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BRACHYPODIUM BOISSIERI NYMAN. AN ENDEMIC GRASS SPECIES OF SOUTHERN SPAIN

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Resumen. *Brachypodium boissieri* Nyman es una especie exclusiva de Sierra Tejeda, Sierra de Almijara, Sierra de Cázulas y Sierra Nevada. Se indican sus diferencias morfológicas y anatómicas con *B. retusum*, así como los números cromosómicos y datos de la distribución de ambas especies.

Summary. *Brachypodium boissieri* Nyman is restricted to the mountainous zone of Sierra Nevada, Sierra Tejeda, Sierra de Almijara and Sierra de Cázulas (provinces of Granada and Málaga). The anatomical and morphological differences between *B. boissieri* and the closely related *B. retusum* are shown and chromosome numbers are presented.

INTRODUCTION

The genus *Brachypodium* Beauv. *(Poaceae)*, which is being investigated in a monographic study by the author, is predominantly distributed in Europe and Asia with disjunct occurrences in Central America and Central and Southern Africa. Six species of *Brachypodium* are present in the Iberian Peninsula: *B. distachyon* (L.) Beauv., *B. sylvaticum* (Hudson) Beauv., *B. rupestre* (Host) Roemer & Schultes, *B. phoenicoides* (L.) Beauv., *B. retusum* (Persoon) Beauv. and *B. boissieri* Nyman. Recently *B. gaditanum* Talavera has been described from Cádiz, a species which seems to be closely related to *B. sylvaticum* (TALAVERA, 1986). The western Mediterranean area can be regarded as the center of divetrsity of the genus.

DIAGNOSTIC CHARACTERS

In most modern floras and nomenclatural accounts *B. boissieri* is treated as being conspecific with *B. retusum* (SMITH, 1980, TALAVERA, 1987). Both taxa are, however, well separated from each other. They differ in several morphological and anatomical characters (Tab. 1).

The majority of diagnostic characters can be found in leaf blade morphology and anatomy.

The apex of the leaf blade of *B. boissieri* is obtuse while it is acute in *B. retusum* (Figs. 1 & 2).

In *B. boissieri*, the vernation of the leaf blade is symmetric in cross section, with the edges rounded and not overlapping (Fig. 3, a-c); in *B. retusum* the leaf blade is asymmetric in vernation with the edges of the blade pointed and usually overlapping (Fig. 3, e-g). These characters are constant in greenhouse cultivation also. Observing the cross section of a leaf blade (vegetative shoot), the two species show differences in their sclerenchyma distribution. *B. retusum* has bar-, T- or anchor-shaped sclerenchyma groups above and beneath the vascular bundles (Fig. 4). In *B. boissieri* similar sclerenchyma groups around the bundles exist; additionally, they are connected by a single row of sclerenchymatic cells which

Character	*B. retusum*	*B. boissieri*	Fig.
Apex of leaf blade	acute	obtuse	1, 2
Vernation of leaf blade	asymmetric	symmetric	3
Distribution of sclerenchyma in cross section of leaf blade (vegetative shoot)	above and beneath vascular bundles	ditto, plus continuous layer under abaxial epidermis	4, 5
Length of leaf blade (2nd culm leaf)	2 - 11 cm	1 - 4 cm	
Length of culm	20 - 65 cm	8 - 30 cm	6
Cataphylls of stolons	glabrous	hairy	
Number of spikelets (2nd or 1st spikelet from base)	(1-)2-4(-7)	1(-2)	
Number of florets (ditto)	10 - 18	6 - 12	
Legth of lemma awn (ditto, 4th floret from base)	0,3 - 3,0 mm	1,8 - 4,1 mm	6, 7

Tab. 1. Diagnostic characters of *Brachypodium retusum* and *B. boissieri*. Measurements are based on 25 and 17 specimens respectively.

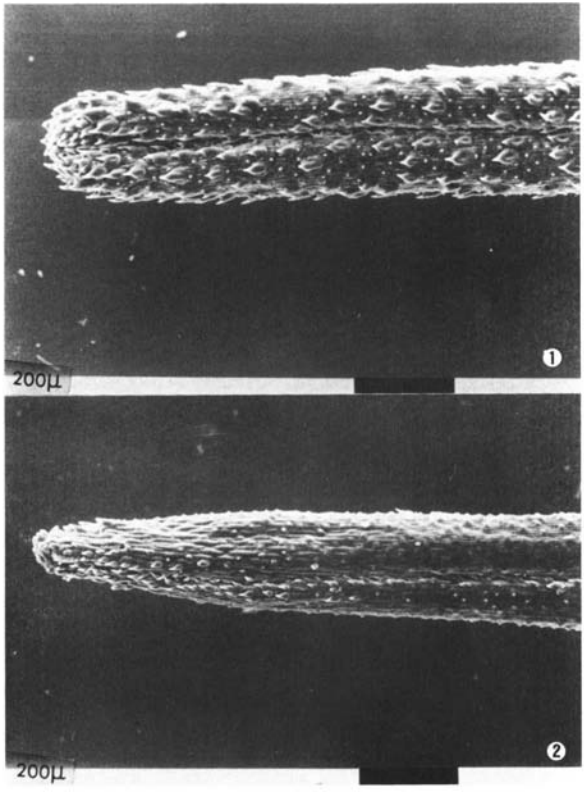


Fig. 1 y 2. *Brachypodium boissieri* (1). Apex of leaf blade obtuse (vegetative shoot). The leaf blade is distinctly rolled and the adaxial side can only be seen as narrow furrow. *Brachypodium retusum* (2). Apex of leaf blade acute (vegetative shoot). The leaf blade is distinctly rolled and the adaxial side can only be seen as narrow furrow.

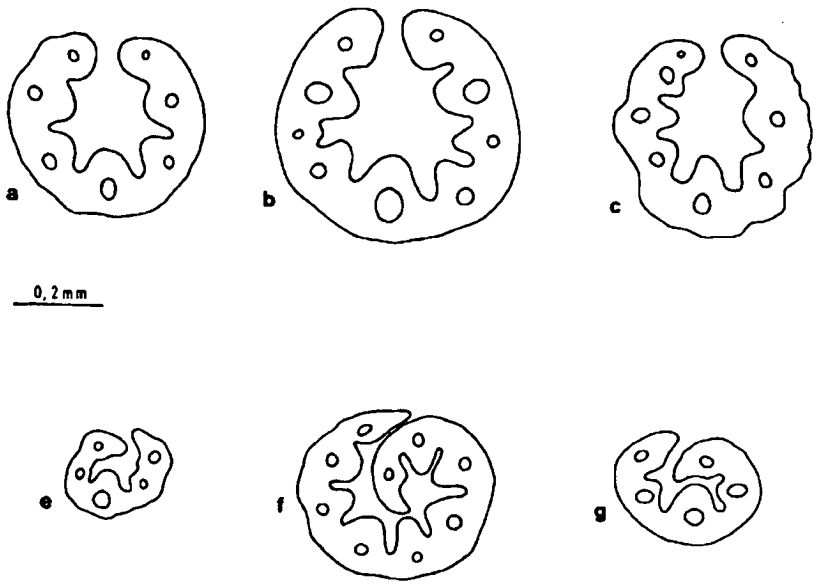


Fig. 3. Vernation of leaf blade of vegetative shoot. a-c, *Brachypodium boissieri*, vernation symmetric; e-g, *B. retusum*, vernation asymmetric.

form a continuous or only partly interrupted layer under the abaxial epidermis (Fig. 5). In *B. retusum* sclerenchymatic cells are only scarcely found spreading out under the intercostal abaxial epidermis.

In a number of morphological features *B. boissieri* shows smaller values than *B. retusum* (length of leaf blade, lenght of culm, number of spikelets, number of florets). This might give way to the conclusion that *B. boissieri* is only a dwarfish mountainous race of *B. retusum*. However, the fact that *B. boissieri* has longer lemma awns than *B. retusum* demonstrates that not all morphological characters have decreasing values in higher altitudes (Figs. 6, 7).

In therefore consider *B. boissieri* to be a separate species.

Brachypodium boissieri Nyman, *Syll. Fl. Eur.* 425 (1855)

Triticum obtusifolium Boiss., *Elenchus* 199 (1838) (Type: "in montanis calcar. Regn. Granat.", VII.1837, E. BOISSIER, K, isotype).

Brachypodium obtusifolium (Boiss.) Boiss., *Voy. Bot. Midi Esp.* 2: 679 (1844), non Link, nom. illeg.

Brachypodium boissieri forma *aristata* Lindberg, *Act. Soc. Sci. Fenn.* n. s. 1(2): 12 (1932) (Type: "Sierra Nevada, in saxosis calc. juxta monast. de S. Francisco, c. 1400 m"; 24.VII.1926, H. LINDBERG 1104, K, lectotype)

Brachypodium ramosum subsp. *boissieri* Saint-Yves, *Candollea* 5: 469 (1934)

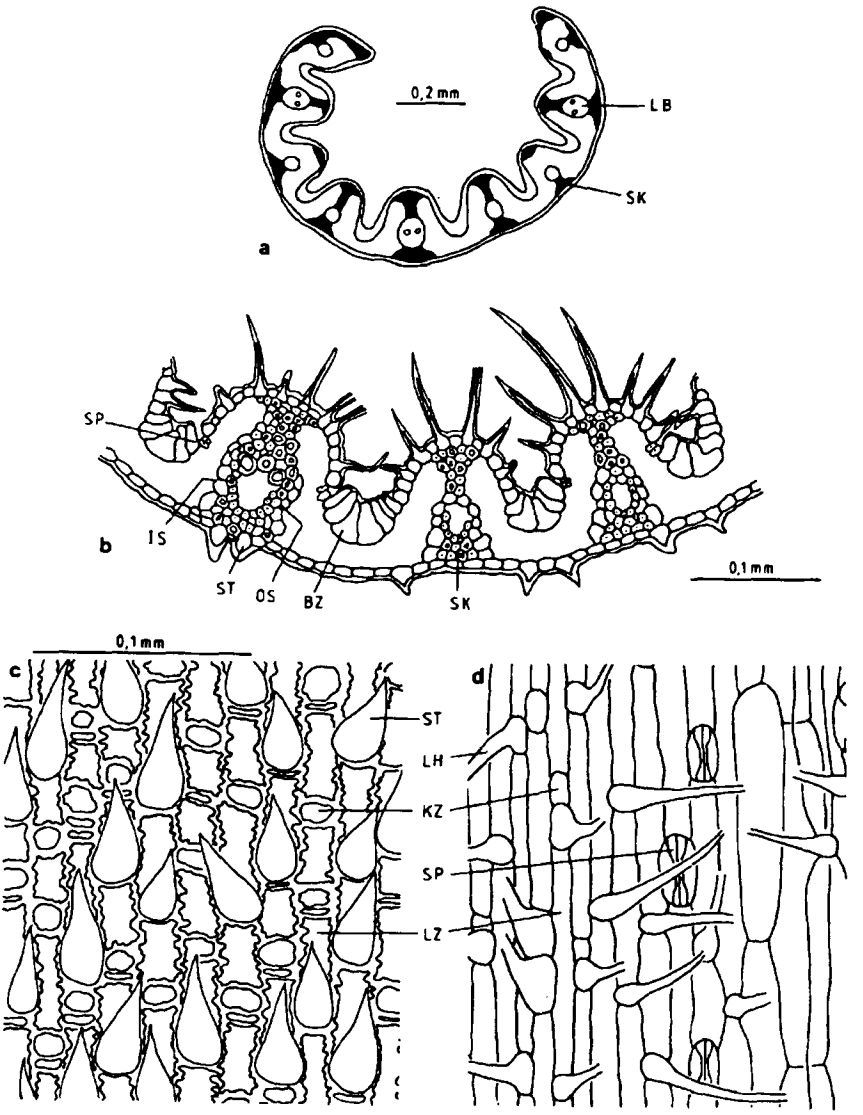


Fig. 4. Leaf blade anatomy of *Brachypodium retusum*. a, survey; b, detail of cross section; c, abaxial epidermis; d, adaxial epidermis. BZ, bulliform cell; IS, inner bundle sheath; OS, outer bundle sheath; KZ, short cell; LB, vascular bundle; LH, macro hair; LZ, long cell; SK, sclerenchyma; SP, stoma; ST, prickle.

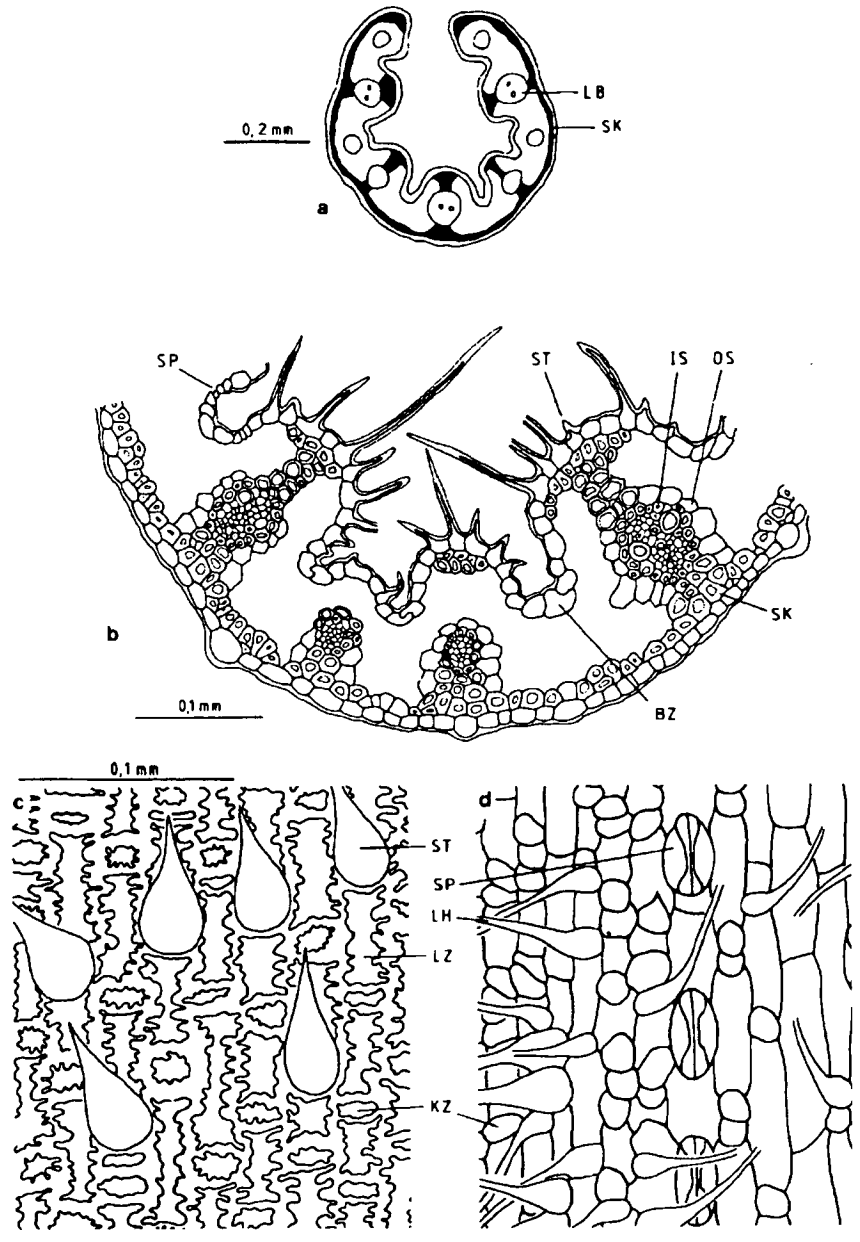
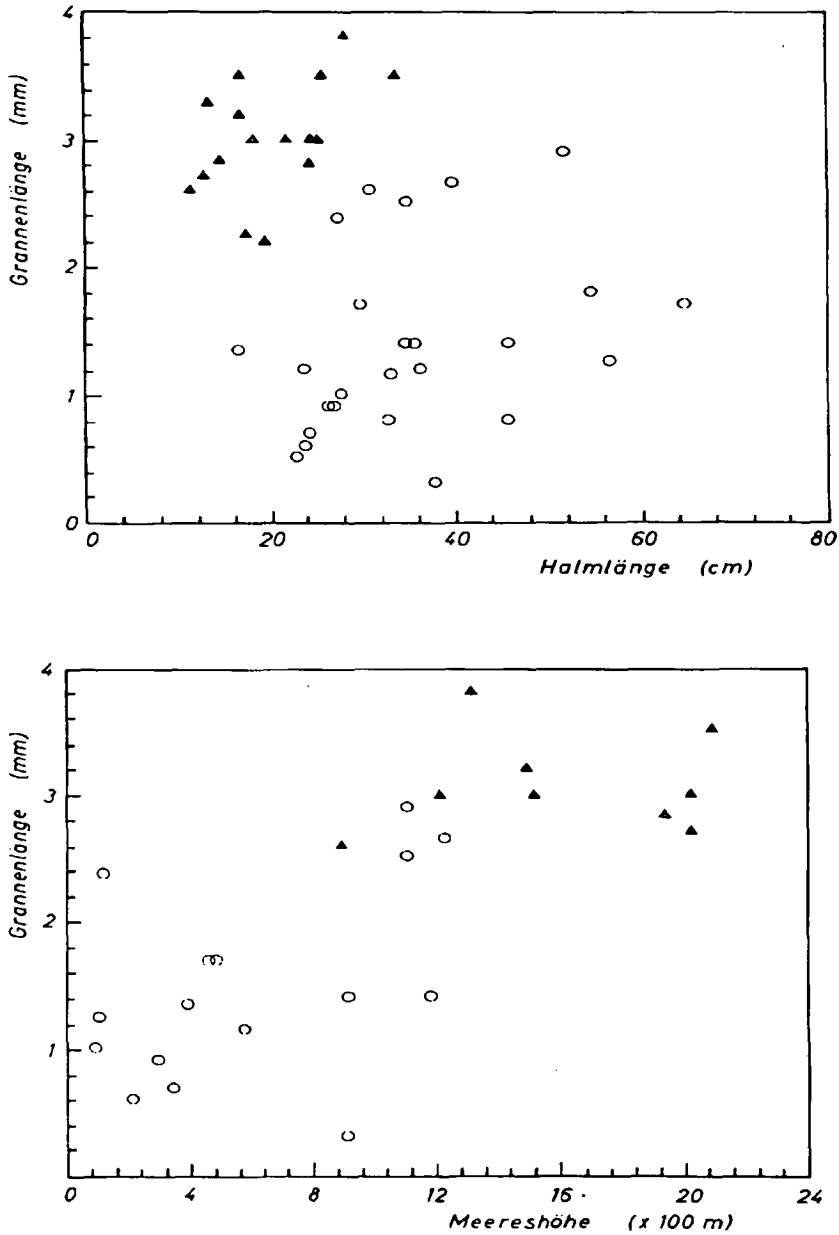


Fig. 5. Leaf blade anatomy of *Brachypodium boissieri*. For explanation, see Fig. 4.



Figs. 6 y 7. (6) Length of lemma awn (Grannenlänge) and length of culm (Halmlänge). ▲, specimens with obtuse apex of leaf blade (= *B. boissieri*); ○, specimens with acute apex of leaf blade (= *B. retusum*). (7) Length of lemma awn (Grannenlänge) is increasing in higher altitudes (Meereshöhe).

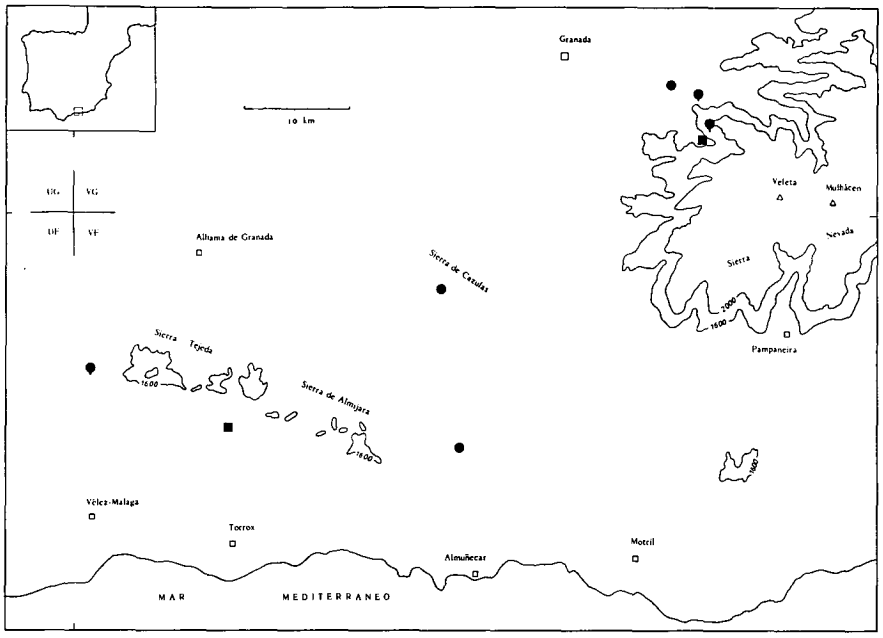


Fig. 8. Distribution of *Brachypodium boissieri*. Contour lines of 1600 and 2000 m and the UTM grid are indicated. ●, material collected by the author. ●, ditto, chromosome counts; ●, collection of uncertain location.

DISTRIBUTION

The present knowledge of the distribution of *B. boissieri* is shown in figure 8. While *B. retusum* is widespread over the Iberian Peninsula, the distribution of *B. boissieri* is restricted to a small area comprising Sierra Nevada, Sierra Tejeda, Sierra de Almijara and Sierra de Cázulas. VALLE TENDERO (1981) gives a further record for the Sierra de Alfacar (VG 5524, not shown in Fig. 8). The species inhabits the mountainous zone from 700 m up to 2050 m.

MATERIAL

Granada. Sierra de Almijara, 1903, *Gandoger* s. n. (M); road from Granada to Almuñecar, 1325 m, VF 34-81, 21.VI.1985, *Schp** 2434 (herb. SCHP); N of Torrox, 900 m, 25.V.1983, *Gronbach & Rodríguez* G.R. 598 (M). Sierra de Cázulas, road from Granada to Almuñecar, 1240 m, VF 35-92, 21.VI.1985, *Schp* 2428 (herb. SCHP). Sierra Nevada, 1500 m, 28.VII.1967, *Segura Zubizaretta* s. n. (M); Mt. Dornajo, 20.VII.1876,

(*) Schp, Uwe Schippmann

2n	sp. number	Collector	Origin
28	us-86	hort. bot. Liége	France, Corsica, Calvi, La Revelleta
28	2766	Schippmann	Greece, Crete, Kidhonia, Skines, 190 m
32	2192	Schippmann	Spain, Málaga, Yunquera, 680m
32	2284	Schippmann	Spain, Lleida, Collada de Comiols , 1140 m
31, 32	2692	Schippmann	Spain, Zaragoza, SW Calatayud
40	2879	Schippmann	Spain, Navarra, Estella, 570m

Tab. 2. Chromosome numbers of *Brachypodium retusum*.

Winkler s. n. (M, BP); ibidem, rock crevices, 2000-2200 m, VII.1891, *Porta & Rigo* 467 (M, BP); ibidem, rocks at Dornajo Tesoro, 1800-2100 m, 21.VII.1879, *Huter, Porta & Rigo* 172 (M, BP); ibidem, 2020-2050 m, VG 60-08, 20.VI.1985, *Schp* 2388, 2413, 2421A; 27.VII.1985, *Schp* 2653 (herb. SCHP); E of Sierra Nevada road, quarry, 1220 m, VG 57-11, 20.VI.1985, *Schp* 2419 (herb. SCHP); road to TV-station N of Sierra Nevada road, 1525 m, VG 59-11, 20.VI.1985, *Schp* 2415 (herb. SCHP); "in saxosis calcareis juxta monast. de S. Francisco", c. 1400 m, 24.VII.1926, *Lindberg* 1104 (K, isotype); "in montanis calcar. Regn. Granat.", VII.1837, *Boissier* (K, isotype). **Málaga.** Sierra Tejeda, NE of Alcaucin, Cortijo de Alcázar, 720 m, VF 02-86, 26.VI.1985, Schp 2459 (herb. SCHP).

CHROMOSOME NUMBERS

All chromosome counts were carried out in root tip cells. The two species *B. retusum* and *B. boissieri* show a considerable infraspecific variance in chromosome numbers. In *B. retusum* 2n = 28, 2n = 32 and 2n = 40 have been counted (Tab. 2). In collection 2692 two different chromosome numbers, 2n = 31 and 2n = 32, were observed in different root tips of the same plant. A literature record for this species is 2n = 27 (NATARAJAN, 1978). In *B. boissieri*

2n	sp. number	Collector	Origin
42	2653	Schippmann	Spain, Granada, Dornajo, 2040 m
46	2419	Schippmann	Spain, Granada, El Purche, 1220 m

Tab. 3. Chromosome numbers of *Brachypodium boissieri*.

2n = 42 and 2n = 46 were found (Tab. 3). ROBERTSON (1981) has published 2n = 36 for this species; C. A. STACE names 2n = 42 as correct chromosome number for this plant (personal communication).

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