

On the identity of two hybrids in the genus *Brachypodium* (Brachypodieae, Poaceae): typification of the names *B. ×cugnacii* and *B. ×pau*

PEDRO PABLO FERRER-GALLEGO¹ & JAVIER FABADO²

¹ Servicio de Vida Silvestre y Red Natura 2000, Centro para la Investigación y la Experimentación Forestal de la Generalitat Valenciana (CIEF), av. Comarques del País Valencià, 114, ES-46930 Quart de Poblet, Valencia, España

² Jardín Botánico, Universitat de València, c. Quart 80, ES-46008 Valencia, España

ORCID iD. P. P. FERRER-GALLEGO: <https://orcid.org/0000-0001-7595-9302>,
J. FABADO: <https://orcid.org/0000-0001-9461-3008>

Author for correspondence: P. P. Ferrer-Gallego (flora.cief@gva.es)

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Abstract

ON THE IDENTITY OF TWO HYBRIDS IN THE GENUS *BRACHYPODIUM* (BRACHYPODIEAE, POACEAE): TYPIFICATION OF THE NAMES *B. ×CUGNACII* AND *B. ×PAU*.— The typification of the names *Brachypodium ×cugnacii* and *B. ×pau* (Brachypodieae, Poaceae) is discussed. All relevant sources, as well as specimens, illustrations, and references cited in the protologues are carefully examined for the purpose to fix the application of the names. The two names above mentioned are lectotypified using specimens preserved at P and BC herbaria, respectively. Finally, a comment on the nomenclatural type of *Brachypodium retusum* is reported.

Key words: *Bromus retusus*; Gramineae; Iberian Peninsula; lectotype; nomenclature; Sennen.

Resumen

SOBRE LA IDENTIDAD DE DOS HÍBRIDOS DEL GÉNERO *BRACHYPODIUM* (BRACHYPODIEAE, POACEAE): TIFICACIÓN DE LOS NOMBRES *B. ×CUGNACII* Y *B. ×PAU*.— Se discute la tipificación de los nombres *Brachypodium ×cugnacii* y *B. ×pau* (Brachypodieae, Poaceae). Todas las fuentes de información, como son los especímenes de herbario, ilustraciones y referencias relevantes citadas en los protólogos, se han evaluado cuidadosamente con el fin de fijar la aplicación precisa de los nombres. Los nombres mencionados se han lectotipificado utilizando especímenes conservados en los herbarios P y BC, respectivamente. Finalmente, se aporta un comentario sobre el tipo nomenclatural de *Brachypodium retusum*.

Palabras clave: *Bromus retusus*; Gramineae; lectotipo; nomenclatura; Península Ibérica; Sennen.

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INTRODUCTION

Brachypodium Palisot de Beauvois (1812: 100, 155) (Brachypodieae, Pooideae) is a genus of temperate grasses distributed worldwide (Smith, 1980; Schippmann, 1991; Catalán & Olmstead, 2000; Piep, 2007) and comprises 15–20 species (Schippmann, 1991; Catalán *et al.* 1995, 2012; 2015; Díaz-Pérez *et al.*, 2018; POWO, 2023). The genus *Brachypodium* represents a model system that is advancing our knowledge of the biology of grasses in the postgenomics era (Draper *et al.*, 2001; IBI, 2010).

For the Iberian Peninsula, the most recent treatment of this genus has been generated by López González (2021). This author recognized only a species in the *Brachypodium distachyon* (L.) P. Beauv. complex. However, Catalán *et al.* (2012, 2016) and López-Álvarez *et al.* (2012, 2015, 2017) published a comprehensive treatment of this complex and recognized three species on the basis of morphological and genetic characters and geographic distribution: *B. distachyon*, *B. hybridum* Catalán, Joch. Müll, Hasterok & G. Jenkins, and *B. stacei* Catalán, Joch. Müll, L. A. J. Mur & T. Langdon.

Interspecific natural hybridization in *Brachypodium* via pollen flow was highlighted by Khan & Stace (1999). *Brachypodium ×pau*i Sennen was described as a hybrid between *B. retusum* (Pers.) P. Beauv. and *B. distachyon* (see Sennen, 1911).

Brachypodium retusum is a rhizomatous perennial C₃ grass that grows in dry grasslands, shrublands and open woodlands of the Mediterranean Basin, Arabian Peninsula, and Africa (Morocco, Algeria, Tunisia, and Egypt) (Smith, 1980; Schippmann 1991; Cope *et al.*, 2007; López González, 2021; AFA, 2023; POWO, 2023). This species is a rhizomatous plant, with stems 15–50 cm, erect or geniculately ascending, slender, glabrous, leaves up to 10 cm, often less, acute, the cauline patent, distichous; raceme 4–9 cm, dense, stiffly erect, with 1–5(–9) spikelets; spikelets (12–)20–30 mm, linear, overlapping considerably, glabrous, glaucous, with (6–)10–15 florets, glumes acute; lemma 7–8 mm, ovate-lanceolate, abruptly narrowed to the apex; awn 2–4 mm, straight, sometimes absent on lower lemmas (Smith, 1980; Schippmann 1991; López González, 2021).

Brachypodium distachyon is a grass species native to southern Europe, northern Africa and southwestern

Asia east to India (Schippmann 1991; POWO, 2023). The close relationship of *B. distachyon* with economically important temperate cereals and forage grasses combined with many other favorable attributes, such as its very small nuclear genome, simple growth requirements, small size, and annual life cycle, prompted Draper *et al.* (2001) to propose it as a model organism (see IBI, 2010). The name of *B. distachyon* is restricted to a stiffly erect annual plant up to (2–)6–15(–56) cm high, culm with (1–)3–4 nodes, leaves (1–)3–7(–8.5) cm × (0.25–)1.5–2(–4) mm, short, bright green and (1–)2(–4) spikelets per panicle, spikelets (9.2–)14–15(–24) mm, and lemmas (5.2–)7–8(–11) mm, 7-veined, awned, with awn (5–)10–11(–15.2) mm. *Brachypodium hybridum* is an erect or spreading annual plant up to (3.5–)30–40(–78) cm high, culm with 3–7(–18) nodes, leaves 7–8(–16) cm × (0.7–)2–3(–4.3) mm, long, pale dark green and 3(–6) spikelets per panicle. Finally, *B. stacei* is an erect annual grass up to 44–76(–150) cm high, with (1–)4(–9) nodes, soft leaves, curled, patent, pale green, (1.6–)7–8(–15.1) cm × (0.26–)2–3(–7) mm, and (1–)3–4(–5) spikelets per panicle (see Catalán *et al.*, 2012, 2015, 2016). From the material studied by Catalán *et al.* (2012, 2016) and from the study of some herbarium sheets collected by Sennen from Llers (Girona, Spain) (see e.g., P03218688, P06768158) the parent of *B. ×pau*i could very probably be *B. hybridum*.

On the other hand, *Brachypodium ×cugnacii* A. Camus was described as a hybrid between *B. pinnatum* (L.) P. Beauv. and *B. sylvaticum* (Huds.) P. Beauv. (see Camus, 1931). *Brachypodium sylvaticum* reportedly produces natural hybrids with *B. pinnatum* in Europe (Long, 1989), and synthetic hybrids with *B. pinnatum* and *B. phoenicoides* (L.) Roem. & Schult. are viable (Khan & Stace, 1999).

Brachypodium sylvaticum is a species common in Europe, but also extends into Asia and North Africa (Catalán & Olmstead, 2000; Catalán *et al.*, 2015; Díaz-Pérez *et al.*, 2018). This species is shortly (or scarcely) rhizomatous, usually pendent at tip of raceme, leaves usually 6–10 mm wide, sheaths usually pubescent, sometimes glabrous, raceme with (3–)5–12 spikelets, lemmas 6–12 mm, with awn 7–15 mm.

Brachypodium pinnatum is a widespread species in temperate regions of the Northern Hemisphere, it is a thermophilous species but also grows in cool

continental climates and reaches higher latitudinal limits in East-Central Asia than *B. sylvaticum*, which grows in areas with more oceanic climates (Tzvelev, 1976; Catalán *et al.*, 2016). *Brachypodium pinnatum* typically grows in more open areas, such as calcareous grasslands. It is extensively rhizomatous, usually erect, leaves 3–6 mm wide, raceme with (3–)6–15 spikelets, lemmas 6–11 mm, often glabrous, with awn 1–5 mm (Tzvelev, 1976; López González, 2021). It is morphologically similar to *B. rupestre* (Host) Roem. & Schult. which also apparently has the same cytotypes as its close congener ($2n = 2x = 18$; $2n = 4x = 28$) (see Stace, 2019) and could also have been involved in the hybridization with *B. sylvaticum*.

The present paper is a further step of our contributions to *Brachypodium* nomenclature (see, e.g., Fabado & Ferrer-Gallego, 2021; Ferrer-Gallego & Martínez Labarga, 2022a, b), the purpose of this paper is to contribute to the stability of the nomenclature of *B. xpau* and *B. xcugnacii* through the lectotypification of each of these two names.

MATERIALS AND METHODS

This work is based on the analysis of protologues, examination of relevant literature and study of the specimens conserved in the herbaria B, BC, BCN, DR, FR, MA, MPU, P, US, and VAL (acronyms follow Thiers, 2023). The identity of the designated types has been verified with the current use of their respective names. The typified names are arranged in alphabetic order, followed by their homotypic synonyms (indicated with the symbol “≡”). The names in current use are indicated in bold italics typeface.

RESULTS AND DISCUSSION

Brachypodium xcugnacii

The protologue of *Brachypodium xcugnacii* (Camus, 1931) includes the name “× *Brachypodium Cugnacii* A. Camus” and the hybrid formula “*B. pinnatum* P.B. × [*Brachypodium*] *sylvaticum* R. et S. var. *villosum* Lej. et Court.”, and a complete diagnosis followed by the geographical provenance and gathering “Seine-et-Oise: Verrières (A. de Cugnac, 1930)”. This citation represents a syntype according

to the Art. 9.6 of *Shenzhen Code* (hereafter as “ICN”; Turland *et al.*, 2018). The protologue also includes a diagnosis and a table with several features to distinguish this hybrid and their parents.

Saint-Yves (1934: 435) synonymized the name *Brachypodium xcugnacii* with *B. pinnatum* var. *glauco-virens* (this taxon is currently recognized as an independent species by several authors, see e.g., Catalán *et al.*, 2015; POWO, 2023). Schippmann (1991) treated *B. xcugnacii* as a synonym of *B. sylvaticum* subsp. *sylvaticum*, and reported “typum non vidi”.

We have found two specimens at P (P03471271 and P03628878) for *Brachypodium xcugnacii*. P03471271 is part of the original material, bearing a plant, with leaves and spikelets, and an original label handwritten by A. Camus annotated as “Herbier E. G. Camus & A. Camus / × *Brachypodium Cugnacii* A. Camus / *B. pinnatum* × *sylvaticum* inter parentes / Seine-et-Oise: Verrières / 1930 / Legit de Cugnac / A. Camus” (Fig. 1). P03628878 bears a complete specimen, with leaves and flowers, and a handwritten label annotated as “× *Brachypodium Cugnacii* // S-et-O: Verrières / 7-VII-1931 / R. de Cugnac”. Since the year of collection (1931) is not that reported in the protologue, P03628878 cannot be considered as part of the original material for *B. xcugnacii*. As a consequence, P03471271 is here designated as the lectotype for the name *B. xcugnacii*. This specimen and the rest of the material match the traditional concept and current use of the name (Camus, 1931; López González, 2021).

Brachypodium xcugnacii A. Camus, Bull. Soc. Bot. France 78: 100. 1931 [= *B. pinnatum* (or cf. *B. rupestre*) × *B. sylvaticum*]

Lectotype (designated here): [France] Seine-et-Oise: Verrières, 1930, *Cugnac s.n.* (P03471271 [photo!]; Fig. 1).

Brachypodium xpau

Sennen’s protologue (1911: 133) of *Brachypodium xpau* (a taxon numbered with “409”) includes the hybrid formula “(*B. ramosum* × *distachyon*)?” followed by a complete diagnosis and the geographical provenances “Hab.: Garrigues et olivettes à Llers, Pont-de-Molins, Figueras; pentes du Tibidabo, près Barcelone; Benicarló à Bóbola”.

Schippmann (1991) reported: “syntypi: “Plantas d’Espagne no. 409, *Brachypodium Pau* Sen.,?”



Figure 1. Lectotype of *Brachypodium* ×*cugnacii* Camus (P03471271). Image courtesy of the herbarium P, reproduced with permission.

(*B. ramosum* + *distachyon*) Sen., Catalogne: Llers et Pont de Molins, olivettes, Juin 1907” (B!, FR!, LD!, M!); “Plantes d’Espagne no. 1046, *Brachypodium Paui* Sen., (*B. ramosum* + *distachyos*)? Sen., Catalogne: Barcelone, pentes du Tibidabo, VI.1910” (B!, FR!, LD!); specimen scheda manu scripta instructa: “Catalogne, Llers, olivettes, 19.VI.1905, F. Sennen” (B!); specimen scheda manu scripta instructa: “Catalonia, Figueras, champs, VI.[19]10, leg. Sennen” (LD!)”, and also commented about the material type and plant that “Das Typusmaterial ist in vielen Doubletten vorhanden. Einige der anatomisch und morphologisch untersuchten Pflanzen zeigen zwischen *B. distachyon* und *B. retusum* intermediäre Merkmale, bei anderen handelt es sich eindeutig um *B. retusum*” [The type material is available in many duplicates. Some of the anatomically and morphologically examined plants show intermediate characters between *B. distachyon* and *B. retusum*, others are clearly *B. retusum*] and “Sennen weist auf den Hybridcharakter dieses Taxons hin” [Sennen points out the hybrid character of this taxon]. Therefore, not all the specimens are syntypes.

We traced several original specimens of *Brachypodium* × *pau* at B, BC, BCN, DR, FR, MA, MPU, P, US, and VAL herbaria. Among them, several (BC616312, BC616227, BC118838, BC71120, BC-Sennen [without number], BCN78982, DR061516, FR0031230, P02569267, P03139060, P03218686, P03218691, MA14348, MA14350, MA163576, MPU027893, MPU027892, VAL172458) are number with “409” as reported in the protologue, and collected in “Catalogne: Llers et Pont de Molins” in June 1907. These specimens can be considered as syntypes (Art. 9.6 of *ICN*) and therefore have a preference for lectotype designation according to Art. 9.12 of *ICN*. We designate as the lectotype of the name *B.* × *pau* the specimen BC616227 (Fig. 2) since it bears a well-developed and complete plant which matches the traditional and current use and concept of the name *B.* × *pau* (Sennen, 1911; López González, 2021): plants extensively branched, erect or geniculately ascending stems, glabrous; leaves up to 10 cm × 2–4 mm, with prominent spaced veins, flat, tough, becoming convolute when dry, acute, the cauline patent, distichous; ligule ca. 1 mm; raceme 4–9 cm, dense, stiffly erect, with 1–5(–7) spikelets; spikelets (12–)20–30 mm, linear, glabrous, glaucous, with (6–)10–15 florets; glumes acute, the lower 4–5 mm, the upper 6–7 mm;

lemma 7–8 mm, ovate-lanceolate, abruptly narrowed to the apex.

Brachypodium* × *pau Sennen, Bull. Géogr. Bot. 21(259): 133. 1911 [= *B. distachyon* complex (probably *B. hybridum*) × *B. retusum*]

≡ *Brachypodium distachyon* subsp. *pau* (Sennen) Malagarriga in Act. Phytotax. Barcinon. 18: 10. 1977

Lectotype (designated here): [Spain] Catalogne, Llers et Pont de Molins, June 1907, *F. Sennen* 409 (BC616227 [photo!]; Fig. 2). **Isolectotypes**: BC616312, BC118838, BC71120, BC-Sennen [without number], BCN 78982, DR061516, FR0031230, MA14348, MA14350, MA163576, P02569267, P03139060, P03218686, P03218691, MPU027893, MPU027892, VAL172458.

Note on the nomenclatural type of *Brachypodium retusum*

The specimen now barcoded as L0043873 is the “holotype” of *Bromus retusus* Pers. according to Schippmann (1991: 106), who stated: “holotypus: “*Bromus retusus* Syn. plant. Enc. Botan., [...] Gallia Meridian.” (L!). - Die Herbarien BM, E, G, GOET, LD, LG und NY haben auf Anfrage mitgeteilt, daß sie kein Typus-Material dieser Art besitzen.” [Herbaria BM, E, G, GOET, LD, LG and NY have indicated upon request that they do not have any material of this type]. Thus, Schippmann unintentionally or “inadvertently” lectotypified the name. Moreover, we have also not found any further herbarium sheet with Persoon’s original material of *B. retusus* and, probably, the specimen at L is the only original material used by the author for the description of this plant. However, as we cannot exclude that there would be more than one specimen of this taxon in his collection, we consider the specimen L0043873 as the lectotype (corrected here according to Art. 9.10 of the *ICN*) of the name *B. retusus*, admitting that the specimen might well be the holotype.

Brachypodium retusum (Pers.) P. Beauv., Ess. Agrostogr.: 155, 156, 101. 1812

Lectotype (designated by Schippmann in Boissiera 45: 106. 1991, corrected here according to Art. 9.10 of the *ICN*): [France] in Gall. meridian, s.d., *Persoon s.n.*, (L0043873; image



Figure 2. Lectotype of *Brachypodium* × *pau* Sennen (BC616227). Image courtesy of the herbarium BC, reproduced with permission.

available at https://bioportal.naturalis.nl/multimedia/L++0043873_0339368672/term=Brachypodium+retusum&from=38).

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REFERENCES

- AFA [African Plant Database] 2022. *Brachypodium retusum* (Pers.) P. Beauv. Retrieved October 15, 2022, from <https://africanplantdatabase.ch/en/nomen/49881>
- Camus, A. 1931. Quelques hybrides des genres *Cistus*, *Bromus* et *Brachypodium*. *Bulletin de la Société Botanique de France* 78(1): 97–102. <https://doi.org/10.1080/00378941.1931.10832870>
- Catalán, P., López-Álvarez, D., Bellosta, C. & Villar, L. 2016. Updated taxonomic descriptions, iconography, and habitat preferences of *Brachypodium distachyon*, *B. stacei*, and *B. hybridum* (Poaceae). *Anales del Jardín Botánico de Madrid* 73(1): e028. <https://doi.org/10.3989/ajbm.2428>
- Catalán, P., López-Álvarez, D., Díaz-Pérez, A., Sancho, R. & López-Herránz, M. L. 2015. Phylogeny and evolution of the genus *Brachypodium*. In: Vogel, J. P. (Ed.), *Genetics and Genomics of Brachypodium* (Plant Genetics and Genomics: Crops and Models, 18). Springer, Cham: 9–38. https://doi.org/10.1007/7397_2015_17
- Catalán, P., Müller, J., Hasterok, R., Jenkins, G., Mur, L. A. J., Langdon, T., Betekhtin, A., Siwinkska, D., Pimentel, M. & López-Álvarez, D. 2012. Evolution and taxonomic split of the model grass *Brachypodium distachyon*. *Annals of Botany* 109(2): 385–405. <https://doi.org/10.1093/aob/mcr294>
- Catalán, P. & Olmstead, R. G. 2000. Phylogenetic reconstruction of the genus *Brachypodium* P. Beauv. (Poaceae) from combined sequences of chloroplast *ndhF* gene and nuclear ITS. *Plant Systematics and Evolution* 200: 1–19. <https://doi.org/10.1007/BF00985367>
- Catalán, P., Shi, Y., Armstrong, L., Draper, J. & Stace, C. A. 1995. Molecular phylogeny of the grass genus *Brachypodium* P. Beauv. based on RFLP and RAPD analysis. *Botanical Journal of the Linnean Society* 117: 263–280. <https://doi.org/10.1111/j.1095-8339.1995.tb02590.x>
- Cope, T. A., Kneess, S. G. & Miller, A. G. 2007. *Flora of the Arabian peninsula and Socotra* 5(1). Edinburgh University Press, Edinburgh.
- Díaz-Pérez, A., López-Álvarez, D., Sancho, R. & Catalán, P. 2018. Reconstructing the origins and the biogeography of species' genomes in the highly reticulate allopolyploid-rich model grass genus *Brachypodium* using minimum evolution, coalescence and maximum likelihood approaches. *Molecular Phylogenetics and Evolution* 127: 256–271. <https://doi.org/10.1016/j.ympev.2018.06.003>
- Draper, J., Mur, L. A. J., Jenkins, G., Ghosh-Biswas, C., Bablak, P., Hasterok, R. & Routledge, A. P. M. 2001. *Brachypodium distachyon*. A new model system for functional genomics in grasses. *Plant Physiology* 127(4): 1539–1555. <https://doi.org/10.1104/pp.010196>
- Fabado, J. & Ferrer-Gallego, P. P. 2021. Typification of four species names published by William Hudson. *Kew Bulletin* 76(1): 1–6. <https://doi.org/10.1007/s12225-021-09932-9>
- Ferrer-Gallego, P. P. & Martínez Labarga, J. M. 2022a. Typification of the name *Brachypodium obtusifolium* (Brachypodieae, Poaceae). *Phytotaxa* 555(3): 273–278. <https://doi.org/10.11646/phytotaxa.555.3.7>
- Ferrer-Gallego, P. P. & Martínez Labarga, J. M. 2022b. (2896) Proposal to conserve the name *Bromus retusus* (*Brachypodium retusum*) against *B. plukenetii* (Brachypodieae, Gramineae). *Taxon* 71: 694–696. <https://doi.org/10.1002/tax.12749>
- Khan, M. A. & Stace, C. A. 1999. Breeding relationships in the genus *Brachypodium* (Poaceae: Pooideae). *Nordic Journal of Botany* 19: 257–269. <https://doi.org/10.1111/j.1756-1051.1999.tb01108.x>
- IBI [International *Brachypodium* Initiative] 2010. Genome sequencing and analysis of the model grass *Brachypodium distachyon*. *Nature* 463(7282): 763–768. <https://doi.org/10.1038/nature08747>
- Long, G. M. 1989. *Morphological and Physiological Variation in Brachypodium sylvaticum*. University of Wales, College of Cardiff, Cardiff.
- López-Álvarez, D., López-Herranz, M. L., Betekhtin, A. & Catalán, P. 2012. A DNA barcoding method to discriminate between the model plant *Brachypodium distachyon* and its close relatives *B. stacei* and *B. hybridum* (Poaceae). *PLoS One* 7: e51058. <https://doi.org/10.1371/journal.pone.0051058>
- López-Álvarez, D., Manzaneda, A. J., Rey, P. J., Giraldo, P., Benavente, E., Allainguillaume, J., Mur, L., Caicedo, A. L., Hazen, S. P., Breiman, A., Ezrati, S. & Catalán, P. 2015. Environmental niche variation and evolutionary diversification of the *Brachypodium distachyon* grass complex species in their native circum-Mediterranean range. *American Journal of Botany* 102: 1073–1088. <https://doi.org/10.3732/ajb.1500128>
- López-Álvarez, D., Zubair, H., Beckmann, M., Draper, J. & Catalán, P. 2017. Diversity and association of phenotypic and metabolomic traits in the close model grasses *Brachypodium distachyon*, *B. stacei* and *B. hybridum*. *Annals of Botany* 119: 545–561. <https://doi.org/10.1093/aob/mcw239>
- López González, G. 2021. *Brachypodium* P. Beauv. In: Romero Zarco, C., Rico, E., Crespo, M. B., Devesa, J. A., Buirra, T. & Aedo, C. (Eds.), *Flora iberica* 19(2). Real Jardín Botánico, CSIC, Madrid: 980–994.
- Palisot de Beauvois, A.-M. F.-J. 1812. *Essai d'une nouvelle agrostographie; ou nouveaux genres des graminées; avec figures représentant les caractères de tous les genres*. Imprimerie de Fain, Paris. <https://doi.org/10.5962/bhl.title.474>
- Piep, M. B. 2007. *Brachypodium*. In: Barkworth M. E., Capels, K. M., Long, S. & Anderton, L. K. (Eds.), *Flora of North America North of Mexico* 24. Oxford University Press, New York-Oxford: 187–192.
- POWO [Plants of the World Online] 2023. Retrieved January 29, 2023, from <https://powo.science.kew.org>
- Saint-Yves, A. 1934. Contribution à l'étude des *Brachypodium* (Europe et région méditerranéenne). *Candollea* 5: 427–493.
- Schippmann, U. 1991. Revision der europäischen Arten der Gattung *Brachypodium* Palisot de Beauvois (Poaceae). *Boissiera* 45: 1–249.

- Sennen, F. 1911. Plantes d'Espagne: Notes et diagnoses. *Bulletin de l'Académie Internationale de Géographie Botanique* 21(259): 101–138.
- Smith, P. M. 1980. *Brachypodium* Beauv. In: Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M. & Webb, D. A. (Eds.) *Flora Europaea* 5. Cambridge University Press, Cambridge: 189–190.
- Stace, C. 2019. *New Flora of the British Isles* (4th ed.). Cambridge University Press, Cambridge.
- Thiers, B. 2023. *Index Herbariorum: a global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium. Retrieved January 18, 2022, from: <http://sweetgum.nybg.org/science/ih>
- Turland, N. J., Wiersema, J. H., Barrie, F. R., Greuter, W., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T. W., McNeill, J., Monro, A. M., Prado, J., Price, M. J. & Smith, G. F. (Eds.) 2018. *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code)* (Regnum Vegetabile, 159). Koeltz Botanical Books, Glashütten. <https://doi.org/10.12705/Code.2018>
- Tzvelev, N. N. 1976. *Zlaki SSSR*. Nauka Publishers, Leningrad.