grand Chavalard, chemin du Lac de Fully, 46°10'N, 7°6'E, 13 Jul 1990, *Castroviejo 11213 SC & al.* (MA); Zermatt, Schwarzsee, 46°39'N, 7°16'E, 11 Aug 1894, *Clarke 48718* (K); Zermatt, moraine van de Findelenglesscher, 46°6'N, 7°51'E, 29 Jul 1922, *Danser 5050* (L); Val des Dix, Pas du Chat, extrémité sud du Lac des Dix, 46°27'N, 7°12'E, 1 Aug 1971, *Dutoit s. n.* (HBC, UPS); Verbier, 46°5'N, 7°12'E, 10 Aug 1968, *Eckardt 1056* (B); Mattmark, 46°2'N, 7°57'E, 1901, *Goethart s. n. & Jongmans* (L); Gornergletschers ändmorän, 46°0'N, 7°44'E, 27 Jul 1883, *Huld s. n.* (H); Zermatt, moraine van de Findelenglesscher, 46°6'N, 7°51'E, Aug 1937, *Jansen s. n.* (L); in valle Binn, 46°21'N, 8°11'E, *Lagger s. n.* (UPS); Westseite des Trifflhorn östl. Saas-Fee, 46°6'N, 7°55'E, 13 Jul 1981, *Lewejohann s. n.* (GOET); Gornergletscher, 45°58'N, 7°49'E, Aug 1894, *Linder s. n.* (MA); Saastal, 46°8'N, 7°56'E, 15 Aug 1872, *Morthier s. n.* (JE); Saas-Fee und der Gletscheralpen, 46°6'N, 7°55'E, 28 Jul 1910, *Poeverlein s. n.* (L); Simplon, an der Strasse nördlich der Passhöhe, 46°15'N, 8°1'E, 28 Jul 1906, *Handel-Mazzetti s. n.* (WU); Portail de Fully, 46°9'N, 7°5'E, 21 Jul 1874, *Vigener s. n.* (B); Zermatt, über dem Riffelberg, 45°59'N, 7°45'E, Aug 1901, *Wolf s. n.* (B, C, GH, JE, L, LE, MA, O, PR, S, US, W). Vaud: Anzeindaz, Alpes de Bex, eboulis de Diablerets, 46°18'N, 7°11'E, 10 Aug 1880, *Cheneoard s. n.* (JE); Alpes de Châteaux-d'Oex, à la Hausseresse et sous le rocher des Tours, 46°28'N, 7°7'E, *Leresche s. n.* (F, K, JE).

Notes—Jonsell (1980), who probably followed Paunero (1950), cited *Trisetum distichophyllum* from the eastern Pyrenees. Unfortunately, this record corresponds to material collected by Rivas Mateos, the labelling of which is questioned by many authors (i.e. Rothmaler 1935, Benedí and Sáez 1996, Bolòs and Vigo 2001). After the study of the herbarium material of this species, we found that the westernmost populations of *T. distichophyllum* are found in the French Alps.

Jávorka (1919) described a new species from the mountains of northern Albania, *T. albanicum* Jávorka, separating it from *T. distichophyllum* because of its flat, less rigid, and green leaves with less marked nerves, less puberulous surfaces, and margins always with hairy to ciliate, more contracted panicles, and shorter callus hairs. Later, Hayek (1932) combined it as a subspecies of *T. distichophyllum* and Rohlena (1942) published a new record of the subspecies from eastern Montenegro. We consider this subspecies a synonym of *T. distichophyllum*, not finding significant differences from the rest of the material to justify separation. The specimens studied from the Balkans have greyish to greenish leaves, flat to conduplicate basal and top leaf blades, and variable indumentum. Comparing the shape of the panicles, we have observed that it is quite variable in the specimens from Albania and the Alps, while the length of the callus indumentum in the Alps specimens is similar to that in the Albanian ones ((1.5)–2.2–3.7(–4.5) mm and 2.5–3 mm length, respectively).

Beauverd (1934) described a new subspecies from the French Alps, *T. distichophyllum* subsp. *delphinense* Beauverd, characterized by its apically and irregularly torn-toothed ligules with ciliate margins, lower glumes with one or two lateral rudimentary nerves, and upper glumes with an acuminate or muticous apex. We consider this subspecies a synonym of *T. distichophyllum*. The material of the species we studied is highly variable, having ligules 0.5–1 mm long, with a lacinate to slightly lacinate apex, rarely slightly lobulated, lower glumes with a variable number of nerves, and upper glumes

with an acuminate to long acuminate apex, sometimes acute. Beauverd also differentiated this subspecies by the inrolled or conduplicate leaves, contrasting it with *T. argenteum*, but these characters are also present in *T. distichophyllum*.

2. *TRisetum ARGENTEUM* (Willd.) Roem. & Schult., Syst. Veg. 2: 665. 1817. *Avena argentea* Willd., Enum. Pl.: 125. 1809. *Trisetum distichophyllum* var. *argenteum* (Willd.) Ducommun, Taschenb. Schweiz. Bot.: 858. 1869. *Trisetaria argentea* (Willd.) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 382. 1996.—TYPE: [unknown locality and collector] (lectotype, here designated, B-W-02187–020 (image!)).

T. argenteum var. *parviflorum* Parl., Fl. Ital. 1: 264. 1850.—TYPE: ITALY. Bergamo, Monte Resegone, 45°51'N, 9°28'E, 1844, *L. Rota* s. n. (lectotype, here designated, FI!; isolectotype, BERG-31548 (image!)).

Herbs (14.7–)23.3–35.4(–36.6) cm tall, short rhizomatous, loosely tufted, culms (0.2–)0.3–0.5 mm diam, glabrous; nodes (3–)4–5(–6), concentrated in lower part of the culm, glabrous. Basal leaf sheaths puberulous, with hairs up to 0.2 mm long, decaying into fibers, brownish to yellowish, sometimes greenish; basal leaf blades (1.2–)2.4–3.8(–6.7) cm long × (0.9–)1.2–1.5(–1.7) mm wide, flat to inrolled, pubescent to slightly puberulous adaxially and abaxially, sometimes glabrous, with hairs (0.05–)0.1(–0.8) mm long, greyish to greenish, sometimes yellowish to brownish; top culm leaf sheaths (4–)6–8.7(–9) cm long, shorter than the internodes, sometimes longer or almost equal, glabrous, without cilia, or sometimes with; top culm leaf blades (1.7–)2.2–3.5(–6) cm long × 0.9–1.5(–1.8) mm wide, flat to conduplicate, rarely parallel to the culm, glabrous to pubescent adaxially, puberulous to slightly puberulous abaxially, sometimes with short hairs on the margins up to 0.1 mm long, greenish to greyish; inner collar region glabrous, with scattered hairs or slightly puberulous on the margins, with hairs (0.05–)0.2–0.8(–1) mm long; ligules 0.3–0.5(–0.7) mm long, pubescent, rarely glabrous or with some scattered hairs on the surface, apex lacinate with hairs up to 0.15 mm long. Basal node of the panicle glabrous. Panicles (3.7–)5.4–7(–7.6) cm long × (0.9–)1.2–2.3(–3.2) cm wide, oblong to elliptic in outline, sometimes narrowly elliptic to lanceolate, lax; rachis glabrous, rarely slightly puberulous or pubescent, with hairs up to 0.08 mm long; longest basal branches (0.4–)0.8–1.3(–2.2) cm. Spikelets (4.8–)5.6–6.5(–8) mm long × (1.4–)2–4(–5.7) mm wide, (1–)2–3-flowered; pedicels (2.2–)3.2–4.2(–5.4) mm, glabrous to slightly pubescent, with hairs up to 0.1 mm long. Glumes unequal (ratio lower glume length/upper glume length = (0.59–)0.65–0.78(–0.87)); lower glume (2.7–)3.5–4.3(–5.7) mm long × 0.5–0.8(–1.4) mm wide, narrowly to broadly lanceolate, sometimes narrowly elliptic or linear (ratio lower glume width/lower glume length = (0.14–)0.16–0.21(–0.25), acuminate, sometimes acute, 1-nerved, glabrous, sometimes with short hairs up to 0.1 mm long from the center to the upper part of the nerve, greenish to yellowish, sometimes surrounded by purple on the laterals and upper part; upper glume (4.6–)5–6(–7.3) mm long × (1.2–)1.4–1.6(–2) mm wide, narrowly elliptic or elliptic to narrowly lanceolate or oblong, rarely oblanceolate (ratio upper glume width/upper glume length = (0.22–)0.24–0.3), acuminate to long acuminate, rarely acute, 3-nerved, glabrous, with short hairs up to 0.08 mm long from the middle to the upper part of the central nerve, greenish to yellowish on the central part, usually surrounded

by purple; rachilla segment between first and second floret (0.6–)1.1–1.3(–1.4) mm long, with hairs (1–)1.7–2.5(–3.4) mm long; rachilla segments to sterile floret 1.3–1.7(–2) mm long, with hairs (0.8–)1.2–1.6(–2) mm long. Lemmas (4–)4.4–5.2(–6.5) mm long × 0.5–0.8(–1.4) mm wide, broadly lanceolate to oblong or elliptic, rarely narrowly lanceolate (ratio lemma width/lemma length = (0.19–)0.25–0.33), glabrous to scabridulous, with hairs up to 0.1 mm long on the central and upper part, greenish on the central part, sometimes yellowish, usually surrounded by purple; apical teeth without or 0.1–0.3(–0.4) mm long, with aristules (0.1–)0.3–0.5(–0.7) mm long; awn (3.7–)5.2–6.4(–7.2) mm long, inserted (1.6–)1.8–2.4(–3.2) mm from the base (ratio awn insertion from the base length/lemma length = (0.35–)0.42–0.46(–0.5)), geniculate and slightly twisted near the base, with very short adpressed hairs up to 0.1 mm long; callus (0.2–)0.3 mm long, oblong to elliptic, with hairs (0.7–)1.4–1.8(–2.6) mm long. Palea (3.5–)3.8–4.2(–5.8) mm long × (0.9–)1–1.3(–1.4) mm wide (ratio palea length/lemma length = (0.73–)0.79–0.89(–0.98)), narrowly elliptic to elliptic, glabrous or with hairs from the middle to the upper part of the outer edges; keels with short antrorse hairs mostly on the upper part, rarely glabrous, ending in teeth 0.1–0.3(–0.4) mm long. Lodicules (0.4–)0.5–0.8(–0.9) mm long, with apex shortly and irregularly lobate. Anthers (1.5–)1.9–2.3(–2.4) mm long. Ovary (0.4–)0.6–0.8(–2.3) mm long, glabrous. Caryopsis 2–2.7 mm long × 0.4–0.7 mm wide. Figure 2.

Phenology—Flowering from June to September.

Chromosome Number— $2n = 28$ (Beuret 1974; Lippert 2006).

Distribution and Habitat—*Trisetum argenteum* occurs in the eastern Alps, from Austria and Italy, reaching to Slovenia; at 200–2,330 m elevation; around rocks and pebbles, in calcareous soils. Figure 5.

Specimens Examined—AUSTRIA. Carinthia: Loiblpass, Tschanko-Fall, 46°26'N, 14°16'E, 12 Jul 1954, *Lohmar* s. n. (HBG); in valle Bartolograben, prope Saifnitz, 46°34'N, 13°34'E, 24 Jul 1914, *Aust* s. n. (GB); Volais, 46°37'N, 12°53'E, 21 Sep 1857, *Ball* s. n. (K, US); Polinik Gipfel, 46°37'N, 12°58'E, 12 Aug 1952, *Doppelbauer* s. n. (M); in glareosis vallis Loibel [Loibl], 46°26'N, 14°16'E, Aug 1883, *Jabornegg* s. n. (B, BM, C, F, FI, MO, NY, PR, W, WU); Ostkarawanken, Petzen, am Hauptweg zw. Berg- u. Talstation der Gondelbahn, 46°30'N, 14°44'E, 13 Aug 1996, *Kalheber* 96–1385 (M); Karawanken, Hochobir-Süd, Auffahrt zur Eisenkappler Hütte, Seitentälchen unterh, Berghaus Fladung, 46°29'N, 14°31'E, 20 Aug 1991, *Leute* s. n. & *Kosch* (WU); Carinthia, 46°45'N, 13°49'E, Aug 1878, *Marchesetti* s. n. (W); Karawanken, Zell-Pfarre, am Hochobir, 46°34'N, 13°34'E, 11 Aug 1949, *Merxmüller* 5533 & *Wiedmann* (M); Sanntaler Alpen, Sulzbach, 47°41'N, 13°37'E, 2 Sep 1904, *Hayek* s. n. (GB); Karnische Alpen, Sittmoosgraben bei Mauthen, 46°41'N, 12°57'E, 30 Aug 1926, *Vierhapper* s. n. (W); PUPS-Alp, ober Ritschberg, 46°30'N, 14°44'E, *Welden* s. n. & *Freyer* (B, JE, UFS, WU); Karawanken, bei Feistritz im Rosental nahe der Kirche, 46°31'N, 14°10'E, 16 Jul 1956, *Wagenitz* 1738 (GOET). Lower Austria: Raxer Alpen, 47°42'N, 15°43'E, *Hausmann* s. n. (B). Styria: Sulzbach, 46°48'N, 15°53'E, *Unger* s. n. (M); prope refugium alpinum "Okreselhütte" in alpinis Lithopolitanis (Steiner-sive Sanntaler Alpen), 46°22'N, 14°34'E, Aug 1904, *Hayek* s. n. (BM, GB, H, L, O, W). Tyrol: juxta Lienz, 46°49'N, 12°46'E, 9 Sep 1854, *Ball* s. n. (F, US); pr. Lienz, Kerschbaumeralpe, 46°49'N, 12°46'E, 19 Aug 1872, *Gander* s. n. (JE); Sep 1855, *Molendo* sn. (M); ober Tres im Nonsberg an steinigem Stellen, 47°17'N, 11°42'E, 26 Aug 1902, *Handel-Mazzetti* s. n. (W); Kerschbaumer bei Lienz, 46°46'N, 12°46'E, 30 Jul 1883, *Witting* s. n. (B).

ITALY: Friuli-Venecia Julia: Provincia di Udine, prope Forno Avoltri, 46°35'N, 12°46'E, Sep 1857, *Ball* s. n. (MO); Udine province, vallée de la Cimoliana [Cimolais], Rifugio Pordenone, 46°22'N, 12°29'E, 7 Aug 1979, *Charpin* 15786 (GOET, MA); Prov. Udine, Alpi Carniche, ander Strasse Misurina-Tolmezzo, im Tal des Tagliamento bei Forno di Sotto, 46°23'N, 12°40'E, 16 Jul 1992, *Lippert* 26158 (M); Prov. Pordenone, Prealpi Carniche, Spalti di Toro range N Cimolais, 46°15'N, 12°28'E, 11 Sep 2012, *Müller* 10983 (JE); Raibl-Mangart, 46°26'N, 13°39'E, *Vierhapper* s. n. (W). Lombardy: monte Campione prope Lecco, 45°51'N, 9°23'E, 8 Sep 1857, *Ball* s. n. (US); Lecco province, montis Grigna, versus Lacum Larium [Como Lake], 45°57'N, 9°23'E, 15 Sep 1855, *Ball* s. n. (US); Como province, Grigna meridionale, Canale Porta, 45°55'N, 9°23'E, 17 Jul 1950, *Berger* s. n. (M); Alpes de Lecco, montant de Ballabio à la Grigna, 45°53'N, 9°25'E, 16 Aug

1859, *Leresche s. n.* (JE, L); Mt. Braulio, 46°31'N, 10°23'E, 3 Aug 1902, *Longe s. n.* (MPU); Como, Grigna Meridionale, "Piana delle Groppe", 45°56'N, 9°23'E, 27 Jul 1965, *Simon s. n.* (HBG, S). Trentino-Alto Adige/Südtirol: Grigna Meridionale, Cresta Segantini, 46°12'N, 10°42'E, 12 Aug 1952, *Reznik s. n.* (M); Pusteria, Landro, 46°37'N, 12°13'E, *Auperdorfer s. n.* (PR). Montis Schlehren supra Ratzes, 46°30'N, 11°34'E, 23 Aug 1869, *Ball s. n.* (US); Val di Fassa, 46°26'N, 11°42'E, 27 Aug 1860, *Ball s. n.* (US); supra Val Rendena, montis Brenta, 46°10'N, 10°53'E, 4 Sep 1858, *Ball s. n.* (GH); supra Val Selva, prope jugum Crosstè [Cima Groste], 46°11'N, 10°54'E, Aug 1875, *Ball s. n.* (US); Trento prov., in sinu Val Selva prope Malè, 46°21'N, 10°54'E, 18 Aug 1860, *Ball s. n.* (US); Seiseralp, 46°31'N, 11°32'E, 24 Aug 1860, *Ball s. n.* (F, US); Trento province, in monte Scanupia, 45°57'N, 11°9'E, 11 Aug 1860, *Ball s. n.* (MO, US); Giudicaria, Monte Tombea, 45°48'N, 10°37'E, Jul 1952, *Baschant s. n.* (B, JE, MA); Val dei Concei (V. van het Gardameer), 45°54'N, 10°43'E, 9 Aug 1959, *Boom s. n.* (L); Monte Cristallo, 46°34'N, 12°11'E, 23 Aug 1896, *Bornmüller s. n.* (B, JE); in rupestribus vallis Prags, 46°43'N, 12°7'E, 20 Aug 1896, *Bornmüller s. n.* (B, BM, C, F, FI, K, L, MO, NY, PR, S, W, WU); Bolzano, Pustaria, Geierwände bei Schenderbach-Landro, 46°37'N, 12°13'E, 20 Aug 1896, *Bornmüller s. n.* (JE); Monte Cristallo, Val Fonda, 46°34'N, 12°11'E, 23 Aug 1896, *Bornmüller s. n.* (B); Monte Bondone, 45°59'N, 11°1'E, *De Sardagna s. n.* (W); Bocca di Brenta, 9 Aug 1884, *De Sardagna s. n.* (W); Bolzano province, Tiers östlich Bozen, Südseite des Tschafon, 46°28'N, 11°31'E, 21 Jul 1984, *Dersch 4488* (GOET); Bozen, Daumkofel (Prags), 0.6 km SSE Daumkofel, 12°8'N, 46°41'E, 26 Jul 2003, *Hilpold s. n.* & *Kiebacher* (W); Pusteria, Landro, 46°37'N, 12°13'E, 27 Jul 1869, *Huter 1171* (B, MPU); Bolzano, Schlern, 46°30'N, 11°34'E, 15 Jul 1967, *Huter s. n.* (B); Pusteria, valle Virchlein, Sexten, 46°42'N, 12°20'E, 23 Aug 1878, *Huter s. n.* (GB); Bad Ratzes, 46°30'N, 11°34'E, 3 Aug 1893, *Jaap s. n.* (HBG); Val d'Adige [Etschtal], Salurn, 46°14'N, 11°12'E, 2 Jun 1952, *Merxmüller 5534* & *Wiedmann* (M); Fassatal valley, Moena, 46°22'N, 11°39'E, Jul 1912, *Paul s. n.* (L); vallis di Bono, 46°1'N, 10°50'E, Jul 1889, *Porta s. n.* (JE); Ledro, 45°53'N, 10°44'E, 2 Aug 1883, *Porta s. n.* (B, G, MA, WU); Val di Ledro, 45°53'N, 10°44'E, 20 Jul 1881, *Porta s. n.* (JE); vallis di Bono, 46°1'N, 10°50'E, Jul 1892, *Porta s. n.* (M); circa pagum Cologne, 45°55'N, 10°38'E, Jul 1896, *Porta s. n.* (MPU); San Martino di Castrozza, 46°16'N, 11°48'E, 5 Aug 1895, *Saint-Lager s. n.* (G, L, NY); pr. Salurn, 46°14'N, 11°12'E, *Sauter s. n.* (W); Ratzes, 46°30'N, 11°34'E, 13 Jul 1903, *Schultz s. n.* (B); Bade Ratzes, 46°30'N, 11°34'E, 6 Jul 1896, *Schultz s. n.* & *Schultz* (B); Prov. de Trento, Calliano-Folgaria, 45°54'N, 11°10'E, 19 Aug 1960, *Segelberg s. n.* (S); Trento province, Ost for Cima Valdritta pa Monte Baldo, 45°43'N, 10°50'E, 6 Aug 1968, *Thornberg s. n.* (C); Bolzano, Wolkenstein (Selva di Val Gardena), Grödnertal (Val Gardena), à gauche du Rio Gardena, 46°33'N, 11°45'E, 7 Aug 1985, *Buggenhout s. n.* (B, C, H, L, M, MA); Bolzano (Bozen), am Wege von St. Constantin nach Hanenstein, im Gerölle, 46°32'N, 11°31'E, 12 Jul 1905, *Handel-Mazzetti s. n.* (GB, WU); monte Schlern, 46°30'N, 11°34'E, 4 Aug 1884, *Vatke s. n.* (JE); Val Gardena, im Langental in Gröden bei Wolkenstein, 46°34'N, 11°40'E, 12 Aug 1907, *Vetter s. n.* (UPS); Saint Ulrich in Gröden [Ortisei], 46°34'N, 11°40'E, 20 Aug 1913, *Zinsmeister s. n.* (M); Seiser Alp, 46°31'N, 11°32'E, Jul 1828, *Zuccarini s. n.* (M). Veneto: Monte Pasubio, 45°47'N, 11°10'E, *Ball s. n.* (NY); Val de Signori, prope Schio, 45°42'N, 11°21'E, 27 Aug 1858, *Ball s. n.* (US); in verticibus Pasubio et Covelalto, 45°47'N, 11°10'E, 27 Aug 1858, *Ball s. n.* (US); Vicenza province, near Recoaro, 45°41'N, 11°13'E, Jun 1863, *Ball s. n.* (GH, NY); Cortina d'Ampezzo, in Monte Tofana, 46°32'N, 12°3'E, 30 Aug 1870, *Ball s. n.* (US); Val di Portole, Sette Comuni, 45°54'N, 11°30'E, Sep 1860, *Ball s. n.* (US); Lago di Alleghe, 46°24'N, 12°0'E, 4 Aug 1865, *Ball s. n.* (US); Judikarien, Gavardina-Pass, 45°58'N, 10°45'E, Aug 1925, *Beger s. n.* (B); Belluno province, Canazei, langs de Avisio, 46°27'N, 12°0'E, 25 Jul 1959, *Boom s. n.* (L); Verona province, E Monte Baldo, in glareosis Giari di Valbrutta vocatis, 45°43'N, 10°49'E, 29 Jun 1880, *Goiran s. n.* (F, L, M, WU); Monte Baldo, vallis del Trovai, 45°43'N, 10°49'E, 6 Jul 1908, *Rigo 1411* (FI, GH, K, LE, W); Rocca Pietore, le long du chemin qui va à Sottoguda, 46°25'N, 11°56'E, 29 Jul 1895, *Saint-Lager s. n.* (G, H, MA, NY, US); bei Ampezzo, 46°25'N, 12°47'E, Aug 1863, *Sonklar s. n.* (W); Prov. Verona, Monte Baldo Wetseite, Abstieg, nach Malcesine, 45°43'N, 10°49'E, 17 Jul 1910, *Frimmel s. n.* (W).

SLOVENIA. Gorenjska: Juljske Alpe, Ponca, Na Vrtcu, 46°27'N, 13°42'E, 14 Aug 2008, *Frajman s. n.* & *Schönschwetter* (WU); Julische Alpen, Wochein [Bohinj], 46°18'N, 13°56'E, *Freyer s. n.* (M); Karawanken, S Loiblpass, Westteil der Kosuta (Koschuta), WNW unter der Kote 1602 bzw. 0,3 km S Pri Jurji, 46°25'N, 14°25'E, 18 Jul 1995, *Greiml s. n.* (WU); Julische Alpen, Massiv des Triglav, am Dom na Komni westlich des Wocheiner Sees, 46°22'N, 13°50'E, 30 Jul 1972, *Holtz s. n.* (GOET). Goriska: Alpi Giulie, Santa Lucia, 46°8'N, 13°44'E, Aug 1897, *Marchesetti s. n.* (FI); Selva di Tarnova, M. Golaki, 45°58'N, 13°51'E, 28 Aug 1966, *Sauli s. n.* (H). Savinjska: Styriae montibus Sulzbacher Alpen, in sinu Logarthal, 46°23'N, 14°36'E, 24 Aug 1867, *Ball s. n.* (NY, US); Sannthaler Alpen, Rinkafall, Logarthal, 46°23'N, 14°37'E, 22 Aug 1879, *Dingler s. n.* (GOET).

Notes—*Trisetum argenteum* is separated from *T. distichophyllum* because of its more slender habit, narrower and more slender leaves (basal leaf blades (0.9–)1.2–1.5(–1.7) mm wide), larger panicles, always 1-veined lower glume, and shorter callus hairs ((0.7–)1.4–1.8(–2.6) mm long). In the studied material, some intermediate specimens were found, mostly in the Central and Eastern Alps. The panicle shape and the number of nerves in the lower glume are highly variable, with *T. distichophyllum* having 1–3 nerves, a character that could be related to the size of the glume. In his work on the cytology and distribution of *T. distichophyllum* and *T. argenteum*, Beuret (1974) separated tetraploid (mostly in the Western Alps), octoploid (Eastern Alps), and hexaploid (dispersed in both the Western and Eastern Alps) races of *T. distichophyllum*. *Trisetum argenteum* was always tetraploid. Comparing this cytological information with the morphology of the plants, Beuret concluded that these three races are very closely related. According to his hypothesis, the tetraploid populations were separated because of the glaciations, and are real vicariants. However, our morphological data do not support the taxonomic separation of these entities.

3. TRisetum MACROTRICHUM Hack., Magyar Bot. Lapok 2: 110. 1903. *Trisetaria macrotricha* (Hack.) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 383. 1996.—TYPE: ROMANIA. Timis river, 45°48'N, 25°39'E, 17 Aug 1881, *J. Barth s. n.* (lectotype, here designated, LD-1213569!)

T. tarnowskii Zapal., Rozpr. Wydz. Mat.-Przyr. Akad. Umiej. Dzial B, Nauki Biol., III, 4: 167. 1904.—SYNTYPES: ROMANIA. in montanis Bucovinae, monte Dadul, prope Kirlibaba, 47°34'N, 25°7'E, *F. Herbich s. n.*; monte Pietrile Domnei (Piatra Domnei) prope Rareu, 45°23'N, 23°46'E, *A. Rehmann s. n.* (no original material found).

Herbs (33–)38.5–67(–77) cm tall, not tufted, stoloniferous rhizomes, culms 0.6–1.1 mm diam, glabrous, sometimes slightly puberulous at the top, with hairs up to 0.1 mm long; nodes 4–6(–7), separated along the culm, enclosed by the sheaths, sometimes the upper ones not enclosed, glabrous or puberulous. Basal leaf sheaths densely pubescent, with hairs 0.9–1.6 mm long, decaying into fibers, brownish, sometimes yellowish; basal leaf blades (3–)3.8–5.7(–6.5) cm long × (2.4–)2.6–5.4(–5.6) mm wide, flat, sometimes inrolled, pubescent to slightly pubescent or with scattered hairs abaxially, densely pubescent adaxially, margins with hairs (0.1–)0.5–1.1(–1.4) mm long, brownish to greenish; top culm leaf sheaths (9.3–)9.7–17.5(–18) cm long, slightly longer than the internodes, sometimes shorter, glabrous, rarely scabridulous, with cilia along the margins; top culm leaf blades (5.3–)5.4–7.8(–11.3) cm long × (4.4–)5–7.2(–10) mm wide, flat, rarely conduplicate, glabrous to slightly pubescent abaxially and adaxially, with hairs on the margins (0.1–)1–1.6(1.8) mm long, greenish; inner collar region with the same indumentum as the leaf blade or sheath, with hairs 0.05–1.2(–1.7) mm long; ligules 1–1.3(–1.5) mm long, slightly lacinate, rarely slightly dentate, glabrous to pubescent, with hairs 0.1–0.3 mm long. Basal node of the panicle glabrous, rarely scabridulous, with hairs 0.2 mm long. Panicles (9)9.2–12.2(–15) cm long × (2–)2.5–5.5(–6) cm wide, oblong to elliptic in outline, rarely narrowly oblong to narrowly elliptic; rachis scabridulous to pubescent, with hairs up to 0.15 mm long; longest basal branches (1.3–)1.6–3(–3.5) cm. Spikelets (5.6–)6–8(–8.2) mm

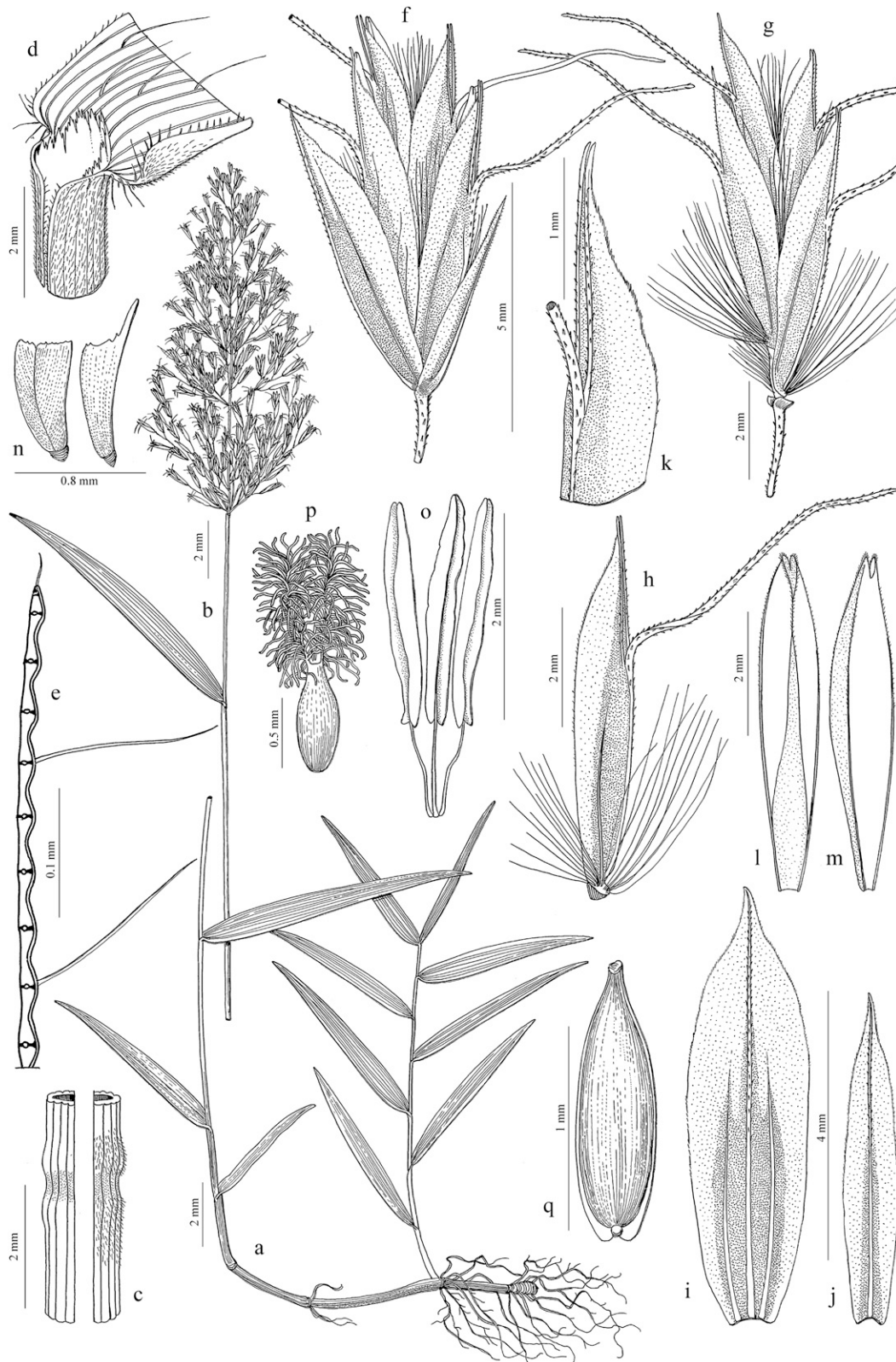


FIG. 4. *Trisetum macrotrichum*. A. Habit. B. Inflorescence. C. Portions of the culm and node. D. Sheath, ligule, and portion of the blade. E. Transverse section of half of the leaf blade. F. Spikelet. G. Florets. H. Floret. I. First glume, dorsal view. J. Second glume, dorsal view. K. Lemma, upper part, lateral view. L. Palea, ventral view. M. Palea, lateral view. N. Lodicules. O. Stamens. P. Pistil. Q. Caryopsis. (Degen 160, JE, O-V2126613, A-P; Hermann s. n., B-100526317, N, Q).

long \times (2.5–)3.7–4.85(–5.2) mm wide, (2–)3–4-flowered; pedicels 2.8–3.5 mm long, pubescent, with hairs 0.1(–0.2) mm long. Glumes unequal (ratio lower glume length/upper glume length = (0.58–)0.62–0.72(–0.78)); lower glume 3.2–4.6(–6) mm

long \times (0.6–)0.7–1(–1.2) mm wide, narrowly lanceolate, rarely narrowly elliptic (ratio lower glume width/lower glume length = (0.19–)0.2–0.22(–0.25)), acuminate to long acuminate, 1(–2)-nerved, glabrous, with very short hairs on the midrib up to

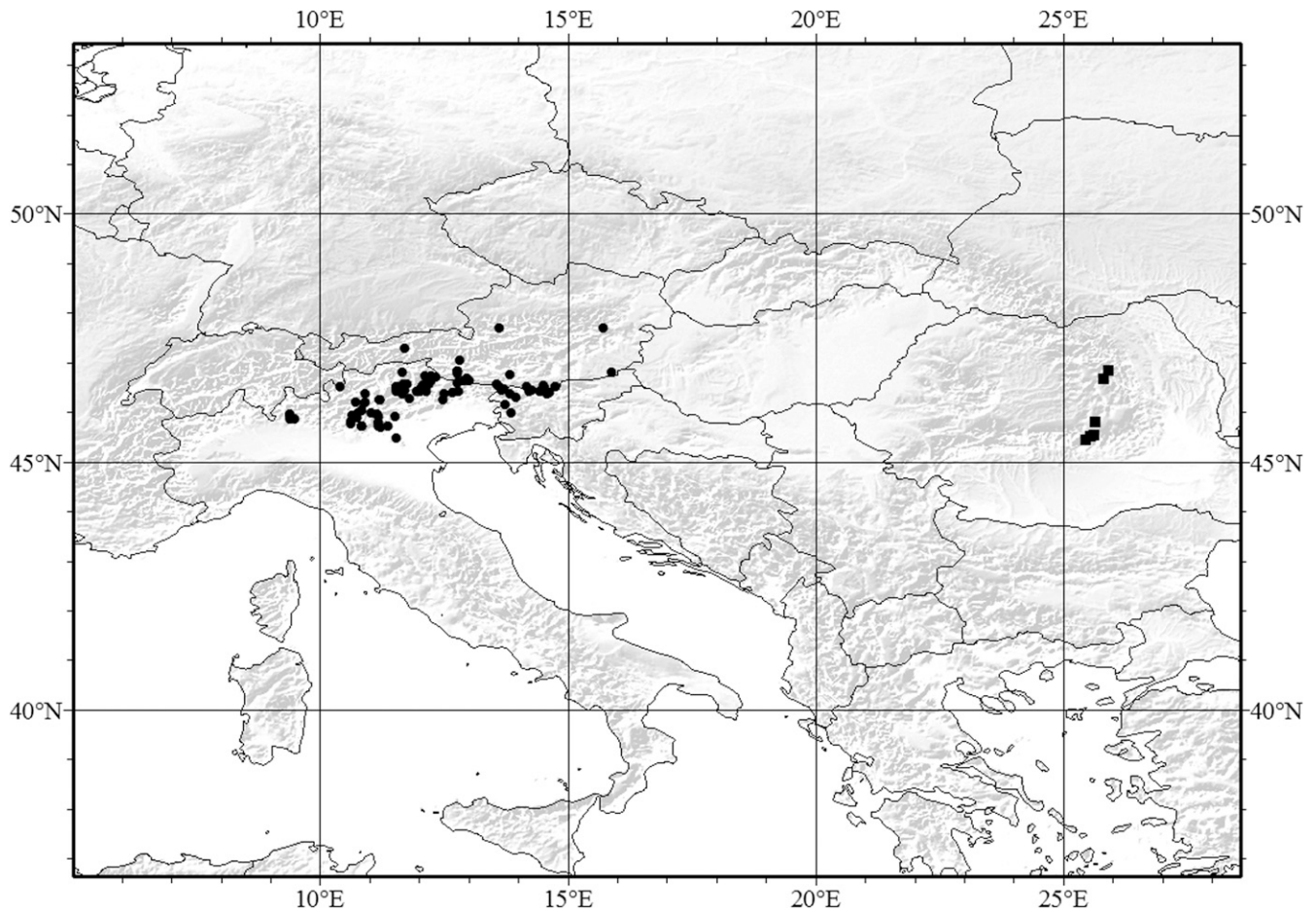


FIG. 5. Distribution of *Trisetum argenteum* (dots) and *T. macrotrichum* (squares).

0.1 mm long, sometimes on the upper part of the margins, greenish to yellowish on the central part, rest hyaline; upper glume (4.8–)5.2–6.7(–7.7) mm long \times 1.9–2.2(–2.4) mm wide, elliptic to oblong, sometimes oblanceolate or narrowly lanceolate (ratio upper glume width/upper glume length = (0.29–)0.31–0.38(–0.42)), acuminate to long acuminate, 3-nerved, glabrous, with very short hairs up to 0.07 mm long, from the middle to the upper part of the central nerve, sometimes also on the upper part of the margins, greenish to yellowish on the central basal part, rest hyaline; rachilla segment between first and second floret (0.6–)0.7–1.1 mm long, with hairs 3–3.7(–4.6) mm long; rachilla segments to sterile floret 1–1.5 mm long, with hairs (1.2–)1.7–2(–2.3) mm long. Lemmas (5–)5.5–6.1(–6.7) mm long \times (0.6–)0.7–1(–1.2) mm wide, elliptic to broadly lanceolate (ratio lemma width/lemma length = (0.23–)0.26–0.3(–0.34)), scabridulous, sometimes with hairs up to 0.1 mm long from the central to the upper part of the midrib, greenish to yellowish; apical teeth (0.2–)0.3–0.4(–0.6) mm long, with aristules 0.3–0.4 mm long; awn (4.5–)5.3–6.7 mm long, inserted (2.2–)2.6–3(–3.7) mm from the base (ratio awn insertion from the base length/lemma length = (0.42–)0.44–0.5(–0.61)), geniculate and slightly twisted near the base, with very short adpressed hairs 0.05–0.1 mm long; callus 0.2–0.4 mm long, oblong to elliptic, rarely rounded, with hairs (2.6–)2.8–3.8 mm long. Paleas 4–5 mm long \times 1–1.3(–1.5) mm wide (ratio palea length/lemma length = (0.71–)0.73–0.8), narrowly elliptic or elliptic to oblong, with short hairs along the outer edges; keels with short hairs on the apex, ending in teeth 0.1–0.2 mm long. Lodicules

(0.7–)0.8(–1.1) mm long, with apex regularly toothed, sometimes with a lateral lobe. Anthers (1.6–)2–2.2(–2.5) mm long. Ovary (0.7–)0.9–1(–1.2) mm long, glabrous. Caryopsis ca. 1.5 mm long \times 0.5 mm wide. Figure 4.

Chromosome Number— $2n = 56$ (Frey 1991).

Phenology—Flowering from June to September.

Distribution and Habitat—This species is endemic to the Romanian Carpathians, in the region of Transylvania; at 800–1,600 m elevation; around limestone rocks and pebbles. Figure 5.

Specimens Examined—ROMANIA. Transylvania: Comit. Csik, in valle Békás-szoros prope pagum Gyergyóbékás, 46°51'N, 25°55'E, 25 Jul 1943, *Baschant s. n.* (B, GB, HBG, M, S); Comit. Brassó, prope Felső-Tömös, 45°31'N, 25°34'E, 10 Jun 1904, *Degen s. n.* (C); Tömös, 45°48'N, 25°39'E, Jun 1904, *Wagner s. n.* (GB, PR); Comit. Brassó, am Fusse des Berges Piatra, 45°33'N, 25°38'E, 20 Jul 1904, *Degen s. n.* (B, C, G, GB, H, IBF, K, L, LE, MA, MO, O, P, PR, S, US, W); Comit. Brassó, prope Felső-Tömös, 45°31'N, 25°34'E, 15 Jun 1905, *Degen s. n.* (B, FI, MA, P); Comit. Brassó, ad pedem montis Piatra mare supra Felső-Tömös, 45°33'N, 25°38'E, 13 Aug 1903, *Degen s. n.* (B, BM, G, GB, GH, JE, K, LE, O, S, W); Tömös, 45°48'N, 25°39'E, Mar 1904, *Wagner s. n.* (PR); Brasov [Kronstadt], Tömös, 45°48'N, 25°39'E, 25 Jun 1909, *Hermann s. n.* (B); Carpatti Orientali, Muntii Hasmasul Mare, Umgebung der Schutzhütte Cabana Piatra Singuratica und Bergrücken gegen den Gipfel des Berges Hasmasul Mare (Nagy Hagymás), 46°40'N, 25°50'E, 23 Aug 1989, *Ehrendorfer s. n.* (WU); Bucegi, 45°26'N, 25°27'E, Oct 1955, *Schwarz s. n.* (JE); Öcsém, 46°40'N, 25°50'E, 13 Aug 1885, *Barth s. n.* (M, P). [unknown locality], Jul 1909, *Hermann s. n.* (JE).

Notes—Chrtek (1965) already included *Trisetum macrotrichum* in sect. *Rigida*, together with *T. rigidum*. Apart from the anatomical characters, these species share \pm short ligules, longer rachilla hairs, and young culms with distichous leaves.

Trisetum macrotrichum is easily differentiated because of the notable width of basal leaf blades ((2.4–)2.6–5.4(–5.6) mm wide) and flat top culm leaf blades ((4.4–)5.1–7.2(–10) mm wide) with ciliate margins, with the internodes evenly distributed along the culm, and callus indumentum length ((2.6–)2.8–3.8 mm long).

Trisetum macrotrichum has been misidentified as *Avena carpatica* auct., non Host (1809) and *T. distichophyllum* auct., non (Vill.) P. Beauv. (1812). Săvulescu (1972) noticed that *T. distichophyllum* has been cited from Romanian Carpathians in floristic literature and stated that both *T. macrotrichum* and *T. distichophyllum* are vicariant taxa and easily confused. Apart from the different size of the plants, both species are easy to differentiate using the aforementioned characters.

4. TRISETUM RIGIDUM (M. Bieb.) Roem. & Schult., Syst. Veg. 2: 662. 1817. *Avena rigida* M. Bieb., Fl. Taur.-Caucas. 1: 77. 1808. *Avena brevifolia* Schrad. ex Spreng., Syst. Veg. (ed. 16) 1: 334. 1824, nom illeg. *Trisetaria rigida* (M. Bieb.) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135: 385. 1996.—TYPE: AZERBAIJAN. Baku: Kuba district, Schirvaniensi altiore ca. Kurt-Bulak [Gora Kara-Bulag] lecta, 41°04'N, 48°20'E, F.A. Marschall von Bieberstein s. n. (lectotype, designated by Tzvelev (1976: 261), LE-1009635!).

Herbs (18.5–)37–57(–76.3) cm tall, not to loosely tufted, short rhizomatous or with stoloniferous rhizomes, culms 0.4–0.9(–1.2) mm diam, glabrous; nodes (4–)5–7(–12), internodes, sometimes concentrated in lower part, not enclosed by the sheaths, puberulous with hairs 0.3–0.6 mm long, or sometimes glabrous. Basal leaf sheaths densely pubescent, rarely glabrous, with hairs (0.1–)0.3–0.7(–1.5) mm long, becoming fibrous in age, brownish to yellowish; basal leaf blades (0.8–)2.8–5.5(–8.6) cm long × (–1.2)2–3.5(–7.6) mm wide, rigid or not, flat, sometimes slightly inrolled, from glabrous to pubescent abaxially and adaxially, with hairs (0.05–)0.2–0.6(–1) mm long along the margins, greenish to greyish; top culm leaf sheaths (5.3–)10–13.4(–17) cm long, shorter than the internodes, rarely longer, glabrous, without cilia on the margins; top culm leaf blades (1–)2.5–5(–10.7) cm long × (1–)1.8–3.3(–6.4) mm wide, flat, usually parallel to the culm, glabrous or with scattered hairs abaxially and adaxially, margins without or with hairs (0.05–)0.1–1(–1.5) mm long, greenish to greyish; inner collar region glabrous, sometimes with scattered hairs along the margins (0.1–)0.3–1(–1.3) mm long; ligules (1.3–)2–3.1(–4.2) mm long, lacinate, glabrous, usually with few hairs (0.05–)0.1–0.4 mm long on the apex. Basal node of the panicle glabrous. Panicle (5.8–)7.5–13(–16) cm long × (1.3–)2.2–3.2(–5.5) cm wide, oblong to elliptic in outline, rarely lanceolate, lax to slightly dense; rachis glabrous, sometimes slightly pubescent, with hairs up to 0.1 mm long; longest basal branches (0.4–)1–2.3(–5) cm. Spikelets (5.3–)7.5–9.1(–11.5) mm long × (1.6–)3.2–5(–6.2) mm wide, 2–3(–4) flowered; pedicels (1.6–)3.3–4.3(–5) mm long, glabrous to pubescent, with hairs up to 0.1 mm long. Glumes unequal (ratio lower glume length/upper glume length = (0.45–)0.55–0.66(–0.83)); lower glume (2.4–)3.7–5.2(–6.2) mm long × (0.4–)0.7–0.9(–1.2) mm wide, lanceolate to narrowly elliptic (ratio lower glume width/lower glume length = (0.11–)0.15–0.22(–0.26)), acuminate, rarely acute, 1-nerved, glabrous, with scattered hairs up to 0.08 mm on the nerve and upper part, greenish on the central part, surrounded by yellowish or hyaline part; upper glume (5.3–)6.6–8(–10.2) mm long × (1.4–)1.7–2(–2.4) mm wide, oblong to elliptic, rarely

lanceolate or oblanceolate (ratio upper glume width/upper glume length = (0.19–)0.23–0.28(–0.32)), acuminate or long acuminate, rarely acute, 3-nerved, glabrous, with very short hairs up to 0.08 mm from the middle to the upper part of the central nerve, sometimes also on the upper part of the margins, greenish on the central part, surrounded by yellowish or hyaline part; rachilla segment between first and second floret 1–1.5(–2.2) mm long, with hairs (3.2–)4–4.7(–5.7) mm long; rachilla segments to sterile floret (0.8–)1.5–2(–2.5) mm long, with hairs (1.6–)2.5–3.3(–4.2) mm long. Lemmas (5.3–)6.4–8.2(–9.3) mm long × (0.4–)0.7–0.9(–1.1) mm wide, narrowly elliptic to narrowly lanceolate, rarely oblong (ratio lemma width/lemma length = 0.18–0.24(–0.28)), strigulose, sometimes with hairs up to 0.1 mm long on the aristules and midrib, greenish to yellowish, rarely purple; apical teeth (0.1–)0.2–0.5(–1.2) mm long, with aristules (0.3–)0.4–1(–1.7) mm long; awn (4.3–)5.7–7.3(–8.6) mm long, inserted (2.4–)3.2–4.2(–5.1) mm from the base (ratio awn insertion from the base length/lemma length = (0.4–)0.45–0.55(–0.62)), recurved near base to straight, not twisted to slightly twisted, with very short adpressed hairs 0.05 mm long; callus 0.2–0.4(–0.5) mm long, elliptic to oblong, with hairs (0.3–)0.6–0.9(–1.4) mm long. Paleas (4–)4.9–5.8(–6.6) mm long × 1–1.3(–1.8) mm wide (ratio palea length/lemma length = (0.54–)0.66–0.81(–0.87)), narrowly elliptic to oblong, rarely slightly oblanceolate, with short hairs along the outer edges; keels with short hairs on the apex, ending in teeth (0.1–)0.2–0.3(–0.5) mm long. Lodicules (0.4–)0.6–0.7(–0.9) mm long. Anthers (1.8–)2.3–2.8(–3.4) mm long. Ovary (0.4–)0.6–0.9(–2.1) mm long, glabrous, rarely with few hairs 0.1–0.3(–0.6) mm long or slightly puberulous on the apex. Caryopsis 1.4–3 mm long × 0.3–0.4 mm wide.

a. subsp. RIGIDUM

Arundo wilhelmsii Ledeb., Mem. Acad. Sci. Petersb. 6: 593, Table 19. 1818. *Avena wilhelmsii* (Ledeb.) Spreng., Syst. Veg. 1: 333. 1824. *Trisetum wilhelmsii* Ledeb. ex Schult. in J.J. Roemer & J.A. Schultes, Mant. 2: 367. 1824.—TYPE: GEORGIA. Ex Iberia, C. *Wilhelms s. n.* (lectotype, designated by Tzvelev (1976: 261), LE!; isolectotypes: P-2255872!).

Avena daenensis Boiss., Diagn. Pl. Orient. 7: 123. 1846. *Trisetum daenense* (Boiss.) Bal., Bull. Soc. Bot. France 21: 14. 1874.—TYPE: IRAN. Kuh-e Dana Mountain, *Dscheschme-Pias* Bsource, 30°44'N, 51°36'E, 29 Jul 1842, K.G.T. *Kotschy 754a* (lectotype, here designated, P-2255864!; isolectotypes, BM-959384! G-176318!, P-2255902!).

T. teberdense var. *brevifolium* Kharadze, Zametki Sist. Georg. Rast. (Tbilisi), 1: 16. 1938.—TYPE: GEORGIA. Samegrelo-Zemo Svaneti: Fontaine Chal-de-čalai, 42°42'N, 42°12'E, 9 Aug 1931, A.L. *Kharadze s. n.* (lectotype, here designated, TBI (image)!).

T. rigidum subsp. *demavandense* Chrtek, Acta Univ. Carol., Biol. 1967: 96. 1968.—TYPE: IRAN. Teheran, in the country near the city, 35°42'N, 51°25'E, K.G.T. *Kotschy 390* (holotype, BM-1134941!; isotypes, LE!).

T. persicum Chrtek, Acta Univ. Carol., Biol. 1967: 98. 1968.—TYPE: IRAN. Kellal mountain, 33°58'N, 48°25'E, 3050 m, 6 Sept 1868, H.C. *Hausknecht s. n.* (holotype, BM-959383!; isotypes, K-808701!, LE!).

Herbs (18.5–)34.3–56.5(–76.3) cm tall. Basal leaf sheaths densely pubescent, rarely glabrous, with hairs (0.1–)0.3–0.7(–1) mm long;

basal leaf blades (0.8–)2.8–5.2(–7) cm long \times (1.2–)2–3(–5.8) mm wide, rigid, glabrous abaxially and adaxially, sometimes slightly pubescent, margins with hairs 0.05–0.6(–1) mm long; top culm leaf sheaths (5.3–)9–13(–17) cm long, shorter than the internodes, sometimes slightly longer; top culm leaf blades (1–)2.5–4.6(–10.7) cm long \times (1–)1.8–3(–5.6) mm wide, divergent, rarely erect, not reaching into the panicle, glabrous abaxially and adaxially, usually with hairs up to 0.4 mm long on the margins; inner collar region glabrous, rarely with few hairs on the margins 0.1–0.8 mm long; ligules (1.8–)2.3–3.4(–4.2) mm long. Panicles (5.8–)8.1–13.9(–16) cm long \times (1.3–)2.3–3.2(–5.5) cm wide, oblong to oblong-elliptic in outline, sometimes lanceolate; longest basal branches (0.4–)1–2.3(–5) cm. Spikelets (5.3–)7.4–9(–11.5) mm long \times (1.6–)3.2–5(–6.2) mm wide; pedicels (1.6–)3.4–4.2(–5) mm long, glabrous to slightly pubescent. Glumes unequal (ratio lower glume length/upper glume length = (0.45–)0.54–0.63(–0.72)); lower glume (2.4–)3.5–5.2(–6.2) mm long \times (0.4–)0.6–1.2 mm wide (ratio lower glume width/lower glume length = (0.11–)0.14–0.22(–0.26)), greenish on the central part, sometimes purple, laterals and upper part hyaline; upper glume (5.3–)6.4–8(–10.2) mm long \times 1.6–2.2(–2.4) mm wide (ratio upper glume width/upper glume length = (0.2–)0.25–0.29(–0.32)), greenish on the central basal part, usually also the nerves, laterals hyaline or yellowish, sometimes purple; rachilla segment between first and second floret with hairs (3.2–)4.2–4.6(–5) mm long. Lemmas (5.3–)6.4–7.7(–9.3) mm long \times (–0.4)0.6–1.1 mm wide, narrowly elliptic to narrowly lanceolate, sometimes elliptic, rarely oblong (ratio lemma width/lemma length = 0.18–0.24(–0.28)); awn (4.3–)5.5–7(–8.6) mm long, inserted (2.4–)3–4.2(–5.1) mm from the base (ratio awn insertion from the base length/lemma length = (0.4–)0.46–0.53(–0.62)); callus with hairs (0.3–)0.6–0.9(–1.4) mm long. Lodicules with apex slightly lobulate to denticulate, rarely with long lobules or teeth. Anthers (1.8–)2.5–2.8(–3.4) mm long. Figure 6.

Chromosome Number— $2n = 28$ (Tzvelev 1976).

Phenology—Flowering and fruiting from June to August.

Distribution and Habitat—It is distributed from East Anatolia in Turkey to Caucasus and north-northeast Iran; at 600–3,000 m elevation; on rocky or pebbled slopes, from open to shrubby places, often in riversides. Figure 7.

Specimens Examined—ARMENIA. Ararat: Ararat district, montes “Gegamski khrebet”, loco Aruni Dzor, 40°12'N, 44°56'E, 11 Jul 1975, *Vasak s. n.* (B, K, M, MA). Gegharkunik: pr. Pambak, 40°23'N, 45°32'E, 20 Jun 2005, *Aedo 11798 & al.* (MA); Nor-Bajazet district, in monte Inak-dagh, 40°14'N, 45°52'E, 28 Jul 1928, *Zedelmejer s. n. & Gejdeman* (LE). Kotayk: Gekhard, 40°9'N, 44°47'E, 5 Jul 1928, *Araratian s. n.* (LE). Shirak: Akhuryan district, the Shikarskiy Range, northwest of Dzhadzbur Pass, 40°51'N, 43°59'E, 23 Jun 1960, *Tzvelev 160 & Cherepanov* (LE). Syunik: Megri district, to the valley of a right tributary of the Megriget River near Vardanadzor, 38°58'N, 46°12'E, 29 Jun 1965, *Egorova 1477 & al.* (LE); montes “Karabakhskoie nagorje”, ad orientem versus ab oppido Goris, 39°30'N, 46°20'E, 25 Jul 1975, *Vasak s. n.* (K). Vayots Dzor: cordillera Vardenis, cerca de 8 km antes del paso de Selim, 39°56'N, 45°14'E, 23 Jun 1900, *Herrero 2718* (B, O).

AZERBAIJAN. Nachrespublica, in mte Ljakatach, 10 Aug 1933, *Gadzhiev s. n. & al.* (LE). Absheron: Kuba district, ad fl. Kussar-czai supra p. Dshagar, 41°34'N, 48°43'E, 2 Jul 1899, *Alexeenko 1101* (LE); Kuba district, prope St. Kussary, 41°25'N, 48°25'E, 20 Jun 1899, *Alexeenko 392* (LE); Kuba district, in valle fl. Ata-czai, 23 Jul 1900, *Alexeenko 5623* (LE); Schemacha district, montis Dibrar, 40°53'N, 48°53'E, 25 Jul 1900, *Alexeenko 6104* (LE); Schemacha district, in decliviis m. Nijal supra p. Zarnova, 40°48'N, 48°20'E, 31 Jul 1900, *Alexeenko 7396* (LE); Baku, Kuba Uyezd, Gilskie polya, 1900, *Grigor'ev s. n.* (LE); Baku, Bibi-Eibat, 40°18'N, 49°48'E, 24 May 1912, *Holmberg 974* (K, S); Shemacha district, iter pass pasc. Neregele et Kaladzich, 30 Jul 1928, *Sachokhija s. n.* (LE). Aran: Araesch district, Montes Arczan-dagh, Oghrudsha, 41°16'N, 48°0'E, May 1908, *Schelkownikov s. n. & Woronow* (G, H, LE, MW, W). Dagit-Shirvan: road Agsu-Shamakhi,

40°38'N, 48°28'E, 12 Jun 1949, *Eideman s. n.* (LE). Ganja-Qazakh: 20–40 km ENE Tabriz usque 1 km ultra pontem trans fluvium Talkheh Rud (Atschi Tschai), 38°4'N, 46°17'E, 31 May 1971, *Rechinger 40731* (G, M, MO, S). Lankaran: Lerik district, in the vicinity of the urban-type settlement of Lerik, 38°46'N, 48°24'E, 18 Aug 1963, *Bobrov 574 & Tzvelev* (LE). Nakhchivan: Ordubad Dist., a gorge 1,5 km east of Ordubad, 38°54'N, 46°1'E, 9 Jun 1956, *Egorova 433 & al.* (LE); in jugo Zangezur, inter p. Aravsya et monte Dashurry-Dagh, 39°17'N, 45°47'E, 5 Jul 1928, *Gavrilov s. n.* (LE); slopes of the Zangezur Range, a slope to the Kyuki-chay River, 39°12'N, 45°24'E, 4 Jul 1952, *Smol'yaninova s. n.* (LE). Shaki-Zaqatala: Zaqatala district, Dzharay, a mount 300 m west of the mansion of the Zagatala State Reserve, south macroslope, 41°39'N, 46°40'E, 12 Jun 1946, *Il'inskaya s. n. & Kirpichnikov* (LE). Yukhari-Karabakh: Shusha, 39°45'N, 46°45'E, 14 Jun 1893, *Lipskiy s. n.* (LE).

GEORGIA. Abkhazia: Gudauta district, in vicinitate lacus Rica, 43°28'N, 40°32'E, 21 Jun 1977, *Vasak s. n.* (M). Imereti: The Meskhiyskiy Range, [Guminda Ioriy] summit, 42°11'N, 43°36'E, 4 Aug 1930, *Dzens-Litovskaya 99* (LE); Oprtsheti pr. Fl. Rion, 42°21'N, 42°42'E, Jun 1877, *Brotherus s. n. & Brotherus* (H). Kakheti: Greater Caucasus, Tusheti, Pirikiti Khersureti, 42°21'N, 45°39'E, 20 Aug 1997, *Gagnidze 2524 & al.* (MO); Terek River valley, the Darlyalskoe Gorge, pebbles by “Tamara Castle” (downstream of the mouth of Kistinka river), 42°44'N, 44°37'E, 24 Aug 1949, *Novopokrovskiy 681* (LE); Telav, 41°55'N, 45°28'E, 22 Jul 1918, *Pastuchov s. n.* (LE, NY). Mtskheta-Mtianeti: Kazbegi region, vill. Targmani area, about 200m N of vill. Targmani, about 80 m left of country road, about 50 m SW of gas pipeline, 42°39'N, 44°39'E, 7 Jul 2004, *Abdaladze 332 & al.* (NY); Kazbegi region, vill. Tsdo area, about 2 km SE of vill. Tsdo, 42°41'N, 44°37'E, 7 Aug 2004, *Abdaladze 409 & al.* (NY); Georgian Military Road, south slope by the way to the Krestoviy Pass, 42°30'N, 44°27'E, 8 Aug 1950, *Beydeman s. n.* (LE); inter Tiflis et Wendikaukas, supra stationem Mleti, 42°25'N, 44°29'E, 10 Aug 1902, *Bornmüller 33* (B); upper reaches of the Ksanka River, the left side of a gorge near the selo of Gorga, 42°8'N, 44°24'E, 5 Aug 1933, *Bush s. n. & Bush* (LE); between Mlety and Passanauri, 42°21'N, 44°41'E, 28 Jun 1897, *Fedchenko s. n. & Fedchenko* (LE); Greater Caucasus, Khevi, Kazbegi, Karkucha, 42°34'N, 44°40'E, 25 Aug 1997, *Gagnidze 2941 & al.* (W); prope pagum Kasbek, 42°38'N, 44°38'E, 9 Aug 1844, *Kolenati 2204* (MO); Khevi, Kazbegi, riv. Tergi Gorge, about 500 m south of vill. Gergeti, about 200 m left of riv. Tergi, 42°39'N, 44°38'E, 18 Aug 2001, *Nakhtsrishvili 103 & Abdaladze* (NY). Racha-Lechkhumi and Kvemo Svaneti: Kassarskoe Gorge upwards of the village of Tli, left side of the Ardon River, 42°29'N, 43°51'E, 10 Aug 1939, *Shiffers s. n. & Moreva* (LE). Samegrelo-Zemo Svaneti: Gul glacier, 43°4'N, 42°40'E, 21 Jul 1911, *Schelkownikov s. n.* (TBI, photo!). Samtskhe-Javakheti: past Abastuman, on the road to the Zekarskiy Pass, 41°45'N, 42°49'E, 24 Jun 1903, *Borodin 197* (LE); Achalzich district, inter Zarzma et Kanly, 41°40'N, 42°39'E, 14 Jul 1914, *Litwinow 2809* (C, G, GH, K, M, MW, S, US). South Ossetia: Java district, Ermani area, the south slope of Mt. Fidarukhokh, 42°28'N, 44°14'E, 11 Sep 1947, *Abramov s. n.* (LE); the Chaparukhskoe Gorge, pebbles along the Chaparukh-don River, 23 Jul 1930, *Bush s. n. & Bush* (LE); The Sbiyskoe Gorge, the left side of the gorge, slightly downwards of the selo of Nizhnyaya Sba, 42°33'N, 44°10'E, 30 Jul 1929, *Bush s. n. & Bush* (LE); upper course of the Ksanka River, the Sagoy Gorge, near the selo of Bagin, 3 Aug 1930, *Bush s. n. & Bush* (LE); Ermani, pebbles on the left side of the Mid. Ermanskaya, 42°31'N, 44°11'E, 20 Aug 1937, *Semenova s. n.* (LE). Tbilisi: Hänge am Cerepasce-See, 31 May 1968, *Fritsch s. n.* (JE); Trockene Hügel bei Gladni, 41°49'N, 44°49'E, 14 Jun 1968, *Fritsch s. n.* (JE); Tiflis, 41°41'N, 44°50'E, 10 Jun 1919, *Grossheim 76* (G, LE, MW, PR, S); Tbilisi surroundings, environs of Kodjori, Mt. Udzo, ca. 1,5 km N of Kodjori, ca. 50 m W of the church, 41°40'N, 44°41'E, 18 Jun 2006, *Lachashvili 189* (NY); Lisi-See, westl. D. Stadt, 41°44'N, 44°44'E, 30 Jun 1969, *Lepper s. n. & al.* (JE); Akhaltsikhe uyezd, the Zekarskiy Gorge, 20 Jun 1892, *Lipskiy s. n.* (LE); Tiflis, prope urbem, 41°41'N, 44°50'E, 6 Jul 1890, *Sommier 1359 & Levier* (FI, LE).

IRAN. Alborz: Mont. Elburs, valle Lur, ad pagum Getschesär, 36°6'N, 51°18'E, 23 Jun 1902, *Bornmüller 8383 & Bornmüller* (B). Est Azerbaijan: Isperchan m. Sahand, 37°43'N, 46°29'E, 4 Aug 1884, *Knapp s. n.* (W). Golestan: M. Shahvar prope Hajjilang, 36°34'N, 54°12'E, Jul 1948, *Rechinger 6091* (B, M). Khorasan-e Shomali: Akher-Dagh mountain, 37°34' N, 57°12'E, Jul 1907, *Haradjian 1619* (S). Mazandaran: Mont. Elburs, Junesar, dictionis m. Demavend, 35°57'N, 52°32'E, 2 Jul 1902, *Bornmüller 8384 & Bornmüller* (B); road of Haraz, 18 Jul 1972, *Dini-Arazm 12132* (K); Elburs, Pole Zangule, 36°11'N, 51°20'E, 14 Jun 1937, *Gaubä 1243* (B); Montes Elburs centr., jugi Kandava [Kandovan], 36°9'N, 51°19'E, 14 Jun 1937, *Gaubä s. n.* (US); ad radices m. Demavend, 35°57'N, 52°6'E, 24 Jun 1843, *Kotschy 391* (G, LE, P); *Kotschy 393* (L, LE, P); in faucibus vallis Chalus supra Valiabad, 36°15'N, 51°18'E, 21 Jun 1974, *Rechinger 48369* (G, M); Nur district, inter Kamarband et jugum Naftab, 36°13'N, 52°17'E, 8 Aug 1948, *Rechinger*

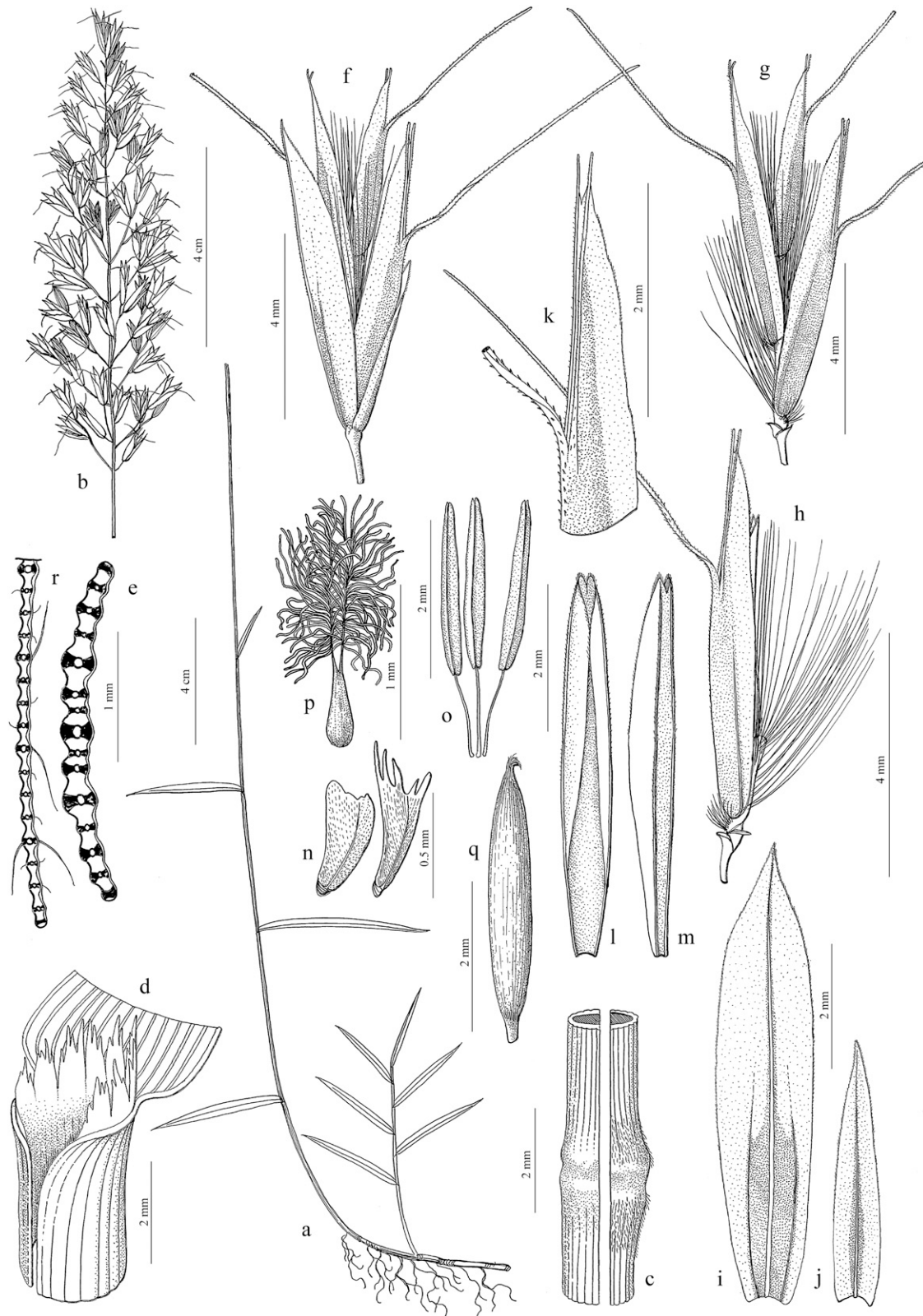


FIG. 6. A–Q. *Trisetum rigidum* subsp. *rigidum*. A. Habit. B. Inflorescence. C. Portions of the culm and node. D. Sheath, ligule, and portion of the blade. E. Transverse section of leaf blade. F. Spikelet. G. Florets. H. Floret. I. First glume, dorsal view. J. Second glume, dorsal view. K. Lemma, upper part, lateral view. L. Palea, ventral view. M. Palea, dorsal view. N. Lodicules. O. Stamens. P. Pistil. Q. Caryopsis. R. *T. rigidum* subsp. *teberdense*. R. Transverse section of half of the leaf blade. (Amirhanov 34, MW, A–B; Gauba 1243, B-100526552, C–J, L–P; Alexenko 9071, LE, N; Vasak s. n., K, Q; Soreng 8009, US-3600681, R).

6447 & Rechner (US); Kudjur district, in monte Ulodj, 9 Aug 1948, Rechner 6509 & Rechner (M, US). Qazvin: Montes Elburs centr., Hesarband mountain, 35°50'N, 51°15'E, 24 Jul 1935, Gauba s. n. (M, US). Semnan: Shahrud-Bustam district, montium Shahvar supra Nekarman

(Nigarman), 36°32'N, 54°50'E, Jul 1948, Rechner 5891 (K, M, US); Elburz mts., Nezva Kuh area, above Taru, 35°58'N, 53°12'E, 7 Jul 1959, Wendelbo 1218 (LE). Tehran: Zentral-Elburs, am Südabhang des Totschal im Tal von Pasghaleh nördlich von Teheran, 35°50'N, 51°25'E, 8 Jul 1948, Aellen 1898

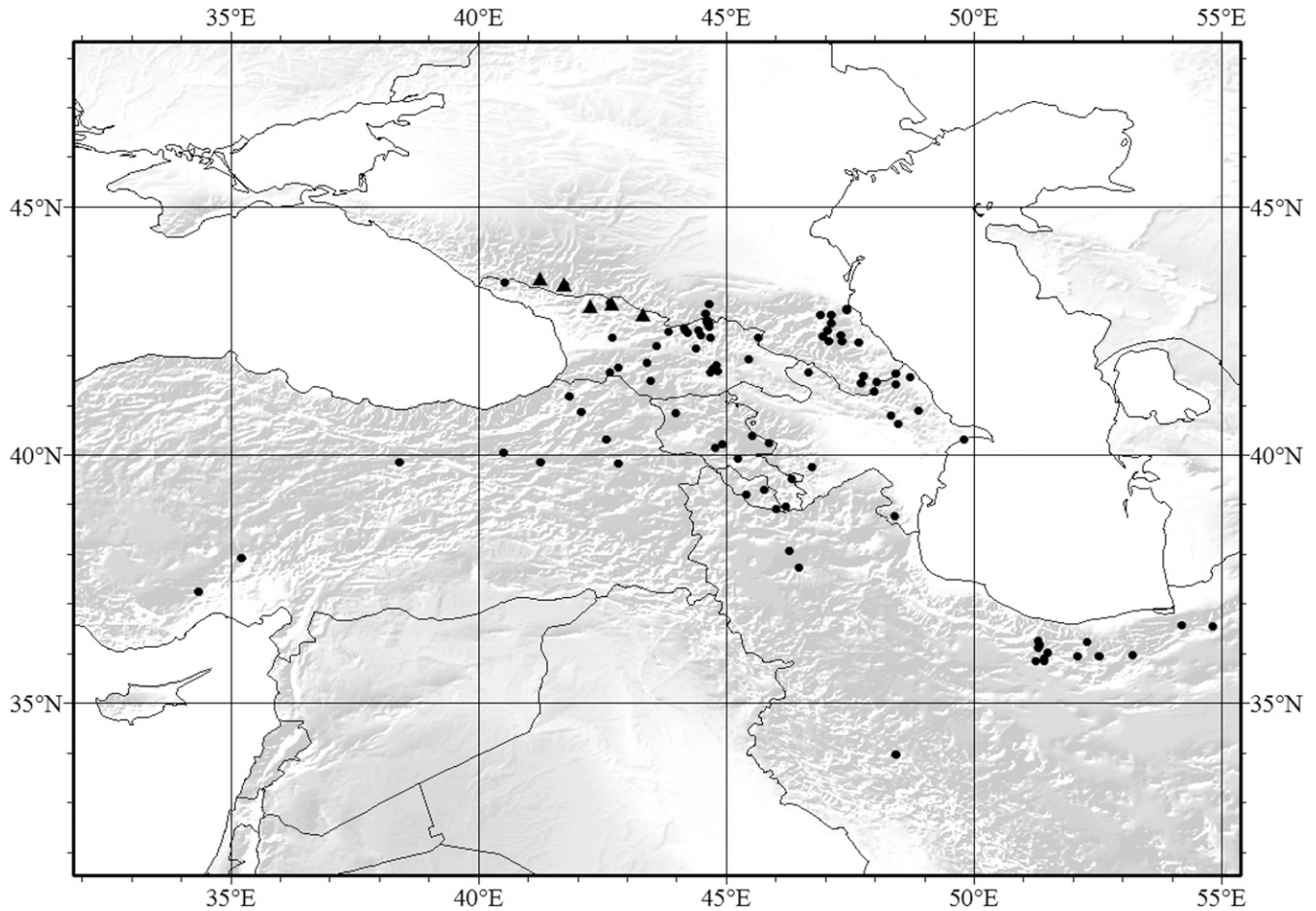


FIG. 7. Distribution of *Trisetum rigidum* subsp. *rigidum* (dots) and *T. rigidum* subsp. *teberdense* (triangles).

(F, MO, S); Zentral-Elburs, am Südabhang des Totschal im Tal Häfthous nordwestlich von Teheran, 35°53'N, 51°25'E, 4 Jul 1948, *Aellen* 1982 (H); Mont. Elburs, ad basin septentr. Alpium Totschal, prope Scheheristanek, 35°57'N, 52°32'E, 15 Jun 1902, *Bornmüller* 8381 & *Bornmüller* (B, PR); *Bornmüller* 8382 & *Bornmüller* (BM, JE, MPU, W); Mont. Elburs, alpe Totschal, prope Scheheristanek, 35°57'N, 52°32'E, 8 Jul 1902, *Bornmüller* 8385 & *Bornmüller* (B, HBG, JE, LE, PR, W); 10 Jun 1902, *Bornmüller* 8385b & *Bornmüller* (B, G); Elburz 24' NNE of Teheran, 35°57'N, 52°32'E, 11 Jul 1962, *Furse* 3141 (LE); Montes Elburz, Shemshak, 36°0'N, 51°29'E, 25 Apr 1977, *Rechinger* 57178 (M).

RUSSIA. Dagestan: Samur district, prope pagum Gedym, 41°38'N, 48°25'E, 17 Aug 1900, *Alexeenko* 9071 (LE); Kürinskii district, prope pagum Kgirchan (Gelchan), 23 Jul 1898, *Alexeenko* s. n. (LE); Dargi district, prope Murguk, 42°16'N, 47°41'E, 7 Jul 1898, *Alexeenko* s. n. (LE); Dargi district, prope silvam Gumra-duz inter Akuscha et Muhi (Meha), 42°17'N, 47°21'W, 14 Jul 1898, *Alexeenko* s. n. (LE); prope Lewaschi, 42°25'N, 47°19'E, 2 Jul 1898, *Alexeenko* s. n. (LE); Dargi district, in declivitate meridionali jugi Shamchal-dag, 5 Jul 1898, *Alexeenko* s. n. (LE); Dargi district, prope pagum Chodshal-makhi, 12 Aug 1898, *Alexeenko* s. n. (LE); Tenir-Chan-Schura district, inter pag. Ischkarty et Temir-Chan-Schura, 42°49'N, 47°7'E, 30 Jun 1897, *Alexeenko* s. n. (LE); Achty, 41°27'N, 47°43'E, 17 Jun 1880, *Becker* s. n. (JE, LE); Makhach-kala district, SE slope of Mt. Tarku-Tau, 42°56'N, 47°27'E, 8 Jun 1925, *Bogdanovskaya-Gienef* s. n. (LE); Gunib district, the selo of Chokh, Mt. Turchidag, 42°18'N, 47°4'E, 10 Aug 1940, *Elenevskiy* s. n. (LE); Magaramkentskiy district, the selo of Garakh, slopes of a mount by the Samur River, 41°28'N, 48°2'E, 15 Aug 2006, *Kotseruba* 30 (LE); valley of the Kurakh River, 12 km downwards of the selo of Kurakh, 41°35'N, 47°46'E, 13 Jul 1956, *Medvedeva* s. n. & al. (LE); Lakskiy district, along the Kazikukhumskoe Koyso River, Kazi-Kukhum, 42°30'N, 47°3'E, 2 Sep 1927, *Poretskiy* 543 & *Shults* (LE); Makhachkala district, the Narat-tyube Range, west of Agach-aul, 42°55'N, 47°27'E, 1 Jul 1955, *Prokhanov* 339 (LE); Buynaksk district, the Gimrinskiy Range, ca. 1 km away from a pass (near the aul of Verkhniy Karanay), 42°49'N, 46°54'E, 23 Aug 1953, *Prokhanov* 163 & *Cheldyshev* (LE). Kuban: Teberda, 43°26'N, 41°44'E, 5 Jul 1905, *Litwinow*

257 (LE). North Ossetia-Alania: SE slopes of Mt. Kandyl above Dzhezhkharovskoe (Georgian Military Road), 42°50'N, 44°36'E, 20 Jul 1940, *Schiffers* 5 & *Moreva* (LE); valley of the Terek River, 37 km south of Dzaudzhikau (former Vladikavkaz), 43°2'N, 44°40'E, 24 Aug 1949, *Vasilchenko* 668 & al. (LE).

TURKEY: partie supérieure du Bousdouan-dagh [Bozdoğan], au dessus de Khabakhor (Lazistán), 40°52'N, 42°5'E, 30 Aug 1866, *Balansa* s. n. (L); région alpine du Taurus, au-dessus de Boulgarmaden, 37°14'N, 21°51'E, IX, *Balansa* s. n. (L); Erzurum, Palandöken dagi unmittelbar S der Stadt Erzurum, 0.2 km oberhalb der Schilift-Talstation, 39°51'N, 41°16'E, 26 Jul 1978, *Ehrendorfer* s. n. & al. (WU); Erzincan/Sivas, Kızıldağ Geçidi, 42 Str.-km W Refahiye, 30 Str. Km E Imranli, 39°51'N, 38°24'E, 3 Aug 1978, *Ehrendorfer* s. n. & al. (WU); Erzurum, zwischen Askale und Bayburt auf dem Kopdagi geçidi steiniger, 40°3'N, 40°30'E, 2 Aug 1973, *Holtz* 978 & al. (GOET); Aladağlar, Emli Bogazi, ca. 1–1.5 km SE des Karasay Tepe, 37°55'N, 35°13'E, 12 Aug 1992, *Parolly* s. n. (B); Kars, Sarikamis, am Pass 10 km westlich der Stadt and der Strasse nach Horasan, 40°19'N, 42°35'E, 23 Jul 1981, *Raus* 4431 (B); between Erzurum and Agri, 25 km west of Toprakkale village, Keeitepe mountain, 39°50'N, 42°49'E, 18 Jul 1976, *Tatli* 4865 (GOET); Batumi, Artvin district, between the villages of Dabatsvriil and Skhloban, 41°10'N, 41°50'E, 16 Jul 1911, *Woronow* 6256 (LE).

b. subsp. **TEBERDENSE** (Litv.) Tzvelev, *Novosti Sist. Vyssh. Rast.* 7: 62. 1971.

Trisetum rigidum var. *teberdense* Litv., *Spisok Rast. Gerb. Fl. S.S.S.R. Bot. Inst. Vsesojuzn. Akad. Nauk* 9: 11. 1932. *Trisetum teberdense* (Litv.) Kharadze, *Zam. Sist. Georg. Rast. (Tbilisi)* 1: 14. 1938.—TYPE: RUSSIA. Kuban Region, Teberda river, 43°26'N, 41°44'E, 10 Jul 1905, *D.I. Litwinow* 2810 (lectotype, designated by Tzvelev (1976: 260), LE!;

isolectotypes, A!, C!, G-305395!, M-210841!, MW!, S-13-32730!, US-2119656!, WISv-262239).

T. rigidum var. *ciliatifolium* Roshev. in Kom. (ed.), Fl. URSS 2: 256. 1934.—TYPE: [unknown locality and collector] (no original material found).

Herbs (47–)50–67(–72) cm tall. Basal leaf sheaths densely pubescent, with hairs up to 1.5 mm long; basal leaf blades (5–)7.5–8(–8.6) cm long \times (3.2–)3.7–5(–7.6) mm wide, not rigid, from glabrous to pubescent abaxially and adaxially, margins with hairs 0.4–1 mm long; top culm leaf sheaths 11–15 cm long, shorter than the internodes; top culm leaf blades (3.7–)6.3–6.7 cm long \times (2.6–)3.3–5.7(–6.4) mm wide, usually erect, sometimes reaching into the panicle, with scattered hairs abaxially and adaxially, margins with hairs 0.05–0.4(–1.5) mm long; inner collar region glabrous, with scattered hairs on the margins (0.4–)0.6–1.3 mm long; ligules 1.3–2.4 mm long. Panicles 11–15.5 cm long \times (2–)2.8–4 cm wide, narrowly elliptic to oblong; longest basal branches 2–4.7 cm long. Spikelets (7.5–)8–9 mm long \times (2.8–)3.4–4.6 mm wide; pedicels 3.5–5 mm long, pubescent to slightly pubescent. Glumes unequal (ratio lower glume length/upper glume length = 0.57–0.64(–0.83)); lower glume 4–5.5 mm long \times 0.5–0.8(–1) mm wide (ratio lower glume width/lower glume length = 0.13–0.18), greenish on the central part surrounded by yellowish; upper glume 6.6–8.4 \times 1.4–1.8 mm long (ratio upper glume width/upper glume length = 0.19–0.26), greenish or sometimes purplish on the central part, surrounded by part hyaline or yellowish; rachilla segment between first and second floret with hairs 4.5–5.7 mm long. Lemmas (6.7–)7–8.5 mm long \times 0.5–0.8(–1) mm wide, narrowly elliptic to narrowly lanceolate (ratio lemma width/lemma length = 0.14–0.24); awn 7–8.6 mm long, inserted 3.6–4.8 mm from the base (ratio awn insertion from the base length/lemma length = 0.5–0.6); callus with hairs 0.7–0.8(–1) mm long. Lodicules regularly toothed or with two straight acute lobules. Anthers 1.9–2.3 mm long. Figure 6.

Chromosome Number—Unknown.

Phenology—Flowering and fruiting from June to August.

Distribution and Habitat—Endemic to the Western Caucasus, from Eastern Turkey to Northern-Eastern Iran; at 1,280–2,000 m elevation; in acidic rocks, under middle mountain forest canopy. Figure 7.

Specimens Examined—GEORGIA. Samegrelo-Zemo Svaneti: Caucasus centralis, in vicinitate oppidi Mestia, ad septentrionem versus, 43°2'N, 42°43'E, 28 Jul 1979, *Vasak s. n.* (M); Kutaisi Governorate, the gorge of the Ingur, passage from the commune of Ipari to the commune of Kal, 43°0'N, 42°16'E, 28 Jul 1911, *Shelkovnikov s. n.* (TBI); the upper reach of the Vanistskali river, Khorogonskiy mountain mass, 25 Aug 1980, *Gagnidze s. n.* & *Mosulishvili* (TBI). Racha-Lechkhumi and Kvemo Svaneti: the upper reach of the Lukhuni river, 42°49'N, 43°20'E, 12 Jul 1981, *Chelidze s. n.* & *Shetekouri* (TBI).

RUSSIA. Karachay-Cherkessia: Teberda district, Teberda, 43°26'N, 41°44'E, 15 Jul 1981, *Mosulishvili s. n.* (MO); Teberda village, Karakul Lake, 43°26'N, 41°45'E, 30 Jul 2010, *Soreng 8009 & al.* (US); Teberda reserve, Teberda valley, 43°26'N, 41°44'E, 30 Jun 1993, *Onipchenko s. n.* (MW); Zelenchuk district, Arkhyz, Abishira-Akhuba Ridge, 43°33'N, 41°16'E, 15 Jul 1981, *Zernov 6527* (MW). Kuban: shore of Kara-gel Lake, 43°26'N, 41°44'E, 1 Jul 1907, *Endaurova s. n.* (LE).

Notes—*Trisetum rigidum* is the most polymorphic taxon of the section and displays great morphological variation throughout its distribution area. The size, as well as the degree of indumentum of the leaf blades and leaf sheaths of this species, is a quite variable character.

Boissier (1846) named some small specimens from southwest Iran as *Avena daenesis*. Chrtek (1968) described an infraspecific taxon from the Demavand Mountains from northern Iran and named it *T. rigidum* subsp. *demavandense*

Chrtek; it was separated from *T. rigidum* s. s. for its smaller size ((8)10–20(–38) cm tall), congested panicles, and larger paleas ((5–)6–7.5 mm long). However, the studied specimens of *T. rigidum* are extremely variable in size (15.5–60 cm tall), as previously noted, and the paleas ((4–)4.5–6(–6.6) mm long) do not differ significantly from those of *T. rigidum* subsp. *demavandense*. In specimens from the Elburz area and Demavand Mountains, size variability also occurs, including the type material of *T. rigidum* subsp. *demavandense* (*T. rigidum* f. *minor* in sched.). The easternmost specimens of *T. rigidum* studied are those collected by Haradjian from the Akher-Dagh Mountains (*Haradjian s. n.* (B-100526547) and *Haradjian 1619* (S)), which are very similar to those from the Demavand Mountains. As previously noted, the size has proved to be a variable character throughout the whole range of the species and has no taxonomic value. For this reason, the smaller specimens have been considered as synonyms of *T. rigidum*.

Chrtek (1968) described *Trisetum persicum* Chrtek from Luristan, in Southwestern Iran. The main characters used to separate this species are stronger panicles and short rachilla indumentum relative to lemma length. *Trisetum persicum* has lemmas that are 8.7 mm long and rachilla hairs that are 3.4–3.7 mm long, while *T. rigidum* has lemmas that are (5.3–)6.4–8.2(–9.3) mm long and rachilla hairs that are (3.2–)4–4.7(–5.7) mm long. It is important to note the morphological distinctiveness of the specimen collected by *Archibald 2984* (K) in Eastern Iran (the Bakhtiari region) with regard to the type of *T. persicum*, which has straight and pubescent leaf blades with hairy margins and spikelets that are 8 mm long. Although these characters are distinctive, they fall well within their variation range in the species, and therefore we consider *T. persicum* to be a synonym of *T. rigidum*.

Trisetum rigidum var. *teberdense* Litv. has taller culms, wider leaves with hairs along the margins, and larger spikelets than *T. rigidum* subsp. *rigidum*. Kharadze (1938) combined it at the specific level, and after Tzvelev (1971), it has been considered a subspecies. *Trisetum rigidum* subsp. *teberdense* specimens have top leaf blades that are (2.6–)3.3–5.7(–6.4) mm wide and pilose along the margins, whereas the studied specimens of *T. rigidum* subsp. *rigidum* have top leaf blades that are (1–)1.8–3(–5.6) mm wide, abaxially and adaxially glabrous, and sometimes slightly pubescent, with short hairs along the margins. Because of that, we also consider it a subspecies of *T. rigidum*. Moreover, those specimens considered *T. teberdense* present similarities in the disposition of the leaves (parallel to the culm) with *T. buschianum* subsp. *buschianum*, which are more or less pubescent and with hairy margins; the rest of the characters of the panicle and, more precisely, those of the rest of the spikelets (ratio lower glume/upper glume, callus indumentum, etc.) are the same as in *T. rigidum*.

Owing to the polymorphism of this species, Kharadze (1938) described a new variety, *T. teberdense* var. *brevifolium*, here included as synonym of *Trisetum rigidum* subsp. *rigidum*. We have only been able to check photos of two of the syntypes. Kharadze's illustration (1938) shows similar traits in the glumes and callus hairs for both taxa. The habit does not differ significantly from specimens of *T. buschianum* subsp. *transcaucasicum*, with short top leaf blades, and ovate to elliptic-oblong and purplish panicles, but with almost glabrous leaves, and hairs only along the margin as in *T. rigidum* subsp. *teberdense*. Further, more detailed studies are needed to verify the taxonomic value of this variety.



FIG. 8. *Trisetum rigidum* subsp. *rigidum*. Specimen with proliferating spikelets, as a possible pseudoviviparous mechanism (Alexeenko 5623, LE).

The tendency of this species to vegetative propagation (f. *vivipara* in sched.), with the transformation of floral bracts into true leaves, is noticeable in the specimens collected by Alexeenko 5623 (LE) (Fig. 8).

5. *TRISETUM BUSCHIANUM* Seregin, Bot. Mat. (Leningrad) 21: 51. 1961.—TYPE: RUSSIA. Kabardino-Balkar Republic, Besengijskij Czerek, pr. fluminis Besenga, 43°07'N, 43°08'E, 10 Jul 1958, R.M. Seregin s. n. (holotype, LE!; isotype, PGFA).

Herbs (10.6–)17.2–28.7(–35) cm tall, not or loosely tufted, short rhizomatous or with stoloniferous rhizomes, culms (0.4–)0.6–0.8(–1.2) mm diam, glabrous; nodes (3–)4–6(–8), separated along the culm or concentrated in lower part, enclosed or not by the sheaths, glabrous. Basal leaf sheaths pubescent to densely pubescent, rarely glabrous, with hairs 0.3–0.7(–1) mm long, yellowish to brownish, sometimes greenish; basal leaf blades (1–)2.5–3.5(–4.7) cm long \times (1.9–)2.3–3.2(–5.2) mm wide, flat, sometimes convolute or inrolled, pubescent to densely pubescent abaxially and adaxially, margins with hairs 0.1–0.8(–1.5) mm long, greenish to greyish; top culm leaf sheaths (3–)4.6–7.6(–10) cm long, shorter or longer than the internodes, glabrous, very rarely with hairs on the upper part, without cilia; top culm leaf blades (1.3–)1.8–5.7(–8) cm long \times (1.8–)2.5–3.4(–5.2) mm wide, flat, sometimes conduplicate, parallel or perpendicular to the culm, glabrous to slightly pubescent adaxially and abaxially, margins with hairs (0.05–)0.1–1(–1.3) mm long, greenish to greyish; inner collar region glabrous, margins with hairs (0.6–)0.9–1.3(–1.8) mm long; ligules (1.2–)1.5–2.1(–3) mm long, lacinate, rarely denticulate, glabrous, sometimes puberulous on the apex, rarely on the surface, with hairs 0.2–0.4(–1.2) mm long. Basal node of the panicle glabrous. Panicles (3.4–)4–7(–8.6) cm long \times (1.3–)1.7–2.5(–3.4) cm wide, elliptic to oblong or ovate in outline, rarely lanceolate, lax to slightly dense; rachis glabrous to slightly pubescent, with hairs up to 0.1 mm long; longest basal branches (0.5–)0.8–1.3(–2.6) cm. Spikelets (5.5–)6.8–7.5(–8.5) mm long \times (1.7–)2.7–4.3(–5) mm wide, 2–3-flowered; pedicels (1.5–)2–2.8(–4.7) mm long, glabrous to slightly pubescent, with hairs up to 0.1 mm long. Glumes unequal to subequal (ratio lower glume length/upper glume length = (0.69–)0.72–0.86(–0.94)); lower glume (4–)4.7–5.5(–6.2) mm long \times (0.8–)1–1.4(–1.8) mm wide, narrowly elliptic to narrowly lanceolate (ratio lower glume width/lower glume length = (0.15–)0.21–0.29(–0.31)), acuminate, sometimes acute or long acuminate, 1–2(–3)-nerved, glabrous, usually with hairs 0.05(–0.2) mm long on the upper part and margins, greenish to purplish; upper glume (5.2–)5.8–6.7(–7.1) mm long \times (1.4–)1.8–2(–2.2) mm wide, narrowly elliptic to oblong, rarely lanceolate (ratio upper glume width/upper glume length = (0.21–)0.26–0.32(–0.38)), acuminate, sometimes long acuminate or acute, 3-nerved, glabrous, with very short hairs up to 0.05(–0.2) mm long from the middle to the upper part of the central nerve and upper part of the margins, greenish to purplish; rachilla segments between first and second floret 1–1.3(–1.6) mm long, with hairs (2.3–)3–3.6(–4.2) mm long; rachilla segments to sterile floret (0.6–)1.4–1.8(–2.3) mm long, with hairs (1.3–)1.7–2.3(–2.7) mm long. Lemmas (4.7–)5.6–6.1(–6.5) mm long \times (0.8–)1–1.4(–1.8) mm wide, elliptic to oblong or broadly lanceolate, sometimes narrowly elliptic or narrowly lanceolate (ratio lemma width/lemma length = (0.18–)0.23–0.28(–0.33)), scabridulous, sometimes glabrous, with hairs up to 0.1(–0.3) mm long on the apex and margins, greenish, sometimes yellowish, surrounded by purple; apical teeth (0.1–)0.3–0.5(–0.9) mm long, with aristules (0.1–)0.4–0.6(–1) mm long; awn (5–)5.6–6.8(–7.8) mm long, inserted (2–)2.5–3.1(–3.3) mm from the base (ratio awn insertion from the base length/lemma length = (0.36–)0.43–0.51(–0.53)), geniculate near the base, rarely straight, not or slightly recurved to twisted, with adpressed hairs up to 0.1 mm long; callus 0.2–0.4 mm long, elliptic, sometimes oblong, with hairs (0.5–)1.2–2(–2.3) mm long. Paleas (4–)4.4–5.3(–6) mm long \times (0.8–)1–1.4 mm wide (ratio palea length/lemma

length = (0.7–)0.78–0.91(–0.94)), elliptic, sometimes slightly oblanceolate, rarely narrowly elliptic or oblong, with hairs on the upper part of the outer edges; keels with short hairs from the middle to the upper part, ending in teeth 0.2–0.4(–0.5) mm long. Lodicules (0.4–)0.6–0.8(–1) mm long. Anthers (1.6–)2–2.5(–2.7) mm long. Ovary 0.5–0.7(–1) mm long, glabrous, sometimes with hairs 0.1–0.4 mm long on the apex. Caryopsis 1.8–2.2 mm long \times 0.4–0.6 mm wide.

a. subsp. *BUSCHIANUM*

T. rigidum var. *molle* Somm. & Levier, Trudy Imp. S.-Peterburgsk. Bot. Sada 16: 444. 1900.—TYPE: RUSSIA. Karachayevo-Cherkesiya, monte Elbrus, flumen Kükürtli, 43°21'N, 42°22'E, 10 Sep 1890, C.P.S. *Sommier & E. Levier* 1359 (lectotype, here designated, FI!; isolectotypes, G-442508!, LE!).

T. transcaucasicum var. *ciliatifolium* Seregin, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 21: 55. 1961.—TYPE: RUSSIA. Digorsky District, Karagom river, 43°9'N, 43°39'E, 11 Aug 1925, *E. Busch & N. Busch* 37 (holotype, LE!).

Herbs (17–)23.7–30.7(–35) cm tall, culm diam 0.6–0.9(–1.2) mm; nodes 4–7, separated along the culm, mostly not enclosed by the sheaths. Basal leaf sheaths pubescent to densely pubescent, with hairs 0.4–0.8(–1) mm long; basal leaf blades (1.3–)2.7–3.4(–4.7) cm long \times 2.3–3.3(–4.7) mm wide, flat, sometimes convolute when dried, pubescent to densely pubescent adaxially and abaxially, margins with hairs 0.6–1(–1.5) mm long; top culm leaf sheaths (6–)6.7–9(–10) cm long, shorter than the internodes; top culm leaf blades (1.8–)2.5–5.7(–8) cm long \times (2.5–)3–4.1(–5.2) mm wide, parallel to the culm, sometimes enclosing it or reaching to the panicle, glabrous to slightly pubescent adaxially and abaxially, with hairs (0.3–)0.7–1.1(–1.3) mm long, also on the margins; ligules (1.4–)1.6–2.1(–2.7) mm long, lacinate, rarely denticulate, glabrous, puberulous on the apex and rarely on the surface with hairs 0.2–0.6(–1.2) mm long. Panicles (4.2–)5.2–7.4(–8.6) cm long \times 1.3–2.6(–3.4) cm wide, oblong to elliptic in outline, slightly dense; longest basal branches (0.6–)0.7–1.3(–1.7) cm. Lower glume acuminate, sometimes acute, 1(2–3)-nerved, greenish surrounded by purplish on the laterals; upper glume acuminate, sometimes acute, greenish surrounded by purplish. Lemma apical teeth (0.3–)0.4–0.6(–0.9) mm long, with aristules (0.1–)0.3–0.6(–0.7) mm long; awn 5–6(–7.2) mm long, slightly or not recurved and more or less geniculate near the base, rarely straight; callus with hairs (0.5–)1–1.8(–2) mm long. Lodicules with apex bilobate. Anthers (2–)2.3–2.7 mm long. Figure 9.

Chromosome Number—Unknown.

Phenology—Flowering and fruiting from June to September.

Distribution and Habitat—Endemic to West and Central Caucasus; at 1,980–2,900 m elevation; on stony slopes and moraines. Figure 10.

Specimens Examined—GEORGIA. Mtskheta-Mtianeti: Pirikiti Khevsureti, v. Arkhoti Netkhecho, 42°35'N, 44°51'E, 19 Jul 1938, *Grigorashvili s. n.* (MA); Kasbek, 17 Sep, *Meyer* 60 (LE); GroBer Kaukasus, Talweitung des T'ruso-Tales, westlich der Schluchtstrecke, 2.7–3.4 km W bis WNW Zemo Ok'rokana oder 7.2–7.9 km WNW Kobi, 42°35'N, 44°25'E, 23 Jul 1997, *Schönsweetter s. n. & Tribsch* (WU).

RUSSIA. Kabardino-Balkar Republic: Sukan River, between Aylangentash and Sukan-bashi-tsyfi natural landmarks, 27 Jul 1931, *Bush s. n. & Bush* (LE); Sukan, 30 Jun 1927, *Bush s. n. & Bush* (LE); Sukan, Altulany-bau-bashi, south slope between Ogary-vtsek and Kysyrtsy-kaya, 23 Jul 1931, *Bush s. n. & Bush* (LE); upwards of Mystilyar-agach, 5 Jul 1913, *Bush s. n. & Bush* (LE); adjoining Ullu-Guluku plane, 43°4'N, 43°15'E, 10 Jul 1913, *Bush s. n. & Bush*

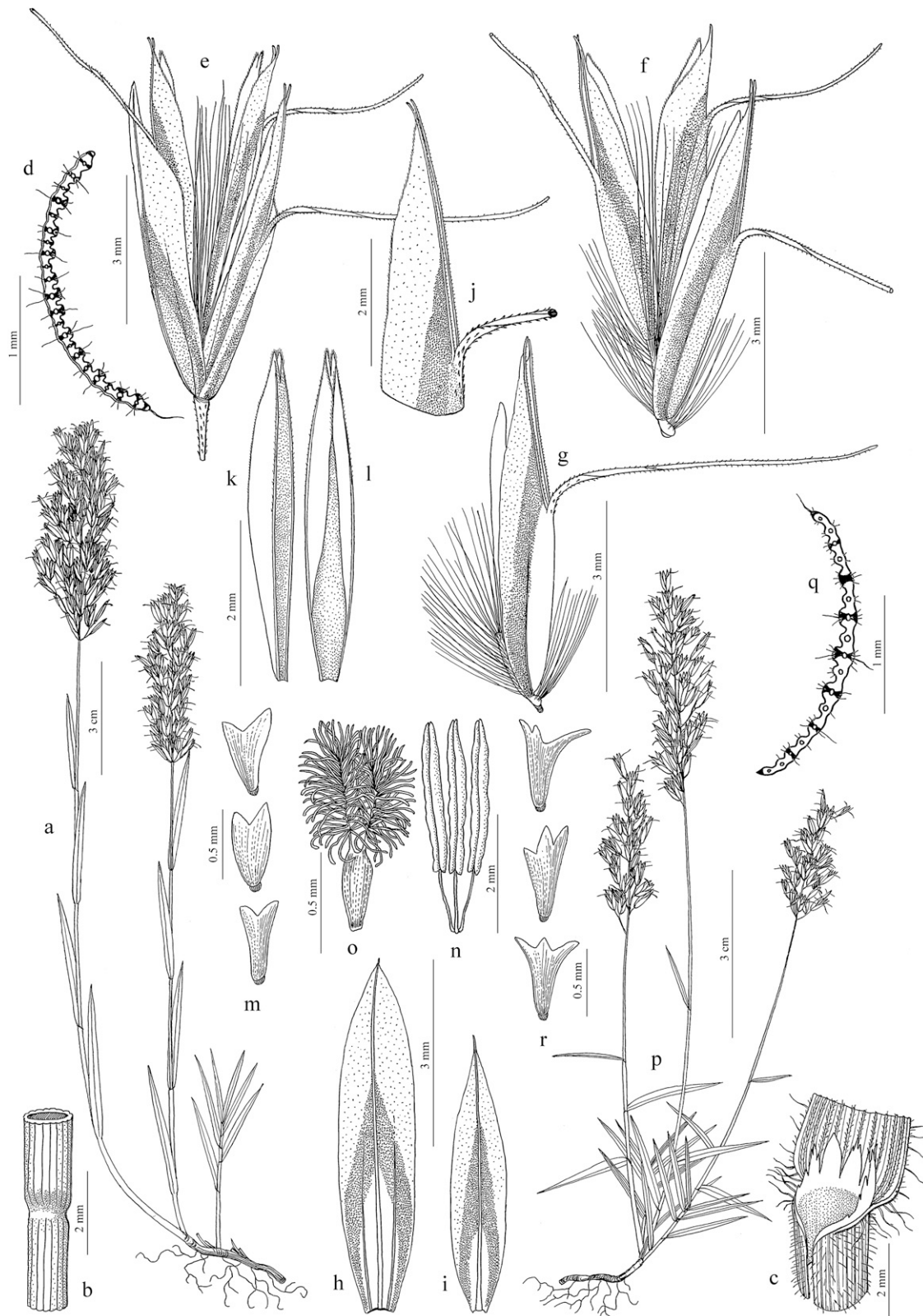


FIG. 9. A–O. *Trisetum buschianum* subsp. *buschianum*. A. Habit. B. Portions of the culm and node. C. Sheath, ligule, and portion of the blade. D. Transverse section of leaf blade. E. Spikelet. F. Florets. G. Floret. H. First glume, dorsal view. I. Second glume, dorsal view. J. Lemma, upper part, lateral view. K. Palea, dorsal view. L. Palea, ventral view. M. Lodicules. N. Stamens. O. Pistil. P–R. *T. buschianum* subsp. *transcaucasicum*. P. Habit. Q. Transverse section of leaf blade. R. Lodicules. (*Lipky s. n.*, LE, A; *Wisniewski s. n.*, K, B–O; *Bush & Bush 11*, *Meyer s. n.*, LE, M; *Karjagin s. n.*, HBG, P–R; *Meyer 59*, LE, R).

(LE); Shaurtu glacier, 43°7'N, 43°1'E, 25 Jul 1913, *Bush s. n.* & *Bush* (LE); Bezengi glacier, 43°6'N, 43°9'E, 5 Aug 1913, *Bush s. n.* & *Bush* (LE); Bezengi glacier, 43°6'N, 43°9'E, 14 Aug 1911, *Bush s. n.* & *Bush* (LE); lower edge of Bezengi glacier, 43°6'N, 43°9'E, 4 Jul 1913, *Bush s. n.* & *Bush* (LE); Bezengi

glacier, on the left bank of the Bezengi River, 43°6'N, 43°9'E, 6 Jul 1913, *Bush s. n.* & *Bush* (LE); by Bezengi glacier, 43°6'N, 43°9'E, 25 Jul 1892, *Bush s. n.* & *Bush* (LE); Sukan, moraines of Sukan-bashi-ullu-chiran glacier, 30 Jun 1927, *Bush s. n.* & *Bush* (LE); by the left side of Mizhirgi glacier, 43°3'N, 43°10'E,

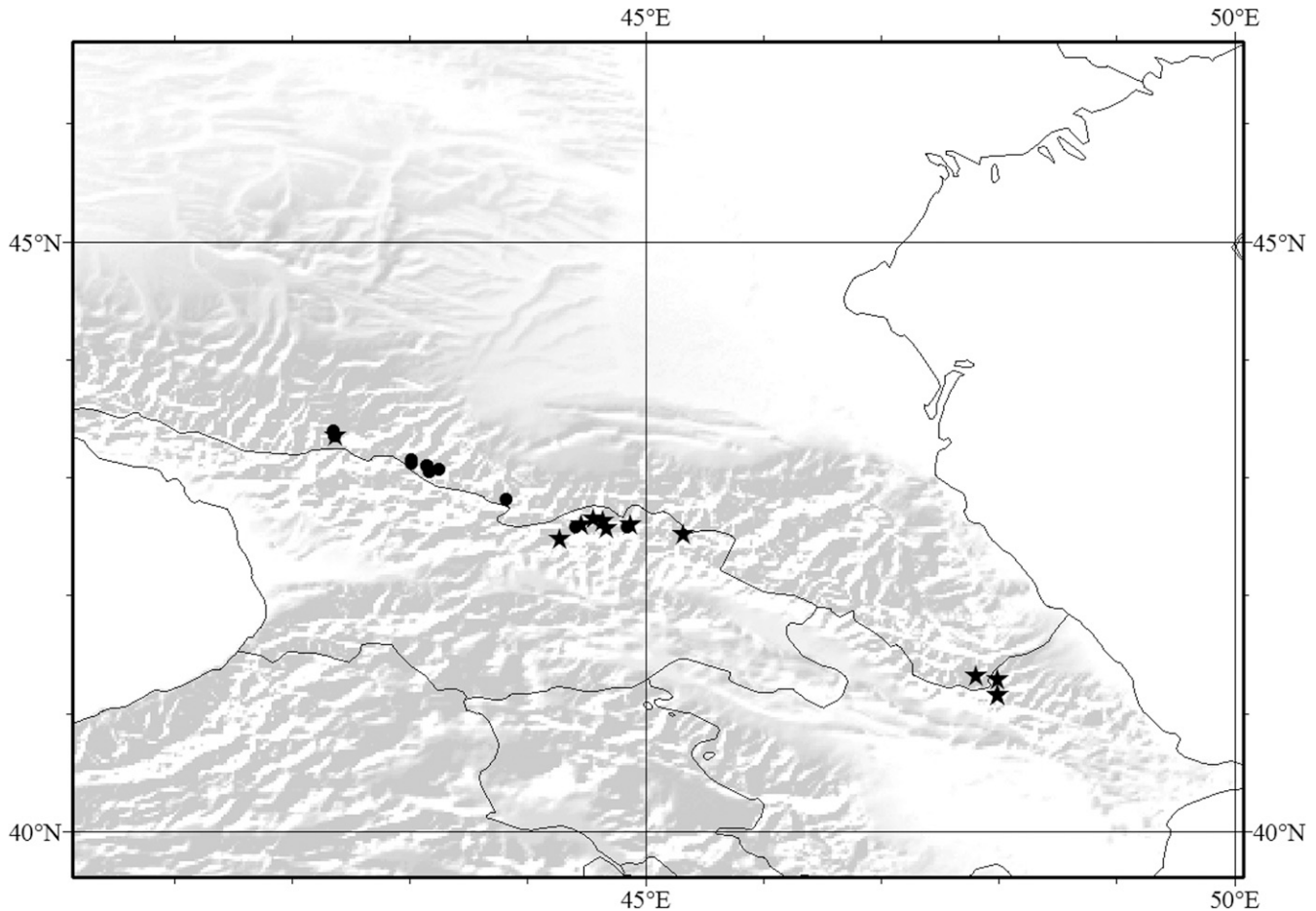


FIG. 10. Distribution of *Trisetum buschianum* subsp. *buschianum* (dots) and *T. buschianum* subsp. *transcausicum* (stars).

8 Jul 1913, *Bush s. n.* & *Bush* (LE); Kulak glacier, upwards of Chegem, 43°9'N, 43°1'E, 27 Jul 1913, *Bush s. n.* & *Bush* (LE); Mizhirgi glacier, 43°3'N, 43°10'E, 16 Aug 1911, *Bush s. n.* & *Bush* (LE). Karachay-Cherkess Republic: glacier Kukurtlu, 43°21'N, 42°22'E, 13 Aug 1961, *Macha s. n.* (MW); western foothills of Mount Elbrus, River basin Bitik-tyubyu, near the mineral springs, 43°24'N, 42°21'E, 31 Jul 2008, *Zernov 6934* (MW); Karachai district, River Gorge Kukurtlu, left side, about 200 m from the edge Pednika, 43°21'N, 42°22'E, 3 Aug 2009, *Zernov 7263* (MW). North Ossetia: Digoria, the Sanguti glacier, 42°49'N, 43°49'E, 12 Jul 1914, *Gladkov 22* (LE).

b. subsp. *TRANSCAUCASICUM* (Seredin) Mosul., *Zametki Sist. Geogr. Rast.* 42: 34. 1991. *Trisetum transcausicum* Seredin, *Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R.* 21: 54. 1961.—TYPE: AZERBAIJAN. Quba District, Tufan Dag Mountain, 41°09'N, 47°59'E, 13 Aug 1935, *J. Karjagin s. n.* (holotype: LE!; isotypes: GH!, MW!).

T. buschianum var. *kasbeghi* Seredin, *Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R.* 21: 53. 1961.—TYPE: GEORGIA. Mount Kazbek, near Devdorak glacier, 42°41'N, 44°31'E, 3 Jul 1916, *P. Krylov & E. Steinberg s. n.* (holotype: LE!).

T. rigidum var. *ovale* Somm. & Levier, *Trudy Imp. S.-Peterburgsk. Bot. Sada* 16: 444. 1900.—TYPE: RUSSIA. Karachayevo-Cherkesiya, monte Elbrus, flumen Kükürtli, 43°20'N, 42°23'E, 10 Sep 1890, *C.P.S. Sommier & E. Levier 1359* (lectotype, here designated, FI!; isolectotype: LE!).

Herbs (10.6–)13.6–18.6(–22.6) cm tall, culm diam 0.4–0.7 mm; nodes (3–)4–5(–8), concentrated in lower part of the culm,

enclosed by the sheaths. Basal leaf sheaths densely pubescent with hairs 0.3–0.5 mm long, rarely glabrous; basal leaf blades (1–)2.3–3(–3.4) cm long × (1.9–)2.1–2.9(–3.8) mm wide, flat, sometimes inrolled when dried, pubescent to densely pubescent abaxially and adaxially, margins with hairs (0.1–)0.2–0.6(–0.7) mm long, greyish to greenish; top culm leaf sheaths (3–)3.6–6.2(–7.3) cm long, longer than the internodes, sometimes shorter; top culm leafblades (1.3)1.5–2.1(2.6) cm long × (–1.9)2.1–2.7(–3.4) mm wide, sometimes conduplicate, perpendicular or parallel to the culm, glabrous to slightly pubescent abaxially and adaxially, margins with hairs (0.05–)0.1–0.6(–1.3) mm long; ligules (1.2–)1.7–2(–3) mm long, lacinate, glabrous, rarely with few hairs up to 0.3 mm on the apex. Panicle (3.4–)3.6–4.6(–7.1) cm long × (1.6–)1.8–2.5 cm wide, ovate to elliptic in outline, rarely lanceolate, lax to slightly dense; longest basal branches (0.5–)0.8–1.2(–2.6) cm. Lower glume acuminate, sometimes long acuminate or acute, 1(2)-nerved, dark purple to purplish, rarely greenish, laterals and upper part hyaline or yellowish; upper glume acuminate, sometimes long acuminate, rarely acute, greenish or purplish on the central part, laterals hyaline or yellowish. Lemma apical teeth (0.1–)0.2–0.4(–0.5) mm long, with aristules (0.2–)0.5–0.8(–1) mm long; awn (5.4–)6–7.3(–7.8) mm long, geniculate and twisted near the base; callus with hairs (1.2–)1.6–2.2(–2.3) mm long. Lodicules apex irregular or regular 2–4-lobed, sometimes with one of them lateral. Anthers (1.6–)2–2.3(–2.6) mm long. Figure 9.

Chromosome Number—Unknown.

Phenology—Flowering and fruiting from July to September.

Distribution and Habitat—Endemic to the Central and Eastern part of the Caucasus; at 1,740–3,250 m elevation; in alluvial rocks and schists. Figure 10.

Specimens Examined—AZERBAIJAN. Baku: Kuba district, mons Tufan-Dag, 41°9'N, 47°59'E, 6 Aug 1935, *Karjagin s. n.* (B, GH, HBG); 6 Aug 1935, *Karjagin s. n.* (HBG); 31 Jul 1830, *Meyer s. n.* (LE); in m. Shach-Dagh, Buldurgan, 41°17'N, 47°59'E, 23 Aug 1929, *Sachokjia s. n.* (LE).

GEORGIA. Kakheti: Großer Kaukasus, Zentralteil, Tush-Psav-Khevsureti, Omalo, im Bereich der Quellzuflüsse des Pirikita Alazani östlich des Azunta-Passes, 42°31'N, 45°19'E, 8 Sep 2009, *Ziendorf 25658 & Gerth* (JE). Mtskheta-Mtianeti: Ermani area, Fidar Volcano, 42°29'N, 44°16'E, 22 Aug 1940, *Dolukhanov s. n. & Mandenova* (LE); Greater Caucasus, Khevi, Kazbegi, Karkucha, 42°34'N, 44°40'E, 25 Aug 1997, *Gagnidze s. n. & al.* (W); Pirikiti Khevsureti, gorge Arhie, bottom glacier Kidegana, 42°36'N, 44°52'E, Jul 1937, *Grigoraschvili s. n.* (MA); Großer Kaukasus, linksseitige Alluvionen des Flusses Terek zwischen Ach'khoti, P'anшет' i und Kazbegi, 42°38'N, 44°38'E, 23 Jul 1997, *Schönschwetter s. n. & Tribsch* (WU); *Schneeweiß s. n.* (WU); Großer Kaukasus T'ruso-Schlucht 0.5–2.7 km WNW Zemo Ok'rokana, d.i. ca. 5–7.2 km WNW Kobi, 42°36'N, 44°27'E, 23 Jul 1997, *Schönschwetter s. n. & Tribsch* (WU); Großer Kaukasus, Zentralteil, Kasbek-(Mkinvarzveri) Massiv westlich Kasbegi, Aufstieg über die Tsminda Sameba, am Fuß des SO-Gletschers am Kasbek, 42°39'N, 44°33'E, 6 Aug 2007, *Ziendorf 24247* (JE).

RUSSIA. Dagestan: Dokuzparinsky district, Gora Shalbudzag, 41°19'N, 47°48'E, 25 Sep 2006, *Kotseruba 56* (LE).

Notes—*Trisetum buschianum* is close to *T. rigidum*, having smaller panicles, usually dark purple, with lower and upper glumes similar in length, longer callus hairs and smaller ligules. *Trisetum rigidum* also has longer hairs on the rachilla segments between the first and second floret than *Trisetum buschianum* ((3.2–)4–4.7(–5.7) and (2.3–)3–3.6(–4.2) mm long, respectively) and longer lemmas ((5.3–)6.4–8.2(–9.3) and 5.6–6.2 mm long, respectively).

We have accepted the criterion of Mosulishvili (1991), and recognize *T. buschianum* and *T. transcaucasicum* at the sub-specific level. Tzvelev (1976) commented about the closeness of these species and hinted that perhaps they should be treated as a subspecies. According to Du Riezt (1930), the subspecies of a species are commonly reciprocally intergrading, and their taxonomical delimitation is thus infinitely more arbitrary than that of the species; Stuessy et al. (2014) recognized geography as a fundamental component for recognition of infraspecific taxa. *Trisetum buschianum* subsp. *buschianum* lives in the central Caucasus, and *T. buschianum* subsp. *transcaucasicum* in the central and eastern parts. These two subspecies overlap only in the central part, where there are transitional taxa such as *T. buschianum* var. *kasbeghi* and *T. transcaucasicum* var. *ciliatifolium*. *Trisetum buschianum* subsp. *transcaucasicum* is smaller and has shorter top culm leaf blades than those of subsp. *buschianum*. The disposition of leaves is normally parallel to the culm and sometimes the leaves reach the panicle in subsp. *buschianum*, whereas the basal leaves are always perpendicular in subsp. *transcaucasicum*. *Trisetum buschianum* subsp. *transcaucasicum* has ovate to elliptic panicles, which are oblong to elliptic in subsp. *buschianum*.

6. TRisetum VELUTINUM Boiss., Elench. Pl. Nov.: 88. 1838. *Avena velutina* (Boiss.) Nyman, Consp. Fl. Eur.: 812. 1882. *Trisetaria velutina* (Boiss.) Paunero, Anales Jard. Bot. Madrid 9: 512. 1950.—TYPE: SPAIN. Granada, Sierra Nevada, 37°03'N, 3°29'W, Aug 1837, *E. Boissier 187* (lectotype, designated by Burdet et al. (1981: 580), G-176291!; isolectotypes: B-100250154!, G-176292!, G-176293!, G-176294!, G-176295!, G-176296!, G-176297!, G-439749!, GH!, GOET-6971!, HI!, JE-18835!, K-808725!, K-808726!, LE!, M-210840!, MA-8011!, NY!, P-2222135!, P-2222141!, P-2222145!, P-2222149!, S-12–12490!, S-13–33131!, SI-30137!, W-1889–0242141!).

T. cavanillesianum Borja & Font Quer, Anales Jard. Bot. Madrid 6: 494. 1946. *Trisetum velutinum* subsp. *cavanillesianum* (Borja & Font Quer) O. Bolòs & Vigo, Fl. Països Catalans 4: 476. 2001.—TYPE: SPAIN. Valencia, sierra de la Murta, cumbres del “Cavall Vernal”, 39°9'N, 0°21'W, *J. Borja s. n.* (lectotype, here designated, MA-8010!).

Herbs (16–)25.5–51(–68) cm tall, not or loosely tufted, shortly rhizomatous or with stoloniferous rhizomes, culms (0.25–)0.4–0.8(–1) mm diam, glabrous, rarely slightly puberulous on the upper part, with hairs 0.1 mm long; nodes (4–)6.5–10(–11), more or less concentrated in lower part of the culm, enclosed by the sheaths except the upper ones, slightly puberulous or glabrous. Basal leaf sheaths densely pubescent, with hairs (0.3–)0.8–1.2(–1.5) mm long, greyish to greenish or yellowish to brownish; basal leaf blades (2.8–)3.3–6.6(–7.4) cm long × (1.3–)2.3–4(–4.8) mm wide, flat to slightly inrolled when dried, densely pubescent abaxially and adaxially, usually longer adaxially, with hairs 0.1–1(–1.2) mm long, greyish to greenish; top culm leaf sheaths (4.8–)7.2–14(–17) cm long, shorter than the internodes, sometimes longer, glabrous to puberulous, with adpressed hairs, normally with cilia along the margins; top culm leaf blades (0.3–)1.5–3.4(–4) cm long × (1–)1.2–2(–2.2) mm wide, inrolled along the margins, sometimes parallel to the culm, densely pubescent abaxially, from glabrous to densely pubescent adaxially, with hairs up to 0.2 mm long, greenish to greyish; inner collar region glabrous or with the same indumentum as the leaf blade, sometimes with hairs 0.1(–0.2) mm long along the margins; ligules (0.5–)1.4–2(–2.5) mm long, lacinate to slightly lacinate, slightly pubescent to pubescent, usually densely on the apex, with hairs (0.05–)0.1–0.4(–0.6) mm long. Basal node of the panicle glabrous or very slightly puberulous, with hairs less than 0.1 mm long. Panicles (4–)5.9–10.5(–15) cm long × (0.7–)1–2.6(–3.6) cm wide, narrowly elliptic to narrowly or broadly lanceolate in outline, sometimes linear, lax to slightly dense with most rachis internodes plainly visible; rachis glabrous to slightly pubescent, with hairs up to 0.1 mm long; longest basal branches (0.4–)0.5–1.4(–3) cm. Spikelets (5–)6.4–8.5 mm long × (1–)2–2.6(–3.2) mm wide, 2(3)-flowered; pedicels (1.7–)2.3–4(–6.5) mm long, pubescent to slightly pubescent, rarely glabrous, with hairs up to 0.1 mm long. Glumes unequal to subequal (ratio lower glume length/upper glume length = (0.71–)0.78–0.8(–0.85)); lower glume (3.5–)4.6–5.6(–6.2) mm long × (0.7–)1–1.1(–1.4) mm wide, narrowly lanceolate, sometimes broadly lanceolate, rarely narrowly elliptic (ratio lower glume width/lower glume length = (0.11–)0.17–0.23(–0.29)), acuminate, sometimes long acuminate, 1(3)-nerved, glabrous, with very short hairs on the midrib up to 0.08 mm long, sometimes on the upper part of the margins, greenish to yellowish on the central part, laterals and upper part hyaline; upper glume (4–)5.7–7.2(–8) mm long × (1.4–)1.6–1.7(–2) mm wide, oblong to lanceolate or narrowly elliptic to narrowly lanceolate, rarely slightly oblanceolate or elliptic (ratio upper glume width/upper glume length = (0.2–)0.25–0.28(–0.34)), acuminate, usually acuminate, 3-nerved, glabrous, with very short hairs up to 0.05 mm long from the middle to the upper part of the central nerve and upper part of the margins, greenish to yellowish on the central basal part, usually also the central nerve, laterals and upper part hyaline or yellowish; rachilla segments between first and second floret 1–1.8 mm long, with hairs (0.3–)0.7–1.6(–2.4) mm long; rachilla segments to sterile floret (0.8–)1.7–2.4(–3) mm long, with

hairs (0.3–)0.6–1(–1.5) mm long. Lemmas (4–)5.4–6.6(–7.8) mm long \times (0.7–)1–1.1(–1.4) mm wide, narrowly elliptic or elliptic to narrowly lanceolate, rarely oblong or slightly oblanceolate (ratio lemma width/lemma length = (0.14–)0.19–0.27(–0.37)), glabrous to strigulose, yellowish to greenish; apical teeth 0.2–0.4(–0.9) mm long, with aristules (0–)0.3–0.8(–2.5) mm long; awn (5–)6–7.6(–9.3) mm long, inserted (1.3–)2–2.6(–5) mm from the base (ratio awn insertion from the base length/lemma length = (0.25–)0.34–0.43(–0.64)), slightly twisted and more or less geniculate near the base, rarely straight, with very short adpressed hairs 0.03 mm long; callus (0.1–)0.2–0.3(–0.4) mm long, elliptic to orbicular or oblong, with hairs 0.25–0.5(–0.7) mm long. Paleas (2.4–)4.2–5.1(–6.1) mm long \times (0.6–)0.75–1.5 mm wide (ratio palea length/lemma length = (0.36–)0.76–0.83(–0.89)), narrowly elliptic, sometimes elliptic, slightly hairy on the upper part of the outer edges; keels with short hairs mostly on the apex, ending in teeth (0.1–)0.3–0.4 mm long. Lodicules (0.4–)0.5–1(–1.6) mm long, with apex irregularly dentate or 2-lobed, rarely with scattered hairs. Anthers (1.6–)2–3.1(–4) mm long. Ovary (0.4–)0.6–1.2(–1.5) mm long, glabrous, rarely with some hairs on the apex up to 0.2 mm long. Caryopsis 1.9–2 mm long \times 0.5–0.6 mm wide. Figure 11.

Chromosome Number— $n = 14$ (Devesa & Romero Zarco 1984).

Phenology—Flowering from June to August.

Distribution and Habitat—Endemic to southeastern and eastern Spain; at 400–2,280 m elevation; in fissures of limestones and dolomitic sand soils, in open places. Figure 3.

Specimens Examined—SPAIN: Albacete: Ayna, mirador sobre la piscina, 38°33'N, 2°3'W, 20 Jul 1984, *Luceño s. n.* (MA); barrancos del río Mundo, Ayna, 38°33'N, 2°4'W, 11 Jul 1971, *Rivas Goday s. n. & al.* (VAL). Alicante: Quatretonda, Serra de Serrella, Les Frares, 38°42'N, 0°17'W, 30 Jun 1997, *Solanas s. n. & al.* (ABH); Sierra de la Safor, Vall de Gallinera, 38°51'N, 0°14'W, 15 Jun 1997, *Soler 7265]XS & Signes* (MA); Castell de Castells (Marina Alta), serra d'Alfaro, 38°44'N, 0°13'W, 7 Jul 1997, *Soler JXS-7339 & Signes* (VAL). Granada: Sierra Nevada, Monte Dornajo, 37°7'N, 3°26'W, 15 Jul 1851, *Bourgeau 1519* (G, GOET, K, LE, P, S); Jul 1891, *Porta 648 & Rigo* (B, FL, G, JE, K, M, MA, NY, P, S, W, WU); 30 Sep 1975, *Fernández Casas 963B* (MA); ad Dornajo et Tesoro, 37°26'N, 3°37'W, Jul 1879, *Huter 1171 & al.* (B, K, GB, L, LE, M, MPU, P, PR, WU); Sierra Nevada, pico del Tesoro, 37°5'N, 3°27'W, 14 Aug 2011, *Aedo 18599* (MA); Sierra Nevada, pico Trevenque, 37°4'N, 3°28'W, 13 Jul 1986, *Aedo s. n.* (MA); 37°4'N, 3°28'W, 25 Jul 2013, *Barberá 941 & al.* (MA); *Barberá 942 & al.* (MA); VII, *Del Campo 93* (GB, GH, H, LE, M, MA, MPU, O, P, S, W); 16 Jun 1852, *Del Campo 98* (B, L, MPU, P); 11 Jul 1990, *Wagenitz 4707 & Hellwig* (GOET, JE); Trevenque, Canal de Huenes, 37°5'N, 3°31'W, 20 Jul 1974, *Charpin s. n. & Fernández Casas* (B, C, M, MA, NY); Sierra Nevada, Alayos de Dilar, Corazón de la Sandia, 37°3'N, 3°30'W, Jul 1996, *Bruno Navarro s. n.* (GDA); Sierra Nevada, Barranco de las Víboras, 37°7'N, 3°27'W, 16 Jul 1981, *Romero C170/81* (SEV); Sierra Nevada, Hoya de la Mora, 37°5'N, 3°22'W, 28 Jul 1967, *Segura Zubizarreta s. n.* (MA); Sierra de Alfacar, 37°14'N, 3°33'W, 2 Jul 1878, *Hegelmair s. n.* (JE, P); Sierra de Jatar, 36°56'N, 3°54'W, 13 Jul 1977, *Litzler 77/765E* (MPU); Sierra Almijara, cerro del Lucero, 36°52'N, 3°53'W, 7 Aug 1978, *López 890GF* (MA); Lentegí, Sierra de Cázulas, 36°51'N, 3°47'W, 1 Jul 1978, *Martínez Parras s. n.* (MA); carretera de Murcia a 3 km del Puerto de la Mora, 37°16'N, 3°27'W, Jun 1986, *Morales s. n.* (GDA); Padul, camino de los Gudaris, 37°2'N, 3°34'W, 5 Jul 2000, *Morales s. n. & Baena* (GDA); Sierra del Manar, 37°2'N, 3°36'W, 18 Jun 1980, *Romero s. n. & Morales* (GDA); Sierra de Huator, Pico Calabozo, 37°17'N, 3°26'W, 25 Jul 1978, *Romero s. n. & Valle* (GDA); Cogollos de la Vega, proximidades a Cortijo de los Asperones, 37°18'N, 3°31'W, 17 Jul 1988, *Socorro s. n. & al.* (GDA). Málaga: Cómpeta, Sierra de Cómpeta, 36°50'N, 3°56'W, 7 Jul 1973, *Cabezudo s. n. & Valdés* (SEV); 36°50'N, 3°56'W, 7 Jul 1973, *Valdés s. n. & al.* (MA); Sierra de la Tejada, subida por Canillas del Aceituno, 36°53'N, 4°3'W, 19 Aug 1977, *López s. n.* (MA, SEV); 15 Jul 1981, *Romero s. n.* (B, BC, BCN, G, GDA, H, LE, MA, SEV, VAL, WU). Valencia: Serra de la Murta, Cavall Vernat, 39°9'N, 0°21'W, 10 Jul 1946, *Borja s. n.* (ARAN, BC, BCN, F, MA, SEV); Quatretonda, Umbría del Buixcarró, 39°0'N, 0°21'W, 12 Apr 1997, *Herrero-Borgoñón s. n.* (ABH, MA); Villalonga, Sierra de La Safor, 38°51'N, 0°15'W, 11 May 1996, *Herrero-Borgoñón s. n. & al.* (ABH); Buñol, El Fustal, 39°25'N, 0°50'W, 11 Jun

1994, *Laguna s. n.* (ABH); Buñol, Sierra de Malacara, umbría del Fresnal, 39°25'N, 0°38'W, 25 Jul 1991, *Laguna s. n.* (VAL); Fuente Umbría, Collado de Umán, Font de Roses, Buñol, 39°25'N, 0°56'W, 13 Aug 1990, *Laguna s. n. & Crespo* (VAL); Barig, 39°0'N, 0°18'W, Jun 1980, *Monsanet s. n. & Mateo* (VAL); Quatretonda, La Vall d'Albaida, ombria del Buixcarró, 39°0'N, 0°21'W, *Riera 3135* (VAL); Quatretonda (La Vall d'Albaida), els Cuderellets, 38°59'N, 0°22'W, 26 Jun 1996, *Riera 3151* (VAL); Moixent (La Costera), pr. l'Heura, 38°53'N, 0°48'W, 17 Jul 1997, *Riera 3719* (VAL); Moixent (La Costera), bc. De la Falç, 38°53'N, 0°46'W, 17 Jul 1997, *Riera 3729* (VAL); Vilallonga de la Safor, Serra de la Safor, pr. Alt de la Safor, 38°51'N, 0°15'W, 12 Jul 2001, *Riera JRV-4480 & Andrés* (VAL); Simat de Vallidigna, entre Les Foies y Mondúver, 39°1'N 0°17'W, 26 Apr 2015, *Barberá 1617 & Quintanar* (MA); Simat de Vallidigna (La Safor), Les Foies, 39°1'N, 0°17'W, 2 Aug 1990, *Soriano 0917PS* (VAL); Quatretonda, Pista Els Coralls-Pinet (La Vall d'Albaida), 38°59'N, 0°20'W, 5 Jul 1991, *Soriano 1652PS* (VAL).

Notes—This species is clearly distinguished because of its velutinous leaves. Font Quer (1946) published certain specimens from the eastern Iberian Peninsula as *Trisetum cavanillesianum*, without making any comparison with *T. velutinum*. The new species may have stood out for its smaller panicle and the general size of the plant, but *T. velutinum* is a highly variable species and we believe that *T. cavanillesianum* does not deserve any taxonomic recognition.

In *Trisetum velutinum* the formation of propagules in the inflorescence by pseudoviviparism has been observed (Pierce et al. 2003) in the specimen collected by *Barberá 1617 & Quintanar* (MA). *T. velutinum* is one of the three species of the genus with pseudoviviparism; the others are the Canarian endemic *T. tamonanteae* Marrero Rodr. & S. Scholz and *T. rigidum*. According to Marrero Rodríguez and Scholz (2013), this phenomenon becomes intensified and affects the whole inflorescence when the plants bloom in especially humid climatic conditions. This situation is common in the habitat of these species.

7. TRISETUM TAMONANTEAE Marrero Rodr. & S. Scholz, Willdenowia 43: 47, 48 Fig. 1, 49 Fig. 2. 2013.—TYPE: SPAIN. Canary Islands, Fuerteventura, Pájara, Jandía, Pico de La Zarza, 28°06'02"N, 14°21'27"W, 11 Jun 1987, *A. Marrero s. n.* (holotype: LPA-24804 (image!); isotype: B).

Herbs 19–30(–32) cm tall, densely tufted, shortly rhizomatous, culms (0.5–)0.6–0.7 mm diam, pubescent, with hairs 0.2–0.3(–0.5) mm long; nodes 5–10, separated along the culm, enclosed by the sheaths, rarely exposed, glabrous, rarely with some hairs. Basal leaf sheaths densely pubescent, rarely the oldest ones glabrous, with hairs 0.4–0.8 mm long, yellowish to brownish, rarely greyish; basal leaf blades (3.2–)4.7–9.3(–12.2) cm long \times (1.3–)1.7–3 mm wide, scattered or distichous in juvenile culms, flat, sometimes inrolled when dried, pubescent abaxially and adaxially, margins with hairs 0.2–0.5 mm long, yellowish to brownish; top culm leaf sheaths (2.6–)3.8–5.7(–6.5) cm long, longer than the internodes, sometimes shorter, pubescent to densely pubescent, without adpressed hairs and cilia along the margins; top culm leaf blades (2–)2.7–10(–14) cm long \times 2.8–4.5(–6) mm wide, flat, usually reaching or surpassing the panicle, pubescent to densely pubescent abaxially and adaxially, with adpressed and not adpressed hairs, with hairs on the margins up to 0.3 mm long, greenish to greyish, sometimes brownish; inner collar region with the same indumentum as the leaf blade, with scattered hairs 0.5–1.3 mm long along the margins; ligules (0.8–)1–1.4 mm long, lacinate to slightly lacinate, glabrous. Basal node of the panicle glabrous. Panicles 3–7.7(9.7) cm long \times (1.2)1.4–1.7(–2) cm wide, narrowly to broadly lanceolate in outline, sometimes from narrowly elliptic to oblong, slightly dense, with most rachis internodes plainly visible; rachis densely pubescent,

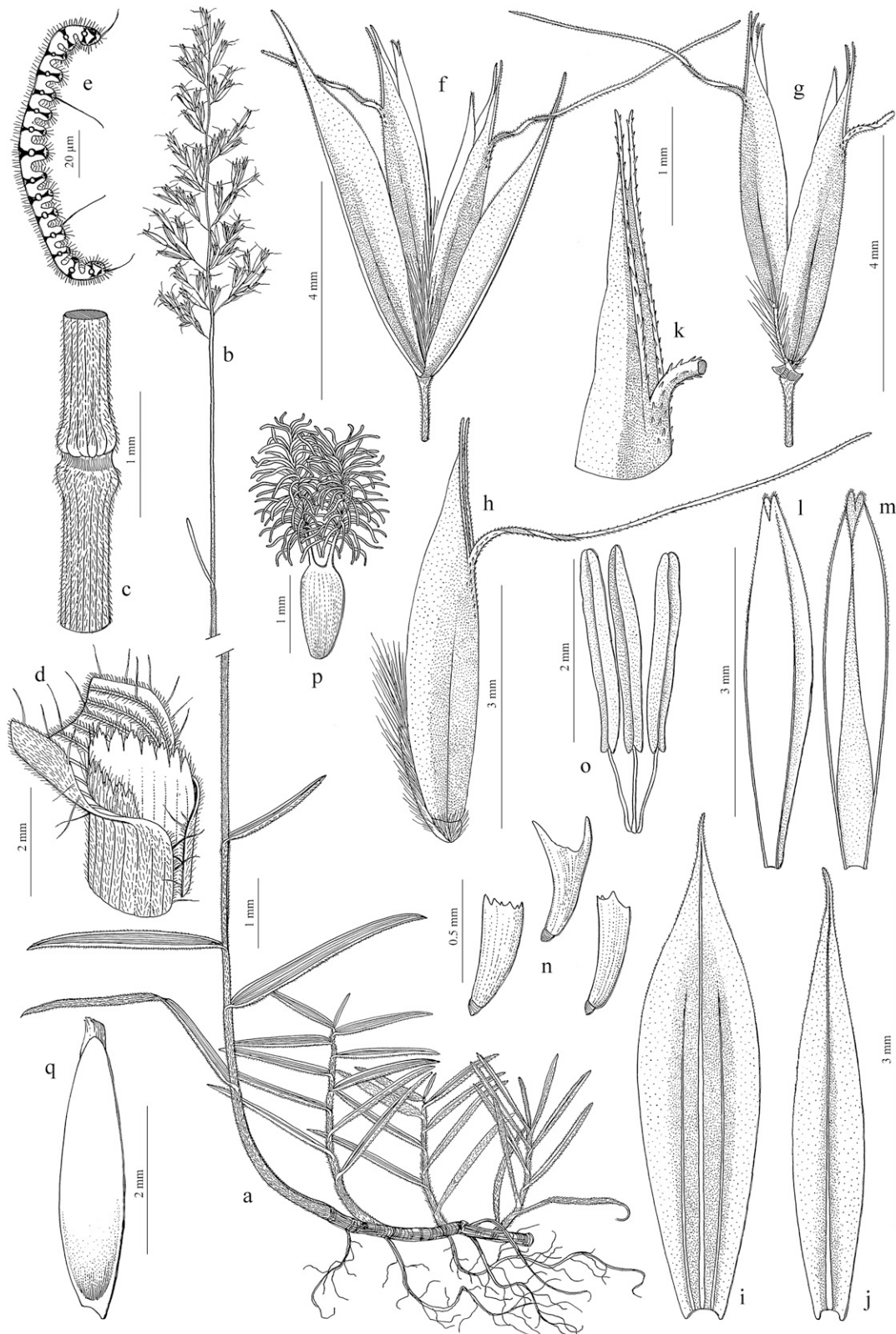


FIG. 11. *Trisetum velutinum*. A. Habit. B. Inflorescence. C. Portion of the culm and node. D. Sheath, ligule, and portion of the blade. E. Transverse section of leaf blade. F. Spikelet. G. Florets. H. Floret. I. First glume, dorsal view. J. Second glume, dorsal view. K. Lemma, upper part, lateral view. L. Palea, dorsal view. M. Palea, ventral view. N. Lodicules. O. Stamens. P. Pistil. Q. Caryopsis. (A–D, F–M, O–Q: *Porta & Rigo* 648, B-100526421, MA-8015. E: *Signes & Soler* 7339, VAL-218705. N: *Cuatrecasas & Font Quer* s. n., BC-878863, *Riera* 3729, VAL-37841).

sometimes pubescent, with hairs up to 0.6 mm long; longest basal branches (0.3–)0.5–1.4 cm. Spikelets 4.5–5.8 mm long \times 2.7–4 mm wide, (2)3–5-flowered; pedicels (1–)1.7–2.4(–3.7) mm long, pubescent, with hairs up to 0.3 mm long. Glumes unequal to subequal (ratio lower glume length/upper glume length = (0.75–)0.77–0.88(–0.91)); lower glume 3.2–4.5 mm long \times 0.7–0.8(–1) mm wide, narrowly lanceolate to narrowly elliptic (ratio lower glume width/lower glume length = 0.18–0.22(–0.3)), acute to acuminate, rarely long acuminate, 1(2)-nerved, glabrous, with some hairs on the main nerve up to 0.2 mm long, greenish on the central part, sometimes yellowish, rest hyaline; upper glume 4–5.7(–6) mm long \times 1.2–1.4 mm wide, oblanceolate, sometimes elliptic or lanceolate (ratio upper glume width/upper glume length = 0.2–0.33), acuminate, sometimes acute, 3-nerved, glabrous, with short hairs up to 0.2 mm long on the central nerve, sometimes also on the margins, greenish on the central part, the remaining hyaline; rachilla segments between first and second floret (0.3–)0.5–0.6 mm long, with hairs 0.1–0.3(–0.7) mm long; rachilla segments to sterile floret 0.4–0.6(–0.8) mm long, with hairs 0.1–0.4 mm long. Lemmas (2.6–)3–4.3(–5.4) mm long \times 0.7–0.8(–1) mm wide, oblong to elliptic, sometimes oblanceolate (ratio lemma width/lemma length = 0.25–0.38(–0.41)), strigulose, sometimes with short hairs on the aristules, longers on the midrib, up to 0.2 mm long, yellowish to greenish, sometimes brownish; apical teeth 0.2–0.5 mm long, with aristules 0.1–0.7(–0.9) mm long, rarely without aristules; awn (2.8–)3.4–5.1(–6.1) mm long, inserted (0.9–)1.1–2.1 mm from the base (ratio awn insertion from the base length/lemma length = (0.26–)0.3–0.4(–0.53)), straight, sometimes slightly twisted on the middle, with very short adpressed hairs 0.05 mm long; callus 0.1–0.2 mm long, elliptic to rounded, with hairs 0.1–0.3 mm long. Paleas 2.3–3 mm long \times 0.6–0.8 mm wide (ratio palea length/lemma length = (0.56–)0.63–0.74), narrowly elliptic, sometimes oblanceolate, with short hairs along the outer edges; keels with short hairs, ending in teeth (0.1–)0.2 mm long. Lodicules (0.3–)0.4–0.6 mm long, with apex slightly bilobate, one of them lateral. Anthers 0.8–1.6(–1.8) mm long. Ovary 0.3–0.7(–0.8) mm long, glabrous. Caryopsis (1.6–)1.8–2(–2.2) mm long.

Chromosome Number—Unknown.

Phenology—Flowering from April to July.

Distribution and Habitat—Endemic to Jandía massif, Fuerteventura (Canary Islands); at 700–800 m elevation; in volcanic rock fissures and cracks. Figure 12.

Specimens Examined—SPAIN. Canary Is.: Fuerteventura, Pájara, Jandía, Pico de La Zarza, 28°6'N, 14°21'W, 30 Mar 1989, Marrero s. n. (LPA, MA, P); 28°6'N, 14°21'W, 26 Jul 2000, Marrero s. n. & Scholz (LPA); 28°6'N, 14°21'W, 8 Apr 2000, Marrero s. n. & Scholz (LPA); entre el Pico de la Zarza y el Pico del Mocán, 28°6'N, 14°21'W, Marrero s. n. & Scholz (LPA); 8 Apr 2000, Marrero s. n. & Scholz (LPA, P); 8 Jul 2000, Marrero s. n. & Scholz (LPA); Pico de la Zarza, andén debajo del paloblanco, 28°6'N, 14°21'W, 8 Apr 2000, Marrero s. n. & Scholz (LPA); Pico de La Zarza, 28°6'N, 14°21'W, 17 Jul 1987, Montelongo s. n. (LPA); Pico del Fraile, 28°5'N, 14°23'W, Aug 2003, Scholz s. n. (LPA); Pico de la Zarza, El Esquinazo, 28°6'N, 14°21'W, Apr 2009, Scholz s. n. (LPA); Pico del Fraile, 28°5'N, 14°23'W, 25 Apr 1999, Scholz s. n. & Almeida (LPA).

Notes—This species has been included in this section provisionally and with hesitation, because only two specimens with distichous leaves in young shoots and culms have been observed; besides, *Trisetum tamonanteae* has unequal to subequal glumes, another typical character of this section. Marrero Rodríguez and Scholz (2013) separated this species from *T. argenteum*, *T. distichophyllum*, *T. macrotrichum*, and *T. velutinum* because these species present a glaucous-velutinous

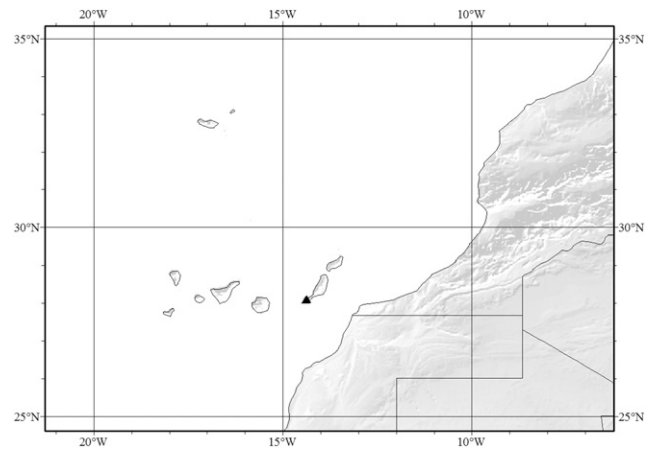


FIG. 12. Distribution of *Trisetum tamonanteae*.

hairiness and all basal and top leaf blades are clearly distichous. This is not the case in *T. tamonanteae*.

Doubtful and excluded names—

Avena distichophylla Host. The IPNI web attributed to Host (1802) the name *Avena distichophylla*. Host (1802), however, when he recorded *Avena distichophylla*, repeated the polynomial of Villars and indicated “Vill. delph. 2. p. 144. t. 4”, suggesting that he was not publishing a nom. nov. Consequently the name “*Avena distichophylla* Host” should be forgotten. *Avena distichophylla* is also attributed to Schrader by some authors [i.e. Roemer and Schultes 2: 666 (1817)]. This case is similar to the one mentioned previously, since Schrader in his *Flora Germanica* 1: 380 (1806) is only indicating Villars’ name, not describing a new species. Therefore, this name should be removed.

Avena distichophylla var. *genuina* Shuttlew., Mag. Zoo. Bot. 2: 17. 1838, nom. inval. (art. 24.3)

Avena penicillata Willd. ex Steud., Nomencl. Bot., ed. 2, 1: 172. 1840, nom. nud., pro syn.

Avena rotae De Not. ex Parl., Fl. Ital. 1: 264. 1850, nom. nud., pro syn.

Trisetum carpaticum (Host) Roem. & Schult., Syst. Veg. 2: 663 (1817). This forgotten name is based on *Avena carpatica* Host, Icon. Descr. Gram. Austriac. 4: 18, Table 31. 1809 which, according to the Host’s drawing, belongs to *Avenula pubescens* (Huds.) Dumort.

Trisetum gmelinii [“Gmelini”] Trin., Mém. Acad. Imp. Sci. Saint-Petersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 4(2): 15. Mar 1836, nom. inval. *Bromus cinereus* S.G. Gmel. ex Trin., Mém. Acad. Imp. Sci. Saint-Petersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 4: 15. Mar 1836, pro syn. *Avena gmelini* (Trin.) Nyman, Suppl. Syll. Fl. Eur.: 71. 1865. TYPE: SPAIN. in collibus siccis argillaico-sabulosis madriti, ex hb. Schreb. (lectotype, here designated, LE-TRIN-1893.1!). This specimen was sent to Trinius by Schreber and there is no collector indicated on the label. It correspond to *Trisetaria scabriuscula* (Lag.) Paunero, a common species around Madrid.

Trisetum rigidum f. *minor* Kotschy, nom. nud., in sched. (P-2255865!).

Trisetum rigidum f. *colorata* Bornm., nom. nud., in sched. (B!).

Trisetum rigidum f. *major* Bornm., nom. nud., in sched. (BM-1134945!).

Trisetum rigidum f. *vivipara* T. Alex., nom. nud., in sched. (LE!).

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APPENDIX 1. Index to numbered collections cited. The numbers in parentheses refer to the corresponding species in the text. Mixed collections are indicated by a slash (e.g., 1/2).

Abdaladze, O. et al. 332 (4.a), 409 (4.a); *Aedo, C.* 18599 (6), 11798 (4.a); *Allen, P.* 1898 (4.a), 1982 (4.a); *Alexeenko, Th.* 1101 (4.a), 392 (4.a), 5623 (4.a), 6104 (4.a), 7396 (4.a), 9071 (4.a); *Barberá, P. et al.* 941PB (6), 942PB (6); *Bobrov, A.E. et N.N. Tzvelev* 574 (4.a); *Boissier, E.* 187 (6); *Bornmüller, J.* 33 (4.a); *Bornmüller, J. et A. Bornmüller* 8381 (4.a), 8382 (4.a), 8383 (4.a), 8384 (4.a), 8385 (4.a), 8385b (4.a); *Borodin, I.* 197 (4.a); *Bot. Exk.* 447 (1), 740 (1); *Bourgeau, E.* 1519 (6); *Castroviejo, S. et al.* 11213SC (1); *Charpin, A.* 15786 (2), 19140 (1);

Charpin, A. et R. Salanar AC17607 (1); *Clarke, C.B.* 48718 (1); *Danser, B.H.* 5050 (1); *Del Campo, P.* 93 (6), 98 (6); *Dersch, G.* 4488 (2); *Dini-Arazm* 12132 (4.a); *Dzens-Litovskaya, N.* 99 (4.a); *Eckardt, T.* 615 (1), 1056 (1); *Egeröd, K.* 9034 (1); *Egorova, T.V. et al.* 433 (4.a), 1477 (4.a); *Fernández Casas, F.J.* 963B (6); *Furse, P.* 3141 (4.a); *Gagnidze, R. et al.* 2524 (4.a), 2941 (4.a); *Gaubá, D.E.* 1243 (4.a); *Gladkov, I.* 22 (5.a); *Grossheim, A.* 76 (4.a); *Herrero, A.* 2718 (4.a); *Holmberg, O.R.* 974 (4.a); *Holtz, F. et al.* 978 (4.a); *Hörandl, E.* 1739 (1); *Huter, R.* 1171 (2); *Huter, R. et al.* 1171 (6); *Jacobs, J.* 3893 (1); *Kalheber, H.* 96–1385 (2); *Kolenati, F.A.* 2204 (4.a); *Kotschy, TH.* 391 (4.a), 393 (4.a); *Kotseruba, V.V.* 30 (4.a), 56 (5.b); *Lachashvili, N.* 189 (4.a); *Lippert, W.* 26158 (2); *Litwinow, D.I.* 257 (4.a), 2809 (4.a); *Litzler, P.* 77765E (6); *López, G.* 890 GF (6); *Lütkenmüller, J.* 2253 (1); *Merxmüller, H. et W. Wiedmann* 5533 (2), 5534 (2); *Meyer, C.A.* 60 (5.a); *Milne-Redhead, E.* 2316 (1); *Moutin, R. et J. Bernard* 475 (1); *Müller, J.* 10983 (2); *Nakhutsrishvili, G. et O. Abdaladze* 103 (4.a); *Novopokrovskiy, I.V.* 681 (4.a); *Podlech, D.* 42147 (1); *Poretsky, A. et G. Shults* 543 (4.a); *Porta, P. et G. Rigo* 648 (6); *Prokhanov, Y.I.* 339 (4.a); *Prokhanov, Y.I. et N.T. Cheldyshev* 163 (4.a); *Raus, T.* 4431 (4.a); *Rechinger, K.H.* 40731 (4.a), 48369 (4.a), 57178 (4.a), 5891 (4.a), 6091 (4.a); *Rechinger, K.H. et F. Rechinger* 6447 (4.a), 6509 (4.a); *Reverchon, E. et A. Derbez* 255 (1); *Riera, J.* 3135 (6); *Riera, J.* 3151 (6), 3719 (6), 3729 (6); *Riera, J. et J.V. Andrés* JRV-4480 (6); *Rigo, G.* 1411 (2); *Romero, C.* C170/81 (6); *Schiffers, E.V. et T.A. Moreva* 5 (4.a); *Soler, J.X. et M. Signes* 7265 JXS (6); *JXS-7339* (6); *Sommier, S. et E. Levier* 1359 (4.a/5.a/5.b); *Soreng, R.J.* 8009 (4.b); *Soriano, P.* 0917PS (6), 1652PS (6); *Stebler, F.G. et C.J. Schröter* 114 (1); *Tatli, A.* 4865 (4.a); *Tzvelev, N.N. et S. Cherepanov* 160 (4.a); *Vasilchenko, I.T. et al.* 668 (4.a); *Wagenitz, G.* 1738 (1/2); *Wagenitz, G. et F. Hellwig* 4707 (6); *Wendelbo, P.* 1218 (4.a); *Woronow, G.* 6256 (4.a); *Zernov, A.S.* 6527 (4.b), 6934 (5.a), 7263 (5.a); *Zündorf, H.J.* 24247 (5.b); *Zündorf, H.J. et A. Gerth* 25658 (5.b).

APPENDIX 2. List of the quantitative characters measured.

Plant height (cm); Culm diameter (mm); Culm indumentum length (mm); Number of nodes; Basal leaf sheath indumentum length (mm); Basal leaf blade length (cm); Basal leaf blade width (mm); Basal leaf blade indumentum length (mm); Top culm leaf sheath length (cm); Top culm leaf blade length (cm); Top culm leaf blade width (mm); Top culm leaf blade indumentum length (mm); Inner collar region indumentum length (mm); Ligule length (mm); Ligule indumentum length (mm); Basal node of the panicle indumentum length (mm); Panicle length (cm); Panicle width (cm); Rachis indumentum length (mm); Longest basal branches length (cm); Pedicel length (mm); Pedicel indumentum length (mm); Spikelet length (mm); Spikelet width (mm); Number of flowers per spikelet; Ratio lower glume length/upper glume length; Lower glume length (mm); Lower glume width (mm); Ratio lower glume width/lower glume length; Lower glume indumentum length (mm); Number of lower glume nerves; Upper glume length (mm); Upper glume width (mm); Ratio upper glume width/upper glume length; Upper glume indumentum length (mm); Number of upper glume nerves; Rachilla segments between first and second floret length (mm); Rachilla segments between first and second floret indumentum length (mm); Lemma length (mm); Lemma width (mm); Ratio lemma width/lemma length; Lemma indumentum length (mm); Apical teeth length (mm); Aristule length (mm); Awn length (mm); Awn insertion from the base (mm); Awn insertion from the base length/lemma length; Awn indumentum length (mm); Callus length (mm); Callus indumentum length (mm); Palea length (mm); Palea width (mm); Ratio palea length/lemma length; Palea teeth length (mm); Lodicule length (mm); Anther length (mm); Ovary length (mm); Caryopsis length (mm); Caryopsis width (mm).