

Bupleurum baimaense (Apiaceae), a new species from Hengduan Mountains, China

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Bupleurum baimaense X.G. Ma & X.J. He *sp. nova* (Apiaceae) is proposed here based on morphological characters and chromosome number ($2n = 12$). The material of this species has thus far been treated in China as *B. dalhousieanum*. However, *B. baimaense* has no branches or lateral umbels on stems, whereas *B. dalhousieanum* has branches and lateral umbels on the distal part of stems. *Bupleurum baimaense* is most similar to *B. commelynoideum*, but differs mainly by its stems usually being decumbent and numerous. *Bupleurum baimaense* is known from northwest Yunnan (Deqin) and southeast Tibet (Zayul) in China.

Bupleurum (Apiaceae) is a genus of about 180 species (Sheh & Watson 2005). The taxonomy of the genus is extremely difficult on account of obscure inter-specific boundaries and wide intra-specific morphological variation. After the publication of the accounts of *Bupleurum* in *Flora Reipublicae Popularis Sinicae* (Li & Sheh 1979) and *Flora of China* (Sheh & Watson 2005), additional taxonomic changes have been proposed for the Chinese taxa of *Bupleurum* (e.g. Wang *et al.* 2011a, 2011b). Despite the former achievements, which include many taxonomic rank adjustments and proposals of new species and new combinations, the species limits are not yet well resolved in some taxa.

Shan and Li (1974) first identified some *Bupleurum* specimens from Deqin County of the Yunnan province as *B. dalhousieanum* (T. T. Yu 9312, KUN). Li and Sheh (1979) and Sheh and Watson (2005) subsequently agreed that those

plants indeed represented *B. dalhousieanum* and extended the distribution of this species to include the Hengduan Mountain region in China.

During our field investigations in 2010–2012, we collected *Bupleurum* plants and fruits from the Bai-ma Mountain (Deqin County, southwestern China) from the same site where the specimens identified as *B. dalhousieanum* by Shan and Li (1974) came from. We also collected some specimens with the same appearance as the specimens from Deqin at Zayul in Tibet.

By comparing the Deqin and Zayul specimens with the syntypes of *B. dalhousieanum* in the Kew herbarium (C. B. Clarke 22151, 22679, 22987B, 23260 (Fig. 1), 23957), we found that the species we collected was not *B. dalhousieanum*. Both species are branched at base and usually have procumbent stems, but their branching patterns are quite different. *Bupleurum dalhousieanum* has branches and lateral umbels on the

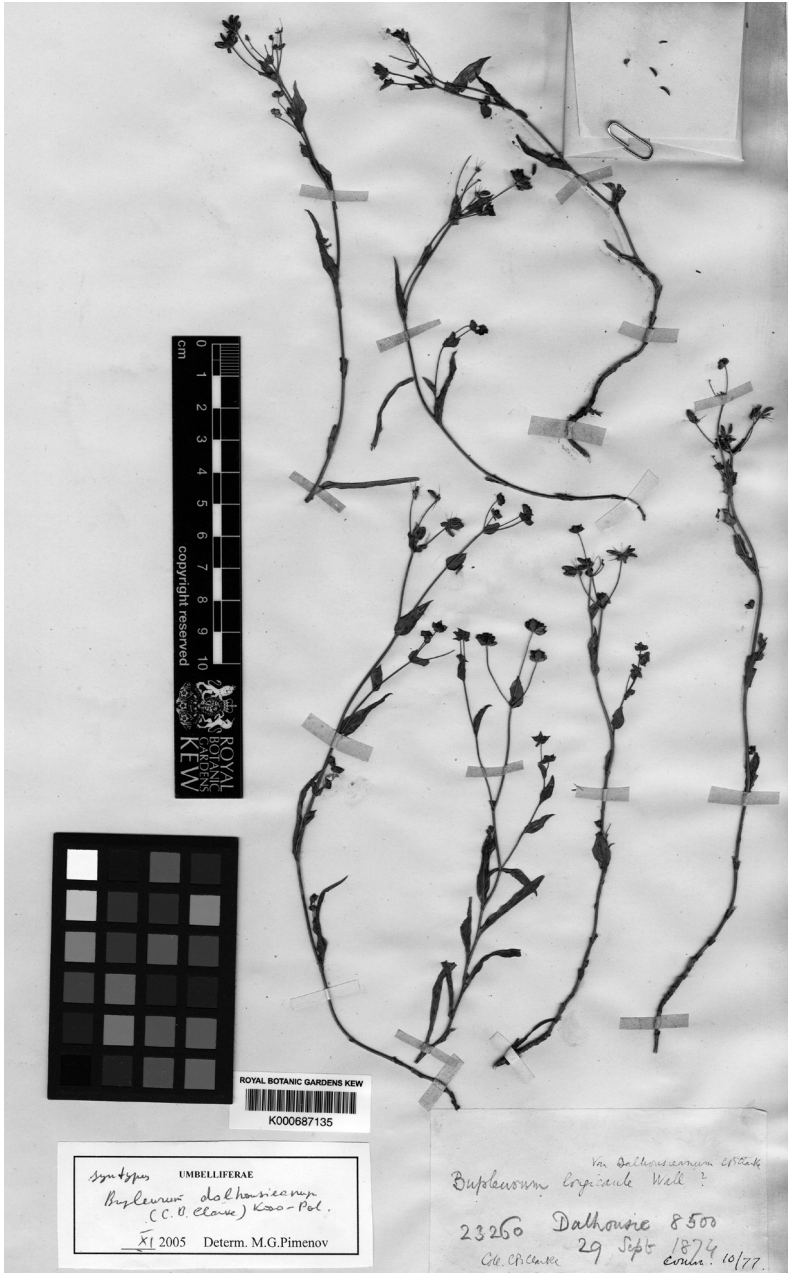


Fig. 1. A syntype of *Bupleurum dalhousieanum* (C. B. Clarke 23260, K). Image published with permission from The Royal Botanic Gardens KEW.

distal part of the stems. However, the species we collected from Deqin and Zayul lacks branches and lateral umbels on the flowering stems. Furthermore, according to Clarke's (1879: 677) description of 'var. *dalhousieana*', it has yellow petals, while those of the species we collected from Deqin and Zayul are purple. Moreover, the taxa we collected can be distinguished from *B.*

dalhousieanum by the size of the bracteoles: *B. dalhousieanum* has bracteoles shorter than or equal to the length of fruits, while the taxon we focus herein usually has bracteoles prominently exceeding fruits in length (Figs. 2D and 3B).

To study the chromosome number of the species, we collected mature fruits of the Bai-ma Mountain population in October 2012. The root

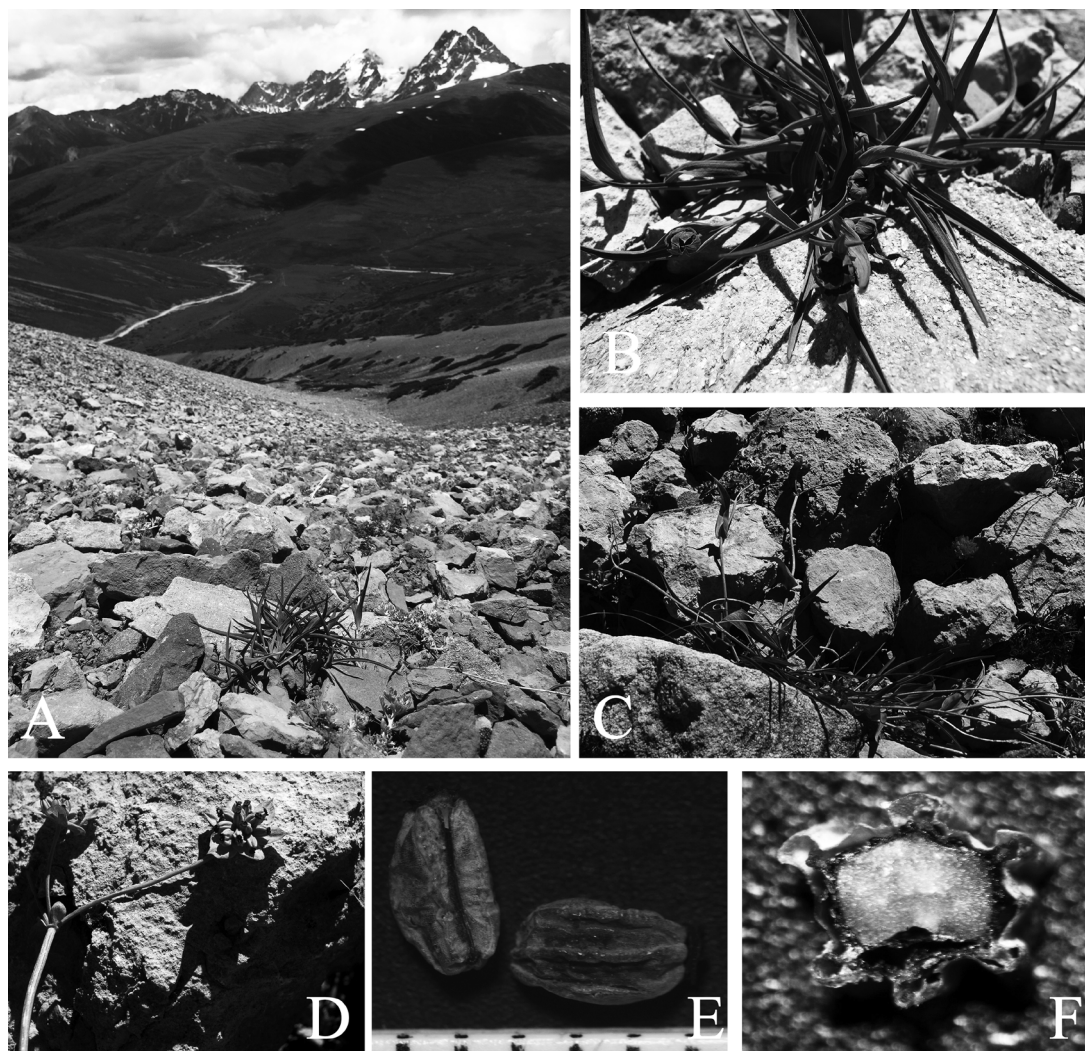


Fig. 2. — **A:** Habitat of *Bupleurum baimaense* (Bai-ma Mountain, Yunnan, China). — **B:** *B. baimaense* in flower. — **C:** *B. baimaense* in fruit. — **D:** Inflorescence and fruits of *B. baimaense*. — **E:** Fruits of *B. baimaense*. — **F:** Transverse section of fruit of *B. baimaense*.

tips from the germinated plants were pretreated in saturated para-dichlorobenzene solution for 5–7 h at room temperature. Then they were fixed in a solution of ethanol: acetic acid (3:1) for at least 12 h at 4 °C. Fixed roots were hydrolysed in 1 mol l⁻¹ HCl at 58 °C for 6–8 min and then stained with modified carbol fuchsin (Kao 1982) for 15–20 min. For chromosome number counting, photographs were taken with an Olympus BX51 microscope. Cytological analysis revealed that the chromosome number is $2n = 12$ ($x = 6$) (Fig. 4), i.e. different from *B. dalhousieanum*, reported as $2n = 16$ ($x = 8$) (Pimenov *et al.* 2001).

Based on these differences, we propose that the specimens described as *B. dalhousieanum* from Deqin in 1974 are placed in the species described here.

***Bupleurum baimaense* X.G. Ma & X.J. He, sp. nova** (Figs. 2 and 3)

B. dalhousieanum auct. non (C.B. Clarke) Koso-Pol. (e.g. Shan & Li 1974, Li & Sheh 1979, Sheh 1986, Sheh 1997, Sheh & Watson 2005).

HOLOTYPE: China. Yunnan province, Deqin County, Bai-ma Mountain, screes, alt. 4400 m, 19 Oct. 2012, X.

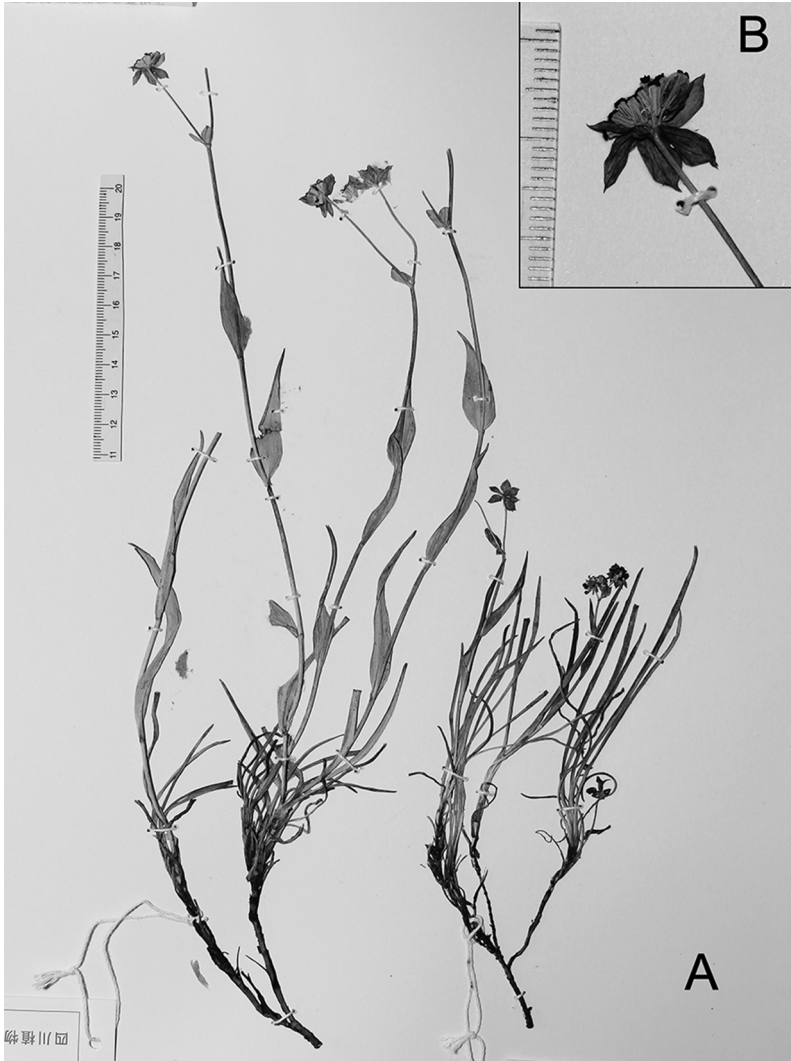


Fig. 3. Holotype of *Bupleurum baimaense*. — **A:** Fruiting specimen. — **B:** Inflorescence and young fruits.

G. Ma m12101901 (SZ), in fruit. — PARATYPES: China. Yunnan province, Deqin County, Bai-ma Mountain, screes, alt. 4400 m, 18 Aug. 1981, *Hengduan Expedition of IB 3236* (PE), and 8 Jul. 2011, *B. Xu 558* (KUN); Yunnan, Deqin, Bai-ma Mountain, Chialoti, 30 July 1937, *T. T. Yu 9312* (KUN); Tibet, Zayul, Ridong village, 3800 m, gravel slope, 17 Aug. 2011, *X. G. Ma XZ2011081737* (SZ); Tibet, Zayul, Ridong village, scrub, grasslands, 3800 m, 20 Sep. 1982, *Qinghai-Tibet Expedition 10583* (PE).

ETYMOLOGY: The specific epithet is derived from the type locality: Bai-ma Mountain, Deqin County, Yunnan.

Plants (5–)10–35 cm, perennial. Rootstock slender, woody, branched. Stems purplish-red, numerous, usually decumbent, base without fibrous remnant sheaths, not branched above.

Basal leaves usually numerous; blade linear to linear-lanceolate, 3–10 × 0.2–0.4 cm, 5–7-nerved, gradually tapering into petiole. Upper leaves sessile; blade lanceolate to ovate, 1.5–5 × 0.3–1 cm, base rounded, clasping, apex acuminate, sometimes caudate. Umbels terminal; rays 2–4, 1–5 cm, unequal; bracts 1–3, ovate, 5–23 × 4–8 mm, unequal; bracteoles (4–)6–10, broadly ovate or obovate, tinged purple, 4–8 × 3.5–6 mm, exceeding flowers and fruits; umbellules 8–17 mm across, 16–24-flowered; pedicels 1–2 mm; Petals purplish, sometimes margins yellow; Stylopodium low-conic, dark purple. Fruit oblong-ovoid, ca. 4 × 2 mm; ribs narrowly

winged; vittae 3 in each furrow, 4 on commissure; fruit wall swollen when ripe. Flowering and fruiting July–October.

HABITAT: On alpine screes or gravel slopes, at elevations over 3800 m a.s.l.

As described above, *B. dalhousieanum* is morphologically distinct from *B. baimaense*. The type locality of *B. dalhousieanum* is “Dalhousie and Dhurmsala” in N India. The distribution range of this species includes N India, Nepal and W Tibet of China. *Bupleurum baimaense* is distributed in NW Yunnan (Deqin) and SE Tibet (Zayul). *Bupleurum baimaense* can be distinguished from the other procumbent W Himalayan alpine members of *Bupleurum*, such as *B. atrovioleaceum* and *B. gracillimum*, by its unbranched stems and longer bracteoles.

In Wang *et al.* (2011b), we identified a specimen from Muli, Sichuan (*X. G. Ma m10093013*, SZ) as *B. dalhousieanum* (Fig. 5). However, that was a misidentification. This as yet unrecognized species is similar to *B. baimaense*, but shorter (5–15 cm) and with fewer rays (1–2, usually 1). The taxonomic position of that specimen has not been assigned at present because of lack of mature fruits and chromosome data. With the exception of that unrecognized species, *B. baimaense* is most similar to *B. commelynoideum*, which is common in W Sichuan. Although *B. baimaense* and *B. commelynoideum* share some

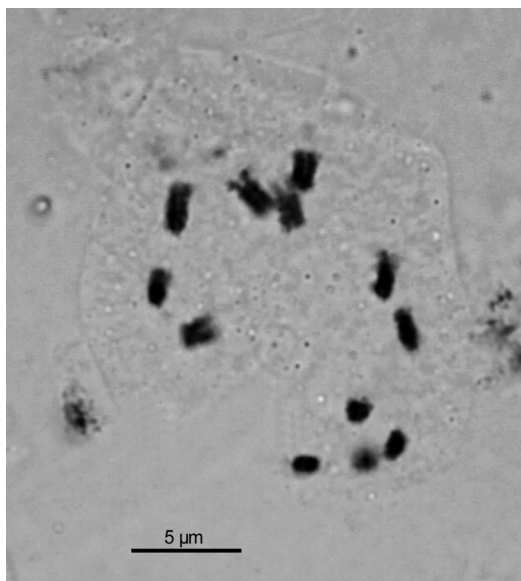


Fig. 4. Metaphase chromosomes of *Bupleurum baimaense* (from the holotype).

similarities, it is easy to distinguish them. A comparison of *B. baimaense*, *B. dalhousieanum*, *B. commelynoideum*, *B. atrovioleaceum* and *B. gracillimum* is presented in Table 1.

ADDITIONAL SPECIMENS EXAMINED: — *Bupleurum dalhousieanum*. **India.** Himachal Pradesh, 11 Sep. 1874, *C. B. Clarke* 22151 (K), *C. B. Clarke* 22679 & 22987B (K); 29 Sept. 1874, *C. B. Clarke* 23260 (K); 17 Oct. 1874 *C. B. Clarke* 23957



Fig. 5. The specimen (*X. G. Ma m10093013*, SZ) collected from Muli, Sichuan, China (see text).

Table 1. Comparison of morphological characters and geographic distribution of *Bupleurum baimaense*, *B. dalhousieanum*, *B. atroviolaceum*, *B. gracillimum* and *B. commelynoideum*.

Characters	<i>B. baimaense</i>	<i>B. dalhousieanum</i>	<i>B. atroviolaceum</i>	<i>B. gracillimum</i>	<i>B. commelynoideum</i>
Number of flowering stems per plant	numerous	numerous	numerous	numerous	usually less than three
Flowering stems position	usually decumbent	usually decumbent	decumbent	decumbent	usually erect
Stem branching pattern	unbranched above	branched above	branched above	branched above	occasionally branched above
Ray number	2–4	3–5	2–4	2–5	3–7
Bract number	1–3	1–3	2–3	2–5	0–2
Bracteole relative length	exceeding fruits	shorter than or equal to fruits	shorter than or equal to fruits	shorter than or equal to fruits	exceeding fruits
Petal color	purple, margin sometimes yellow	usually yellow	dark purple to black	usually yellow	adaxially purple or yellowish-tinged, abaxially purple
Distribution	Hengduan mountains (Deqin and Zayul)	N India, Nepal and W Tibet	N India, Afghanistan and Pakistan	W Himalayas	W Sichuan and NE Yunnan

(K). **China.** Tibet, Nyalam, 3710 m, 1 July 1966, *Y. T. Zhang et al.* 4619 (PE); Nyalam, 3810 m, 22 June 1975, *C. Y. Wu et al.* 75-451 (PE); Nyalam, 3800 m, 23 June 1975, *Qinghai-Tibet Expedition 5821* (PE); Gyirong, 4300 m, 28 July 1975, *Qinghai-Tibet Expedition 5620* (PE); Burang, 4400 m, 14 July 1976, *Qinghai-Tibet Expedition 76-8436* (PE). — *Bupleurum atroviolaceum.* **India.** Jammu-Kashmir, 28 Aug. 1928, *R. R. Stewart 9880* (K). **Afghanistan.** Badakhshan, east shore of Lake Shewa, 3195 m, 28 June 2008, *M. Jacobs & C. Schloeder 1706* (KUFS); Parwan, Salang-Suedeite, 3600 m, 8 Aug. 1969, *S. Breckle 2673* (KUFS). — *Bupleurum gracillimum.* **Afghanistan.** Badakhshan, 15 July 1971, *O. Anders 7457* (KUFS). — *Bupleurum commelynoideum.* **China.** Sichuan, Muli, 17 June 1982, *Q. S. Zhao et al.* 8474 (CDBI). Sichuan, Xiangcheng, 3 Aug. 1981, *Qinghai-Tibet Expedition 3686* (CDBI). Sichuan, Kangding, 21 Sep. 1998, *M. G. Pimenov et al.* 291 (PE).

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