

# A new species of *Doronicum* (Asteraceae, Senecioneae) from central China

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The name *Doronicum tibetanum* Cavill. has been inadvertently applied in herbarium labels to designate a species distributed in central China (provinces of Gansu and Sichuan). However, the study of the type specimen reveals that it is actually a species of *Aster*. The central Asian species of *Doronicum* has no available name and is thus here described as *D. cavillieri* Álv. Fern. & Nieto Fel. This new species has as its closest relatives five central Asian species: *D. altaicum* Pall., *D. briquetii* Cavill., *D. falconeri* C.B. Clarke, *D. kamaonense* (DC.) Álv. Fern. and *D. stenoglossum* Maxim. Their morphological affinities and phylogenetic relationships are commented upon and an identification key is provided.

Key words: Asteraceae, China, *Doronicum*, Senecioneae, new species, taxonomy

## INTRODUCTION

The genus *Doronicum* (Asteraceae, Senecioneae) is comprised of 26 species and four subspecies distributed in Asia, Europe and north Africa (I. Álvarez Fernández unpubl.). All representatives are perennial rhizomatose herbs with alternate simple leaves, bearing one to several radiate yellow-flowered capitula. The involucre is composed of 2–3 rows of uniform herbaceous phyllaries. The cypselae are broadly elliptic-oblong and have 10 longitudinal ribs. The pappus consists of bristles in all cypselae except in those of the radiate flowers

of the heterocarpic capitula, where it is lacking. *Doronicum* species occur in open or forested habitats from sea level up to 5 000 m of elevation.

The genus has been traditionally placed in the tribe Senecioneae (Cassini 1819, Bentham 1873, Hoffmann 1892, Nordenstam 1977, Bremer 1994). This placement has received molecular support from the chloroplast gene *ndhF* (I. Álvarez Fernández, Fuertes Aguilar & Nieto Feliner unpubl.). Nevertheless, the circumscription of the genus has undergone significant changes. The most significant has been the exclusion of species currently placed in several other genera (*Arnica*,

*Aster*, *Nannoglottis*), belonging to different tribes.

A taxonomic revision of the genus based on ca. 4 500 herbarium specimens from 47 herbaria has resulted in a new taxonomic treatment (Álvarez Fernández & Nieto Feliner 1999 and I. Álvarez Fernández unpubl.). The objective of the present paper is to provide a formal taxonomic description for an undescribed Chinese species. This species had been identified in herbarium labels as *Doronicum thibetanum* Cavill. However, to our knowledge the application of Cavillier's name to populations of the species we are here describing has never been published. Further, such application is wrong because the study of the type material of *D. thibetanum* (Cavillier 1907) reveals that the type specimen is actually an *Aster*. Additionally, a discussion is provided on the relationships among the central Asian species of the genus where the closest relatives of the new species are found. This is based not only on the taxonomic revision but also on a phylogenetic study using DNA sequences and morphological data (I. Álvarez Fernández, J. Fuertes Aguilar & G. Nieto Feliner unpubl.).

## MATERIAL AND METHODS

More than 50 morphological qualitative and quantitative characters were studied from the 19 dried specimens of the new species found in the herbaria examined. These specimens are from BM, E, K, GH, LE, NY, MO, S, and W. Observations were made using either a binocular lens or SEM. Quantitative characters were recorded with the aid of a Brown & Sharpe Plus digital caliper (model 599-571-3).

## RESULTS AND DISCUSSION

### DESCRIPTION OF THE NEW SPECIES

*Doronicum cavillieri* Álv. Fern. & Nieto Fel., *sp. nova* (Fig. 1)

*Speciei D. briquetii* Cavill. *similis, a qua praesertim differt bracteis involucralibus apice glandula sessili praeditis, foliis caulinis constanter*

*integris atque obtusis, capitulo basi pilis glanduliferis ut plurimum 2 mm longis instructo (nec ut in D. briquetii ut plurimum 5 mm longis).*

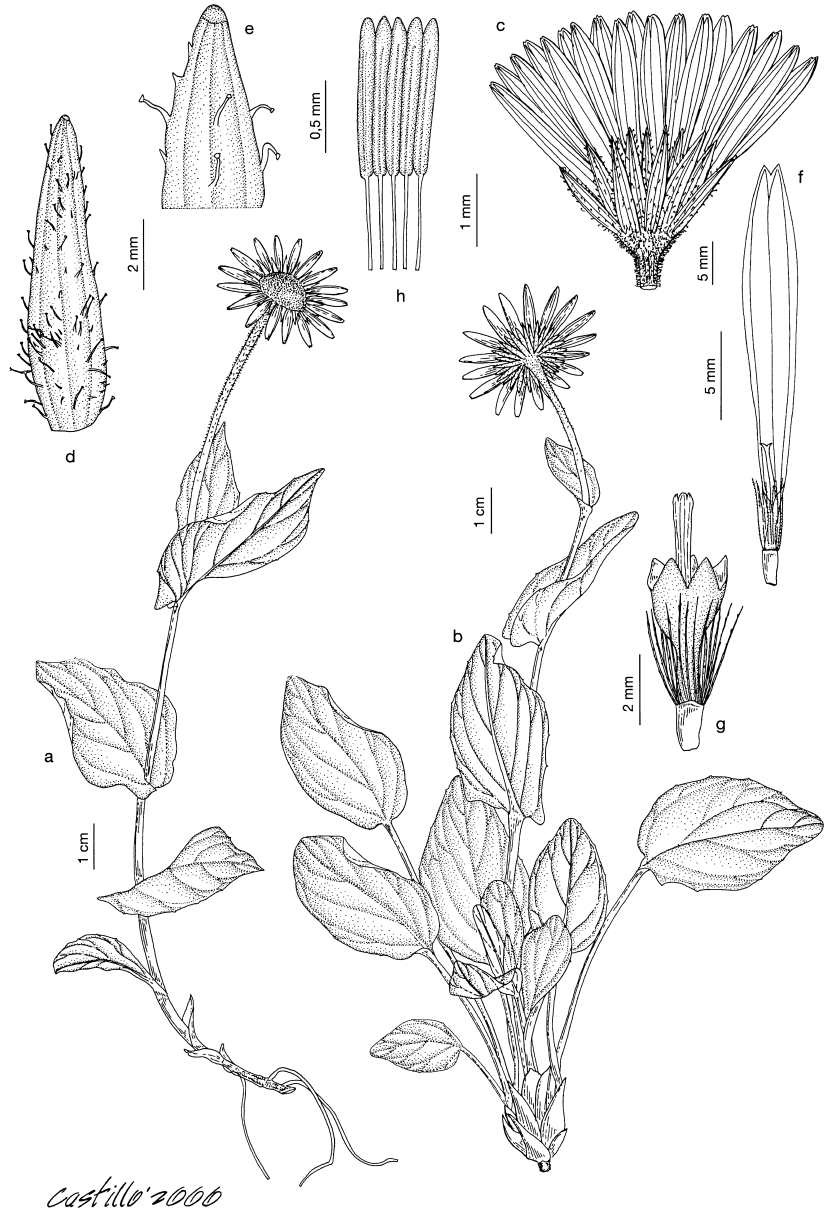
HOLOTYPE: China. SW Gansu, T'ao river basin, Minshan range, mt. Kuang ke, 3 700 m, meadows, VI.1925, *J. F. Rock s. n.* (NY; isotypes BM, GH, LE).

Rhizome fleshy to somewhat woody, glabrous, with uniform internodes. Stem up to 30 cm, not branched, sometimes with persistent leaf remains forming dark scales at base, with uniform internodes shorter than the adjacent leaves or scarcely longer than them. Leaves distributed along the stem, entire, with blunt apex, truncate to attenuate base, and pinnate-reticulated veins. Basal leaves orbicular to elliptic, blade 14–35 × 15–30 mm, petiole 30–87 × 0.75–1.5 mm, sometimes reduced (cataphylls). Cauline leaves sessile, semiamplexicaul, broadly elliptic to ovate, 15–50 × 7–35 mm. Capitula terminal, solitary, 30–60 mm in diameter including ligules. Involucre 20–35 mm in diameter. Phyllaries subulate to narrowly ovate, 10–16 × 1.5–2.5 mm, with blunt apex that bears a sessile gland. Receptacle glabrous. Flowers yellow. Style 4.0–6.25 mm. Stamen filaments ca. 4 mm, anthers ca. 2.5 mm. Ligulate flowers 20–25 × 2–3 mm, very narrowly elliptic, the ligules with 2–3 teeth at apex. Tubular disk flowers ca. 5 × 2 mm. Cypselae homomorphic, ca. 3 × 1 mm (immature), brown. Pappus ca. 4 mm, with minutely scabrous bristles, whitish to yellowish. Indumentum variable, composed of glandular hairs up to 2 mm and uniseriate eglandular hairs up to 0.5 mm, abundant near the capitulum to very scarce at the base of the plant, eglandular hairs present mainly on the leaves. Flowering in June. Mature cypselae not seen.

DISTRIBUTION: Mountains of central China (provinces of Gansu and Sichuan).

HABITAT: Open rocky places, grassy slopes, meadows, and in forests, from 3 000 m to 3 700 m of elevation.

ADDITIONAL SPECIMENS EXAMINED (PARATYPES): — China. *Gansu Province*. Siku, high cool gullies, 16.VI.1914 *R. Farrer 144* (E); T'ao river basin, Merku valley, SW Gansu, 3 000 m, grassy slopes, VI.1925 *J. F. Rock 12192* (E, K, NY, S, W); T'ao river basin, Minshan range, mt. Kuang Ke, SW Gansu, 3 700 m, meadows, VI.1925 *J. F. Rock 12389* (BM, GH, LE, NY); upper Tebbu country, foot of Shimen, SW Gansu, 3 660 m, rock limestone wall extending east & west, 1925 *J. F. Rock 13020* (E, K, GH, LE, NY,



**Fig. 1.** *Doronicum cavillieri* Álv. Fern. & Nieto Fel. (from J.F. Rock 12192, K). — a and b: Habit. — c: Capitulum. — d: Involucral bract. — e: Apex of an involucral bract. — f: Ligulate flower. — g: Tubular flower. — h: Androecium.

S, W). *Sichuan Province*. Scarp on S edge of Hongyuan plain, on road to Songpan, 3 350 m, in moss under shrubs, 1989 D. Chamberlain, P. Cox & P. Hutchison (E); Lianhuashan, Kangle Xian, 3 000 m, under forest, 23.VI.1991 G. H. Wang 91161 (MO).

#### CENTRAL ASIAN RELATED SPECIES

According to our taxonomy (I. Álvarez Fernández unpubl.), there are six species of *Doronicum* oc-

curing east of the 60° meridian: *D. altaicum* Pall., *D. briquetii* Cavill., *D. falconeri* C.B. Clarke, *D. kamaonense* (DC.) Álv. Fern. (= *D. roylei* DC.), *D. stenoglossum* Maxim., and the new species described here as *D. cavillieri*. Their distribution areas span a large territory from Altai to the eastern Himalayas and central China across Pamir and Kashmir. Some of their areas partly overlap.

Although we have failed to detect a synapomorphic morphological character that supports

their monophyly, they all possess a combination of non-exclusive characters. These are the glabrous and somewhat woody rhizomes, the uniform distribution of leaves along the stem, and the pinnate-reticulate leaf venation. A parsimony analysis of the genus, based on three different data sets (nuclear ribosomal ITS sequences, chloroplast spacer sequences of the *trnL-trnF* region, and morphological characters) gives some support to the monophyly of the group composed of these central and eastern Asian species (I. Álvarez Fernández, J. Fuertes Aguilar & G. Nieto Feliner unpubl.). In the phylogenetic hypothesis obtained by simultaneously analyzing the three data sets for representatives of all species of *Doronicum*, the six Asian species form a clade. However, the bootstrap support for this clade is moderate. Further molecular evidence is needed to determine if these species do form a monophyletic group and thus deserve taxonomic recognition at an infrageneric rank. Within that group, *D. cavillieri* appears as sister to *D. briquetii*, and this pair, in turn, is sister to the one formed by *D. falconeri*, *D. kamaonense* and *D. stenoglossum*.

At the specific level, taxonomic differentiation is not problematic. Characters relative to the indumentum, homocarpy, and number of capitula are useful to distinguish *Doronicum altaicum*, *D. briquetii*, *D. falconeri* and *D. kamaonense*. The remaining two species, *D. stenoglossum* and *D. cavillieri*, additionally present some exclusive (autapomorphic) characters.

On morphological basis, the closest species to *Doronicum cavillieri* are *D. altaicum* and *D. briquetii*. The three of them are homocarpic and bear a single capitulum (*D. altaicum* exceptionally up to four). Besides the exclusive character of *D. cavillieri* (sessile gland in the apex of every involucre bract), this species can also be distinguished from the other two by the type of indumentum. Glandular hairs at the base of the capitula are at most 2 mm long in *D. cavillieri* while those in *D. briquetii* are up to 5 mm, and the ones in *D. altaicum* are almost sessile (< 1 mm).

Of the remaining Asian species, *Doronicum stenoglossum* can be easily distinguished from *D. cavillieri*. In fact, *D. stenoglossum* was placed by

Cavillier (1911) in a different section (sect. *Soulieastrum*) than the bulk of the genus (sect. *Doronicastrum*). Characters separating the two species are the number of heads (usually more than two in *D. stenoglossum*), the shape of ligules (almost linear, 0.5–1.5 mm wide in *D. stenoglossum* vs. narrowly elliptic, 2–3 mm wide in *D. cavillieri*), and the relative length of ligules as compared to involucre bracts (clearly longer in *D. cavillieri* vs. almost equal or even shorter in *D. stenoglossum*). *Doronicum kamaonense* differs from *D. cavillieri* mainly by its heterocarpy and a higher number of capitula (2–18).

#### KEY TO THE SPECIES OF *DORONICUM* IN CENTRAL ASIA

1. Heterocarpic heads; cypselae of the ligulate flowers without a pappus ..... 2
1. Homocarpic heads; pappus present in all cypselae although sometimes caducous ..... 3
2. Unbranched stem with a solitary terminal capitulum (40–75 mm in diameter, ligules included) *D. falconeri*
2. Branched stem with several (2–18) capitula (15–40 mm in diameter, ligules included) ..... *D. kamaonense*
3. Flowers pale yellow to greenish; ligules linear (0.5–1.5 mm wide); involucre bracts equaling or even exceeding ligules; pappus of ligulate flowers sometimes caducous ..... *D. stenoglossum*
3. Flowers yellow; ligules narrowly elliptic (1.5–3.5 mm wide); involucre bracts much shorter than ligules, rarely equaling them; pappus never caducous ..... 4
4. Involucre bracts with a blunt apex (ending in a sessile gland) ..... *D. cavillieri*
4. Involucre bracts with an acute apex (without a gland at the apex) ..... 5
5. Indumentum at the base of the head usually composed of glandular hairs (1–5 mm); capitulum solitary ..... *D. briquetii*
5. Indumentum at the base of the head composed of subsessile glands or hairs (less than 1 mm), sometimes subglabrous; capitula 1–4 ..... *D. altaicum*

#### NOMENCLATURE OF *DORONICUM CAVILLIERI*

*Doronicum thibetanum* was described by Cavillier (1907). The author cited a single collection in the protologue: “Thibet (Murr, ann. 1882, in herb. Boissier)”. In G-BOIS there is only one sheet whose label matches the protologue: “Tibet, Murr

1882". Attached to this specimen is another label showing Cavillier's handwriting: "*Doronicum tibetanum* sp. nov., Fr. Cavillier determ, anno 1906". There is thus a single type element on which the identity of the name has to be based. The overall appearance of the specimen is rather ambiguous and the ligules are currently yellowish. But this latter character is rather unstable and thus the original ligule color may well be blue (Grierson 1964). An examination of the style branches is conclusive to reject the identification of the type specimen as a *Doronicum*.

The flattened acuminate style branches combined with the lack of anther appendages and the radiate capitula indicate that the type of *Doronicum tibetanum* belongs in tribe Astereae. Characters such as a small herb with one capitulum, herbaceous subequal (> 1 mm wide) phyllaries, relatively wide ligules (> 1 mm wide), and a simple pappus as long as the corolla suggest an *Aster* sect. *Alpigeni* subsect. *Homochaeta* (Grierson 1964). A more precise identification is nevertheless problematic due to the immature state of the specimen as well as to the lack of other relevant characters of the rhizome.

Two factors contributed to all this taxonomic confusion. First, the fact that Cavillier misidentified an *Aster* for a *Doronicum*. This was probably due to the misleading color of the ligules and the fact that he did not dissect the capitulum (the only one in the specimen was intact). Second, the existence of a good species of *Doronicum* in the Tibet area demanding a name coupled with an available epithet associated with an ambiguous description.

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## REFERENCES

- Álvarez Fernández, I. & Nieto Feliner, G. 1999: Lectotypification of 16 species names in *Doronicum* (Asteraceae, Senecioneae). — *Taxon* 48: 801–806.
- Bentham, G. 1873: Notes on the classification, history, and geographical distribution of Compositae. — *J. Linn. Soc., Bot.* 13: 335–577.
- Bremer, K. 1994: *Asteraceae. Cladistics & Classification*. — Timber Press, Portland, Oregon. 752 pp.
- Cassini, H. 1819: Suite du sixième mémoire sur la famille des synanthérées. — *J. Phys. Chim. Hist. Nat. Arts.* 88: 189–204.
- Cavillier, F. 1907: Étude sur les *Doronicum* a fruits homomorphes. — *Annuaire Conserv. Jardin Bot. Genève* 10: 177–251.
- Cavillier, F. 1911: Nouvelles études sur le genre *Doronicum*. — *Annuaire Conserv. Jardin Bot. Genève* 13–14: 195–368.
- Grierson, A. J. C. 1964: A revision of the Asters of the Himalayan area. — *Notes Royal Bot. Garden Edinburgh* 26: 67–163.
- Hoffmann, O. 1892: *Doronicum* L. — In: Engler, A. & Prantl, K (eds.), *Die Natürlichen Pflanzenfamilien* 4: 294. Leipzig.
- Nordenstam, B. 1977: Senecioneae and Liabeae systematic review. — In: Heywood, J. B. & Turner, B. L. (eds.), *The biology and chemistry of the Compositae*: 799–830. Acad. Press, London.