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Taxonomic study in the *Centaurea langei* complex (Asteraceae)

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The morphological variability of *Centaurea langei* Nyman (*Centaurea* sect. *Centaurea*), an endemic to the north-central and north-west Iberian Peninsula, was studied. Seven subspecies with reasonably well-defined areas are recognized, of which *C. langei* subsp. *dominguezii* E. López, Devesa & Arnelas is described as new, and for the others the following combinations are proposed: *C. langei* subsp. *exilis* (Arènes) E. López, Devesa & Arnelas, *C. langei* subsp. *coutinhoi* (Franco) E. López, Devesa & Arnelas, *C. langei* subsp. *geresensis* (Arènes) E. López, Devesa & Arnelas, *C. langei* subsp. *kheilii* (Pau) E. López, Devesa & Arnelas, and *C. langei* subsp. *rothmalerana* (Arènes) E. López, Devesa & Arnelas. Nomenclatural and taxonomic synonyms are provided for each taxon, most of which are typified. For *C. langei* subsp. *dominguezii*, the chromosome number was also studied (2n = 18).

Introduction

Centaurea comprises about 250 species (Susanna & Garcia-Jacas 2007). It is mainly distributed in Europe, the Mediterranean region, and SW Asia, with some introductions in other more or less distant regions. The paraphyletic nature of its classical delimitation is well known (Susanna *et al*. 1995, García-Jacas *et al*. 2000), so that its classification is ongoing and subject to information derived from molecular characters in phylogenetic studies (Bremer 1994, Gabrielian 1995, Susanna *et al*. 1995, Wagenitz & Hellwig 1996, Garcia-Jacas *et al*. 2000, 2001). One result has been the segregation of certain groups traditionally included in *Centaurea* (e.g., subgen. *Centaurea*, now in the genus *Rhaponticoides*), and re-incorporation of others that had been segregated into separate genera (*see* López & Devesa 2008a). It also became necessary to select a new type for the genus: *Centaurea paniculata* L. (Greuter *et al*. 2001).

Currently, included in the section *Centaurea* are most taxa of the traditional subgenera *Acrolophus* (= *Acosta*; Holub 1972) and *Phalolepis*. The sections form a monophyletic group (Garcia-Jacas *et al*. 2006, Suárez-Santiago *et al*. 2007) in which there has been frequent hybridization between species (Ochsmann 2000) and they also share the same derived pollen type (*Jacea* type, following Wagenitz 1955). Although most species of the section *Centaurea* are found in

the East Mediterranean and the Irano–Turanian region, the Iberian Peninsula and NW Africa also constitute a major centre of diversification.

In the Iberian Peninsula, the section *Centaurea* includes in its current delimitation more than 60 taxa, with a high degree of endemism, and notoriously difficult taxonomy. An essential source for the group in the area is the synthesis by Dostál (1976) for *Flora Europaea*, which for the taxa of the *Willkommia* group is complemented by important subsequent contributions (Blanca 1980a, 1980b, 1981a–f, 1984, Talavera 1984b). For the taxa of the *C. alba* group, however, there clearly remain uresolved taxonomic problems which led to new contributions (Talavera 1984a). This is also the case with the *C. paniculata* group, for which there are classical reviews by Arènes (1949, 1951). Both groups have been the subject of recent studies (López 2008), which gave novel karyological (López & Devesa 2008c) and taxonomic (López & Devesa 2008a, 2008b, 2008d) contributions of interest.

The goal of the recent studies cited above was the account of the genus for the volume XVI of *Flora Iberica*, and as a further contribution we here study *C. langei*, a species of the *C. paniculata* group endemic to the N and NW Iberian Peninsula. This comprises a very variable taxon, with seven subspecies being recognized, some hitherto regarded as independent species, and the recognition of one new subspecies described in the present work.

Material and methods

This study is based on morpho-geographical and biometrical analyses carried out on material collected by the authors and on material deposited in different herbaria (BC, BCN, COFC, COI, COI-Willk., JACA, JAEN, LISE, LOU, MA, MAF, MGC, SALA, SANT, SEV, UNEX; abbreviations according to Holmgren *et al*. 1990). Some of these herbaria contain material of interest for lectotypifications, others were consulted for that purpose only (C-Lange, LISI, LY-Rouy).

For *C. langei* subsp. *dominguezii*, chromosome counts of root meristem cells were made. The antimitotic agent used was 0.002 M 8-hydroxyquinoline (Tjio & Levan 1950), and as fixative a mixture of absolute alcohol and ferric acetate (3:1). The stain used was alcoholic acetocarmine (Snow 1963) applied for 24–48 hours. The description of the chromosome morphology follows the terminology of Levan *et al*. (1964). Chromosome size is expressed by three values: the length of the longest chromosome, the length of the shortest chromosome and the mean length (with the standard deviation in parentheses).

Results and discussion

Centaurea langei includes plants of the NW Iberian Peninsula which many authors (among others Willkomm 1865, Merino 1915, Arènes 1949, Dostál 1976) have identified as *C. aristata* Hoffmans. & Link or *C. micrantha* Hoffmans. & Link. However, *C. aristata* is a different species (cf. López & Devesa 2008b), and *C. micrantha* is a homonym of a name (*C. micranthos* S.G. Gmel.) previously used in a different sense, which led to its substitution by new names (*C. hoffmanseggiana*, Lázaro (1896: 889); *C. hoffmanseggi*, von Hayek (1901: 588). This is also the case with *C. divergens* Lange (1862), *non C. divergens* Vis. (1847), and *C. langeana* Willk. (1865).

Within the group of *C. paniculata*, *C. langei* presents the greatest affinity with *C. limbata* and *C. hanryi*. It shares with these two species the characters of oblong-obovoid achenes, brownish at maturity, and involucral bracts with an appendage well differentiated from the base, with at least the upper lateral fimbriae concolorous, and it is differentiated by the cauline leaves generally being entire (López & Devesa 2008a, 2008d). It has marked variability, with seven groups of populations or subspecies being recognizable that are geographically well defined, but with very similar characteristics and some degree of sympatry (Fig. 1), and not infrequent transitional individuals in zones of contact. Thus it is not surprising that from this geographic nucleus a multitude of subspecies, varieties, and have been described (Merino 1915, Arènes 1949).

Centaurea langei subsp. *langei* is distributed in the north-west and central-north Iberian Peninsula. The plants usually have the capitula arranged in small groups, with a relatively slen-

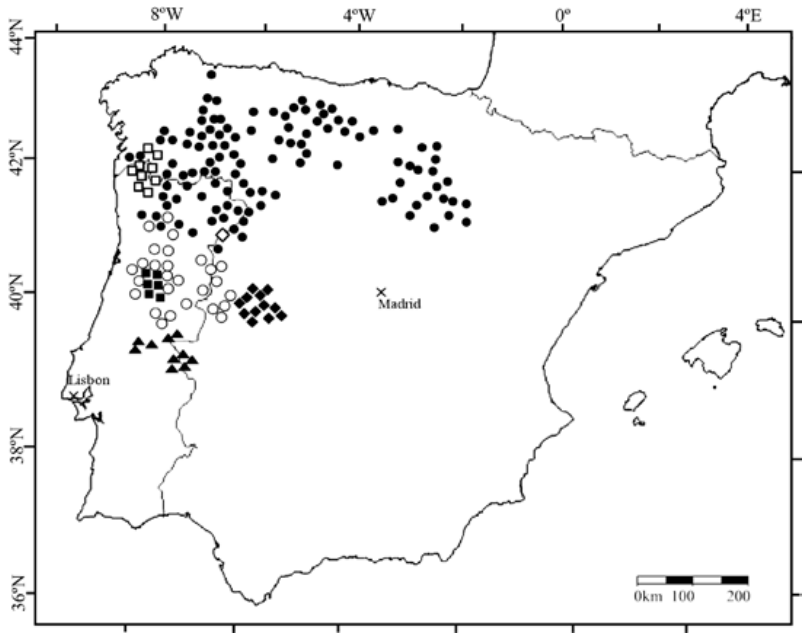

Fig. 1. Distribution of *Centaurea langei*: subsp. *langei* (●), subsp. *dominguezii* (◇), subsp. *exilis* (○), subsp. *coutinhoi* (▲), subsp. *geresensis* (□), subsp. *kheilii* (◆), subsp. *rothmalerana* (■).

der involucre (2.5–5 mm), and narrow appendages of the middle involucral bracts — which are barely mucronate at the apex — and the pappus about as long as the achene. The remaining subspecies have wider involucres of 3–8 mm, and the pappus shorter than the achene, although the latter character does not apply for subsp. *dominguezii* described in the present work, and as yet only known from the vicinity of the Aldeadávila de la Ribera (Salamanca province).

Subsp. *kheilii* is characterized above all by often having the capitula in groups of 2–3 and the appendage of the middle bracts being erecto-patent to patent at anthesis. Its range extends over the mountainous regions to the west of the *Sistema Central* (northern part of the Cáceres province, and southern part of the Salamanca province). Subspp. *exilis* and *coutinhoi* have capitula that are usually solitary and the pappus only slightly shorter than the achene. They are distributed in the north-central and north-east Portugal, and the western parts of the provinces Cáceres and Salamanca. They are distinguished by the size of the involucre and the morphology of the appendages of the middle bracts. Subsp. *rothmalerana*, endemic to the Serra da Estrela (Beira Alta, Portugal), consists of plants of generally short habit, with more or less dense tomentose-arachnoid indumentum, and with the pappus length less than than halfof that of the achene. This latter feature is shared with the subsp. *geresensis*, restricted to the Serra da Peneda, Serra do Gerês, and adjacent areas (south of Orense, and north of Minho and Tras-Os-Montes), which in general is very similar to the previous two taxa but it is subglabrous or laxly arachnoid.

Centaurea langei *Nyman*

Syll. Fl. Eur., Suppl.: 6 (1865) [January–October] — *C. divergens* Lange, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 12: 87.1861 [nom. subst.], *non C. divergens* Vis., Fl. Dalmat. 2: 37, t. 12b. 1847. — *C. langeana Willk. in* Willk. & Lange, Prodr. Fl. Hispan. 2: 157. 1865 [December] nom. illeg. — *C. paniculata* subsp. *langeana* Arènes, Agron. Lusit. 11: 21. 1949. — *C. aristata* subsp. *langeana* (Arènes) Dostál, Bot. J. Linn. Soc. 71: 199. 1976. — LECTOTYPE (designated here): Spain. León, Villafranca del Bierzo, *in rupibus schistosis*, 18.VII.1852 *J. Lange s.n.* (C-Lange!) (Fig. 2).

Perennial, suffruticose (non-spiny) herb, multi-stemmed, unarmed (except occasional involucral bracts), ± scabrous, glabrous, subglabrous or more frequently with arachnoid unicellular hairs and eglandular pluricellular hairs with or without translucent sessile glands (especially

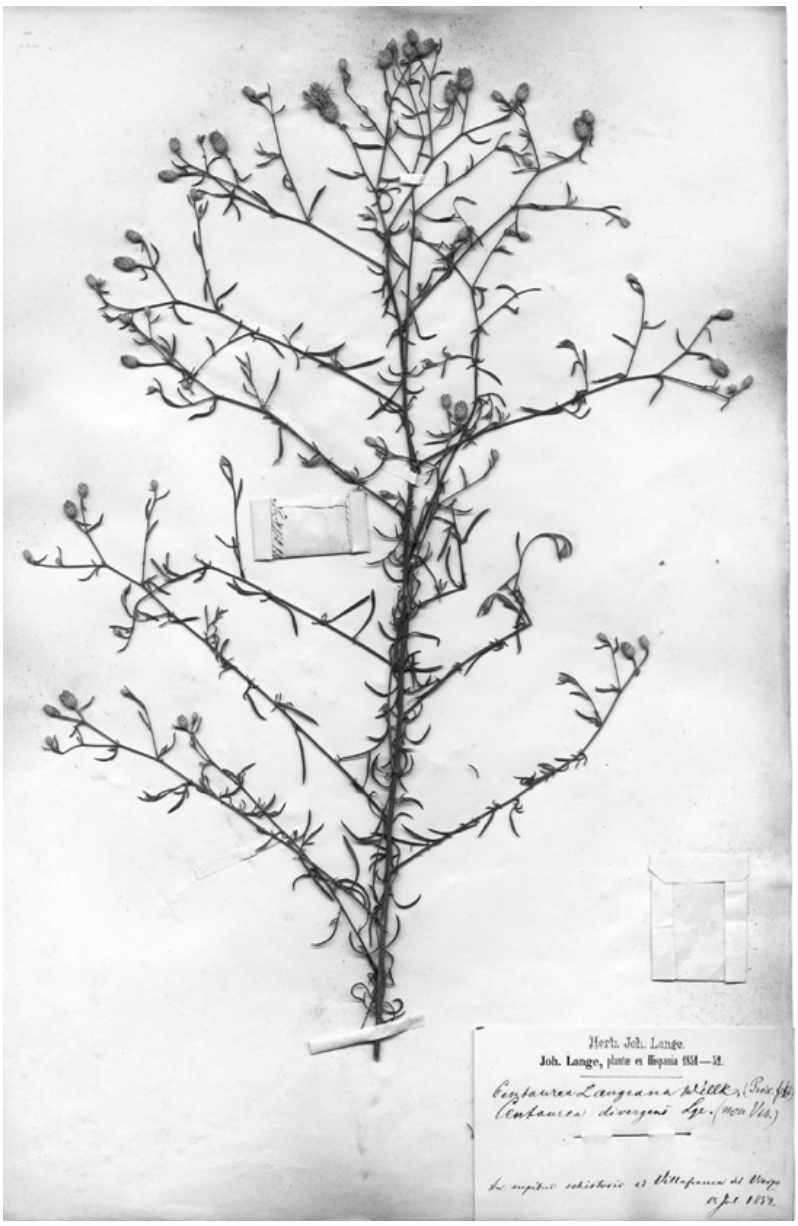

Fig. 2. Lectotype of *Centaurea langei* Nyman (C-Lange).

abundant on leaves). Stems up to 105 cm, erect or ascendant, often branched from middle or in upper part, section ± prismatic, longitudinally costate, non-alate, glabrous, subglabrous or more frequently with ± lax indumentum of rigid patent pluricellular hairs, and scattered arachnoid hairs. Leaves up to 16 × 6 cm; lower ones petiolate, and arranged in a rosette (often dessicated by flowering), entire, 1–2 pinnatipartite or 1–2 pinnatisect, with lobes oblanceolate, ovate-lanceolate, lanceolate, or linear-lanceolate, entire or pinnatifid, mucronate, and margins smooth or slightly serrate; cauline leaves sessile, not decurrent, decreasing upwards in size, entire, pinnatifid, pinnatipartite, or pinnatisect, and with 1–4 pairs of lobes ovate, lanceolate, or linear-lanceolate, entire or pinnatifid, terminal usually broader, margins smooth and slightly revolute, mucronate, adaxial surface glabrous to tomentose-arachnoid, and abaxial surface generally

arachnoid and with short, rigid, antrorse-scabrous pluricellular hairs. Capitula homogamous, discoid, with sterile outer flowers and hermaphrodite central flowers, solitary or in groups of 2–4 and in turn in lax subcorymbose coflorescences, usually terminal, reached by last leaves or with a 5–50 mm glabrous or white-tomentose peduncle. Involucre 8–14 × 2.5–8(9) mm, ovoid or cylindrical, ± rounded or narrowed at base. Imbricate involucral bracts, apparently arranged in 6–7 rows and gradually increasing in size inwards; outer and middle bracts ovate to ovate-oblong, greenish, yellowish, or less frequently distally purplish, with lightly marked longitudinal nerves, with or without narrowly hyaline margins, glabrous or rarely laxly arachnoid, with a semilunate, triangular, or orbicular apical appendage, erect to patent, pectinate-fimbriate, with (2)4–8 pairs of flexuous lateral fimbriae of 0.3–2 mm, terminating in a mucro, awn, or apical spine of 0.2–2 mm, glabrous or laxly pilose and glandular; inner bracts 7–14 mm, linear or linear-spatulate, glabrous, with margins narrowly hyaline along entire length, and apical appendage barely distinguishable, ovate to oblong, flat, scarious, entire, unarmed or weakly mucronate, of a pale green. Corolla of sterile flowers 9–16 mm, with whitish tube and ± pink limb, with lobes 2–4.5 mm; that of hermaphrodite flowers 8–15 mm, with whitish tube of 3–7 mm, and limb 4–8 mm, pink or pinkish-white (rarely entirely white), with lobes 2–4 mm. Stamens with uniformly pilose filament, with hairs of up to 0.3 mm, whitish; anthers 4–6.5 mm, yellowish, with basal appendage of 0.3–0.5 mm, membranaceous and frequently lacerate. Style whitish; stigmatic branches yellowish or orange. Achenes 2.2–4.2 × 1–2 mm, oblong-ovoid, smooth, lax, and inconspicuously villous, with apical nectary 0.1–0.2 mm, sometimes absent, and hilum 0.2–0.8 mm, brownish or dark green at maturity, with yellow linear maculae arranged lengthwise more or less irregularly. Pappus double, outer ones with bristles 0.5–3.5 mm. Flowering time: May–November.

DISTRIBUTION: NW and central-west Iberian Peninsula (Fig. 1).

HABITATS: In clearings and margins of woodland (mostly of pine, cork oak, chestnut, or deciduous oak), scrub, ditches and edges of roadways, embankments and wasteland, generally on rocky or coarse-textured soils, siliceous or calcareous, not overly nitrified; 100–1800 m.

Key to the subspecies of *Centaurea langei*

1. Pappus 2–3.5 mm, about as long as achene or somewhat shorter 2
1. Pappus 0.5–2(2.5) mm, 1/3–1/2(2/3) as long as achene 3
2. Stems, branches, and leaves laxly arachnoid and scabrous, green at base ..... subsp. *langei*
2. Stems, branches, and upper leaves glabrous or subglabrous, grayish-white, tomentose at base ..... subsp. *dominguezii*
3. Capitula usually in groups of 2–3, rarely solitary; appendage of middle bracts erect-patent to patent at anthesis ..... subsp. *kheilii*
3. Capitula solitary; appendage of middle bracts erect to erect-patent at anthesis 4
4. Pappus 1.5–2.5 mm, longer than half the achene 5
4. Pappus 1–2(2.5) mm, shorter than or equal to half of the achene 6
5. Appendage of middle bracts with central part longer than wide ..... subsp. *exilis*
5. Appendage of middle bracts with central part wider than long ..... subsp. *coutinhoi*
6. Plant subglabrous or laxly arachnoid, dark green; erect or ascendant, laxly branched from mid or upper part ..... subsp. *geresensis*
6. Plant tomentose-arachnoid, ± grayish especially in its lower part; prostrate-ascendant to erect, highly branched from base ..... subsp. *rothmalerana*

subsp. *langei*

C. micrantha Hoffmanns. & Link, Fl. Portug. 2: 220.1825, *non C. micranthos* [*micrantha*] S.G. Gmel., It. 1 t. 23 f. 1. 1770. — *C. castellana* subsp. *micrantha* Nyman, Consp. Fl. Eur. 2: 426. 1879. — *C. hoffmanseggiana* Lázaro, Comp. Fl. Españ. 2: 889. 1896. — *C. hoffmannseggii* Hayek, Cent.-Art. Ost.-Ung.: 588. 1901, *nom. illeg.* — *C. gallica* var. *micrantha* Gugler, Ann. Hist.-Nat. Mus. Natl. Hung. 6: 158. 1907. — *C. paniculata* subsp. *micrantha* (Nyman) Cout., Fl. Portugal: 656. 1913. — *C. paniculata* var. *hoffmanseggiana* (Lázaro) Samp., Lista Esp. Herb. Portug.: 137. 1913. — *C. paniculata* subsp. *hoffmannseggii* Arènes, Agron. Lusit. 11(1): 25. 1949, *nom. illeg.* — TYPE: Not found.

C. limbata var. *melanosticta* Lange, Vidensk. Meddel. Dansk Naturhist. Foren. *Kjøbenhavn* 12: 86. 1861. — *C. paniculata* var. *melanosticta* (Lange) Cout., Fl. Portugal: 657. 1913. — *C. limbata* "raza" *melanosticta* (Lange) Merino, Brotéria, Sér. Bot. 13: 21. 1915. — *C. paniculata* var. *melanosticta* (Lange) Arènes, Agron. Lusit. 11(1): 27. 1949, *comb. superfl.* — *C. micrantha* subsp. *melanosticta* (Lange) Dostál, Bot. J. Linn. Soc. 71: 199. 1976. — *C. melanosticta* (Lange) Franco, Nova Fl. Portugal 2: 478, 573. 1984. — LECTOTYPE (designated here): Spain. Lugo, Sobrado, 24.VII.1852

J. Lange s.n. (C-Lange!, right-hand-side specimen).

C. orensensis Gand., Bull. Soc. Bot. France 45: 590. 1898. — Isotype: Spain. Orense, VI.1898 *M. Gandoger 135294* (MA!).

C. micrantha var. *squamomutica* Pau, Bol. Soc. Aragonesa Ci. Nat. 1: 50. 1902. — Lectotype (designated here): Spain. "Flora de Galicia", 1897 *B. Merino 135286* (MA!, left hand specimen).

C. xerolepida Pau, Bol. Soc. Aragonesa Ci. Nat. 1: 50. 1902. — Lectotype (designated here): Spain. Lugo, Roqueira, 1900 *B. Merino 135261* (MA!).

C. nigricolor Pau, Bol. Soc. Aragonesa Ci. Nat. 1: 49. 1902. — Lectotype (designated here): Spain. Pontevedra, Verín, Islas Cíes, 1897 *B. Merino 135279* (MA!, left specimen).

C. limbata "raza" *venusta* Merino, Brotéria, Sér. Bot. 13: 24. 1915. — Lectotype (designated here): Spain. Orense, Casayo, without data, *B. Merino 1249/8* (LOU!, of the 3 elements present, the most branched, with the longest branches and most capitula is chosen).

C. limbata var. *stenocephala* Merino, Brotéria, Sér. Bot. 13: 22. 1915. — Lectotype (designated here): Spain. Orense, Humoso, without data, *B. Merino 1247/10* (LOU!, of the 3 elements present, the complete specimen is chosen).

C. limbata subvar. *aggregata* Merino, Brotéria, Sér. Bot. 13: 22. 1915. — Lectotype (designated here): Spain. Lugo, Cerezal, without data, *B. Merino 1247/7* (LOU!).

C. limbata var. *candidans* Merino, Brotéria, Sér. Bot. 13: 24. 1915. — Lectotype (designated here): Spain. Orense, Casayo, without data, *B. Merino 1248/11* (LOU!).

C. micrantha var. *fastigiata* Merino, Brotéria, Sér. Bot. 13: 30. 1915. — Lectotype (designated here): Spain. Orense, Verín, without data, *B. Merino 1255/19* (LOU!).

C. micrantha var. *laxa* Merino, Brotéria, Sér. Bot. 13: 29. 1915. — Lectotype (designated here): Spain. Orense, Casayo, without data, *B. Merino 1255/20* (LOU!, of the 4 elements present, joined in a small bunch, the largest, most complete and most branched one is chosen).

C. micrantha f. *arguta* Merino, Brotéria, Sér. Bot. 13: 29. 1915. — Lectotype (designated here): Spain. Lugo, Sequeiros, without data, *B. Merino 1255/17* (LOU!).

C. paniculata var. *planifolia* Merino, Brotéria, Sér. Bot. 13: 27. 1915. — Lectotype (designated here): Spain. Orense, Humoso, without data, *B. Merino 1251/22* (LOU!).

C. paniculata var. *flexicaulis* Merino, Brotéria, Sér. Bot. 13: 26–27. 1915. — Lectotype (designated here): Spain. Orense, Humoso, without data, *B. Merino 1251/21* (LOU!, of the 4 specimens the most branched one and with most capitula is chosen).

C. semilunaris Merino, Brotéria, Sér. Bot. 13: 32. 1915. — Lectotype (designated here): Spain. Orense, San Esteban de Ribas del Sil, without data, *B. Merino 1253/6* (LOU!, of the 2 specimens present that with two stems is chosen).

C. limbata var. *microblepharis* Merino, Brotéria, Sér. Bot. 13: 21. 1915. — Type: Not found.

C. paniculata f. *atra* Merino, Brotéria, Sér. Bot. 13: 26. 1915. — Type: Not found.

Laxly arachnoid and scabrous, with translucent sessile glands. Stems 10–105 cm, erect or ascendant, highly branched in their mid or upper part. Capitula solitary or in groups of 2–3. Involucre 8–13 × 2.5–5 mm, narrowly ovoid-cylindrical, ± narrowed at base. Middle involucral bracts with appendage 1–2.5(3) × 1–3(4) mm, brown to black, erect, with 2–7 pairs of 0.3–1.5 mm lateral fimbriae, and mucro or apical spine 0.2–1(1.5) mm. Achenes 2.2–3.5 mm. Outer pappus 2–3.5 mm, about as long as achene. Flowering time: June–November.

Chromosome number: 2n = 18 (López & Devesa 2008c).

Distribution and habitats: N and NW Iberian Peninsula; in weakly nitrified pastures with coarse-textured, preferably siliceous soils; 100–1800 m (Fig. 1).

In the areas of contact of this subspecies with *C. aristata* (*see* López & Devesa 2008b), there appear individuals with characteristics intermediate between the two taxa, as is also the case with *C. limbata* (*see* López & Devesa 2008d) and with *C. langei* subsp. *dominguezii* (*see* Appendix)

Additional selected specimens examined. — **Portugal**. Beira Alta, Gagim–Armamar, 3.IX.1934 *J. de Varmellos 3641* (LISE); Murça, VII.1880 *M. Ferreira 24469* (COI); Beira Litoral, Vila Flor, 16.VII.1980 *L. A. Grandvaux 413446* (MA); Douro Litoral, Amarante, 2.VII.1928 *J. Cuatrecasas 78257* (BC); Porto, V.1887 *E. Gohunton 24392* (COI); Minho, Monçao, 2.IX.1965 *B. J. Rainha & J. Martins 94610* (LISE); Ponte do Mouro, VI.1885 *A. R. da Cunha 24396* (COI); Tras-os-Montes, Chacim, Balsemão, 22.VI.1968 *P. Silva & A. N. Teles 67071* (LISE); Vimioso, 21.VI.2004 *J. López & E. López 30710* (COFC). — **Spain**. Burgos, Ciruelos de Cervera, 11.VII.1979 *Pons-Sorolla & A. Susanna 413020* (MA); Gumiel de Izán, Malvecino, 12.VIII.1919 *F. Martín 34787* (BC); La Coruña, Caldelas, without date, *B. Merino 135306* (MA); León. Alcuetas, 25.VII.1992 *P. Montserrat 283092* (JACA); Robledo de Losada, 14.VIII.1980 *M. J. Díez 204068* (SEV); Lugo, As Nogais, between Nullán and Alence, 31.VII.1988 *J. Giménez & J. Amigo 27348* (SANT); Los Nogales, 23.VII.1983 *F. J. Silva-Pando 32252 & 32254* (LOU); Orense, Navea, 11.VIII.1982 *A. Rigueiro 31771 & 31776* (LOU); Penalba–Liñares, 23.VI.2004 *J. López & E. López 30704* (COFC); Palencia, Camporredondo, 10.VIII.2005 *C. Aedo & J. Pedrol 732647* (MA); Velilla del río Carrión, Peña Lampa, 12.VII.1995 *X. Giráldez, A. Guillén & E. Rico 101937* (SALA); Pontevedra, As Neves, 4.IX.2004 *J. Amigo 51562* (SANT); Bellós, without date, *B. Merino 1247/11* (LOU); Logroño, Mansilla, 1899 *Zubia 135211* (MA); Ojacastro, 29.VIII.1999 *G. García-Baquero 100234* (SALA); Salamanca, La Fregeneda, 30.VI.2003 *A. Ortega & E. López 30713* (COFC); Villarino de los Aires, Teso de San Cristobal,

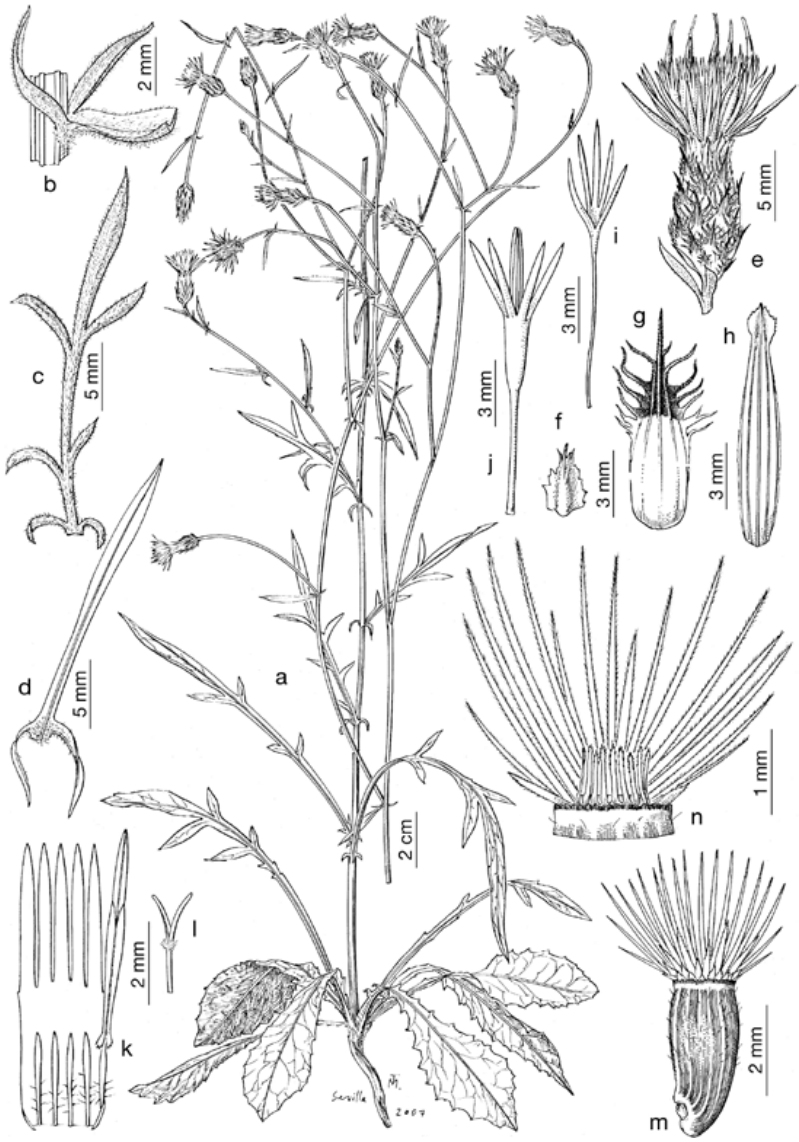

Fig. 3. *Centaurea langei* subsp. *dominguezii* (from the holotype). — **a**: Habit. — **b**: Node of a cauline leaf. — **c**: Lower leaf. — **d**: Cauline leaf. — **e**: Capitulum. — **f**: Outer involucral bract. — **g**: Middle involucral bract. — **h**: Inner involucral bract. — **i**: Outer sterile flower. — **j**: Inner hermaphrodite flower without pappus. — **k**: Corolla of an inner hermaphrodite flower showing stamen filaments and one anther. — **l**: Upper part of style and stigmatic branches. — **m**: Achene. — **n**: Pappus.

8.VIII.1976 *J. Sánchez 17181* (SALA); Soria, Almazán, 21.VII.1976 *B. Casaseca 10972* (SALA); Vinuesa, VIII.1968 *J. Fernández Casas 409841* (MA); Valladolid, Encinas de Esgueva, 12.VII. 2004 *J. A. Devesa & E. López 34467* (UNEX); Zamora, Galende, 18.VII.1945 *C. Vicioso 135288* (MA); Sandín, 1.VII.2003 *A. Ortega & E. López 30700* (COFC).

subsp. *dominguezii* E. López, Devesa & Arnelas, *subsp. nova* (Fig. 3)

Plantae glabrae vel glabriusculae exceptis vero foliis partibusque basalibus (pilis quidem praeditis copiosis, tam unicellularibus atque araneosis quam pluricellularibus non glanduliferis), glandulis translucidis atque sessilibus carentes. Caules nonnumquam 70 cm, erecti vel ascendentes, parte media vel superiore ramificati. Capitula solitaria, quod ad involucrum attinet 10–13 × 3.5–8 mm, ovoideo-cylindrica, basi rotundata vel attenuata; eorum bractearum involucralium mediarum appendix 2.5–4 × 3–4 mm, fusca vel nigra, erecta, spina vel mucrone apicali praedita pectinatisque fimbriis lateralibus (utrinque 4–6)

0.5–1.5 mm. Achaenia 3–3.5 mm. Pappus externus 2.5–3 mm (paulo brevior quam achaenium).

TYPE: Spain. Salamanca, Aldeadávila de la Ribera, presa, paredes graníticas en dirección a la central, 40°96´N, 5°65´E, 1.VII.2003 *A. Ortega & E. López 34470* (holotype UNEX).

ETYMOLOGY: Named in honour of Eugenio Domínguez Vilches, Professor at the University of Córdoba.

Glabrous or subglabrous, except for basal parts and leaves with abundant arachnoid unicellular hairs and eglandular pluricellular hairs, without translucent sessile glands. Stems up to 70 cm, erect or ascendant, branched at middle or upper part. Capitula solitary. Involucre 10–13 × 3.5–8 mm, ovoid-cylindrical, rounded to narrowed at base. Middle involucral bracts with appendage 2.5–4 × 3–4 mm, brown to black, erect, with 4–6 pairs of lateral fimbriae of 0.5–1.5 mm and apical spine or mucro of 0.5–2 mm. Achenes 3–3.5 mm. Outer pappus 2.5–3 mm, slightly less than achene. Flowering time: May–August.

CHROMOSOME NUMBER: 2n = 18 [7m + 2sm; chromosome size 3.5–0.26 μm (mean ± SD 2.95 ± 0.32 μm); Salamanca: Aldeadávila de la Ribera, dam, 1.VII.2003 *A. Ortega & E. López 34470* (UNEX)].

DISTRIBUTION AND HABITAT: NW Spain, Salamanca province; on granitic slopes and weakly nitrified, siliceous pastures; 650–700 m (Fig. 1).

ADDITIONAL SELECTED SPECIMEN EXAMINED. — **Spain**. Salamanca, Aldeadávila, 28.III.1977 *F. Amich 15091* (SALA).

subsp. *exilis* (Arènes) E. López, Devesa & Arnelas, *comb. nova*

C. paniculata subsp. *exilis* Arènes, Agron. Lusit. 11(1): 20.1949. — *C. aristata* subsp. *exilis* (Arènes) Dostál, Bot. J. Linn. Soc. 71: 199. 1976. — TYPE: Portugal. Beira Baixa, Monfortinho, prox. das Termas, num pinhal, terrenos áridos, ca. 300 m, 15.VI. *B. Rainha 23137* (holotype LISE!).

Laxly arachnoid and scabrous, with translucent sessile glands. Stems 11–80 cm, erect or ascendant, branched at middle or upper part. Capitula solitary. Involucre 9–12(13) × 3–5 mm, ovoid-cylindrical, ± rounded at base. Middle involucral bracts with appendage 1.2–3.2 × 2–4 mm, brown to dark brown, erect or erecto-patent, with 3–7 pairs of lateral fimbriae of 0.5–1.5 mm, and apical spine or mucro of 0.4–1.5(2) mm. Achenes 2.7–3.7 mm. Outer pappus 1.5–2.5 mm, 1/2–2/3 as long as achene. Flowering time: May–October.

CHROMOSOME NUMBER: 2n = 18 (López & Devesa 2008c, as *C. paniculata* subsp. *exilis*).

DISTRIBUTION AND HABITAT: central-west Iberian Peninsula; in pastures on the fringes of woodland on coarse-textured siliceous soils; 220–1050 m (Fig. 1).

In the northern part of the Cáceres province, plants are frequent with intermediate characteristics between this subspecies and subsp. *kheilii* (*see* Appendix).

ADDITIONAL SELECTED SPECIMENS EXAMINED. — **Portugal**. Beira Alta, Almeida, Junça, VI.1890 *M. Ferreira 24258* (COI); Oliveira do Conde, 16.VII.2003 *J. A. Devesa & E. López 30696* (COFC); Beira Baixa, Alpedrinha, 16.VII.2003 *J. A. Devesa & E. López 30694* (COFC); Fundão, 16.V.1978 *J. A. Devesa & J. Pastor 204081* (SEV); Beira Litoral, Oliveira do Hospital, 15.VI.1954 *J. Matos & al. 24360* (COI); Douro Litoral, Penafiel, 14.VIII.1948 *F. Fontes & al. 41000* (LISE); Serra do Marão, VIII.1882 *G. Henriques 24250* (COI). — **Spain**. Cáceres, Perales del Puerto, 21.VII.1988 *J. P. Carrasco & R. Tormo 19532* (UNEX); Santibáñez el Alto, 30.VI.1978 *A. Valdés 74093* (SALA); Salamanca, between El Bodón and Robleda, 13.VII.1973 *S. Rivas Goday & al. 90647* (MAF); Puerto Seguro, 13.VI.1976 *E. Rico 9607* (SALA).

subsp. *coutinhoi* (Franco) E. López, Devesa & Arnelas, *comb. nova*

C. coutinhoi Franco, Nova Fl. Portugal 2: 477, 572. 1984. — TYPE: Portugal. Alto Alentejo, Marvão, 500 m antes de entrar nas muralhas, nas margens de um souto, esposiçao E, 750 m, 23.VI.1973 *M. Pinheiro de Mello s.n.* (holotype LISI!).

Laxly arachnoid and scabrous, with translucent sessile glands. Stems 30–80 cm, erect or ascendant, branched at middle or upper part. Capitula solitary. Involucre 8–14 × 4–7 mm, ovoid, rounded at base. Middle involucral bracts with appendage 1.5–3.5 × 2–4 mm, dark brown to blackish, erect or erecto-patent, with 4–7 pairs of lateral fimbriae of 0.5–1.7 mm, and apical spine or mucro of 0.6–2 mm. Achenes 3–3.7 mm. Outer pappus 1.5–2.5 mm, 1/2–2/3 as long as achene. Flowering time: May–August.

CHROMOSOME NUMBER: 2n = 18 (López & Devesa 2008c, as *C. coutinhoi*).

DISTRIBUTION AND HABITAT: central-west Iberian Peninsula; in weakly nitrified, siliceous pastures and slopes; 350–1000 m (Fig. 1).

ADDITIONAL SELECTED SPECIMENS EXAMINED. — **Portugal**. Alto Alentejo, Castelo de Vide, 18.VII.1953 *Beliz 42920* (LISE); Marvafio, 4.VI.2005 *F. J. Valtueña 30684* (COFC); Beira Baixa, Castelo Branco, 24.VI.1986 *J. A. Devesa & al. 3438* (UNEX); *ibid*., VI.1938 *W. H. P. Rothmaler 4632* (LISE); Ribatejo, Abrantes, VII.1880 *P. Coutinho 24320* (COI); Chão do Couce-Abrantes, 25.V.1974 *A. Fernandes & al. 24247* (COI). — **Spain**. Cáceres, Aceña de La Borrega, 22.V.2003 *E. López & F. J. Valtueña 34475* (UNEX); Valencia de Alcántara, 5.VI.1990 *A. Rubio 140415* (MAF).

subsp. *geresensis* (Arènes) E. López, Devesa & Arnelas, *comb. nova*

C. paniculata subsp. *geresensis* Arènes, Agron. Lusit. 11(1): 22. 1949. — *C. aristata* subsp. *geresensis* (Arènes) Dostál, Bot. J. Linn. Soc. 71: 199. 1976. — *C. limbata* subsp. *geresensis* (Arènes) Franco, Nova Fl. Portugal 2: 476, 572. 1984. — TYPE: Portugal. Minho, Serra do Gerês, entre Lage e Leonte, ca. 900 m, VII.1948 *P. Silva, Fontes, Rainha & M. Silva 23138* (holotype LISE!).

C. paniculata f. *straminea* Arènes, Agron. Lusit. 11(1): 27. 1949. — TYPE: Portugal. Minho, Lavadeira-Monçao, VI.1885 *Herbario da Flora Lusitanica de A. R. da Cunha 12448* (holotype LISE!).

Laxly arachnoid and scabrous, less frequently subglabrous, with translucent sessile glands. Stems 20–90 cm, erect, branched at middle or upper part. Capitula solitary. Involucre 9–14 × 4–9 mm, ovoid or ovoid-cylindrical, rounded or slightly narrowed at base. Middle involucral bracts with appendage 1.2–3 × 2–4 mm, dark brown to blackish, erect, with 4–8 pairs of lateral fimbriae of 0.5–1.5 mm, and apical spine or mucro of 0.3–1.5 mm. Achenes 2.7–3.9 mm. Outer pappus 1–1.5(2.5) mm, equal to or less than half as long as achene. Flowering time: June–October.

CHROMOSOME NUMBER: 2n = 18 (López & Devesa 2008c, as *C. paniculata* subsp. *geresensis*).

DISTRIBUTION AND HABITAT: NW Iberian Peninsula (Spain and Portugal); in pastures and slopes at the edges of woodland, on coarse, siliceus soils; 100–1300 m (Fig. 1).

The taxon has some resemblance to *C. limbata*, especially in the size and morphology of the involucre, and in the frequent presence of an indumentum of arachnoid hairs on the involucral bracts. However, its general appearance, the morphology of the basal leaves and of the appendages of the middle bracts, and the size of the pappus relative to the achene indicate that these plants are best included in the *C. langei* complex. Plants are known that are intermediate or transitional between this subspecies and subsp. *langei* (*see* Appendix).

ADDITIONAL SELECTED SPECIMENS EXAMINED. — **Spain**. Orense, Castrelo de Miño, 23.VII.1935 *A. Rodríguez 135284* (MA); Torneiros, Portela do Homen, 22.VI.2004 *J. López & E. López 30690* (COFC). Portugal. Minho, Arcos de Valdevez, 13.VII.1944 *C. Fontes & al. 15840* (LISE); Leonte, 1.VII.1948 *S. Rivas Goday 79338* (MAF); Tras-os-Montes, Serra de Geres, Cabril, VII.1883 *A. Moller 24377* (COI).

subsp. *kheilii* (Pau) E. López, Devesa & Arnelas, *comb. nova*

C. coerulescens var. *kheili* Pau, Actas Soc. Esp. Hist. Nat. 26: 200. 1897. — *C. kheilii* (Pau) Pau, Bol. Soc. Aragonesa Ci. Nat. 1: 49. 1902. — LECTOTYPE (designated here): Spain. Cáceres, Sierra de Gata, VII.1897 *N. M. Kheil 135269* (MA!, left-hand-side specimen).

C. limbata f. *elata* Pau, Bol. Soc. Aragonesa Ci. Nat. 1(3): 49. 1902. — LECTOTYPE (designated here): Spain. Cáceres, Baños de Montemayor, VII.1900 *Caroli Pau Herbarium Hispanicum 135272* (MA!).

Laxly arachnoid and scabrous, with translucent sessile glands. Stems 20–100 cm, erect, branched from middle. Capitula solitary or in groups of 2–3. Involucre 8–13 × 3–7 mm, ovoid or ovoid-cylindrical, rounded or slightly narrowed at base. Middle involucral bracts with appendage 1.5–3.5 × 2–4.5 mm, brown to blackish, erecto-patent or patent, with 4–7 pairs of lateral fimbriae of 0.7–2 mm, and mucro or apical spine of 0.3–1.5(2) mm. Achenes 3–3.7 mm. Outer pappus 0.5–2.5 mm, 1/3–2/3 as long as achene. Flowering time: May–November.

CHROMOSOME NUMBER: 2n = 18 (López & Devesa 2008c, as *C. kheilii*).

DISTRIBUTION AND HABITAT: central-west Spain (west of the *Sistema Central*); in pastures and slopes on the edges of woodland, on siliceous, coarse-textured soil; 430–1620 m (Fig. 1).

Plants are known in Cáceres province that are intermediate between this subspecies and *C. aristata* (*see* Appendix).

ADDITIONAL SELECTED SPECIMENS EXAMINED. — **Spain**. Cáceres, Baños de Montemayor, VIII.1903 *C. Escribano 135268* (MA); Hervás, 27.VII.1992 *J. A. Devesa & A. Ortega 19539* (UNEX); Salamanca, Béjar, VIII.1914 *J. Cogolludo 135267* (MA); Miranda del Castañar, Garcibuey, 30.VI.2003 *A. Ortega & E. López 30708* (COFC).

subsp. *rothmalerana* (Arènes) E. López, Devesa & Arnelas, *comb. nova*

C. paniculata subsp. *rothmalerana* Arènes, Agron. Lusit. 11(1): 24. 1949. — *C. rothmalerana* (Arènes) Dostál, Bot. J. Linn. Soc. 71: 199. 1976. — TYPE: Portugal. Beira Alta, Covilhã, *in pascuis montanis* Sierra de Estrela, Penhas de Saúde, 1500 m, 17.VI.1938 *W. Rothmaler 4649* (holotype LISE!).

C. herminii Rouy, Naturaliste 2(5): 372. 1883. — *C. gallica* f. *herminii* (Rouy) Gugler, Ann. Hist.-Nat. Mus. Natl. Hung. 6: 159. 1907. — *C. paniculata* var. *herminii* (Rouy) Cout., Fl. Portugal: 657. 1913. — *C. micrantha* var. *herminii* (Rouy) Merino, Brotéria, Sér. Bot. 13: 30. 1915. — *C. micrantha* subsp. *herminii* (Rouy) Dostál, Bot. J. Linn. Soc. 71: 199. 1976. — LECTOTYPE (designated here): Portugal. Beira Alta, Serra da Estrella, VIII.1878 *M. Ferreira s.n.* (lectotype LY-Rouy!, isotype COI!).

C. paniculata subvar. *occidentalis* Arènes, Agron. Lusit. 11(1): 20. 1949. — TYPE: Portugal. Beira Baixa (Beira Alta?), Covilhã, *in rupestribus herbosis versus* Teixoso, 650 m, 17.VI.1938 *W. Rothmaler 4656* (holotype LISE!).

Tomentose-arachnoid (especially lower part) and scabrous, with translucent sessile glands. Stems (5)15–70 cm, erect, ascendant or prostrate-ascendant (sometimes with a pulvinulate aspect), highly branched from base or middle. Capitula solitary. Involucre 8–13 × 4–7 mm, ovoid, rounded at base. Middle involucral bracts with appendage 1.5–3 × 2–4.5 mm, brown to blackish, erect or erecto-patent at anthesis, with 4–8 pairs of lateral fimbriae of 0.5–2 mm, and mucro or apical spine of 0.5–2 mm. Achenes 3–4.2 mm. Outer pappus 1–2 mm, equal to or less than half as long as achene. Flowering time: May–October.

CHROMOSOME NUMBER: 2n = 18 (López & Devesa 2008c, as *C. paniculata* subsp. *rothmalerana*).

DISTRIBUTION AND HABITAT: north-central Portugal (Serra da Estrela); in pastures on weakly nitrified of coarse texture, siliceous soils; 900–1500 m (Fig. 1).

Despite its very limited range, plants of subsp. *rothmalerana* show marked differences from the other subspecies, particularly in the habit and indumentum, with the plants growing in less exposed places being taller and less tomentose-arachnoid.

ADDITIONAL SELECTED SPECIMENS EXAMINED. — **Portugal**. Beira Alta, Caldas de Manteigas, 19.X.1951 *U. Beau 24473* (COI); Manteigas, Boveia, 16.VII.2003 *J. A. Devesa & E. López 30687* (COFC); Penhas de Saúde, 16.VII.2003 *J. A. Devesa & E. López 30722* (COFC); Valhelas, 5.VII.1989 *W. O. van der Knaap & J. F. N. Leeuwen 24317* (COI).

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Appendix

Intermediate plants (specimens examined)

Centaurea langei subsp. *langei* to *C. aristata*: **Spain**. Soria, Matamala de Almazán, 26.VII.1985 *L. F. Sánchez & J. A. Alejandre 339531* (MA); Valladolid, Encinas de Esgueva, 14.VIII.1982 *J. L. Fernández Alonso 333648* (MA); *ibid*., X.1982 *J. L. Fernández Alonso 333649* (MA); *ibid*., 14.VIII.1982 *J. L. Fernández Alonso 37715* (SALA). — *Centaurea langei* subsp. *langei* to *C. limbata*: **Spain**. Lugo, Lugo, IX.1913 *F. Beltrán 135277* (MA). — *Centaurea langei* subsp. *langei* to *C. langei* subsp. *dominguezii*: **Spain**. Salamanca, Pereña, 16.VI.1976 *J. Sánchez* 17184 (SALA). — *Centaurea langei* subsp. *langei* to *C. langei* subsp. *kheilii*: **Portugal**. Tras-os Montes, Montalegre, VI.1943 *A. Cabral & G. Pedro 15410* (LISE) & *135230* (MA). — *Centaurea langei* subsp. *kheilii* to *C. aristata*: **Spain**. Cáceres, Barrado, Sª Bernabé, 10.VI.1990 *A. Amor 85451* (SALA); Cáceres, Villanueva de la Vera, 18.VII.1990 *M. Ladero & A. Amor 84769* (SALA). — *Centaurea langei* subsp. *kheilii* to *C. langei* subsp. *exilis*: **Spain**. Cáceres, Valverde del Fresno, 1.VII.1989 *I. Montero 10292* (UNEX); *ibid*., 17.VI.1989 *I. Montero 10273* (UNEX); *ibid*., 3.VI.1989 *I. Montero 10214* (UNEX); *ibid*., La Chopera, 15.X.1978 *E. Rico 74096* (SALA).