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Helictotrichon devesae, a new endemic grass species from Castilla-La Mancha (Central Spain)

by

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Abstract

Romero Zarco, C. 2007. *Helictotrichon devesae*, a new endemic grass species from Castilla-La Mancha (central Spain). *Anales Jard. Bot. Madrid* 64(2): 205-211.

Helictotrichon devesae Romero Zarco (Aveneae; Poaceae), a new grass species is described and its anatomical and morphological characters are compared in relation to other species in the genus.

Keywords: *Helictotrichon*, Aveneae, Gramineae, taxonomy, leaf anatomy, Spain.

Resumen

Romero Zarco, C. 2007. *Helictotrichon devesae*, una nueva especie de gramínea endémica de Castilla-La Mancha (centro de España). *Anales Jard. Bot. Madrid* 64(2): 205-211 (en inglés).

Se describe *Helictotrichon devesae* Romero Zarco (Aveneae; Poaceae), una nueva especie de gramínea y se comparan sus caracteres anatómicos y morfológicos con los de otras especies del género.

Palabras clave: *Helictotrichon*, Aveneae, Gramineae, taxonomía, anatomía foliar, España.

Introduction

The genus *Helictotrichon* Besser (Aveneae; Poaceae), sensu stricto (*Helictotrichon* subgen. *Helictotrichon* sensu Röser, 1989), was the subject of several taxonomic surveys in the last century (Gervais, 1973; Romero Zarco, 1984, 1985a; Röser, 1989, 1996). Those studies provided a large data set for Western European and North African taxa. At present, up to 7 *Helictotrichon* taxa, belonging to 3 (Romero Zarco, 1984) or 4 (Röser, 1989) species, have been identified for the Iberian Peninsula.

The Mediterranean region is the likely scenario for recent speciation events involving ancestors of the pre-Mediterranean flora, probably similar to now existing species in South-eastern Asia or tropical East Africa (Röser, 1996: 256). The genus' geographic range in Spain is conditioned by the orophilic or somewhat steppe character and mainly basiphilic affinity of its species.

Two isolated areas are known to include *Helictotrichon* species: one in the North and another in the South-East (Fig. 1). The former comprises a small portion of the Iberian System, Central and Western Pyrenees and the Cantabrian Range, where the endemic *H. cantabricum* (Lag.) Gervais grows in a great variety of plant communities from sea level to 2200 m. The meso-xerophilic Alpine-Atlasic *H. sedenense* (DC.) J. Holub occurs in alpine meadows, subalpine and oro-mediterranean dwarf-shrub communities, and open subalpine coniferous woodlands (Röser, 1996).

In the second area, south-eastern Iberia, *H. sedenense* grows in open hemicryptophytic formations affected by cryoturbation (cryoromediterranean) and at lower altitudes in xerophilic spiny shrubs (oro-mediterranean), from 2000 to 3300 m above sea level. The *H. filifolium* (Lag.) Henrard complex occurs in most of SE Spain, from the Sierra de Grazalema (Cádiz province, S Spain) to Segorbe (Castellón province, E Spain), including Sierra de Cazorla and the Júcar valley. In this interesting complex, low ploidy levels (2x, 4x, 8x) are found in the central part of the Betic Ranges (S Spain: Sierra de Rute, Sierra Tejeda, south of Jaén province and several places in Granada province, specially in Sierra Nevada). In a previous paper Romero Zarco (1984) identified these populations as *H. filifolium* subsp. *velutinum* (Boiss.) Romero Zarco. However, Röser (1989, 1996, 2006),

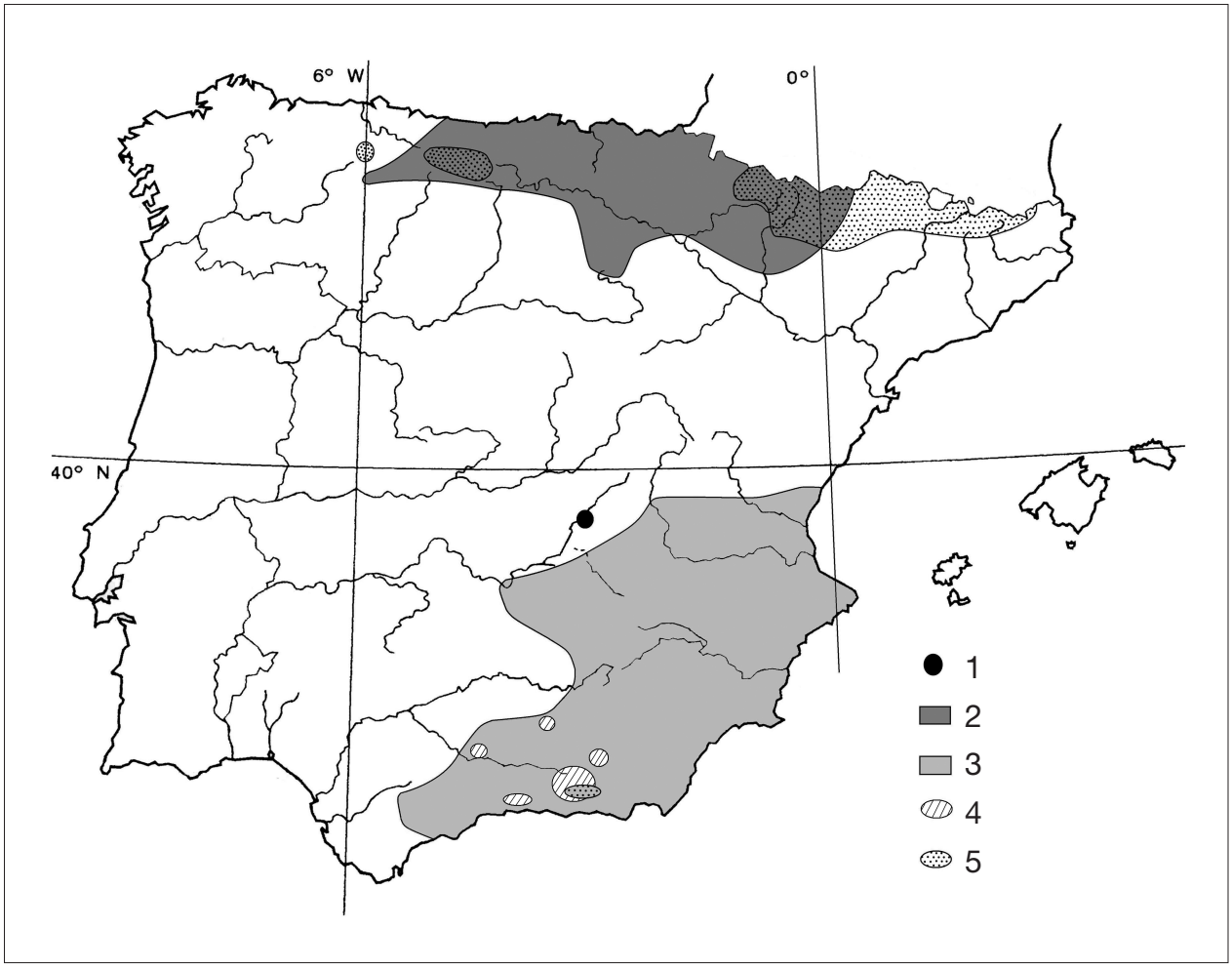

Fig. 1. Distribution range of Spanish *Helictotrichon* species: 1, type locality of *H. devesae*; 2, *H. cantabricum*; 3, *H. filifolium*; 4, *H. sarracenorum*; 5, *H. sedenense*. 2-5 according to Romero Zarco (1984) and Röser (1989). 3 including localities from Martín-Blanco & Carrasco (2005).

considered these plants to be very well delimited from the rest of the complex and worth of specific recognition as *H. sarracenorum* (Gand.) J. Holub. Awaiting for future phylogenetic evidences, we accept Röser's proposal, mainly because it seems more consistent with the taxonomic treatment of the genus. It has been suggested that plants with $2n = 70$ (10x) from the western Betic ranges (coexisting with *Abies pinsapo* Boiss.) correspond to *H. filifolium* subsp. *arundanum* Romero Zarco, a taxon accepted by Röser in his taxonomic (Röser, 1989) and ecogeographic (Röser, 1996) studies. The more extended *H. filifolium* subsp. *filifolium* includes two varieties: var. *cazorlense* Romero Zarco ($2n = 98$) distributed in Sierra de Cazorla, Sierra del Pozo and perhaps in other central Betic mountains, and var. *filifolium* ($2n = 84$) somewhat smaller and with relatively narrower leaves, being the single *Helictotrichon* representative occurring in Central Spain (Albacete and Ciudad Real provinces, and Serranía de Cuenca).

In 1989, we found a herbarium specimen labelled *"Helictotrichon filifolium"* (MA 447900). The plant was collected in 1976 near Puebla de Almoradiel, in Toledo province, 70 Km away from the nearest localities known for that species. It was immediately evident that its small spikelets, extremely narrow leaves and pale basal sheaths did not match well with the characters of any known species of the genus *Helictotrichon*. The presence of hairs on some leaves, a typical character of young individuals of the *Helictotrichon filifolium* complex (Romero Zarco, 1984), led to the assumption that it was *H. sarracenorum,* but the locality of origin was out of the expected distribution range. Consequently, it was set aside as "study material" pending Dr. Röser's review of the genus in 1989. Nevertheless, his ample and excellent review did not

provide a satisfactory taxonomic position for this species.

Material and methods

Herbarium material from the Universities of Seville (SEV) and Barcelona (formerly BCF, currently included in BCN) were used to illustrate leaf anatomy. Additional material from the Royal Botanic Garden of Madrid has been used to described the new species. Data previously published by the author have been included in this study (Romero Zarco, 1984, 1985a). Cross-sections of leaf blades were made by hand using well developed, basal leaves from innovations shoots. Pollen grains from unopened anthers where observed by optical microscopy in isotonic water solution.

Results

Leaf anatomy

In general leaf blades of the new taxon show a structure similar to those from other xerophilic species in the genus. The new taxon presents shorter and narrower leaf blades than other close species, accompanied by an overall reduction in vascular tissue. It presents 7 vascular bundles, instead of the 9 to 13 which are common in the rest of the species, and the girders are absent or very reduced, a character yet unreported for this genus (Fig. 2).

Pollen grains

Pollen grains were observed and measured. The appearance was normal, and the size ranged from 29.7 to 33.8 µm.

Diagnosis

Helictotrichon devesae Romero Zarco, **sp. nov.**

Ab Helictotricho filifolio (Lag.) Henrard *praecipue differt statura minore, vaginis stramineis nec rubrotinctis; laminis quidem summe filiformibus* (0,5-0,6 mm *diametro), sectione transversali* 7*-nerviis atque trabe-*

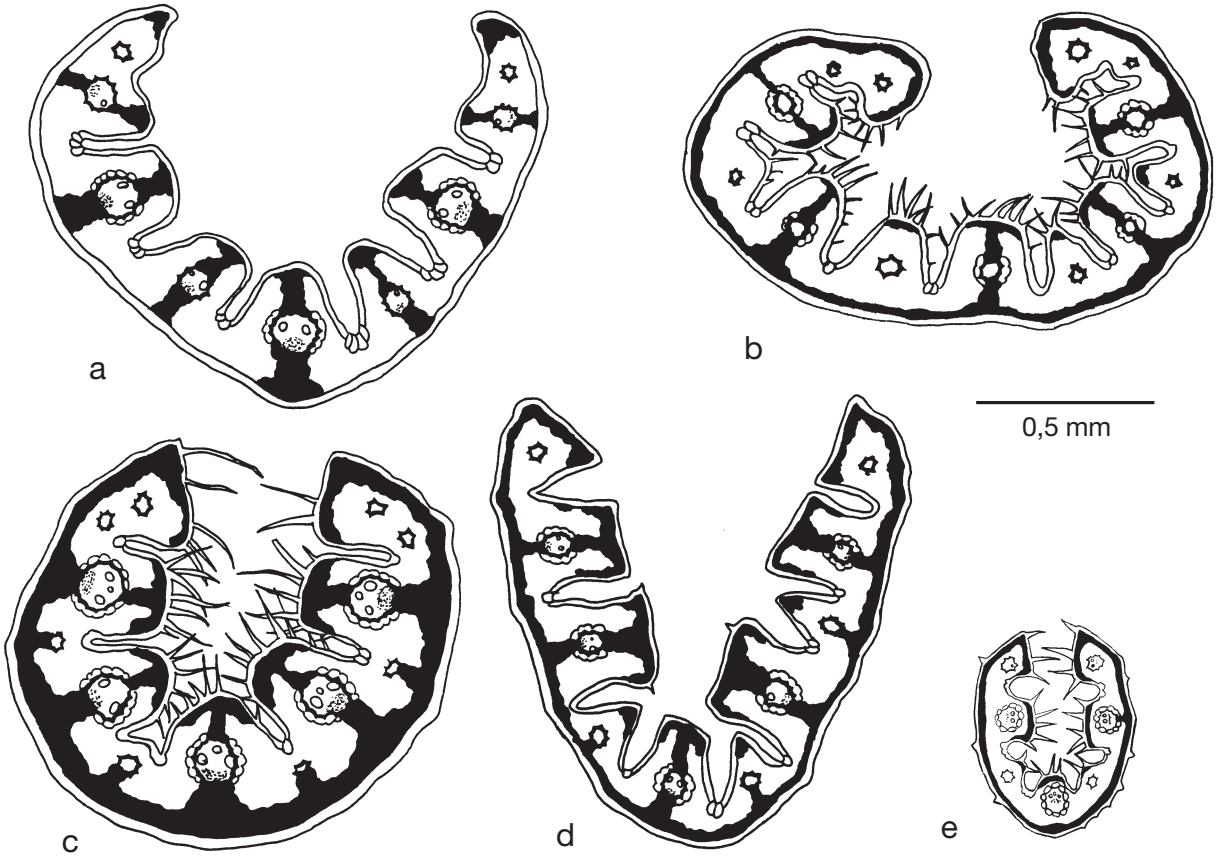

Fig. 2. Idealized cross-sections of leaf blades from innovation shoots in 5 taxa of *Helictotrichon* (sclerenchyma in black): a, *H. sedenense* subsp. *sedenense* (España, Lérida, BCF 1481); b, *H. sarracenorum* (España, Málaga, SEV 86653); c, *H. filifolium* var. *filifolium* (España, Alicante, SEV 86669); d, *H. cantabricum* (España, Burgos, SEV 77612); e, *H. devesae* (España, Toledo, SEV 217062).

culis destitutis; denique, spiculis minoribus (c. 10 mm *longis). Ab Helictotricho sarracenorum* (Gand.) J. Holub *praecipue differt foliis certe angustissimis, glabris vel iuvenilibus parce atque breviter pilosis (pilis* c. 0,1 mm).

Typus: in provincia toletana Hispaniae, ad rivulum Cigüela dictum, prope oppidum La Puebla de Almoradiel, *in salsuginosis pascuis appellatis a quibusdam «Senecio auriculae-Lygeetum et Schoeno nigricantis-Plantaginetum maritimae», legit* S. Cirujano *mense Julio anni* 1976; *in herbario Universitatis Hispalensis asservatur sub numeris* SEV 217062 *(holotypus) et* SEV 217063 *(isotypus) atque in herbario Horti Regii Matritensis, insuper, sub numero* MA 447900 *(isotypus). Ut patet, species clarissimo cordubensi botanico* J.A. Devesa *obsequentissime dicata.* Fig. 3.

Description

Perennial herb, caespitose; non-flowering shoots mainly intravaginal; culms 27-35 cm, glabrous; basal leaf sheaths subauriculate, straw-coloured; ligules 0.5-1 mm, truncate, shortly ciliate; leaf blades 5-16 cm × 0.5-0.6 mm, setaceous, ribbed and scabrid above, glabrous or shortly pubescent beneath when young (hairs 0.1-0.2 mm), with 7 veins and a continuous subepidermal layer of sclerenchyma in cross-section. Panicle 7-12 cm, ovate, lax, with 15-25 spikelets and shortly pubescent branches; peduncles 3-11 mm, clavate, shortly pubescent. Spikelets 9.6-10.3 mm, three- to four-flowered, the upper sterile; rhachilla 1.8-2.5 mm, disarticulating below the floret, with hairs up to 3 mm; glumes unequal, the lower 6-6.7 × c. 1,5 mm, 1-nerved, the upper 9-9.8 × c. 2.1 mm, 3-nerved; callus ovate-elliptic, hirsute with hairs of 0.5-2 mm; lemma of the lower floret 8-9 mm, lanceolate, 7-nerved, 2-dentate in the apex, glabrous; awn 10.5-13.5 mm, arising from the middle of the back, geniculate, with terete, shortly pubescent column and scabrid bristle; lodicules c. 1.5 mm, narrowly lanceolate, entire; anthers 4-4.5 mm; ovary hairy; caryopsis not seen.

Flowering time in July. Habitat: steppe-subsaline grassland community of *Lygeum spartum*, c. 700 m above sea level.

The name is dedicated to Dr. J.A. Devesa Alcaraz, author of interesting taxonomic studies on Spanish grasses and composites. The new species is known only from the type locality in Central Spain, where it has probably not been collected since 1976.

IDENTIFICATION KEY FOR EUROPEAN SPECIES OF *HELICTOTRICHON* (SPECIES CIRCUMSCRIPTION ACCORDING TO RÖSER, 1996 PRO SUBGEN. *HELICTOTRICHON;* INFRASPECIFIC TAXA NOT ANALYZED)

1. Spikelets disarticulating only above the glumes 2
1. Spikelets disarticulating above the glumes and below the florets 4
2. Ligules 3-6 mm, oblong; blades persistent when dead ..... **H. parlatorei**
2. Ligules 0.2-1.5 mm, truncate; blades soon deciduous when dead 3
3. Basal leaves setaceous, 0.5-0.8 mm in diameter ..... **H. setaceum**
3. Basal leaves convolute, 0.9-1.5 mm in diameter or flat and 2-4 mm wide ..... **H. sempervirens**
4. Basal leaves without a continuos subepidermal layer of sclerenchyma; non-flowering shoots extravaginal 5
4. Basal leaves with a continuous subepidermal layer of sclerenchyma; non-flowering shoots mostly intravaginal 6
5. Leaves greyish-green above, dark green beneath; pedicels scarcely clavate; basal sheaths open to the base ..... **H. decorum**
5. Leaves greyish-green on both surfaces; pedicels clearly clavate; basal sheaths open only in the upper half ..... **H. sedenense**
6. Ligules of basal leaves 3-8 mm, lanceolate, acute; basal leaves setaceous, up to 0.7 mm wide ..... **H. desertorum**
6. Ligules of basal leaves up to 1.5 mm, wider than longer, truncate; leaves setaceous or not, up to 4 mm wide when flat 7
7. Lower glume 6-6.7 mm; spikelets c. 10 mm; basal leaves 0.5-0.6 mm in diameter ..... **H. devesae**
7. Lower glume 8.5-17 mm; spikelets 10-20 mm; basal leaves (0.5) 0.7-2 mm in diameter, up to 4 mm wide when flat 8
8. Basal leaves densely pubescent beneath (hairs 0.5-1 mm), at least when young; basal sheaths greyish, pale brown or straw-coloured ..... **H. sarracenorum**
8. Basal leaves usually glabrous beneath, sometimes the younger leaves pubescent in plants with reddish-brown basal sheaths 9
9. Sheaths of basal leaves dark violet-brown to reddish-brown ..... **H. filifolium**
9. Sheaths of basal leaves greyish or brownish 10
10. Hairs of rhachilla up to 3.5 mm; lemma 9-11 mm ..... **H. convolutum**
10. Hairs of rhachilla 4.5-5 mm; lemma 10-14 mm ..... **H. cantabricum**

Discussion

Leaf blade anatomy in cross-section of the new species is very similar to those of other grasses adapted to xeric environments. Thus, the differences in leaf anatomy between the meso-xerophilic *H. sedenense* and the extreme xerophilic *H. devesae* are parallel to those observed in other grass genera, like the closely related *Pseudarrhenatherum*. The Eurosiberian *Pseudarrhenatherum longifolium* (Thore) Rouy presents wide, soft blades whereas *P. pallens* (Link) J.

Fig. 3. *Helictotrichon devesae* (España, Toledo, La Puebla de Almoradiel, SEV 217062): **a,** habit; **b,** ligule of basal leaf; **c,** spikelet; **d,** dispersal unit in lateral view; **e,** lemma; **f,** palea; **g,** lodicules and fertile parts of floret.

Holub, an endemic species from central-western Portugal limestone areas, resembles our new species in leaf anatomy (Romero Zarco, 1985b). The evolution from meso-xeromorphic to strictly xeromorphic species in Mediterranean perennial oats has also been documented by Röser (1989, 1996, 1998).

Two other non-Spanish *Helictotrichon* species have similar leaf blade anatomy than that of *H. devesae*: *H. setaceum* (Vill.) Henrard, a West-Alpine species belonging to the *H. parlatorei* group, and *H. desertorum* (Lees.) Nevski, from the steppes and rocky hills of Eastern Europe and Western Asia (see Saint-Yves, 1931, sub *Avenastrum*). The former differs from our species mainly in its sinaptospermic spikelets, whereas the latter differs in its elongated ligules.

The spikelets of *H. devesae* show a similar morphology and structure to those of other Spanish species (Table 1): the rhachilla disarticulates below each floret, so the dispersal unit is a single mature floret. By contrast, in the Alps-endemic *H. parlatorei* group (Röser, 1989: 65), the spikelets disarticulate only above the glumes, and the dispersal units are sinaptospermic. This character (probably derived) occurs in other Avenea genera, e.g. *Avena sterilis* group, *Pseudarrhenatherum* and *Holcus*.

Regarding spikelet size, *H. devesae* resembles *H. sedenense* and small-spikelet individuals of *H. sarracenorum* (Table 1). It differs from both, however, in its smaller leaf-blade diameter and sclerenchyma pattern. The persisting leaf pubescence observed in young individuals of *H. devesae* leaves usually occurs in *H. sarracenorum*, but in the former the hairs are shorter (0.1-0.2 mm) and scattered. Setaceous leaves are present in both *H. devesae* and *H. filifolium* subsp. *filifolium* however, in *H. filifolium* var. *filifolium* from SE Spain (0,5-1 mm in diameter), well-defined sclerenchyma girders are visible in cross-section. Similar differences separate *H. devease* from *H. cantabricum*, though the angular shape of the ribs is common in both species. Differences in leaf anatomy have been shown to persist in cultivated plants of *Helictotrichon* taxa (Gervais, 1973; Röser, 1989).

The species most closely related to *H. devesae* is *H. convolutum* (C. Presl) Henrard, a diploid, xerophilic, central to eastern Mediterranean species proposed by Röser (1996: 237) as a geographical vicariant to the *H. filifolium-sarracenorum* complex. The cross-section leaf blade of *H. devesae* is very similar to those of *H. cantabricum* and *H. convolutum* (see Gervais, 1973, and Fig. 2), indicating a close affinity of the former taxon to the latter taxa, probably originated in the Eurosiberian part of the Mediterranean basin, whereas the *H. filifolium-sarracenorum* complex probably originated in the Betic-North African area.

It is highly unlikely that the new species could be a hybrid as the only possible extant parental species in the region is *H. filifolium,* and intergeneric hybrids do not occur between this species and other congeners or non-congeners (Gervais, 1983). Furthermore, the pollen grains show normal shape and their size falls within the known range of other *Helictotrichon* spp. (e.g. *H. sarracenorum,* 30-38 µm; Romero Zarco, 1984, sub *H. filifolium* subsp. *velutinum*).

H. devesae grows in *albardinar* plant communities (*Senecio auriculae-Lygeetum* Rivas Goday & Rivas Martínez in Rivas Martínez & Costa 1976). It is a grass formation on subsaline soils exposed to severe hydric stress during summer. No other species in the genus is known to grow in subsaline habitats. The only taxon present in steppe-like, highly arid environments is *H. filifolium* var. *filifolium* which grows in *Stipa tenacissima* formations on basic substrate in SE Spain (*Stipo-Helictotrichetum filifoliae* G. López 1973) and on diverse calcareous substrates in the Serranía de Cuenca mountain range (López, 1976).

More precise data about the type-locality of *H. devesae* were provided by Dr. S. Cirujano (in lit.). The new *Helictotrichon* species was collected in the transition between *Senecio auricula-Lygeetum* and *Schoeno-Plantaginetum maritimae* Rivas-Martínez, 1984 phy-

Table 1. Size range of spikelets and floral elements (in mm) in 5 *Helictotrichon* species present in Spain and in *H. convolutum*. According to Holub (1980), Romero Zarco (1984) and Röser (1989).

Species	Spikelet	Lower glume	Upper glume	Rhachilla (1th segment)	Lemma (1th floret)	Awn
H. sedenense	7.5-14	6-10	(7.5) 8-12	2-2.5	(7.5) 8-10 (11)	12-20
H. devesae	9.6-10.3	6-6.7	9-9.8	1.8-2.5	8-9	10.5-13
H. convolutum	11-17	9-12	10-14	c. 3	9-11	?
H. cantabricum	(10) 11-17	8.5-13	10-15	3-4	10-14	15-20
H. sarracenorum	10-15	8.5-11	11-13	2-2.5	9-12	15-22
H. filifolium	14-20	9-17	11-20	2.5-4	9-17	18-30

tocenoses (the plant communities included, among others, *Schoenus nigricans*, *Plantago maritima*, *Doricnium gracile*, *Linum maritimum*, *Agrostis stolonifera* and *Cynodon dactylon*).

These data suggest that *H. devesae* could be a new and noteworthy example of grass speciation related to ecogeographic adaptations.

The original population (lecotype) of *H. devesae*, was destroyed by agricultural practices some years ago (Dr. Cirujano, in lit.). Though the plant was seen (but not collected) at other *Schoenus nigricans* sites in the La Mancha area. Further search on populations of *H. devesae* from Central Spain (River Guadiana Valley and the surrounding mountains) are needed to establish the ecology, distribution and ploidy level of this species.

Acknowledgements

This paper is devoted to the memory of the late Dr. Camille Gervais (Montreal, 1933, Québec, 2002), who guided my first steps through the group's taxonomy with his fine study on perennial oats. Thanks are given to Dr. Martin Röser (Halle, Germany) who sent me many useful publications. The Herbarium of the Royal Botanic Garden of Madrid (Spain) provided the material used to describe the new species. Dr. S. Cirujano (Madrid) kindly offered information about the new species collection sites. Pollen grain observations were made by Dr. Regina Berjano from the University of Seville (Spain). Latin diagnosis was kindly revised by M. Laínz.

References

Gervais, C. 1973. Contribution à l'étude cytologique et taxonomique des avoines vivaces. *Denschriften der Schweizerischen Naturforschenden Gesellschaft* 88: 1-166; 1-56 (Figures et Cartes).

Gervais, C. 1983. Wide hybridization attempts in the tribe Aveneae Nees. *Botanica Helvetica* 93: 195-212.

Holub, J. 1980. Helictotrichon Besser. In: Tutin, T.G. & al. (eds.), *Flora Europaea* 5: 208-210. Cambridge.

López, G. 1976. Contribución al conocimiento fitosociológico de la serranía de Cuenca, I. *Anales del Jardín Botánico de Madrid* 33: 5-87.

Martín-Blanco, C.J. & Carrasco, M.A. 2005. *Catálogo de la flora vascular de la provincia de Ciudad Real*. Monografías de la Asociación de Herbarios Ibero-Macaronésicos vol. 1: 581 pp. Madrid.

Romero Zarco, C. 1984. Revisión taxonómica del género Helictotrichon Bess. ex Schultes & Schultes fil. (Gramineae) en la Península Ibérica. I. Estudio taxonómico. *Anales del Jardín Botánico de Madrid* 41: 97-124.

Romero Zarco, C. 1985a. Revisión taxonómica del género Helictotrichon Bess. ex Schultes & Schultes fil. (Gramineae) en la Península Ibérica. II. Estudios experimentales. *Anales del Jardín Botánico de Madrid* 42: 133-154.

Romero Zarco, C. 1985b. Estudio taxonómico del género Pseudarrhenatherum Rouy en la Península Ibérica. *Lagascalia* 13(2): 255-273.

Röser, M. 1989. Karyologische, systematische und chorologische Untersuchungen an der Gattung Helictotrichon Besser ex Schultes & Schultes (Poaceae) im westlichen Mittelmeergebiet. *Dissertationes Botanicae* 145, 250 pp.

Röser, M. 1996. Ecogeography of the grass genus Helictotrichon (Poaceae: Aveneae) in the Mediterranean and adjacent regions. *Plant Systematics and Evolution* 203: 181-281.

Röser, M. 1997. Patterns of diversification in Mediterranean oat grasses (Poaceae: Aveneae). *Lagascalia* 19(1-2): 101-120.

Röser, M. 2006. Notes on the distribution and taxonomy of some Iberian and Maghrebian perennial Aveneae [genera Helictotrichon Besser, Pseudarrhenatherum Rouy, Arrhenatherum P. Beauv., Avenula (Dumort.) Dumort.]. *Lagascalia* 26: 140-147.

Saint-Yves, A. 1931. Contribution à l'étude des Avena Sect. Avenastrum (Eurasia et région Méditerranée. *Candollea* 4: 353-504.

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