CASTRILANTHEMUM VOGT & OBERPRIELER, A NEW GENUS OF THE *COMPOSITAE-ANTHEMIDEAE*

by

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Resumen

VOGT, R. & CH. OBERPRIELER (1996). Castrilanthemum Vogt & Oberprieler, un nuevo género de Compositae-Anthemideae. *Anales Jard. Bot. Madrid* 54: 336-346 (en inglés).

Se estudia en detalle *Pyrethrum debeauxii*, una especie anual endémica del sudeste de España, y se compara con los géneros cercanos. Esta especie debe adscribirse a un nuevo género, monotípico, *Castrilanthemum* Vogt & Oberprieler, que se describe aquí, a la vez que se propone la combinación *C. debeauxii* (Degen, Hervier & É. Rev.) Vogt & Oberprieler.

Palabras clave: *Spermatophyta, Compositae, Castrilanthemum*, taxonomía, cladística, España.

Abstract

VOGT, R. & CH. OBERPRIELER (1996). Castrilanthemum Vogt & Oberprieler, a new genus of the Compositae-Anthemideae. *Anales Jard. Bot. Madrid* 54: 336-346.

Pyrethrum debeauxii, a poorly-known annual species endemic to SE-Spain, was studied in detail and compared with related genera. It is found to represent a new monotypic genus, *Castrilanthemum* Vogt & Oberprieler. The new combination *C. debeauxii* (Degen, Hervier & É. Rev.) Vogt & Oberprieler is proposed.

Key words: *Spermatophyta, Compositae, Castrilanthemum*, taxonomy, cladistic, Spain.

Pyrethrum debeauxii was described by A. von Degen and J. Hervier (in HERVIER, 1905) on the basis of plant material collected in Andalusia at the beginning of this century by Élisée Reverchon, who distributed the specimens in his well-known exsiccata "Plantes d'Espagne" in 1904 and 1905. To the present day this rare endemic of SE Spain has been recollected only once, by J. Leal Pérez-Chao in 1978.

The tribal placement of *Pyrethrum debeauxii* in the *Compositae-Anthemideae* was never a matter of doubt, whereas the uncertainty of its affinities within this tribe already dates back to Degen & Hervier (in HERVIER, 1905: 99) who write in the original diagnosis: "Planta nana, certe annua (...) facie *Anthemidis* cujusdam, a congeneribus acheniis ecoronulatis valde diversa et in genere paradoxa". HEYWOOD (1954), in his revision of *Tanacetum* subsect. *Leucanthemopsis* Giroux –later on recognized at generic level as *Leucanthemopsis* (Giroux) Heywood– placed *P. debeauxii* in the vicinity of this taxon, mentioning it under his 'species dubiae'. However, a few years later GALIANO

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& HEYWOOD (1960: 172) stated: "Esta especie constituye probablemente una sección nueva del género *Leucanthemum*, pero no hay material suficiente para una investigación completa", and therefore placed it with or close to *Leucanthemum*. Later treatments of the so called *Chrysanthemum*-complex (HEYWOOD & HUMPHRIES, 1977), e.g. in *Flora Europaea* (HEYWOOD in TUTIN & *al.*, 1976) as well as in the recent monograph of *Asteraceae-Anthemideae* by BREMER & HUMPHRIES (1993) and of the whole family by BREMER (1994), do not consider *P. debeauxii* due to the lack of material available to them at that time.

To ascertain the taxonomic position of *Pyrethrum debeauxii* within the *Compositae-Anthemideae*, we carried out a comprehensive morphological study. Special emphasis was placed on morphological and anatomical features of the fruit, due to their fundamental importance in the generic delimitation within both the tribe and the *Chrysanthemum*-complex.

MATERIAL AND METHODS

The study is based on herbarium specimens housed at B, BP, M, P and W and private collections of J. Leal Pérez-Chao and R. Vogt.

For comparative anatomical studies achenes were taken from herbarium specimens and soaked in a mixture (6 : 1) of 10% aqueous solution of dioctyl sodium sulfosuccinate and 96% ethanol for two days (PETERSON & *al.*, 1978). Following dehydration through a 20% incremental series to absolute ethanol with changes every 24 hours, achenes were infiltrated with Technovit 7100 (Heraeus-Kulzer) for four to six weeks. After embedding, median-transverse sections of achenes were made using a rotary microtome. Three to five micron thick sections were stained in toluidine blue and mounted in Vitroclud (Langenbrinck).

Cladistic analyses were undertaken with Hennig86, version 1.5 (FARRIS, 1988). The *ie** option was used to detect the most parsimonious trees, and strict consensus trees were obtained using the nelsen command.

RESULTS AND DISCUSSION

In their recent generic monograph of the *Compositae-Anthemideae*, BREMER & HUMPHRIES (1993) subdivided the tribe into 12 subtribes which they considered to represent predominantly monophyletic assemblages of genera, although no attempt was made in that paper to test the monophyly of the erected subtribes. Some have to be considered as provisional groups. This is mainly due to the obvious lack of characters having any cladistically useful significance on a level higher than generic groups (e.g. *Leucanthemum*-group, *Achillea-Anacyclus-Leucocyclus*-group, *Cotula*-group), causing the collapse of the proposed cladogram for the interrelationships of the 12 subtribes as mentioned by BREMER & HUMPHRIES (1993: 90). Another consequence seems to be that several of the proposed subtribes have a core formed by a monophyletic group of genera surrounded by a considerable number of satellite genera for which relationships to the core group or definite subtribal membership are not resolved. Thus, it is difficult to place taxa not included by BREMER & HUMPHRIES, such as *Pyrethrum debeauxii*, in the right subtribe. Nonetheless, we consider the combination of T-shaped hairs, epaleate receptacles, 10-ribbed achenes with myxogenic cells, and anthers with triangular apical appendages as sufficient evidence to include *P. debeauxii* in the *Leucantheminae* sensu BREMER & HUMPHRIES (1993).

To determine the position of *Pyrethrum debeauxii* within the subtribe *Leucantheminae* we re-ran the data set provided by BREMER & HUMPHRIES (1993), using the central block of columns of the data matrix (BREMER & HUMPHRIES, 1993: 138) with additional 34 scores for *P. debeauxii* (see table 1). We used *Lepidophorum* as the outgroup.

The cladistic analysis resulted in 30 most

TABLE 1

DATA MATRIX FOR *PYRETHRUM DEBEAUXII* USED IN THE CLADISTIC ANALYSES TOGETHER WITH DATA GIVEN FOR THE *ANTHEMIDEAE-LEUCANTHEMINAE* IN BREMER & HUMPHRIES (1993: 138, tab. 21, middle columns)

Character number in BREMER & HUMPHRIES (1993: 78-79)	11 1 11111111111 11 1 1111 1 4532 78410786057336822123647 4026 11533422244442537145640602581319 59
Pyrethrum debeauxii	1100010111000??00000??0000000000000

1 = presence; 0 = absence; ? = missing data or not applicable

parsimonious cladograms with a cladogram length of 48 steps, a consistency index of 0.70, and a retention index of 0.75. Figure 1A shows the strict consensus tree. Figure 1B and 1C show two of the 30 most parsimonious cladograms. It is obvious that only the so-called *Leucanthemum*-group, consisting of *Leucanthemum, Rhodanthemum, Mauranthemum, Chlamydophora, Chrysanthoglossum, Glossopappus, Coleostephus*, and *Plagius*, is supported as a monophyletic assemblage of genera by all of the cladograms, while the tree structure beyond this subclade is unresolved and the position of *Pyrethrum debeauxii* remains unclear. As pointed out by BREMER & HUMPHRIES (1993), VOGT (1991), and earlier by BRIQUET (1916), the members of the rather well defined *Leucanthemum*-group are all characterized by their specialized achene wall with vallecular resin ducts and vascular strands. This group of genera forms the core of the subtribe *Leucantheminae*.

Concerning the position of *Pyrethrum debeauxii*, the 30 most parsimonious trees may be subdivided into the following two scenarios: in most of the trees (18 out of 30) *P. debeauxii* forms a monophyletic group with *Nivellea* and *Phalacrocarpum* (as shown in fig. 1B), partly being the sister taxon of *Nivellea* (based on its annual habit), partly the sister taxon of *Phalacrocarpum* (based on its involucral bracts with dark brown margins). This monophyletic group is characterized by the apomorphic character state "pappus absent in ray and disc achenes" which occurs in parallel in *Leucanthemella* also. In the remaining most parsimonious trees (12 out of 30), either *P. debeauxii* alone, a *Pyrethrum-Nivellea*-clade, or a *Pyrethrum debeauxii-Phalacrocarpum*-clade is found within a pectinate sequence of genera starting with *Nipponanthemum* and *Leucanthemella* and ending with the *Leucanthemum* group (fig. 1C).

It is interesting to note that most of the disturbances leading to the partial collapse of the consensus tree are caused by the position of *Leucanthemopsis*. In 20 of the 30 most parsimonious trees this genus represents the sister taxon of the *Leucanthemum*-group, while in the remaining trees it forms a monophyletic group with *Hymenostemma* and *Prolongoa*, due to the joint occurrence of a flimsy pappus (character 165) in these three genera. BREMER & HUMPHRIES (1993) considered this character to be more important than differences in life habit and colour of involucral bract margins and consequently felt justified in accepting a cladogram one step longer than the most parsimonious one. If we accept their argument and give double weight to this character, our analyses produce 10 most parsimonious trees (similar to the cladogram presented in fig. 1B), all of them having a *Hymenostemma - Prolongoa - Leucanthemopsis-* and a *Nivellea-Phalacrocarpum-Pyrethrum debeauxii*-subclade besides the *Leucanthemum*-group, with *Phalacrocarpum* as the sister group of *Pyrethrum debeauxii* in all cases.

It becomes obvious that *Pyrethrum debeauxii* possesses several characters of several genera of the *Leucantheminae* which makes it

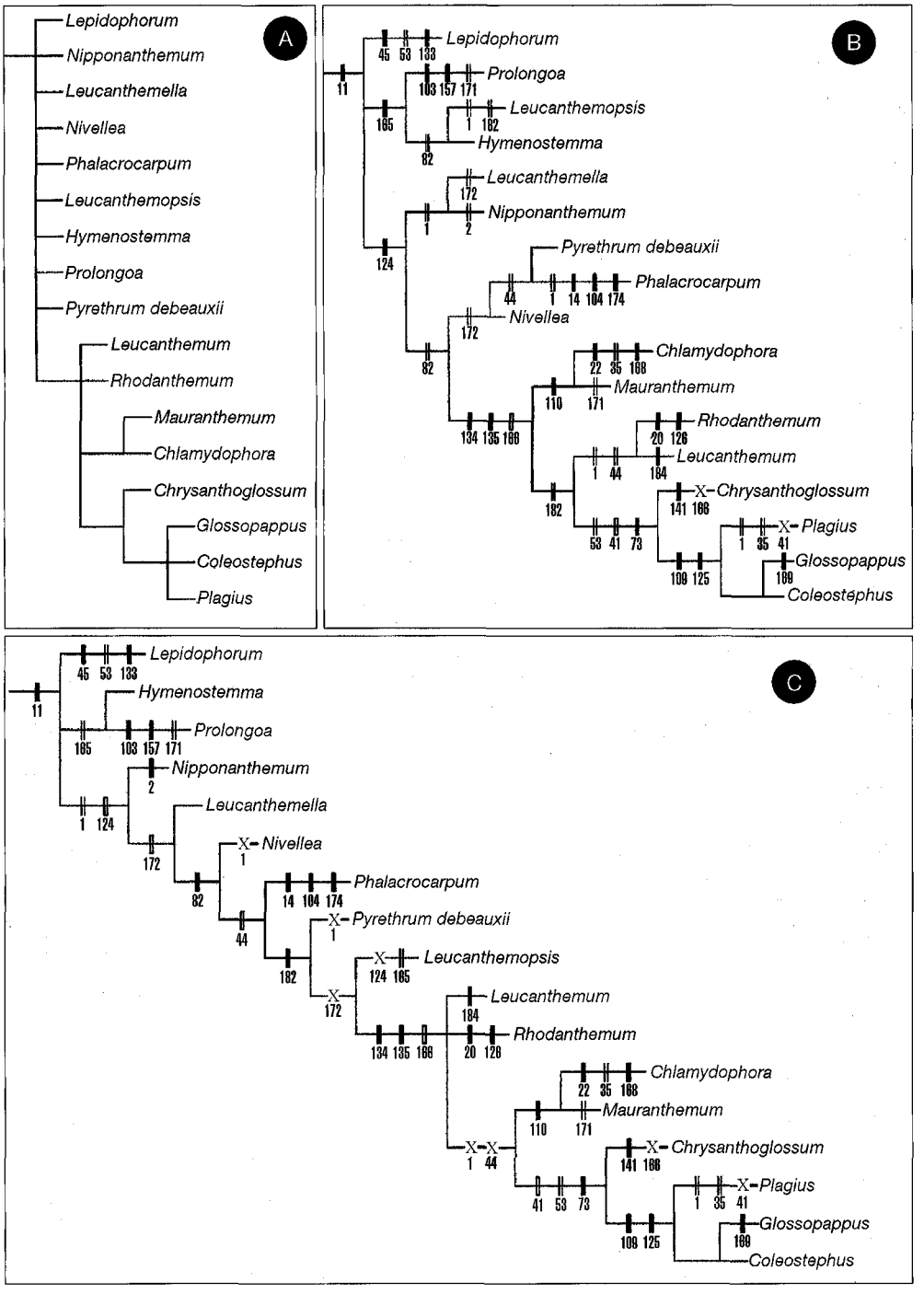

Fig. 1.–Strict consensus tree (A) and 2 of the 30 most parsimonious cladograms (B-C) of the *Anthemideae-Leucantheminae* after inclusion of *Pyrethrum debeauxii*. Solid bars indicate non-homoplastic synapomorphies; open bars indicate homoplastic synapomorphies with reversals; double bars indicate parallelisms; crosses indicate reversals.

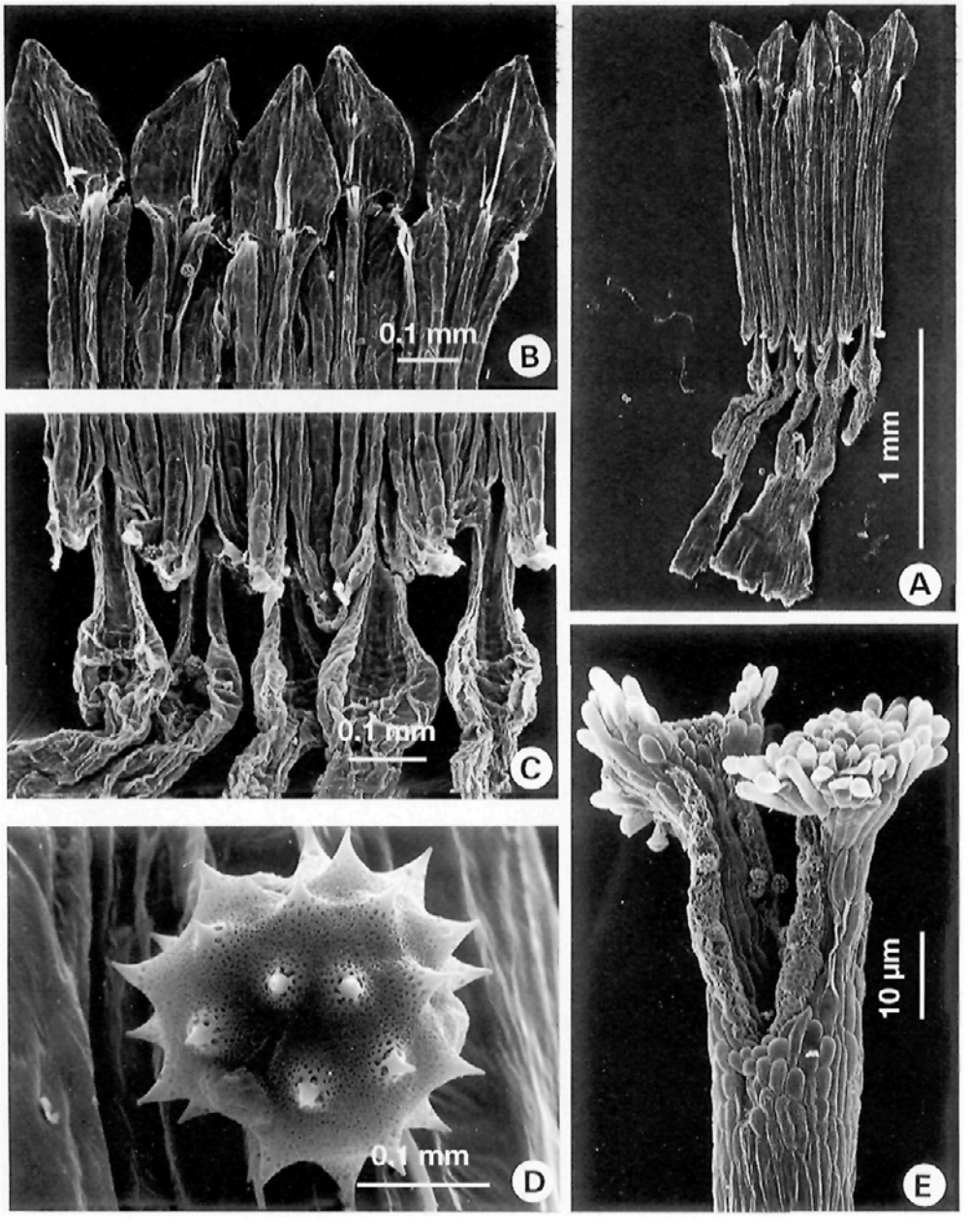

Fig. 2.–*Castrilanthemum debeauxii*, Leal 263 (Herb. Vogt): A, stamens; B, apical appendages of the stamens; C, basal part of anthers and apical part of filaments; D, pollen grain; E, tip of style with the diverging branches.

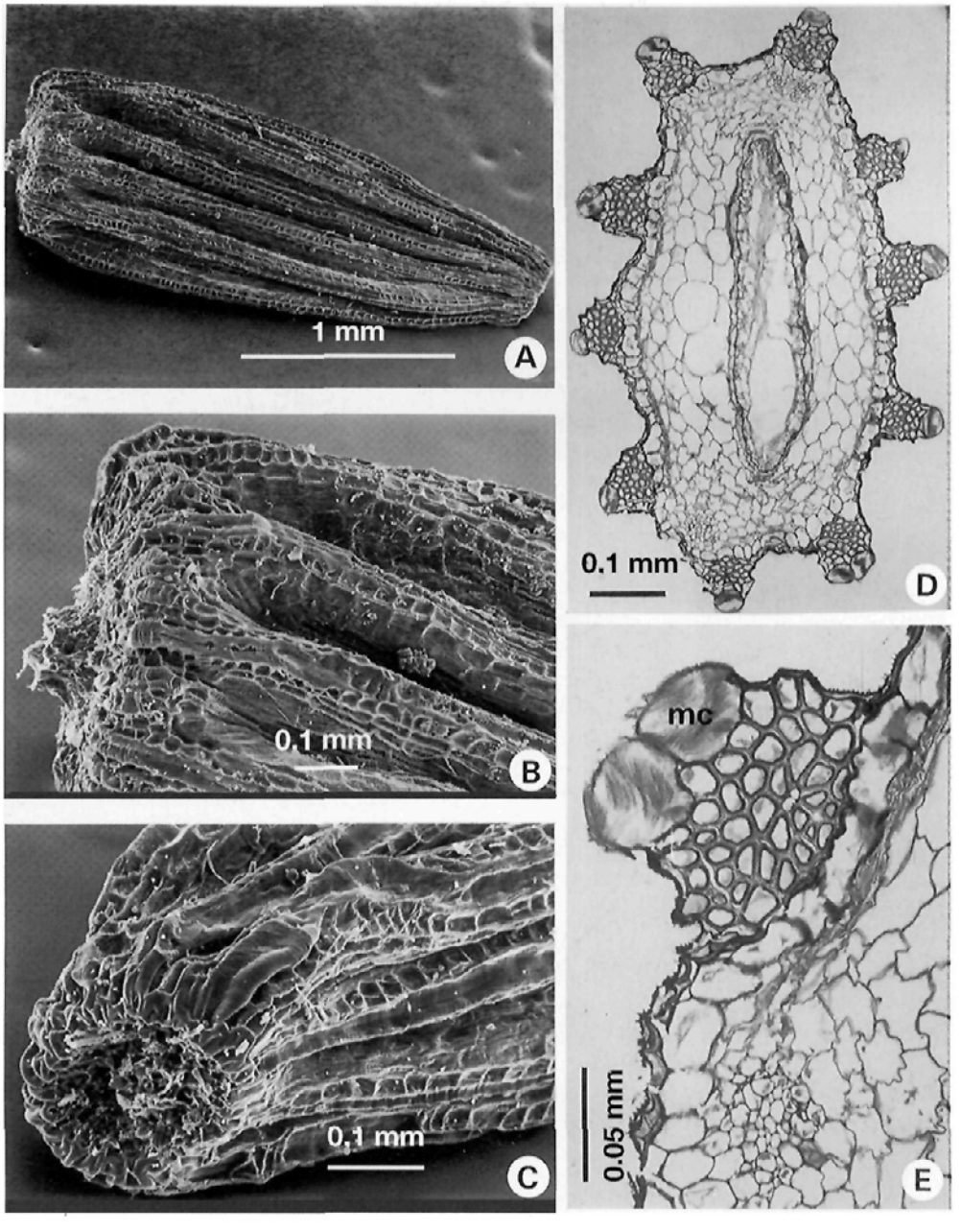

Fig. 3.–*Castrilanthemum debeauxii*, Leal 263 (Herb. Vogt): A, achene; B, apical part of achene; C, basal detachment area of achene; D, transverse section of achene; E, detail of transverse section of achene (mc = myxogenic cell).

impossible to link this taxon to on of the already existing genera. With its achenes devoid of resin ducts it is clearly not a member of the *Leucanthemum*-group which forms the core of the *Leucantheminae*. It may be associated rather loosely with this group because of its 10-ribbed achenes with myxogenic cells (fig. 3). Most of the trees obtained connect it with the two endemic SW Mediterranean genera *Nivellea* and *Phalacrocarpum*, mostly because its ray and disc achenes lack an apical corona. This character state is presumably apomorphic within the *Leucantheminae* and occurs in parallel in the Eurasian genus *Leucanthemella*. However, a relationship to the latter genus is unlikely because its achenes lack myxogenic cells. *Pyrethrum debeauxii* differs from *Nivellea* in its possession of T-shaped hairs (fig. $4B_1$) and a conical receptacle, and from *Phalacrocarpum* by its annual habit and alternate leaves. As BREMER & HUMPHRIES (1993) have pointed out, the subtribal position of *Nivellea*, and especially those of *Phalacrocarpum* and hence, also the position of *Pyrethrum debeauxii*, have to be considered as rather provisional.

In line with efforts to circumscribe monophyletic units within the *Leucantheminae*, it is necessary to classify *Pyrethrum debeauxii* on the same taxonomic level as the other units of this group. Therefore, the new genus *Castrilanthemum* Vogt & Oberprieler is proposed.

Castrilanthemum Vogt & Oberprieler, **gen. nov.**[1]

Planta annua. Caules inferne foliati, pilis medifixis dense obsiti. Folia petiolata, dense pilosa pilis medifixis, lamina pinnatisecta ad bipinnatisecta, segmentis ultimis brevibus, linearibus. Capitula solitaria pedunculata, radiata, heterogama. Involucri phylla imbricata, triangulari-ovata vel oblongo-lanceolata, dorsaliter dense pilosa pilis medifixis, scariose fuscimarginata. Receptaculum convexum, epaleaceum. Flores heteromorphi. Flores marginales ligulati, feminei, fertiles, albi; centrales infundibulares, hermaphroditi, fertiles, lutei sed parte superiore purpurei. Stamina glabra, antherae basi rotundatae, filamenta infra antheras tumida, connectivum supra antheram ovate dilatatum. Stylus teres, glaber, nectario basi cinctus, ramis 2 divaricatis, anguste oblongis, apice paulo penicillatis. Achaenia anguste obovoidea, decemcostata, canalibus intercostalibus secretoriis carentia, cellulis myxogenis epicostalibus instructa. Pappus nullus.

Chromosomatum numerus: $2n = 18$

Typus: Castrilanthemum debeauxii (Degen, Hervier & É. Rev.) Vogt & Oberprieler based on *Pyrethrum debeauxii* Degen, Hervier & É. Rev.

Castrilanthemum debeauxii (Degen, Hervier & É. Rev.) Vogt & Oberprieler, **comb. nov.**

≡ *Pyrethrum debeauxii* Degen, Hervier & É. Rev. in Bull. Acad. Int. Géogr. Bot. 15: 99-100 (1905) [basion.]

Ind. loc.: "In Hispaniae meridionalis provincia Jaën. In aridis calcareis montis Sierra de Castril alt. cc. 1800 mèt. s. m. mense majo 1903 rarissimum detexit cl. É. Reverchon".

Lectotype (designated here): Élisée Reverchon, Plantes d'Espagne 1904 (Province de Jaén), n.° 1239, Pyrethrum debeauxii de Degen, Herv. Spec. nova!, Sierra de Castril, lieux arides, sur le calcaire, 1800 mètres. Juin. Rare. (B!; isolectotypes in M!, P!).

– *Pyrethrum debeauxii* Degen & Hervier in É. Rev., Pl. Espagne 1904, n.° 1239 (1904), nom. nudum

Icones: HERVIER, 1905: 177.

Exsiccata: Élisée Reverchon - Plantes d'Espagne - 1905, Province de Jaén, n.° 1239 (sub *Pyrethrum debeauxii* Degen & Herv.,

[1] The name *Castrilanthemum* refers to the Sierra de Castril, a mountain range in SE Spain, where the new genus occurs.

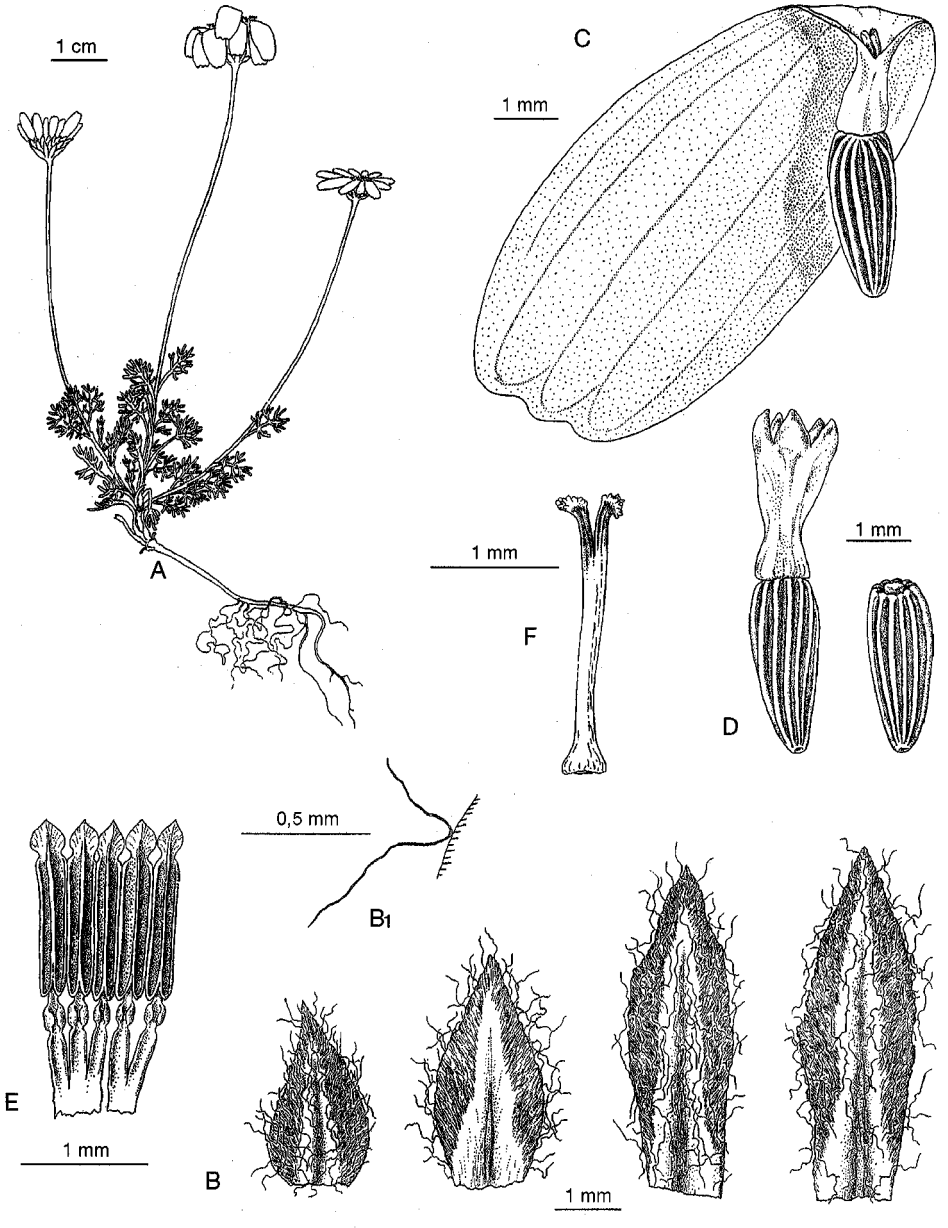

Fig. 4.–*Castrilanthemum debeauxii*, Leal 263 (Herb. Vogt): A, habit; B, involucral bracts, from outermost to innermost, second bract from adaxial side; B_1, T-shaped hair from involucral bract; C, ray floret; D, tubular floret and achenes; E, stamens; F, style.

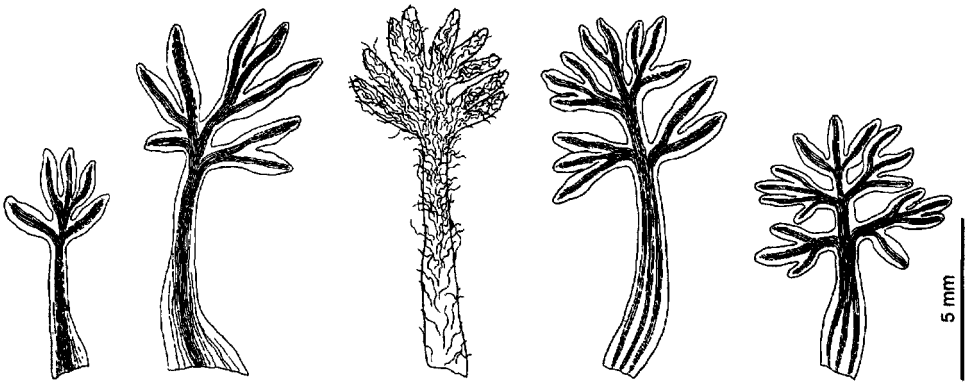

Fig. 5.–*Castrilanthemum debeauxii*, Leal 263 (Herb. Vogt): Outline of leaves, from base to peduncle, middle leaf with hair-covering.

Spec. nova.); Élisée Reverchon - Plantes d'Espagne - 1904 (Province de Jaén), n.° 1239 (sub *Pyrethrum debeauxii* de Degen & Herv., Spec. nova!).

Plants annual. Stems 4-10 cm high, solitary or branched at the base, erect or ascending-erect, green to glaucous, sulcate, reddish brown basally and on the ribs, covered with T-shaped hairs, leafy in the lower part, peduncles 2-7 cm long, leafless. Leaves (fig. 5) alternate (first leaves opposite and often reddish brown), green to glaucous, closely set in the lower part, broadly ovate to elliptical in outline, pinnatisect to bipinnatisect with linear, minutely mucronate lobes, densely hairy with T-shaped hairs, petiolate, petioles 3-7 mm long, slightly broadened at the base. Capitula terminal, long-pedunculate, solitary, 1.3-2.5 cm in diameter, heterogamous and radiate. Involucre hemispherical, 0.8-1.2 cm in diameter (measured from pressed specimens). Involucral bracts (fig. 4B) imbricate, in 4 rows, with broad brown to dark brown scarious margins, abaxially and marginally densely hairy with T-shaped hairs (fig. $4B_1$); outermost bracts triangular; middle ones ovate to oblong, 4-5 mm long and c. 1.5 mm wide, apically minutely mucronate; innermost ones oblong or narrow obovate, rounded or mucronate, only distally with a brown margin. Receptacle convex, epaleaceous. Florets heteromorphic. Ray florets (fig. 4C) 7-15, female, fertile; limb white, revolute after anthesis, elliptical, broadly oblong or obovate, 7-12 mm long and 3.5-5 mm wide, apically 3-lobed, tubular part c. 1.5 mm long, laterally slightly winged. Tubular florets (fig. 4D), hermaphrodite, fertile, corolla 2.5-3 mm long, funnel-shaped, apically 5-lobed, yellowish with reddish lobes, abaxially slightly overlapping the achenes. Anthers (figs. 2A-C, 4E) obtuse at the base, the filaments with a distinctly enlarged collar, apical anther appendages ovate and blunt. Pollen tricolporate, spiny (fig. 2D). Style (figs. 2E, 4F) terete, slightly swollen at the base, set in a conspicuous nectary, style branches truncate-penicillate at the tips. Achenes (figs. 3A-E, 4D) narrowly obovoid, 2.5-3 mm long, 10-ribbed, with myxogenic cells along the ribs. Pappus absent.

Chromosome number: $2n = 18$.

Flowering period: May-June.

Distribution and habitat: Castrilanthemum debeauxii is endemic to the NE corner of Andalusia in SE Spain (fig. 6). It is known from the Sierra de la Cabrilla in Jaén province and the Sierra de Guillimona and the Sierra de Castril in Granada province. The plants grow on dry stony slopes in scrub on limestone between 1700 and 1800 m.

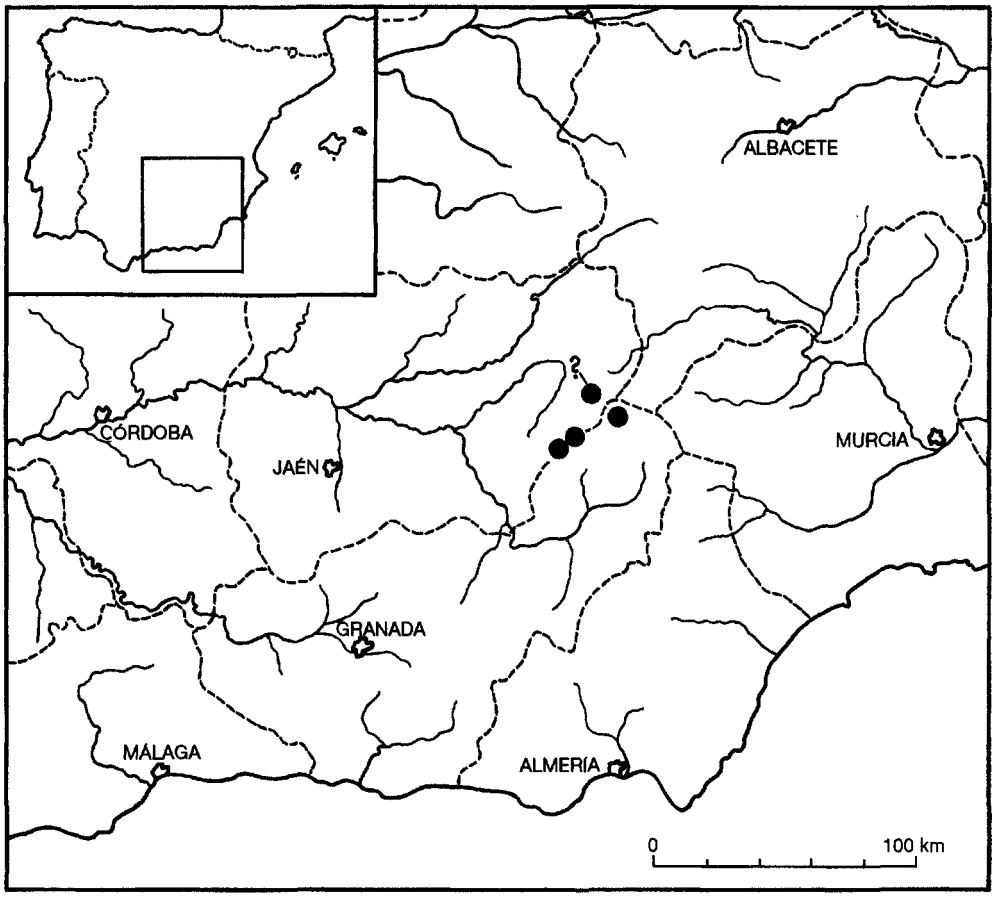

Fig. 6.–Distribution of *Castrilanthemum debeauxii* in SE Spain according to material examined.

Cytology: The chromosome number was reported by LEAL PÉREZ-CHAO & *al.* (1980) who found $2n = 18$, the most common number for diploids in the *Compositae-Anthemideae*. More information concerning the formation of the karyotype is not available.

Remarks: Castrilanthemum debeauxii was discovered 1903 by É. Reverchon in the Sierra de Castril in southern Spain (HERVIER, 1905: 19) and forwarded for description to A. von Degen and J. Hervier who studied Reverchon's extensive Andalusian plant collections. In 1905, Reverchon recollected the species in the mountain ranges of the Sierra del Cuarto and the Sierra de la Cabrilla (HERVIER, 1906: 207, 215). These remained the only known localities for more than 70 years. It was collected again in 1978 by J. Leal Pérez-Chao in the Sierra de Guillimona. All localities are localized in a small area at the eastern edge of Jaén and Granada provinces, demonstrating the restricted area and the scarcity of *Castrilanthemum debeauxii*.

Lectotypification: Type locality is the Sierra de Castril where *Castrilanthemum debeauxii* was collected in May 1903 (HERVIER, 1905: 99). The plant material was distributed in 1904 by Reverchon as n.° 1239 of his exiccata "Plantes d'Espagne" under the name "Pyrethrum debeauxii de Degen, Herv. spec. nova!". Already in 1903 some unnumbered specimens of the collection were

distributed to O. Debeaux, A. von Degen and J. Hervier (HERVIER, 1905: 100) under the provisional name "Pyrethrum hispanicum Willk.?" The latter specimens, probably used by Degen and Hervier for the original diagnosis, have not been found in the herbaria of the institutions which took over the private collections of these scientists. From the type material available in Berlin, Munich and Paris, we designated as lectotype the specimen kept in the Botanical Museum Berlin-Dahlem (B).

Specimens seen

SPAIN. GRANADA: Huéscar, Sierra de Guillimona, cerca del Cortijo de la Vidriera, matorrales en calizas, 1700 m, 30SWH4010, 20-V-1978, *J. Leal 263*, Leal, Vogt. Flora Hispanica, Sierra de la Cabrilla, lieux arides, calc., 1800 m, VI-1905, *É. Reverchon*, M. JAÉN: Sierra de Castril, lieux arides, sur le calcaire, 1800 m, juin, *É. Reverchon*, B, M, P. Sierra de Cabrilla, lieux arides, sur le calcaire, 1800 m, VI-1905, *É. Reverchon*, B, BP, M, P, W. Sierra del Cuarto, lieux arides, sur le calcaire, 1800 m, VI-1904, *É. Reverchon*, BP.

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