

Taxonomic revision of the genus *Succisella* (Dipsacaceae) in the Iberian Peninsula

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A revision of the three endemic Iberian species of *Succisella* G. Beck (*S. carvalhoana*, *S. microcephala* and *S. andreae-molinae*), based on herbarium studies, SEM photographs and field observations, is presented utilizing morphological, palynological, karyological, biogeographical and ecological characters. The distribution of the species in the Iberian Peninsula is shown in a grid map. Full synonymy is given for all taxa. © 2004 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2004, 144, 351–364.

ADDITIONAL KEYWORDS: distribution – karyology – morphology – palynology – Portugal – Spain – taxonomy.

INTRODUCTION

Succisella G. Beck is the only genus of Dipsacaceae endemic to Europe and the Caucasus. It is assigned to the tribe Scabioseae DC., together with *Lomelosia* Raf., *Pseudoscabiosa* Devesa, *Pterocephalidium* G. López, *Pterocephalodes* V. Mayer & Ehrend., *Pterocephalus* Adans., *Pycnocomon* Hoffmanns. & Link, *Scabiosa* L. and *Succisa* Haller. The tribe includes representatives whose inflorescences have an involucre with herbaceous bracts and a bracteolate receptacle, sessile involucels, a square or subcylindrical tube, more or less octonervate and with no basal elaiosome, and a sessile or more or less stipitate calyx, persistent, with or without setae.

Taxonomically it was not recognized fully (Verlaque, 1986) until the works of Baksay (1952, 1955). One of its main diagnostic characteristics is the extraordinary reduction of the calyx, which is integrated by a disc-like or subquadrangular platform, somewhat fleshy and without setae. The identification of its species is more difficult, their distinguishing characteristics being largely those of the diaspores, something common to the family (Coulter, 1824; van Tieghem, 1909).

Since the work of Baksay (1952, 1955), the diversity of the genus underwent no modification (Cannon, 1976) until the recent description of a new species from the south of Spain, *S. andreae-molinae* Pajarón & Escudero (Escudero & Pajarón, 1994). Consequently, the genus is currently considered to contain five species, all of which are perennial but generally little known given their scarcity and their small and distant relict areas of distribution (Baksay, 1955; Verlaque, 1986). Three are species endemic to the Iberian Peninsula (*S. carvalhoana* (Mariz) Baksay, *S. microcephala* (Willk.) G. Beck and *S. andreae-molinae* Pajarón & Escudero). Another is *S. petteri* (Kerner & Murb.) G. Beck, endemic to the Dinara Planina (Bosnia-Herzegovina and Croatia) and the fifth is found in the south and east of Europe from Italy to the Baltic States and the Caucasus (*S. inflexa* (Kluk) G. Beck). In other regions *S. inflexa* is considered to be naturalized.

This paper presents a critical revision utilizing morphological, palynological, karyological and ecological characters of the species of *Succisella* native to the Iberian Peninsula. Keys to taxa are provided together with discussions of salient characters for identification of each species.

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MATERIAL AND METHODS

In a study of the morphological variability between taxa, material from different herbaria (COI, GDA, GDAC, HVR, JAEN, MA, MACB, MAF, MGC, MUB, PO, SALA, SEV and UNEX) was used, as well as that obtained from numerous collections made around the Iberian Peninsula, gathered to determine *in situ* the ecological preferences of the taxa and to provide fresh material for karyological studies.

A Garmin e-map GPS was used for geographically locating the taxa using 1 × 1-km UTM coordinates. To obtain biogeographical and bioclimatic features, the criteria of Rivas-Martínez *et al.* (2002) were adopted. Concerning nomenclature of plant communities, we follow Rivas-Martínez *et al.* (2001, 2002).

Micromorphological, palynological and karyological observations were based on material collected in the field (Table 1). Voucher specimens were kept at the Herbarium of the University of Salamanca, Spain (SALA). For the micromorphological study of the calyx

Table 1. Origin of material of *Succisella* used for karyological studies and morphological description (SEM) of the calyx, involucl and pollen grains

Sample	Provenance of samples	Voucher
<i>S. andreae-molinae</i>		
SAM 1	Spain, Jaén, Segura de la Sierra, 1240 m, 30SWH3340, 9.ix.2000	SALA 103291
<i>S. carvalhoana</i>		
SCA 1	Spain, Zamora, Mayalde, 975 m, 30TTL6369, 3.ix.1983	SALA 30949
SCA 2	Spain, Salamanca, Aldehuela de Yeltes, 775 m, 29TQF3116, 29.ix.2001	SALA 103758
SCA 3	Spain, Salamanca, Vitigudino, 745 m, 29TPF1143, 25.viii.1990	SLIDE 5390
SCA 4	Spain, Zamora, Mayalde, 890 m, 30TTL6369, 18.ix.2000	SALA 107244
<i>S. microcephala</i>		
SMI 1	Spain, Ávila, Cepeda La Mora, 1380 m, 30TUK2880, 3.ix.1984	SALA 33455
SMI 2	Spain, Ávila, Hoyocasero, Venta del Obispo, 1280 m, 30TUK2873, 12.ix.2001	SALA 107243
SMI 3	Spain, Puerto de Menga, 1425 m, 30TUK2881, 17.x.1998	SLIDE 11293
SMI 4	Spain, Ávila, Cepeda La Mora, 1375 m, 30TUK2880, 12.ix.2001	SALA 107242

and involucre, a total of 50 diaspores for each Iberian species of *Succisella* were measured.

Some details of calyx, epicalyx (involucl) and pollen grains were investigated using a scanning electron microscope (SEM). Samples were coated with gold in a Bio-Rad ion-sputter and then observed by standard techniques using a Zeiss DSM 940 microscope.

The palynological preparations were lodged in the Department of Botany, University of Salamanca, Spain. We used acetolysed pollen for light microscope (LM) examination (Erdtman, 1960; Reitsma, 1969). For SEM examination the pollen grains were acetolysed and suspended in 98% ethanol in Eppendorf tubes. Thirty measurements per population were taken for all parameters using a video camera (Sony DCX-930P) connected to the LM to transfer the image to a computer. The following parameters were measured: polar axis (P) and equatorial diameter (E); the P/E ratio is also given.

Chromosome counts were usually made using ovaries sampled at a very early stage of development. Young flower buds were fixed in absolute ethanol – glacial acetic acid (3/1), sometimes modified to 6/1. Fixed material was stored at 4 °C until stained with 2% acetic orcein. Mounting involved squashing in 45% acetic acid. At least three counts were made for each population. Chromosomes were drawn and microphotographs were taken through a Nikon Optiphot microscope. Drawing and negatives were deposited in the Department of Botany of the University of Salamanca. Photographs and negatives were digitized in order to facilitate their conservation and further use. A Nikon Optiphot-2 LM connected to a video camera (Sony DCX-930P) was used to take videoprinter images, which are also deposited in the Department of Botany of the University of Salamanca.

Karyotypes were obtained from well-spread metaphase plates. The nomenclature adopted by Levan, Fredga & Sandberg (1964) was followed for identifying chromosome types, and the standards of Stebbins (1938) were used for distinguishing the chromosomes: <2 µm, small; 2–5 µm, medium–small; 5–9 µm, medium–large; >9 µm, large. For comparison of the present results with those of Verlaque (1984), the chromosome size scale proposed by Verlaque was also used: >3.5 µm, very long chromosomes ('TL'); 2.5–3.5 µm, long ('L'); 1.5–2.5 µm, medium ('M'); and <1.5 µm, short ('C'). The method of Stebbins (1971) was used to calculate the asymmetry index.

RESULTS

TAXONOMIC CHARACTERS

Stems. Stems of very variable size (40)50–90(125) cm, always erect or ascending, root-forming at the lower

nodes. *S. carvalhoana* has 7–10 internodes, densely hirsute over the basal third, with reflexed hairs but losing hair towards the distal region. *S. microcephala* has 5–7 internodes, moderately hirsute at the base, glabrous or glabrescent in the medial and distal regions, whereas *S. andreae-molinae* has the same number of internodes but which are glabrous or glabrescent almost everywhere.

Leaves. The leaves lie opposite one another and are decussate over the whole length of the stem, those at the base commonly forming a rosette. Their morphology and indumentum are characters of taxonomic interest, particularly the former. *Succisella carvalhoana* always has some cauline, pinnatifid or pinnatipartite leaves, but all are entire or weakly crenulate in *S. microcephala* and *S. andreae-molinae* (Figs 1–6). In this last species a few irregular incised-dentate leaves can be found exceptionally.

With respect to the indumentum, the rosette leaves of *S. carvalhoana* and *S. microcephala* are densely strigose-pilose when young, losing hair progressively until limited to the edges of the leaf veins, especially on the abaxial surface; in *S. andreae-molinae* they are sparsely ciliated. The cauline leaves are hairy in *S. carvalhoana*, weakly hairy in *S. microcephala*, and glabrous or glabrescent in *S. andreae-molinae*.

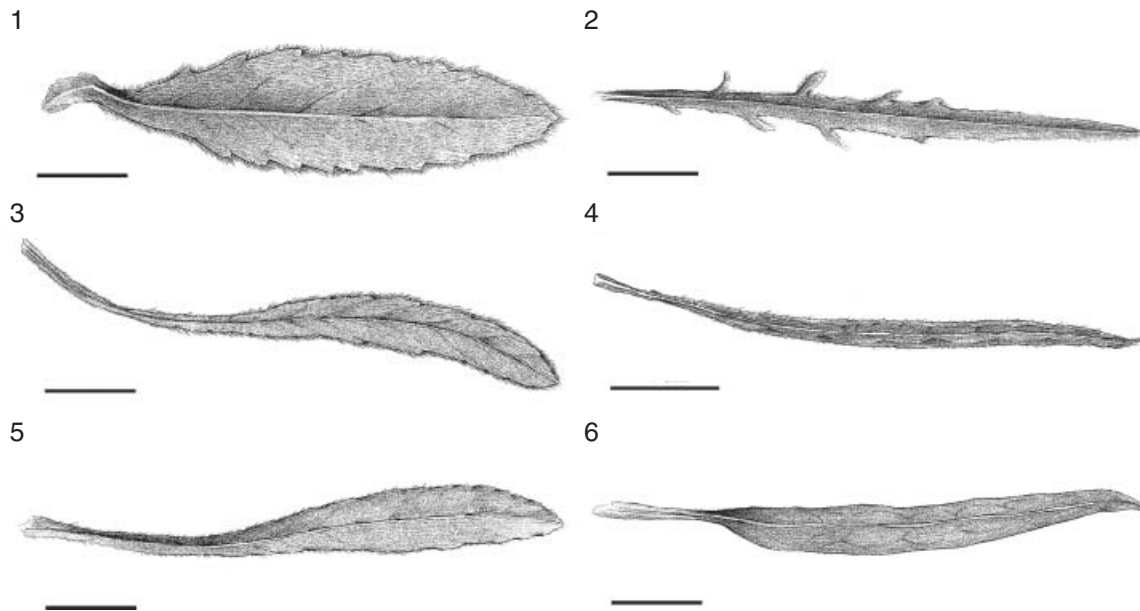
Inflorescences and flowers. The flowers are hermaphrodite, gathered into capituliform inflorescences,

which are more or less hemispherical at anthesis, (10)12–15 mm in diameter in *S. carvalhoana* and (5)8–12 mm in *S. microcephala* and *S. andreae-molinae*. If, as Verlaque (1986) suggested, one of the characteristics that reflects the morphological evolution of the genus is the increase in size of the inflorescence, then *S. carvalhoana* is the most highly evolved of the three Iberian species.

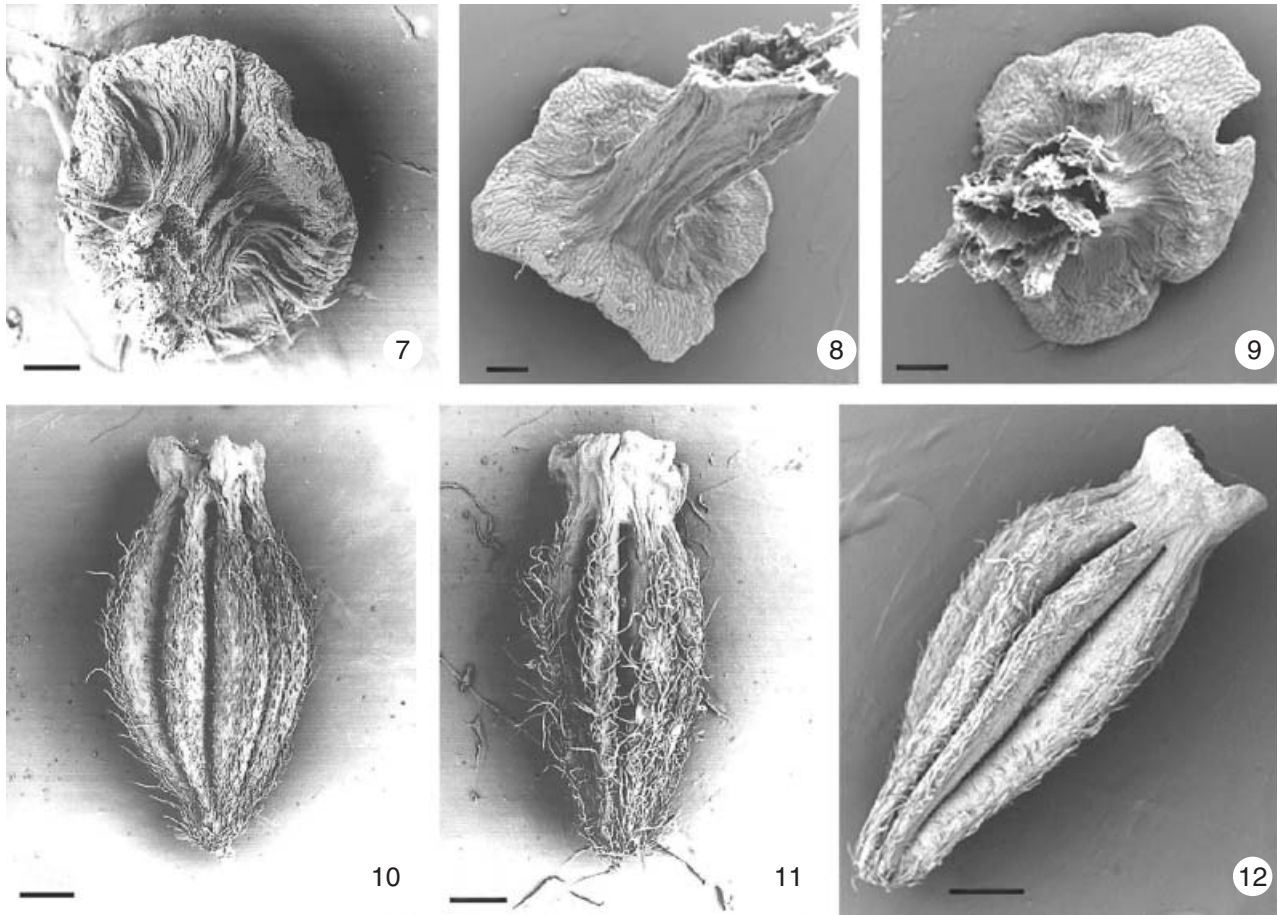
The corolla is gamopetalous, tetramerous and subactinomorphic, largest in *S. carvalhoana* (4–4.7 mm) and slightly smaller in *S. microcephala* (3–4 mm) and *S. andreae-molinae* [(2.5)3–3.5(4) mm]. All have short adpressed hairiness on the external face (internal face glabrous), and are pink or whitish-pink.

The calyx is reduced to a disc-like structure in *S. carvalhoana* (Fig. 7) and to a more or less subquadrangular structure in *S. microcephala* and *S. andreae-molinae* (Figs 8, 9), with no teeth or setae, persistent in fruit; these characters are very constant in the three species. The calyx can be hidden by the corona of the involucl in *S. microcephala* and *S. andreae-molinae*, or on occasion can clearly extend beyond it in *S. carvalhoana*; it can be glabrous (Figs 8, 9) or have isolated trichomes, both on its lower face and on the upper part of the ovary cone (*S. carvalhoana*, Fig. 7).

The androecium comprises four stamens, alternating with corolla lobes, inserted into the tube of the corolla, with medifixed anthers. The ovary is unicarpellate and epigynous, with a terminal style and cap-



Figures 1–6. Details of basal rosette (left) and cauline leaves (right) of species of Iberian *Succisella*. Figs 1, 2. *S. carvalhoana*, sample SCA 2. Scale bars = 2 cm. Figs 3, 4. *S. microcephala*, sample SMI 4. Scale bars, Fig. 3 = 3 cm, Fig. 4 = 4 cm. Figs 5, 6. *S. andreae-molinae*, sample SAM 1. Drawn from material vouchered in SALA. Scale bars = 3 cm.



Figures 7–12. Scanning electron micrographs of calyx (Figs 7–9; scale bars = 100 µm) and involucler (Figs 10–12; scale bars = 500 µm) of species of Iberian *Succisella*. Figs 7, 10. *S. carvalhoana*, sample SCA 4. Figs 8, 11. *S. microcephala*, sample SMI 2. Figs 9, 12. *S. andreae-molinae*, sample SAM 1. Vouchers at SALA.

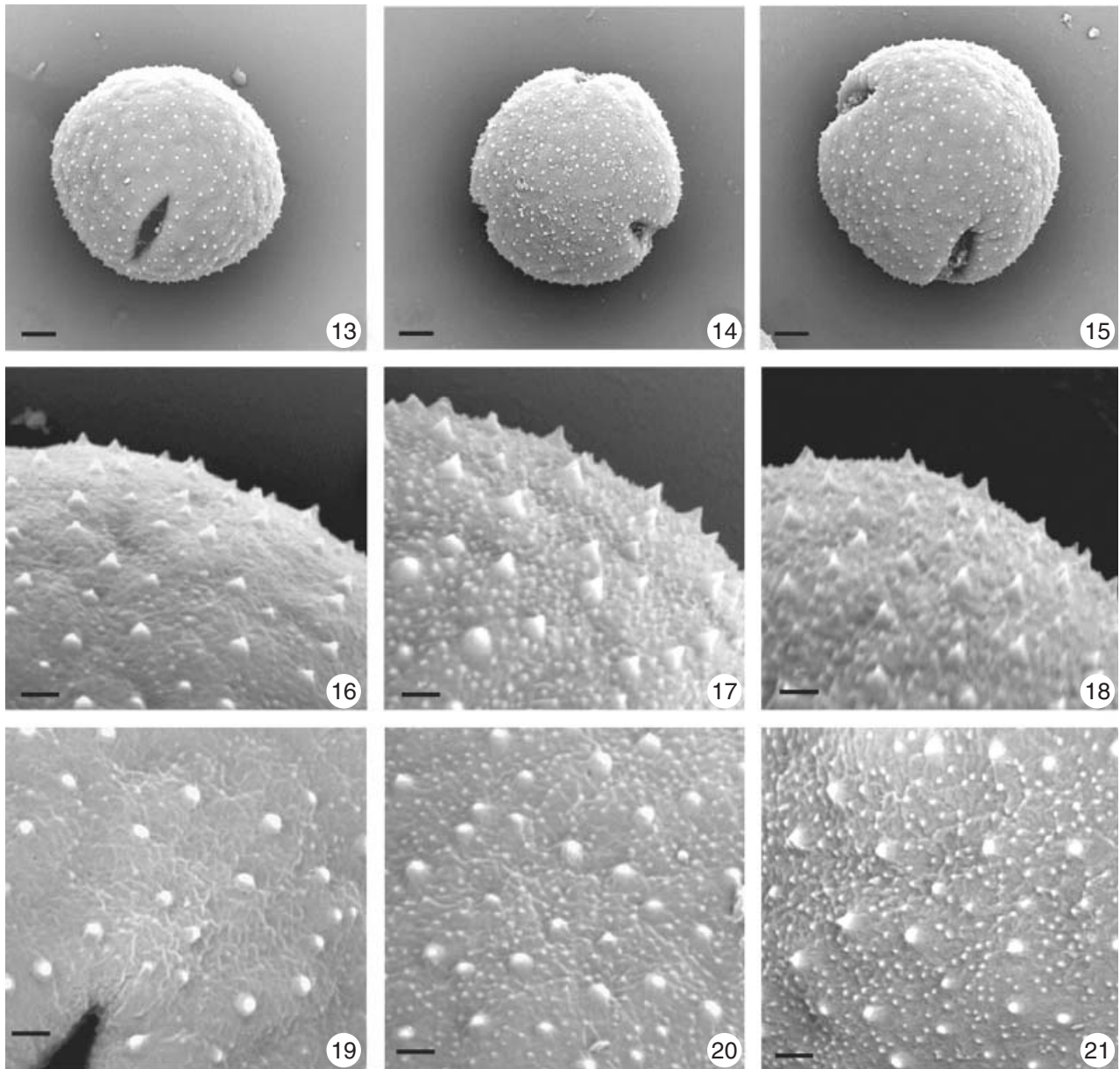
itate stigma. The fruit is an achene that remains enclosed in the involucler.

Epicalyx (involucler). The involucler is one of the most important diagnostic characteristics, both for this genus and for the Dipsacaceae. An urceolate structure arising out of the bracts, it encircles the ovary and, when mature, forms the diaspora along with the fruit and the persistent calyx. It varies in shape from ovate to elliptical, and has eight thick, sparsely hairy ribs separated by furrows, and the upper border is expanded into a scarious corona, lightly scalloped to shallowly 4-lobed (Figs 10–12). Its size, morphological characteristics and indumentum allow the Iberian Peninsula taxa to be distinguished easily from each other (Figs 10–12). As for the inflorescences, Verlaque (1986) maintained that morphological development in *Succisella* leads to an increase in size of the diasporas; therefore, *S. carvalhoana* should be the most highly evolved.

PALYNOLOGY

In agreement with Verlaque (1985), in the family Dipsacaceae there are three pollen types, each characteristic of the three recognized tribes (Dipsaceae, Knautieae and Scabioseae). The pollen of the Iberian Peninsula species of *Succisella*, which undoubtedly belongs to the third of these, is tricolpate (Figs 13–15) with a polar axis/equatorial axis (P/E) ratio of between 0.86 and 1.03 (Verlaque, 1986). No differences were seen between the studied taxa. Pollen dimensions are given in Table 2.

In all cases the pollen is oblate-spheroid, almost spheroid, (Figs 13–15) with a weakly striated exine (Figs 19–21), covered in small, sparse spines, the largest of which are 0.8–1 µm in *S. microcephala* and *S. andreae-molinae*, and the smallest 0.2–0.3 µm in *S. carvalhoana* (Figs 16–18). These palynological characteristics reveal the primitive nature of the genus within the Dipsacaceae.



Figures 13–21. Scanning electron micrographs of pollen grains of species of Iberian *Succisella*. Figs 13, 16, 19. *S. carvalhoana* SCA 1. Figs 14, 17, 20. *S. microcephala*, SMI 1. Figs 15, 18, 21. *S. andreae-molinae* SAM 1. Vouchers at SALA. Scale bars = 10 μm in Figs 13–15 and 2 μm in Figs 16–21.

Table 2. Values of polar axis (P), equatorial axis (E) and polar/equatorial ratio (P/E) in pollen of Iberian species of *Succisella*

Species	P	E	P/E
<i>S. carvalhoana</i>	63.60 \pm 3.52	65.71 \pm 2.71	0.968
<i>S. microcephala</i>	64.83 \pm 2.98	66.93 \pm 2.65	0.968
<i>S. andreae-molinae</i>	64.11 \pm 3.10	66.27 \pm 2.89	0.967

KARYOLOGY

The karyotype formulae, degrees of asymmetry, chromosome numbers and chromosome sizes are shown in Table 3.

To date, all the karyological studies performed have been on *S. carvalhoana*, *S. petteri* and *S. inflexa*, and $2n = 20$ has always been the result (Kachidze, 1929; Baksay, 1955; Hindakova & Cincura, 1967; Majovsky, 1970; Verlaque, 1986). The species are therefore dip-

Table 3. Chromosome numbers, chromosome size, karyotype formulae and asymmetry of some Iberian species of *Succisella*

Species	Chromosome no.	Karyotype formula	Asymmetry (Stebbins, 1971)			Degree of asymmetry	Size (μm)	Type (Stebbins, 1938)	Type (Verlaque, 1984)
			% chromosomes with ratio ≥ 2	Longest/shortest ratio					
<i>S. carvalhoana</i> SCA 4	$2n = 20$	8 m + 10 sm + 2 st	50	4.75	2C	1.4–5.3	Small to medium-large	10 TL + 6 L + 2 M + 2 C	
<i>S. carvalhoana</i> (Verlaque, 1986)	$2n = 20$	14 m + 6 st	–	–	–	–	–	8 TL + 6 L + 6 M	
<i>S. microcephala</i> SMI 4	$2n = 20$	14 m + 2 sm + 4 st	30	2.03	2B	3.1–6.5	Medium–small to medium-large	14 TL + 6 L	
<i>S. andreae-molinae</i> SAM 1	$n = 10,$ $2n = 20$	–	–	–	–	–	–	–	

loid with a basic number of $x = 10$, the highest in the family, in which records of $x = 5, 7, 8$ and 9 are also known (Verlaque, 1984).

The karyological study of the present work on the three Iberian Peninsula species confirms that $n = 10$ or $2n = 20$, for the species already studied (*S. carvalhoana*, Figs 22–24) and for *S. microcephala* (Figs 25–27) and *S. andreae-molinae* (Figs 28, 29), whose chromosome numbers are reported here for the first time.

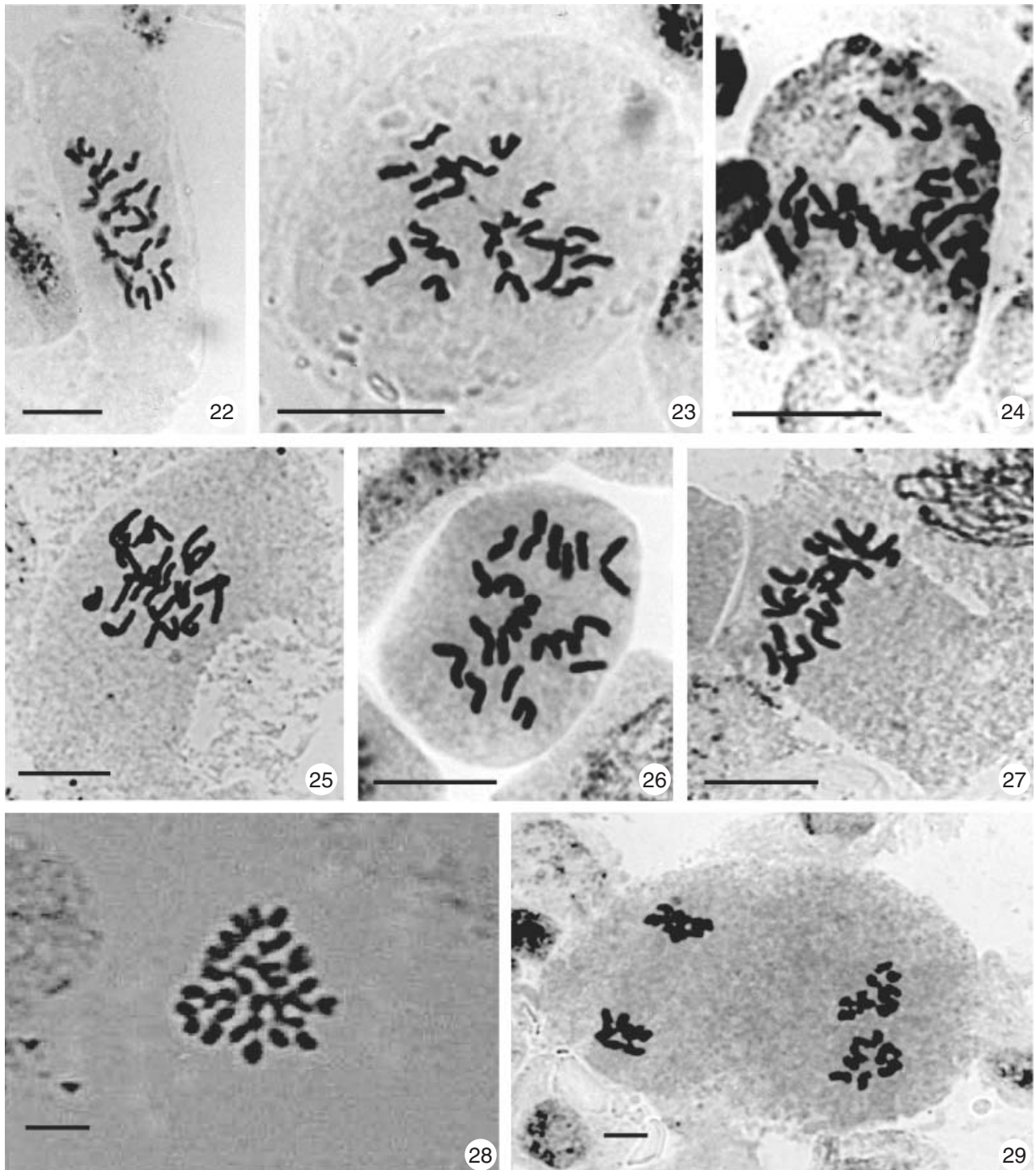
The size of the chromosomes of *S. microcephala* (Table 3) varies between 3.1 and 6.5 μm , medium–small to medium–large, according to the classification of Stebbins (1938); all ten pairs are long (L) or very long (TL), according to the classification of Verlaque (1984), whereas in *S. carvalhoana* they are smaller, 1.4–5.3 μm , small to medium–large, according to the classification of Stebbins (1938); eight long (L) or very long pairs (TL) according to that of Verlaque (1984). The analysis of the karyotype of the *S. carvalhoana* showed four pairs of metacentric chromosomes, five submetacentric pairs and one subtelocentric pair (Table 3). The karyogram obtained is shown in the Figure 30. In *S. microcephala* the karyotype showed seven pairs of metacentric chromosomes, one submetacentric pair and two subtelocentric pairs (Table 3). The karyogram obtained is shown in Figure 31.

Comparison of the karyotypes of *S. carvalhoana* and *S. microcephala* (the quality of the chromosome spreads obtained did not allow that of *S. andreae-molinae* to be determined) shows notable differences, with respect to both the chromosomes and the degree of asymmetry. Thus, whereas the karyotype of *S. microcephala* is weakly asymmetrical (2B), asymmetry is greater (2C) in *S. carvalhoana*, which can be interpreted as a more highly evolved taxon.

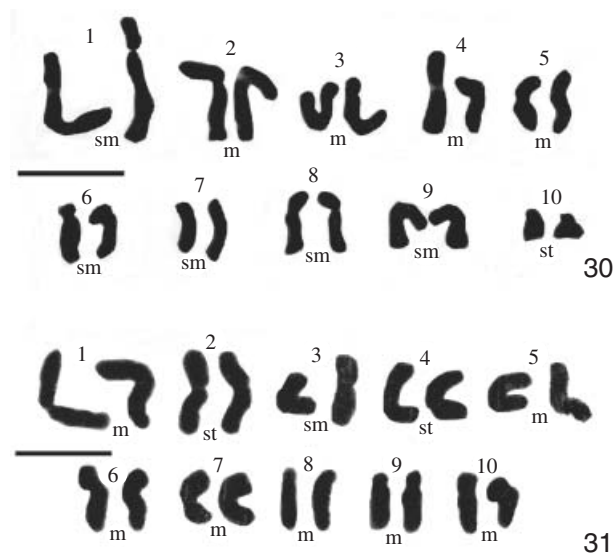
ECOLOGICAL BEHAVIOUR

The Iberian species of the genus *Succisella* are adapted to damp areas, preferentially integrating into the lush vegetation of meadows that have been cultivated for pasture or hay. Apart from a few species of *Succisa* Haller, this ecological behaviour is unique in the Dipsacaceae.

S. carvalhoana lives in communities of the alliance *Juncion acutiflori* Br.-Bl. in Br.-Bl. & Tüxen 1952 (rushy pastures usually unmanured on marshy or mineral peaty soils), with a special preference for the phytocenosis of the association *Lobelio urentis*–*Lotetum pedunculati* Rivas Goday 1964. It is also found in eutrophic meadows subject to intense pasture activity, corresponding to the association *Festuco amplae*–*Cynosuretum cristati* Rivas-Martínez ex Fuente 1986 (*Arrhenatherion* Koch, 1926, eutrophic manured



Figures 22–29. Photomicrographs of chromosomes of species of Iberian *Succisella*. Scale bars = 10 μm . Figs 22–24. *S. carvalhoana*, mitotic metaphase, $2n = 20$, samples SCA 2, SCA 3, SCA 4. Figs 25–27. *S. microcephala*, mitotic metaphase, $2n = 20$, samples SMI 3, SMI 2, SMI 4. Figure 28. *S. andreae-molinae*, mitotic metaphase, $2n = 20$, sample SAM 1. Figure 29. *S. andreae-molinae*, telophase II, $n = 10$, sample SAM 1.



Figures 30–31. Karyograms of species of Iberian *Succisella*. Fig. 30. *S. carvalhoana*, sample SCA 3. Fig. 31. *S. microcephala*, sample SMI 2. Scale bars = 5 μ m.

meadows on well-drained fertile mineral soils, mowed at least twice a year).

S. microcephala lives in communities of *Campanulo herminii*–*Nardion strictae* Rivas-Martínez 1964 (anthropogenic, intensely grazed acidophilous grasslands growing on summer-moist, deep and strongly acidic organic mineral and peaty mineral soils), integrating into the association *Nardo strictae*–*Genistetum carpetanae* Rivas-Martínez 1964, pasturelands termed ‘cervuno’ (*Nardus stricta* L.), which show temporary flooding and which are grazed by cattle during the summer.

Finally, *S. andreae-molinae* appears in the phytocenosis corresponding to the alliance *Molinio-Holoschoenion vulgaris* Br.-Bl. ex Tchou 1948 (summer green pastures and grasslands, growing on deep and damp soils, clubbrush pastures), both in the most damp reed beds of the association *Lysimachio ephemeri*–*Holoschoenion* Rivas Goday & Borja 1961

and in the driest of *Holoschoenion vulgaris* Br.-Bl. ex Tchou 1948.

TAXONOMIC TREATMENT

Succisella G. Beck, Fl. Nieder Österreich 2(2): 1145 (1893).

Scabiosa subgen. *Succisella* (G. Beck) Rouy, Fl. France 8: 113 (1903).

Description. Perennial herbs with short stolons. Stems leafy with indumentum of non-glandular hairs. Leaves sessile or stalked, simple, crenate-serrate, dentate, incised-dentate, pinnatifid, pinnatipartite or pinnatisect, with indumentum of non-glandular hairs; basal leaves in rosette, generally non-persistent in anthesis. Capitulum hemispherical, conical-ovate at fruiting; involucre with 1–2 lines of free bracts, simple, herbaceous; receptacle conical, glabrous or with dispersed hairs, filiform at fruiting, with herbaceous bracteoles. Flowers hermaphrodite, tetramerous, subactinomorphic, subequal. Involucels homomorphic, without basal elaiosome; tube ovate to elliptical, covered by 8 thick ribs separated by furrows, more or less hairy on the ribs; diaphragm absent; scarious corona, lightly scalloped or shallowly 4-lobed. Calyx composed of a discoid or subtetragonous platform, sessile, somewhat fleshy, glabrous or with a few multicellular glandular hairs, without setae, persistent. Corolla with 4 short lobes, one slightly larger than the rest, pink or whitish-pink. Androecium of four stamens. Ovary unicarpellate and epigynous. Style simple with capitate stigma, umbilicate, oblique. Achene glabrous. $x = 10$.

1. *Succisella carvalhoana* (Mariz) Baksay in Ann. Hist.-Nat. Mus. Natl. Hung., nov. ser., 6: 174 (1955). Basionym \equiv *Succisa carvalhoana* Mariz in Bol. Soc. Brot. 8: 147–148 (1890) \equiv *Succisella petteri* ssp. *carvalhoana* (Mariz) Malag., Sin. Fl. Ibér. 1106 (1977).

KEY TO ENDEMIC IBERIAN SPECIES OF *SUCCISELLA*

1. At least some leaves pinnatifid or pinnatipartite. Corolla 4–4.7 mm. Capitulum (10)12–15 mm in diameter at anthesis. Tube of involucre widely fusiform, with trichomes adpressed, 0.45–0.55 mm 1. *S. carvalhoana*
- 1'. All leaves whole to crenate-serrulate, rarely some irregularly incised-dentate. Corolla 2.5–4 mm. Capitulum (5)8–12 mm in diameter at anthesis. Tube of involucre fusiform with trichomes of 0.65–0.75 mm, crispate, or obovate and with trichomes of 0.2–0.4 mm, adpressed 2
2. Tube of involucre fusiform with trichomes of 0.65–0.75 mm in medial and distal regions. Bracteoles rhomboid to spatulate with 1–3 veins 2. *S. microcephala*
- 2'. Tube of involucre obovate with trichomes of 0.2–0.4 mm, adpressed. Bracteoles linear-spatulate, unveined 3. *S. andreae-molinae*

Ind. loc.: Arredores de Coimbra: Vil de Mattos, S. Fagundo [terrenos pantanosos] (Leg. A. Moller e M. Ferreira – VI & VII, 1890).

Lectotype: (designated here): [Portugal] Arredores de Coimbra, Vil de Matos, S. Fagundo, vii–viii.1890, *Moller & Ferreira s.n.* (COI!).

Description. Stems up to 120 cm, erect, higher ones branched, densely hirsute in the bottom third, glabrescent in the mid and distal regions, with 7–10 internodes. Leaves 120×40 mm; basal leaves in rosette, lanceolate to ovate-lanceolate, more or less dentate, densely strigose-pilose when young, losing hair progressively until limited to edges of leaf veins, especially on the abaxial surface; mid-cauline leaves linear-lanceolate, pinnatifid to profoundly pinnatipartite, hairy, upper ones linear, entire. Capitulum (10)12–15 mm in diameter at anthesis, on peduncles of up to 20 cm, densely covered in short hairs, curved and reflexed under the inflorescence. Involucre with 1–2 lines of ovate-lanceolate bracts, scabrous at the edge; bracteoles smaller than the flowers, linear-lanceolate or linear-spathulate, sharp, single veined. Involucels $(2.8)3\text{--}3.6(3.8) \times 1.7\text{--}1.9$ mm; tube widely fusiform with trichomes of $0.45\text{--}0.55(0.6)$ mm, more or less adpressed; corona $0.3\text{--}0.4(0.5)$ mm, glabrous. Calyx platform discoid, on occasions clearly exceeding the corona, glabrous or with glandular hairs. Corolla 4–4.7 mm, pink or whitish-pink, adpressed-pilose on the external face, glabrous on the interior; tube 2.7–3 mm; lobules 1.4–2 mm, ovoid to rounded, obtuse. Achene glabrous, markedly veined.

Distribution and biogeography. Endemic to the centre and west of the Iberian Peninsula: Beira Litoral, Douro Litoral, Ávila, Cáceres, Madrid, Salamanca, Toledo, Valladolid and Zamora provinces (Cantabrian-Atlantic, Carpetan-Leonese and Lusitan-

Extremadurean biogeographical subprovinces) (Fig. 32).

Notes. Although many sites for this taxon are known in the centre and west of the Iberian Peninsula (Amich, 1988; representative specimens examined), and although sites often meet the ecological and bioclimatic requirements of the plant, its distribution is very disjointed and irregular, and the number of individuals in the different populations varies greatly from one year to the next. Over the last 3 years, searches for this species have proved fruitless at the known Portuguese sites and in Valladolid (where it was cited by Gutiérrez Martín, 1908), and from which material has been preserved (MA 120085).

Illustration. Figure 33.

Representative specimens examined. PORTUGAL: Beira Litoral, Arredores de Coimbra, Vil de Mattos, viii.1890, *Moller s.n.* (COI) (PO 8527); Beira Litoral, Figueira da Foz, Foja, vii.1894, *Ferreira s.n.* (COI); Beira Litoral, Montemor-o-Velho, Matas de Foja, 18.vii.1949, *Matos s.n.* (PO 23812); *ibidem*, 7.viii.1950, *Matos & Matos s.n.* (COI); Beira Litoral, Santa Luzia, between Estarreja and Murtoza, 22.vii.1961, *Paiva, Matos & Masques s.n.* (COI); Beira Litoral, Aveiro, Eiról, Ribeiro de Calada, 7.viii.1969, *Ormonde s.n.* (COI); Douro Litoral, Vila Nova de Gaia, Lavadores, viii.1895, *Sampaio s.n.* (PO 8528); *ibid.*, viii.1898, *Sampaio s.n.* (PO 8529); *ibid.*, xi.1898, *Sampaio s.n.* (COI); Douro Litoral, Porto, Vila Nova de Gaia, Lavadores, 9.x.1979, *Matos et al. s.n.* (COI). SPAIN: Ávila, Poyales del Hoyo, 30TUK15, 8.ix.1968, *Rivas Goday & Ladero s.n.* (GDA 8786); Cáceres, Valdastillas, 30TTK54, 4.ix.1982, *Rico s.n.* (MA 283811) (SALA 28916); Madrid, Rozas de Puerto Real, next to the Presa de los Morales, 800 m, sandy shores next to the lake, cow pasture, 30TUK7064, 25.x.1998, *N. López & A. G. Ojesto s.n.* (MA 628829); Salamanca, Palacios del Arzobispo, 30TTL56, 6.ix.1976, *Sánchez Sánchez s.n.* (MA 248107) (MA 248110) (MAF 96306) (SALA 8496); Sancti-Spiritus, 29TQF10, 6.ix.1977, *Rico s.n.* (MA 248106) (SALA 14678); Fuentes de Oñoro, 29TPE89, 8.ix.1977, *Rico s.n.* (MA 248109) (SALA 14679); between Vitigudino and Lumbrales, 29TQF14, 19.ix.1977, *Amich s.n.* (MA 248105) (SALA 16356); Fuenteliante, 29TQF02, 21.ix.1977, *Amich s.n.* (SALA 16355); Lumbrales, 29TQF14, 15.x.1977, *Amich s.n.* (MA 480563); La Fuente de San Esteban, 29TQF32, 16.x.1977, *Rico s.n.* (SALA 14677); El Cubo de Don Sancho, 29TQF23, 6.ix.1982, *Amich s.n.* (MA 248108) (SALA 26210); Palacios del Arzobispo, Fuente de la Vega, 30TTL56, bullrush meadows, 18.x.1983, *M. Ladero, Marcos & C. Valle s.n.* (GDAC 17501) (SEV 104072); Zamayón, 30TTL65, 28.x.1984, *Valle, Ruiz &*

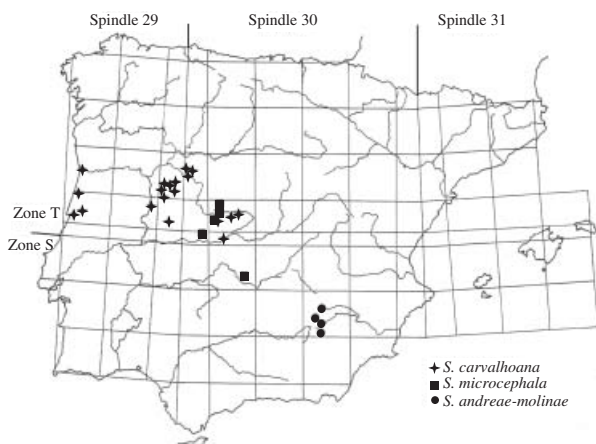


Figure 32. Distribution of *S. carvalhoana*, *S. microcephala* and *S. andreae-molinae* in the Iberian Peninsula.

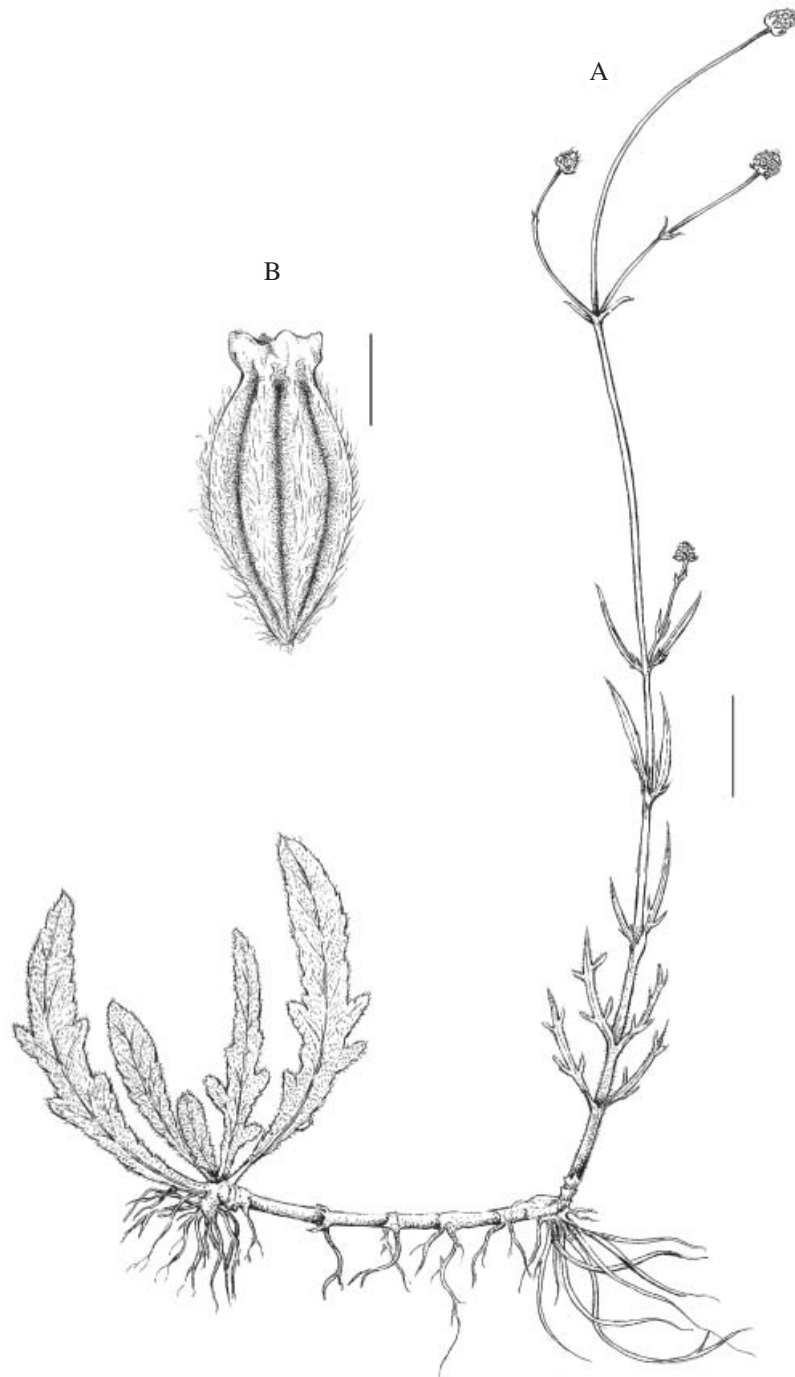


Figure 33. *Succisella carvalhoana*. Spain, Salamanca, El Cubo de Don Sancho, 6.ix.1982, Amich s.n. (SALA 26210). A: habit, scale bar = 4 cm; B: involucre, scale bar = 1 mm.

Fdez-Arias s.n. (SALA 73002); Palacios del Arzobispo, Fuente de la Vega, 30TTL56, bullrush meadows, 22.x.1999, *J. A. Devesa & T. Ruiz s.n.* (UNEX 25615); Aldehuela de Yeltes, 775 m, 29TQF3116, 29.ix.2001, *Amich & Bernardos s.n.* (SALA 103758) (SALA 107245); *ibid.*, 7.ix.2002, *Amich & Bernardos s.n.* (SALA 107815); Toledo, Navamorcuende, 1100 m,

30TUK44, granitic soil, 6.x.1980, *A. Segura Zubizarreta s.n.* (MA 362497); Velada, 450 m, 30SUK32, soil sandy granitic, damp, 28.viii.1985, *A. Segura Zubizarreta s.n.* (MA 580689); Zamora, Cubo del Vino, 30TTL77, 16.x.1981, *Giráldez s.n.* (SALA 30942); *ibid.*, 24.ix.1983, *Giráldez s.n.* (SALA 30943); Mayalde, 975 m, 30TTL6369, 3.ix.1983, *Giráldez s.n.* (SALA

30949); Mayalde, 980 m, 30TTL6369, 18.ix.2000, *Amich & Bernardos s.n.* (SALA 107244); Valladolid, Olmedo (Cast. la Vieja), n. 51, sin fecha, *D. Gutiérrez s.n.* (MA 120085).

2. *Succisella microcephala* (Willk.) G. Beck in Fl. Nieder Österreich 2 (2): 1145 (1893).

Basionym \equiv *Succisa microcephala* Willk. in Flora 34 (47): 740–741 (1851)

\equiv *Scabiosa microcephala* (Willk.) Nyman, Syll. Fl. Eur. 59 (1855)

\equiv *Succisella petteri* ssp. *microcephala* (Willk.) Malag., Sin. Fl. Ibér. 1106 (1977).

Ind. loc.: Hab. in Extremadura superiore in pascuis arenosis siccis quercetorum inter pagum Toril et fluvium Tietar raro, ubi d. 10 Octob. Florentem fructiferamque legi.

Lectotype: (designated here): [Spain] In quercetis inter Toril et Malpartida in Extremadura superiori raro, ix. 1850, *Willkomm s.n.* (COI!, in Herb. Willkomm).

Description. Stems up to 115 cm, erect, upper ones branched, patent divaricate branches, glabrous or glabrescent in the mid and distal regions, moderately hirsute at the base, with 5–7 internodes. Leaves up to 150 \times 10 mm; basal leaves in a rosette, lanceolate to ovate-lanceolate, attenuate, entire or very weakly crenulate, strigose-pilose at least at the margins and on the veins when young, losing hair progressively when mature; mid-cauline leaves linear-lanceolate, entire or weakly dentate at the base, sparsely hairy, the uppermost linear, simple. Capitulum 10–12 mm in diameter at anthesis, on peduncles of up to 20–25 cm, with some curved, short and reflexed hairs under the inflorescence. Involucre with 1–2 lines of ovate-acuminate bracts, scabrous at the edge; bracteoles smaller than the flowers, rhomboid to spatulate, sharp, with one main and two secondary veins setose at the distal margin. Involucels (2.6)3.1–3.7(3.9) \times 1.3–1.5 mm; tube fusiform with long trichomes 0.65–0.75 mm, crispate; corona 0.3–0.4 mm, glabrous; calyx platform always hidden by the corona. Corolla 3–4 mm, pink or whitish pink, adpressed-pilose on the external face, glabrous on the interior; tube 2.5–2.7 mm; lobules 1–1.7 mm, ovate to rounded, obtuse. Achene glabrous, markedly veined.

Distribution and biogeography. Endemic to the centre-west of Spain: Ávila, Cáceres and Ciudad Real provinces, the Bejaran-Gredensean and Toledan-Taganean biogeographical sectors (Fig. 32).

Notes. Strong pressure from stock grazing on the habitats of this microendemic was indicated long ago (Willkomm, 1852). This keeps the populations small. Sites where it can be found are very scarce. In Poyales

del Hoyo (Ávila province) there are populations with individuals that have characteristics intermediate between *S. carvalhoana* and *S. microcephala*, especially with respect to the basal and cauline leaves, which range from simple to clearly divided.

Illustration. Figure 34.

Representative specimens examined. SPAIN: Ávila, Poyales del Hoyo, 30TUK15, 8.ix. 1968, *Rivas Goday & Ladero s.n.* (MGC 6196); Puerto de Menga, 30TUK28, 29.viii.1979, *Amich & Sánchez Rodríguez s.n.* (MA 248111) (SALA 18726); Hoyocasero, Venta del Obispo, 30TUK27, 3.ix.1984, *Amich s.n.* (SALA 33454); Cepeda La Mora, 1380 m, 30TUK2880, 3.ix.1984, *Amich s.n.* (SALA 33455); Venta del Obispo, río Alberche, Puente Nuevo, 1260 m, 30TUK27, 3.viii.1985, *Sánchez-Mata s.n.* (SALA 108119); Hoyocasero, Venta del Obispo, 1280 m, 30TUK2873, 12.ix.2001, *Amich & Bernardos s.n.* (SALA 107243); Cepeda La Mora, 1375 m, 30TUK2880, 12.ix.2001, *Amich & Bernardos s.n.* (SALA 107242); Cáceres, in quercetis inter Toril et Malpartida in Extremadura superiori raro, ix.1850, *Willkomm s.n.* (COI, in Herb. Willkomm); Ciudad Real, Piedrabuena, río Bullaquejo, Valle de la Viuda, El Gargantón, 30SUJ82, 5.ix.1965, *Rivas Goday & Ladero s.n.* (GDA 6079).

3. *Succisella andreae-molinae* Pajarón & Escudero in Anales Jard. Bot. Madrid 51(2): 250 (1994)

Ind. loc.: Jaén: Hornos, cerca del cortijo de la Fuente del Charco, 30SWH32, 1450 m, 27.viii.1992, *Pajarón s.n.*

Holotype: Jaén: Hornos, cerca del cortijo de la Fuente del Charco, 1450 m, zona húmeda, 30SWH326, 27.viii.1992, *Pajarón s.n.* (MACB 50000!). Isotypes (MA, MACB).

Description. Stems up to 125 cm, erect, upper ones branched, branches patently divaricate, from glabrescent to glabrous with 5–7 internodes. Leaves up to 180 \times 14 mm; basal leaves in rosette, from lanceolate to lanceolate-spathulate or obovate-spathulate, attenuate, entire or denticulate, exceptionally irregularly incised-dentate, sparsely ciliate and with the odd sparse hair on the veins; mid-cauline leaves linear-lanceolate, entire or distally denticulate, glabrous or with hairs at least on the margins, the highest linear, entire. Capitulum (5)8–12 mm in diameter at anthesis, on peduncles of up to 25–30 cm, densely covered with short hairs, reflexed under the inflorescence. Involucre with 1–2 lines of ovate-acuminate bracts, scabrous at the margin; bracteoles shorter than the flowers, linear-spathulate, sharp, unveined, setose in the distal margin. Involucels (2)2.9–3.3(4) \times 1.2–1.4 mm; tube obovate, with trichomes of 0.2–0.4 mm,

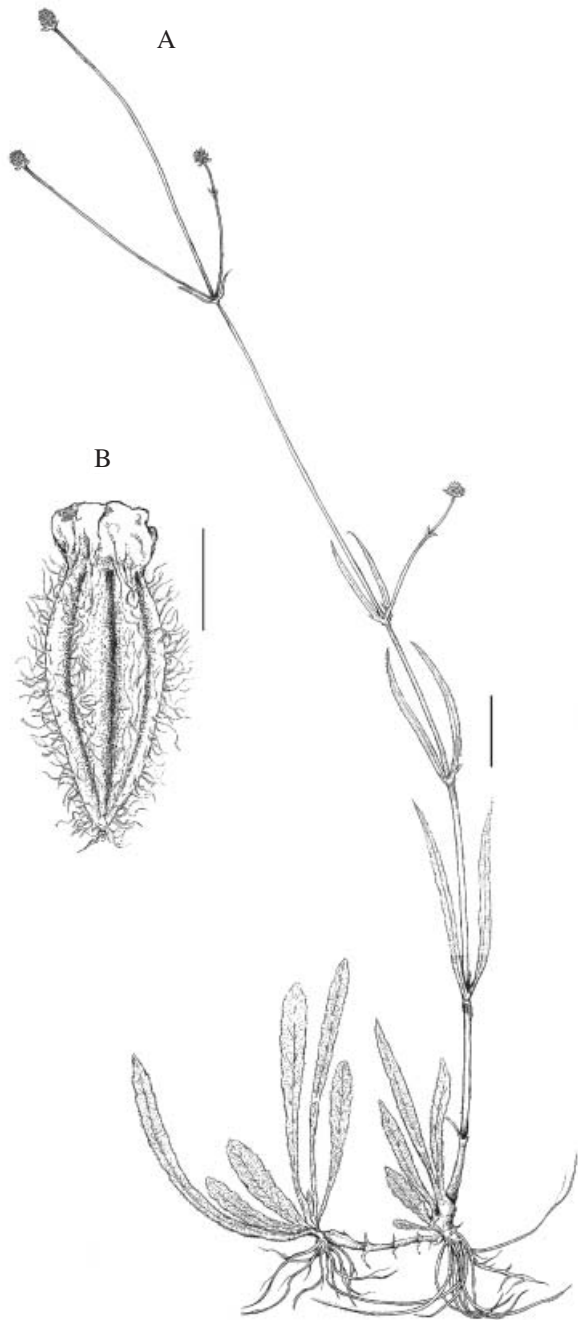


Figure 34. *Succisella microcephala*. Spain, Ávila, Hoyocasero, Venta del Obispo, 12.ix.2001, Amich & Bernardos s.n. (SALA 107243). A: habit, scale bar = 4 cm; B: involucre, scale bar = 1 mm.

adpressed; corona 0.3–0.4 mm, glabrous. Calyx platform shallowly 4-lobed, always hidden by the corona. Corolla (2.5)3–3.5(4) mm, pink to whitish-pink, adpressed-pilose on the entire external face, glabrous on the interior; tube 1.2–2.5 mm; lobules 0.7–1.7 mm, ovate to round, obtuse. Achene glabrous, markedly veined.

Distribution and biogeography. Endemic to the south-east of Spain: Albacete, Granada and Jaén provinces, the Subbetic biogeographical sector (Fig. 32).

Notes. Taxon restricted to a few sites in south-east Spain: Sierras de Alcaraz, Cazorla and Segura. Until its recognition as a new species it was cited as *S. microcephala* (Fernández Galiano & Heywood, 1960).

Illustrations. Escudero & Pajarón (1994: 252, fig. 2); Figure 35.

Representative specimens examined. SPAIN: Albacete, between Salobre and Riópar, 10 km, Sierra de Alcaraz, 1125 m, communities of *Lysimachio-Holoschoenetum*, 30SWH4266, 9.ix.2000, Amich & Bernardos s.n. (SALA 103288); between Salobre and Riópar, 12 km, Sierra de Alcaraz, 1245 m, communities of *Lysimachio-Holoschoenetum*, 30SWH4264, 10.ix.2001, Amich s.n. (SALA 103289); Granada, Río Huéscar or Barbatas, Barranco Cueva de la Cadena, 1420 m, in reedbeds on limestone, 30SWH4305, 2.ix.1995, C. Salazar s.n. (GDAC 40043); Río Huéscar, Puebla de Don Fadrique, 1480 m, 30SWH40, 26.x.1996, C. Salazar s.n. (GDAC 40722); Jaén, Segura de la Sierra, on a cliff of the Río Madera, 30SWH43, 12.ix.1954, Galiano s.n. (MA 173390) (SEV 5079); Siles, Arroyo Madera, 30SWH43, 15.viii.1987, Segundo Ríos & Alcaraz s.n. (MUB 18570); Siles, La Balasua, 30SWH43, 10.viii.1990, Segundo Ríos & Robleda s.n. (MUB 31857); Hornos, close to the Fuente del Charco farm, 1450 m, damp area, 30SWH3126, 27.viii.1992, Pajarón s.n. (MA 520131) (MACB 50000); ibid., 24.x.1992, Pajarón s.n. (MACB 46886); Segura de la Sierra, Sierra de Segura, 1240 m, damp sides of the road, 30SWH3340, 9.ix.2000, Amich & Bernardos, s.n. (SALA 103291); ibid., 1285 m, damp sides of the road, 30SWH3440, 9.ix.2000, Amich & Bernardos s.n. (SALA 103290, 107813); Segura de la Sierra, Fuente del Tejo farm, 1345 m, along edges of streams, 30SWH4037, 9.ix.2000, Amich & Bernardos s.n. (SALA 107246).

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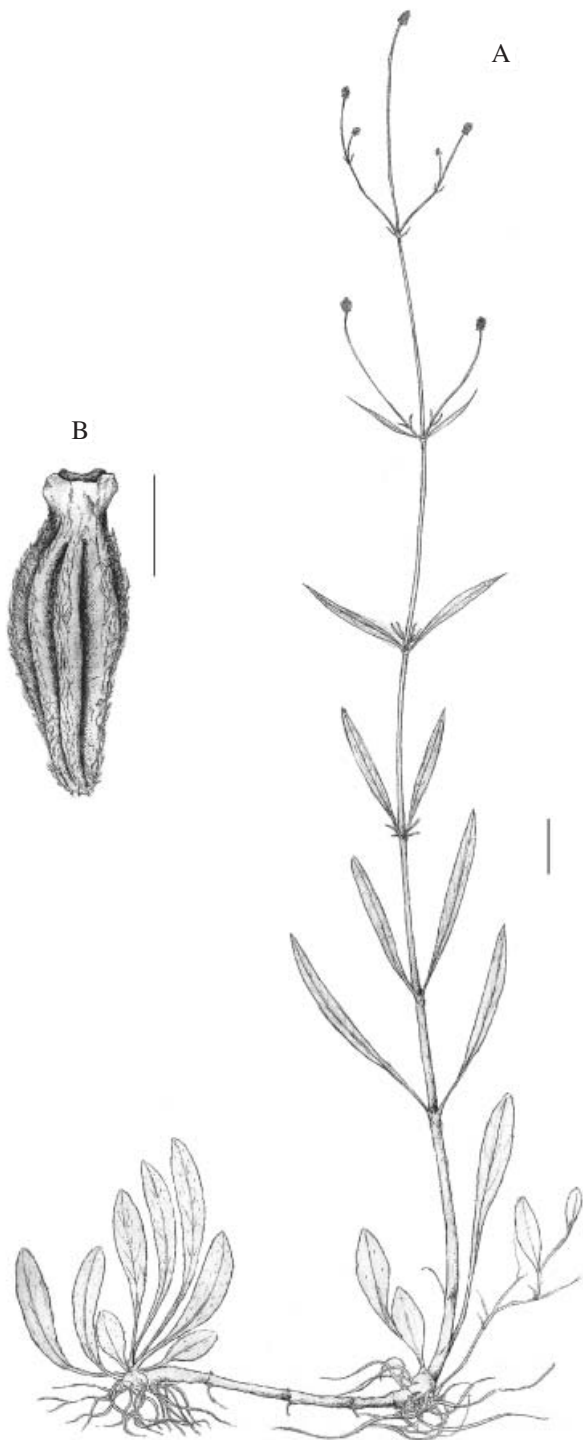


Figure 35. *Succisella andreae-molinae*. Spain, Jaén, Segura de la Sierra, Sierra de Segura, 9.ix.2000, Amich & Bernardos s.n. (SALA 103290). A: habit, scale bar = 4 cm; B: involucre, scale bar = 1 mm.

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