Some comments on the genus Bromus (Poaceae) and three new species

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Abstract

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Number and geography of its species, which are mostly anecophytic, indicate a noncentred origin and distribution of *Bromus* s.str. (≡ *Bromus* sect. *Bromus*). With some certainty a larger number of its known species have been evolving only since the beginning of the Anthropocene, about 10 000 year ago, promoted by human impact. Another three probably recently originated species are described as new to science, *B. parvispiculatus* from the Balkan Peninsula, *B. incisus* with a chromosome number of $2n = 4x = 28$ from Central Europe and *B. supernovus,* a species of dubious provenance only known from the type specimen of a plant cultivated in Australia. The ancestry of *B. hordeaceus, B. intermedius* and *B. secalinus* is discussed. Two new combinations, *B. intermedius* subsp. *optimae* and *B. rechingeri* subsp. *afghanicus,* are validated and a conspectus indicating the known ploidy level and distribution (endemic or indigenous to Europe) of the species of *Bromus* s.str. is provided.

Additional key words: *Bromus* sect. *Bromus,* brome grasses, taxonomy, evolution, ancestry problems, anecophytes

Introduction

The genus *Bromus* L. and the genera *Anisantha* K. Koch, *Boissiera* Hochst. ex Steud., *Bromopsis* Fourr., *Ceratochloa* P. Beauv., *Littledalea* Hemsl., *Nevskiella* Krecz. & Vved., *Stenofestuca* (Honda) Nakai and *Trisetobromus* Nevski constitute the tribe *Bromeae* Dumort. within the *Poaceae* subfam. *Pooideae* according to the classification of Tzvelev (1998). The above genera, alternatively, have been included in *Bromus* and treated as sections or subgenera, e.g., *Anisantha* (type *A. pontica* K. Koch = *A. tectorum* (L.) Nevski) as *Bromus* sect. *Genea* Dumort. (Smith 1970). The treatment of *Bromus* and *Anisantha* as separate genera is not an "invention" of modern times (as sometimes believed) but has a long tradition that was confused by Parlatore (1840), who substituted *Bromus* with his new name *Serrafalcus* and used *Bromus* for taxa of *Anisantha*. Both names sensu Parlatore were widely accepted for a long time in some southern European Floras of the 19th century, nearly up to the moment when *Bromus secalinus* L. was chosen by Shear in 1900 as the representative of Linnaeus' *Bromus* concept, later formally designated as the lectotype of *Bromus* L. and *Bromus* sect. (or subg.) *Bromus* (Smith 1970).

Resent molecular phylogenetic analyses are changing our view of the phylogeny of the *Bromeae*. Davis & Soreng (2007) provided evidence that *Littledalea* is not part of the *Bromeae* but the sister group of a clade comprising both *Bromeae* and *Triciceae*. Fortune & al. (2008) detected reticulate evolution within *Bromus* sect. *Genea.* Saarela & al. (2007) indicate that the entities treated as separate genera allied to *Bromus* or infrageneric taxa of *Bromus* are partly polyphyletic and that generic limits need reconsideration. *Bromus* sect. *Bromus,* in the present contribution treated as *Bromus* s.str., however, appears to be a monophyletic entity but only few species were included in the analysis.

Bromus s.str. consists entirely of annuals (or biennials), nearly all of which are ruderal, and many of them are strongly weedy (Stebbins 1981). It is originally distributed over a vast Old World area reaching from Macaronesia and W Europe in the west to the Himalayas, China and Japan in the east, with outpost species in southern Africa and Australia/New Zealand, but is now introduced in the New World and elsewhere.

The present contribution focuses on selected problems within *Bromus* s.str., describes two species new to science from Europe and one only known from former cultivation in Australia. A conspectus of *Bromus* s.str. is given in an Appendix.

Bromus s.str. origin: centre or noncentre?

It has been taken for granted that the centre of diversity and probable the centre of origin of the genus *Bromus* s.str. is Central and SW Asia (Stebbins 1981). A new evaluation of species numbers and distribution, however, casts some doubts on this assumption, which is perhaps influenced by Vavilov's theory of origin centres of cultivated plants ("ex oriente lux"). Of the total of 47 species (see Appendix), 24, with 13 regional endemics, are native to Europe. The Orient is the cradle of western civilization and agriculture and of the *Triticum* and *Secale* cereal crops (Zohary & Hopf 1988), but its weedy mimics *B. bromoideus, B. grossus, B. secalinus* and *B. arvensis* subsp. *segetalis* are restricted to Europe (Smith 1980; Hultén & Fries 1986). Similar is the situation in other European brome grasses (e.g., *B. hordeaceus* subsp. *pseudothominei, B. interruptus, B. lepidus* and *B. pseudosecalinus*), which are well adapted as contaminants to small-grained species of *Lolium*, *Festuca*, *Trifolium,* etc., sown and harvested for fodder and greenings (Smith 1968a, 1986). All these taxa apparently have evolved in and are indigenous to Europe. Smith (1986) gives the pros and cons for such a generalized view and suggests in some cases introductions from the Orient. The question is, whether *Bromus* s.str. is a polytopic, polyphyletic taxon, with no centre of species diversification and distribution. Comparable is Harlan's noncentre concept of agriculture origin (Harlan 1971). A possibly polyphyletic hybrid origin of *Bromus* s.str. in the Near and Middle East was already stressed by Scholz (1981).

Bromus s.str. an anecophytic genus?

If the taxa of *Bromus* s.str. "evolved to a large extent in adaptation to conditions produced by human agriculture, and particularly the grazing livestock" from the genus *Bromopsis* (*"Bromus* subg. *Festucaria";* Stebbins 1981: 372, 377) approximately 12 000 years ago in the late Pleistocene, the beginning of the Anthropocene (Crutzen & Stoermer 2000) when the human race first began to have a significant global impact on the Earth's ecosystems, inevitably most of them would be "homeless plants", anecophytes (Scholz 2007). Wagenitz (2003, with references) gives the following definition of anecophytes (translated from German): "Plant taxa originated under the influence of human activities, without natural occurrences; they may comprise cultigenic taxa and weeds". But this definition does not fit well to *B. commutatus* subsp. *commutatus* and *B. racemosus,* which inhabit wet meadows, or to *B. hordeaceus* subsp. *thominei,* which occurs from the Mediterranean and Atlantic coasts to the Baltic Sea on seashore cliffs and sand dunes and also in inland salt-swamps (Melzer & Barta 2005). All their habitats may be natural (only recently subsp. *thominei* was found on pastures; Gregor 2004). Partly against these conjectures is the view that at least some parts of the European grasslands are man-made (Scholz 1975). Thus, a decisive statement on the anecophytic status of the whole of *Bromus* s.str. is problematic.

Ancestry problems

Bromus s.str. includes diploid ($2n = 14$) and allopolyploid species (mostly $2n = 4x = 28$, rarely $2n = 8x = 56$). The presence of both $2n = 14$ and $2n = 28$ in several species (compare Appendix) may be worthwhile to consider in future evolutionary studies. For example, most authors report $2n = 28$ for *B. commutatus* (Smith 1980; Oja 1998 and many others), other reports $2n = 14$ (Goukasian & Nazarova 1998, and earlier literature cited; Probatova & al. 2001). What does this mean for the unresolved ancestry of the allotetraploid representatives of *B. secalinus* (Smith 1972)? In some cases such discrepancies may be, admittedly, due to misidentification of the species involved. Smith (1968b), e.g., suggests that the report of $2n = 14$ for *B. secalinus* from Sweden may actually refer to the diploid *B. pseudosecalinus*. However, it is quite common to have diploid and polyploid races within the same species, and this leads to the assumption of multiple and recurrent origins of polyploid species (Soltis & al. 2004).

As a rule (see references in Oja 2005), allogamous diploids occupy wider distribution ranges and contain more variation than the autogamous derivative diploids with a relatively limited geographic distribution. Great was the surprise as could be demonstrated that the autogamous *Bromus intermedius* from the countries around the Mediterranean Sea contrary to the rule is genetically more variable than the much wider distributed allogamous *B. arvensis,* the assumed progenitor of *B. intermedius* (Oja 2005). A possible explanation is the following scenario: *B. bidentatus* from Cyprus, only known from the type (Holmström & Scholz 2000), is an allogamous diploid species like *B. intermedius* subsp. *optimae (B. optimae)* and *B. regnii* from Cyprus, Asia Minor and the E. Aegean region (inferred from 3-5 mm long anthers exposed in flowering time) and closely related to *B. intermedius* subsp. *intermedius* and *B. arvensis,* respectively (see Scholz 1995). *B. arvensis* may be the progenitor of *B. bidentatus* and *B. regnii,* and *B. intermedius* subsp. *optimae* (probably a relict taxon in former times more widespread, or overlooked?) the one of *B. intermedius* subsp. *intermedius*.

Ainouche & Bayer (1997) reject the hypothesis of Smith (1972) that the ancestor of the allotetraploid *Bromus hordeaceus* were the diploids *B. arvensis* and *B. scoparius,* and believe that at least one of its diploid ancestors might have been an extinct or undiscovered species. An alternative scenario would be a gradual or repeated sudden haplome alteration in the tetraploid *B. hordeaceus* in the past, which allows to assume that the "extinct" or "undiscovered" parental progenitor never existed (compare Scholz 1994).

The difficult delimitation of the Central/Westmediterranean centred *Bromus hordeaceus* subsp. *molliformis* from subsp. *thominei* (according to Smith 1983 arisen from subsp. *molliformis*) and subsp. *hordeaceus* (colonizing most successfully man-made habitats) has caused much confusion and obscured its geographic distribution. Sometimes an extreme lumping has been favoured (Ainouche & al. 1996; Ainouche & Bayer 1997). In the literature "subsp. *molliformis*", always with compact inflorescences (pedicels and branches shorter than the often nearly sessile spikelets), comprises two entities: the one (1) with lemma awns at base c. 0.2 mm broad, distinctly flattened and spreading at maturity (Smith 1980, 1981; Acedo & Llamas 1999: fig. 39 as subsp. *divaricatus*), the other (2) with narrower, thin awns never spreading (Scholz 1970; Portal 1995). In contrast, subsp. *hordeaceus* has moderately compact inflorescence (up to 3 pedicels or branches exceeding the length of their spikelets; Spalton 2001a) and rather stout, erect awns. Only very recently Portal (2004) has examined authentic material of *B. molliformis* J. Lloyd ex Billot deposited in the Botanical Museum of Angers, France (ANG), with the following result: populations with the features of (1) have to be named *B. hordeaceus* subsp. *molliformis,* those of (2) subsp. *mediterraneus*. Moreover, probably not all taxa relevant in this context are detected and described yet (see Scholz 1998).

Three new *Bromus* species of putative recent origin

The first two ruderal or weedy species described below from the Balkan Peninsula (and Crete) and Central Europe, respectively, may be recently originated natives in their distribution area. In

favour for this hypothesis are the facts that each of its probable ancestors occur sympatrically and, more important, that both species were only collected in the last decades (with one exception) and could not be traced in any other regions. Thorough search has not revealed any indication whatsoever, that both species, occupying a more or less wide distribution area and being well-established there, are casual, accidental introductions, xenophytes or neophytes.

Bromus parvispiculatus H. Scholz, **sp. nov.** – Fig. 1A
Holotype: Greece, "Achaia, Ep. Patron, NW Platanovrysi, krautige Ruderalfluren", 11.4.2001, *R. & E. Willing 87413* (B).

Gramen annuum. Culmi erecti, 15-70 cm alti, glabri, vaginis dense villosis (pili patentes vel semideflexi), foliorum laminae pilosa. *Panicula* elliptica, 3-10 × 2-5 cm, ramis usque ad 4 cm longis, patulis vel erectis. *Spiculae* ovato-oblongae, 10-12 × 4-5 mm, hirsutae, 5-7-florae; glumae subaequales 5-7 mm longae; lemma chartaceum, glumis aequilongum, marginibus obtuse angulatis, apice obtusum, integrum vel minuitissime bidentatum. *Arista* tenera, recta, (3-)4-6 mm longa, 0.5(-1) mm infra apicem lemmatis inserta. *Palea* bicarinata, nervis ciliatis. *Antherae* 0.5-1.5 mm longae. *Caryopsis* plana, paleae subaequilonga.

Bromus hordeaceus L. s.str. (atque subsp. *pseudothominei*) differt lemmatibus maioribus ac aristis robustioribus atque area geographica extramediterranea, *B. molliformis* J. Lloyd ex Billot (*B. hordeaceus* subsp. *molliformis*) paniculis dense compactis ac aristis 0.7-1.3 mm infra apicem insertis.

The constancy of species specific characters of *Bromus parvispiculatus* was proven by cultivation in experimental plots in 1999.

Further specimens seen. – Albania: Skutari, 17.5.1929, *Schütt* (BREM). — Greece: Ipiros: Nomos Thesprotias, Eparchia Thyamidos, SO Platasia (39°26'25"N, 39°17'23"E), Affodillfluren, 30 m, 17.4.2000, *Eisenblätter & Willing 78144* (B); ibid., Limnopoula Paramythias, river with *Platanus orientalis,* damp places, 900 m, 16.6.1999, *Bozika s.n.* (B). – Sterea Ellas: Nomos Etolias-Akarnanias, Eparchia Valtou, near Lake Amvrakia, 2.10.2001, *Zotos 103* (herb. Zotos), *112* (B); Eparchia Mesolongiou, W Zevgaraki (38°32'18"N, 21°23'21"E), krautreicher Ölbaumhain, Straßenrand, 40 m, 26.3.1999, *Eisenblätter & Willing 72257* (B); Eparchia Nafpaktias, village of Riganion (38°29'N, 21°46'E), wet meadow, 600 m, 16.5.1996, *Nielsen 11214* (B); Nomos & Eparchia Evritanias, c. 6 km from Kato Potamia village towards Kato Valaora (39°03'N, 21°27'E), field margins, sandy and moist places by the river, 350 m, 5.4.2001, *Constantinidis, Chitos & Thanopoulos 9294* (ACA, B); W parts of Mt Ftheri, along a forest road, open area in *Abies* forest with *Pteridium aquilinum,* 1300 m, 3.6.2001, *Constantinidis & Thanopoulos 9504* (ACA, B); Nomos Fthiotidos, Eparchia Lokridos, Agios Serafim, 16.7.1997, *Kislev & Melamed 58b* (B), cult. in private garden, Berlin, 2.5., 16.5. & 24.5.1998, *Scholz* (B). – Peloponnisos: Nomos Achaias, Eparchia Patron, N Kritharakia (38°02'47"N, 21°43'28"E), Ackerrand, 240 m, 12.4.2001, *Willing & Willing 87613* (B); NW Platanovrisi (38°08'28"N, 21°43'55"E), krautige Ruderalfluren, 230 m, 11.4.2001, *Willing & Willing 87413* (B); Hochebene unterhalb Kato Lousi beim antiken Lousi, Feuchtgebiet, c. 1000 m, 10.5.2007, *Raabe s.n.* (B, herb. Raabe); Panachaiko Mt Pelouses ecorchees, 1650 m, sine dato, *Laliotis 56/1042* (B). – Kriti: Nomos Chanion, Eparchia Apokoronou, W of Dramia, Kavros, Neo Kournas (35°20'54"N, 24°17'48"E), *Phragmites frutescens*-Ried mit *Pulicaria dysenterica*, *Cirsium creticum, Epilobium parviflorum, Rubus sanctus,* 5-10 m, 21.5.1999, *Böhling 10099* (B); Neo Kournas (35°21'N, 24°18'E), lehmig-tonige Brache, 5-10 m, 30.6. 1999, *Böhling 10302* (B).

The new species – certainly undercollected – is a member of the *Bromus hordeaceus* alliance (2*n* = 28) that have spikelets in both large and small lemma version (Smith & Sales 1993). The extremes exhibit *B. hordeaceus* subsp. *hordeaceus* and subsp. *molliformis* (incl. subsp. *mediterraneus*) with 8-11 and 7(-8)-10(-11) mm long lemmas, respectively, and *B. parvispiculatus* with 5-7 mm long lemmas. Main common features are the ovate-oblong spikelets, the prominent veins

Fig. 1. A: *Bromus parvispiculatus* (from the holotype, *Willing 87413*). – B: *B. hordeaceus* subsp. *mediterraneus* (France, Var, 1860, F. Schultz, herbarium normale, nov. Ser. Cent. 13, No. 1272 as *B. molliformis*). – Scale bar = 1 cm.

of glumes and lemmas on drying, a relative high lemma awn insertion of 0.5-1.7 mm below the obtuse or short-bilobed lemma apex as well as the more or less spreading, softly and densely long-hairy indumentum at least on the lower leaf sheaths (except for *B. hordeaceus* subsp. *longipedicellatus,* a probably hybrid derivative; Spalton 2001). The interrelationships of all these taxa are obscure. Some similarities in the loose panicle configuration of *B. hordeaceus* subsp. *pseudothominei* (6.5-8 mm long lemmas; the mostly non-weedy subsp. *thominei,* similar in lemma size, differs, e.g., by its compact inflorescences!) and *B. parvispiculatus* may one lead to the assumption that the latter is the Mediterranean vicariant of the more northerly distributed subsp. *pseudothominei* and should therefore better be treated as a subspecies of *B. hordeaceus.*

However, a common ancestry, the prerequisite for every taxa pair vicarious distribution (Stott 1981; Schroeder 1998), appears unlikely. Subsp. *pseudothominei* evolved in W, N and Central Europe from *B. hordeaceus* subsp. *hordeaceus* (Smith 1968a), and *B. parvispiculatus* probably in S Europe from the co-existing *B. hordeaceus* subsp. *mediterraneus* (Fig. 1, left panicle; see also last paragraph of Ancestry problems, above), or reversely.

Bromus incisus R. Otto & H. Scholz, **sp. nov.**
Holotype: Germany, Franconia superior (Bavaria), "Gundelsheim, westl. Ortsausgang am Hochwasserdamm", 31.5.2000, *Otto 3992* (B; isotype: herb. Otto).

Gramen annuum (vel bienne?). *Culmi* erecti, 50-70 cm alti, infra paniculam scaberuli vel puberulentes ceterum glabri, vaginis dense villosis (pili patentes vel deflexi), foliorum laminae pilosae. *Panicula* lanceolata, laxa, 4-12 cm longa, ramis usque ad 6 cm longis. *Spiculae* ovato-oblongae, (5-)7-9(-20) × 5-7 mm, glabrae (rarissime pubescentes), 5-9(-17)-florae; glumae 6-7 mm longae, subaequales; lemma chartaceum, tenue, (6.5-)7-8 mm longum, marginibus 0.5-0.7 mm late hyalinis distincte angulosis, apice hyalino, 0.5-1.2 mm inciso, basim arista insertum. *Arista* recta, 5-8 mm longa. *Palea* bicarinata, nervis ciliatis. *Antherae* 0.5-2(-3) mm longae. *Caryopsis* plana, paleae subaequilonga.

Bromus lepidus Holmb. differt culmis tenuioribus, lemmatibus minoribus 4.5-6.5 mm longis atque palea caryopside brevior in partem superiorem ecarinata.

Chromosome number. – The number of $2n = 4x = 28$ was counted by Monika Lüchow (BGBM Berlin-Dahlem) in root tip mitoses of germinated caryopses from *Otto 10784* (see Specimens).

Selected specimens. – GERMANY: BAVARIA: Sand am Main, Ortsteil Sandwörth, MTB 6029/2, 6.6.2005, *Otto 10497, 10499* (herb. Otto); Limbach, W Tunnel "Schwarzer Berg", Rand eines Wirtschaftsweges unterhalb der Autobahnbrücke, MTB 6029/2, 19.6.2005, *Otto 10651* (herb. Otto); zwischen Viereth und Unterhaid, am Rand eines Wirtschaftsweges an der A 73, MTB 6030/4, 17.6.2006, *Otto 11659* (herb. Otto); Bamberg, Starkenfeldstr., Parkplatz Graf-Stauffenberg-Schulen, MTB 6031, 3.5.2005, *Otto 10435* (herb. Otto); ibid., Margaretendamm, Rabatten am Parkplatz gegenüber der Feuerwehr oberhalb des Rhein-Main-Donau-Kanals, 6031, 2.6. 2005, *Otto 10464* (herb. Otto); ibid., Starkenfeldstraße, Grünanlagen, MTB 6031/344, 22.5 .2006, *Otto 11484* (B, herb. Otto); Hallstadt, Valentinstr., Böschung am Hochwasserdamm zum Main, MTB 6031/314, 5.6.2006, *Otto 11613* (B, herb. Otto); Gundelsheim, südl. Ortsausgang, Hochwasserdamm, MTB 6031/413, 28.5.2000, *Otto 3968* (B, herb. Otto); ibid., Bambergerstraße, Rückhaltebecken, MTB 6031/413, 4.6.2005, *Otto 10483* (B, herb. Otto); ibid., MTB 6031/4, Fürstenweg, Brache gegenüber dem Bauhof der Gemeinde, sandige Schüttung, 3.7.2005, *Otto 10784* (B, herb. Otto); Kemmern, Böschung zum Main bei der Mainbrücke, Ostufer, MTB 6031/143, 24.5.2005, *Otto 10319* (herb. Otto), ibid., Kompostplatz eines Bauern westl. Hütsee MTB 6031/312, 14.6.2005, *Otto 10579* (herb. Otto); ibid., Sportplatz, 6031/312 und 134, 24.6. 2005, *Otto 10709* (herb. Otto), *10712* (herb. Otto); Memmelsdorf, Straßenrand und Acker *(Trifolium resupinatum).* Nähe Tauschholz, MTB 6031/422, 9.7.2001, *Otto 6379* (B, herb. Otto); Hallstadt, Michelinstr., Böschung mit Brache, MTB 6031/323, 27.5.2005, *Otto 10372* (herb. Otto); zwischen Eschenau und Großgeschaidt, Fahrradweg entlang B2, Ansaat, MTB 6433/100, 10.6. 2006, *Höcker* (*Otto 11811*) (herb. Otto). – BRANDENBURG: Prenzlau, Hindenburg, unter *Medicago,* 7.1871; *Grantzow* (B). — AUSTRIA: Oberösterreich Innviertel, Raab, Riedhof, 7647/2, Saatgutvermehrungsbetrieb, 380-400 m, 13°39'23"N, 48°21'42"E, 4.7.2006, *Hohla* (B, herb. Hohla).

Bromus incisus contaminates amenity grassland artificially created on road verges, river embankments, urban parks, etc. It was at first recognized as a distinct species by Rainer Otto in 2000. The character expression of *B. incisus* is often not very stable. With high probability this species is a hybrid or an introgressive hybridisation product of *B. lepidus* and *B. hordeaceus* s.l., and thus arisen not earlier than c. 200 years ago, when *B. lepidus* probably evolved. Once unintentionally sown with seeds of commercial turf cultivars this weedy species reproduces success-

fully over several years. The reason why *B. incisus* remained unnoticed so long is its very restricted distribution area in Bavaria (although occasionally found in distant regions as a rare import (see specimen list) and its superficial resemblance with *B. hordeaceus*. However, *B. incisus* is more similar to *B. lepidus* than to *B. hordeaceus*. Decisive features are the thin lemmas, its sharply angled and broad hyaline margins and the awn insertion on the lemma cleft. From *B. lepidus* the new species deviates (Fig. 2) by greater spikelets and lemmas, the shape and length of palea and the more robust habit. More collections of *B. incisus* are expected in the future.

To avoid confusion with *Bromus hordeaceus* carefully examination of the lemma is needed because in old or damaged *B. hordeaceus* plants or specimens the slightly bidentate lemma apex can be split down to the base of the awn (Smith & Sales 1993; Spalton 2001b).

Bromus supernovus H. Scholz, **sp. nov.**

Holotypus: Cult. hortus Hawkesbury Agricultural College, "National Herbarium of New South Wales / Botanic Garden, Sydney / *Bromus racemosus,* Linn. / Loc. Hawk. Agric. Coll. Richmond, N.S.W." 11.1912, *C. I. Musson* (B; isotypus: NSW).

A *Bromo racemoso* L. *foliorum* vaginis dense pubescentis (nec plusminusve hispidis), panicula contracta ramis brevioribus ac apice lemmatis profunde inciso basim arista inserto differt.

The Herbarium of the Botanical Museum Berlin-Dahlem (B) holds a mounted specimen of an annual brome grass obtained in 1946 from R. Gross, who himself received it from the National Her-

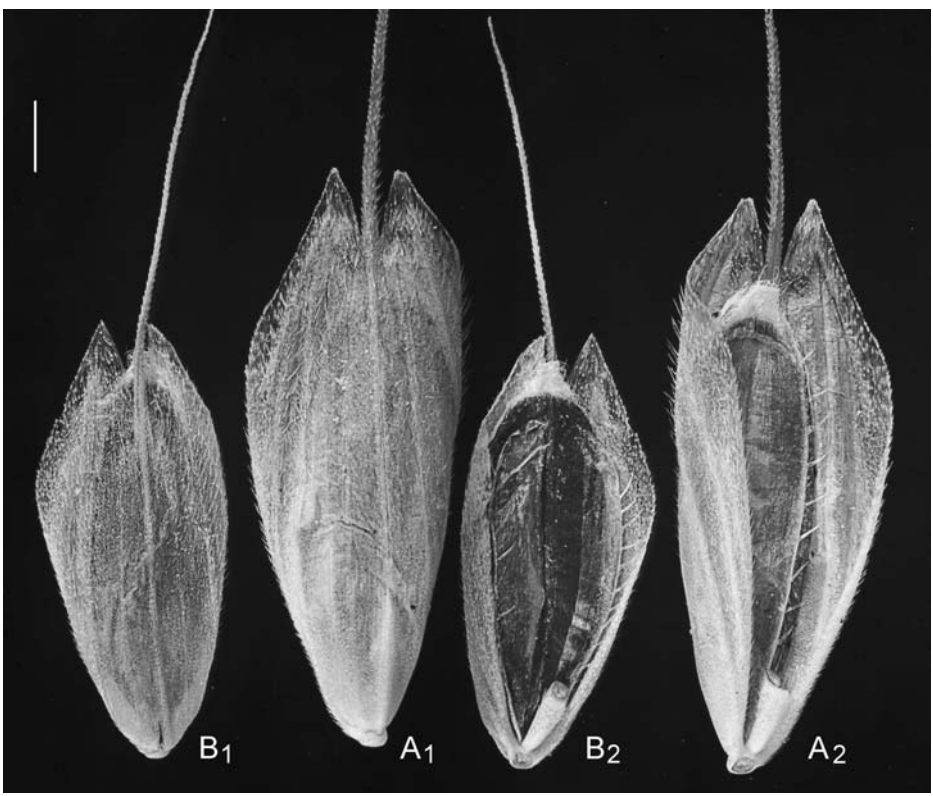

Fig. 2. Florets in fruiting state (1 = dorsal and 2 = ventral view) – A: *Bromus incisus* (from *Otto 10651*); B: *B. lepidus* (from *Otto 10461*). – Scale bar = 1 mm; photograph by Otto.

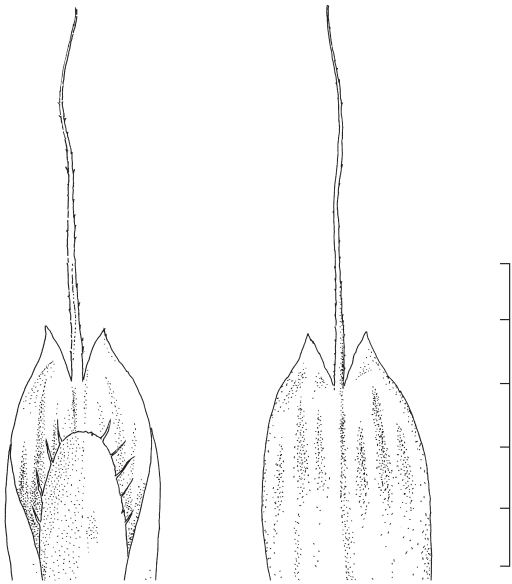

Fig. 3. *Bromus supernovus* – upper part of florets (from the holotype, 1912, *Musson*); scale bar = 5 mm.

barium of the Royal Botanic Gardens Sydney in Australia. Professor Surrey Jacobs of the same institution kindly sent per e-mail of 17 October 2005 the additional information that both the Botanical Gardens and the Hawkesbury Agricultural College imported and grew seeds of any grass and pasture legume, but unfortunately, there does not appear to be any record of the source of the seed, and as no further collection has been made it was also assumed that it had not become naturalized and no further action was initiated.

The awn insertion of *Bromus supernovus* (Fig. 3), directly at the bottom of the apical lemma cleft (not below it) is quite unusually in the *Bromus* s.str. otherwise only known from *B. incisus* (Fig. 2A), *B. lepidus* (Fig. 2B), both being members of the *B. hordeaceus* s. latiss. assemblage, and from *B. bidentatus* (a relative of *B. arvensis*). *B. supernovus* may have arisen in cultivation and perhaps could be found growing in the wild on man-made habitats somewhere in the world.

Many researchers might hesitate to describe a species based only on a single specimen. How can we be sure that all individuals of *Bromus supernovus* (supposed they could be found) share its diagnostic characters? But is having two specimens really that much better than only one? What about three? asks Wiens (2007: 876) and continues: “In fact, being reasonably certain ... that a trait is truly fixed within a species is basically impossible, even if hundreds or thousands of individuals are sampled”.

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Appendix – Conspectus of *Bromus* L. s.str. [*Bromus* sect. vel subg. *Bromus*]

Chromosome numbers according to literature records; E = indigenous in Europe, Ee = endemic in Europe.

Bromus alopecuros Poir.
- subsp. ***alopecuros*** – 2*n* = 14, 28; E
- subsp. ***biaristulatus*** (Maire) Acedo & Llamas
- subsp. ***caroli-henrici*** (Greuter) P. M. Sm. – 2*n* = 14; E

Bromus arenarius Labill. [*B. australis* R. Br.] – 2*n* = 28

Bromus arvensis L. – 2*n* = 14, 28; E
- subsp. ***arvensis***
- subsp. ***parviflorus*** (Desf.) H. Scholz
- subsp. ***segetalis*** H. Scholz

Bromus barobalianus G. Singh

Bromus bidentatus Holmström & H. Scholz – 2*n* = 14

Bromus brachystachys Hornung – Ee

Bromus briziformis Fisch. & C. A. Mey. – 2*n* =14

Bromus bromoideus (Lej.) Crép. – 2*n* = 28; Ee

Bromus cabrerensis Acedo & Llamas – 2*n* = 28; Ee

Bromus chrysopogon Viv. [*B. szaboi* Pénzes] – E

Bromus commutatus Schrad. – E
- subsp. ***commutatus*** – 2*n* = 14, 28, 56
- subsp. ***decipiens*** (Bomble & H. Scholz) H. Scholz
- subsp. ***neglectus*** (Parl.) P. M. Sm.

Bromus danthoniae Trin.
- subsp. ***danthoniae*** – 2*n* = 14
- subsp. ***pseudodanthoniae*** (Drobov) H. Scholz – 2*n* = 28
- subsp. ***rogersii*** H. Scholz

Bromus depauperatus H. Scholz – E

Bromus elidis H. Scholz – Ee

Bromus gedrosianus Pénzes – 2*n* = 14

Bromus grossus Desf. ex DC. – 2*n* = 28; Ee

Bromus hordeaceus L. [*B. mollis* L.]
- subsp. ***hordeaceus*** – 2*n* = 14, 28; E
- subsp. ***bicuspis*** Hohla & H. Scholz – Ee
- subsp. ***longipedicellatus*** L. M. Spalton – Ee
- subsp. ***mediterraneus*** H. Scholz [*B. molliformis* subsp. *mediterraneus* (H. Scholz) H. Scholz & F. M. Vázquez, *B. hordeaceus* subsp. *molliformis* auct. p.p.]
- subsp. ***molliformis*** (J. Lloyd ex Billot) Maire & Weiller [*B. molliformis* (J. Lloyd ex Billot, *B. hordeaceus*) subsp. *divaricatus* auct.] – 2*n* = 28
- subsp. ***pseudothominei*** (P. M. Sm.) H. Scholz – 2*n* = 28; Ee
- subsp. ***thominei*** (Hardouin) Braun-Blanq. [*B. ferronii* (Mabille) P. M. Sm., *B. hordeaceus* auct.) – 2*n* = 28; Ee

Bromus incisus R. Otto & H. Scholz – 2*n* = 28; Ee

Bromus intermedius Guss.
- subsp. ***intermedius*** – 2*n* = 14, 28; E
- subsp. ***divaricatus*** Bonnier & Layens
- subsp. ***optimae*** (H. Scholz) H. Scholz, **comb. & stat. nov.** [≡ *B. optimae* H. Scholz in Bocconea 11: 86. 1999]

Bromus interruptus (Hack.) Druce – 2*n* = 28; Ee

Bromus japonicus Thunb.

subsp. ***japonicus*** – 2*n* = 14, 28; E
subsp. ***anatolicus*** (Boiss. & Heldr.) Pénzes – 2*n* = 14
subsp. ***phrygius*** (Boiss.) Pénzes
subsp. ***pseudosquarrosus*** (Borb.) Pénzes; E
subsp. ***sooi*** Pénzes
Bromus lanceolatus Roth – 2*n* = 14, 28, 42; E
Bromus lepidus Holmb. – 2*n* = 28; Ee
Bromus macrocladus Boiss.
Bromus nervosus Acedo & Llamas – Ee
Bromus oostachys Bornm. – Ee
Bromus oxyodon Schrenk – 2*n* = 28
Bromus parvispiculatus H. Scholz – E
Bromus pectinatus Thunb. [*B. garamas* Maire, *B. adoensis* Steud.] – 2*n* = 28
Bromus psammophilus P. M. Sm.
Bromus pseudobrachystachys H. Scholz – 2*n* = 14
Bromus pseudojaponicus H. Scholz [*B. patulus* var. *falconeri* Stapf]
Bromus pseudosecalinus P. M. Sm. – 2*n* = 14; Ee
Bromus pulchellus Fig. & De Not. [*B. tytthanthus* Nevski]
Bromus racemosus L. – E
subsp. ***racemosus*** – 2*n* = 14, 28
subsp. ***lusitanicus*** (Sales & P. M. Sm.) H. Scholz & L. M. Spalton [*B. popovii* Drobov, *B. tuzsonii* Pénzes] – 2*n* = 14
Bromus rechingeri Melderis
subsp. ***rechingeri*** – 2*n* = 28
subsp. ***afghanicus*** (H. Scholz) H. Scholz, **stat. nov.** [≡ *B. rechingeri* var. *afghanicus* H. Scholz in Bot. Jahrb. Syst. 102: 482. 1981]
Bromus regnii H. Scholz
Bromus scoparius L. [*B. degenii* Pénzes] – 2*n* = 14, 28; E
Bromus secalinus L. – 2*n* = 14, 28; Ee
subsp. ***secalinus*** [subsp. *barthae* Pénzes]
subsp. ***billotii*** (F. W. Schultz) Asch. & Graebn.
Bromus sewerzowii Regel – 2*n* = 28
Bromus splendens Velen. – Ee
Bromus squarrosus L. – E
subsp. ***squarrosus*** [*B. stribrnyi* Velen.] – 2*n* = 14, 28
subsp. ***danubialis*** Pénzes [*B. wolgensis* Fisch. ex Jacq. f.]
subsp. ***noeanus*** (Boiss.) Pénzes
Bromus supernovus H. Scholz
Bromus tibetanus H. Scholz
Bromus tigridis Boiss. & Noë [*B. aegyptiacus* Tausch, *B. palaestinus* Melderis]
Bromus turcomanicus H. Scholz
Bromus tzvelevii Musajev