

BERBERIS EXTENSIFLORA* (BERBERIDACEAE): A NEW RANK FOR *BERBERIS CONCINNA* VAR. *EXTENSIFLORA

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The new rank and combination *Berberis extensiflora* (Ahrendt) Bh. Adhikari & Harber is proposed based on morphological and molecular studies of the Himalayan species of *Berberis* (Berberidaceae). Morphologically, *Berberis extensiflora* differs from *B. concinna* Hook.f. by its much longer (3–4 cm) inflorescence with 2 or 3 flowers in umbels (vs < 2 cm long solitary flowers) and 10- to 13-seeded berries (vs 5- to 9-seeded berries). A detailed taxonomic description, notes on habitat and ecology, and colour photographs are provided.

Keywords. Himalaya, Nepal, new rank, taxonomy.

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Introduction

Berberis L., the largest genus of Berberidaceae, is likely to contain 400–500 species (see Harber, 2020, for more details), but the total number worldwide is uncertain. *Berberis* is represented by 21 species in Nepal (Adhikari et al., 2012), 55 in India (Rao et al., 1998a, 1998b), and at least 278 in China (Harber, 2020).

Materials and methods

This report is based on field observations, DNA studies, and examination of herbarium specimens of Himalayan species of *Berberis*. The second author (J. Harber) also studied living collections of *Berberis concinna* Hook.f. and *B. concinna* var. *extensiflora* Ahrendt. Additionally, herbarium specimens (including types) from BM, E and KATH (herbarium codes follow Thiers et al., continuously updated) were examined, and the relevant literature (Adhikari et al., 2012; Harber, 2020) was consulted. All the specimens collected were deposited at E and KATH herbaria.

Taxonomic history of *Berberis concinna* and *B. concinna* var. *extensiflora*

Berberis concinna was first published by Hooker (1853) as a single (rarely two)-flowered species from Sikkim, India. Although accompanied by an excellent colour plate that included line drawings, the written description in the protologue was somewhat imprecise.

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The descriptions in Hooker and Thomson (1855, 1872) were even briefer. Neither of the descriptions gave the length of the pedicels.

Ahrendt (1945) published *Berberis concinna* var. *brevior* (as *breviora*) on the basis that it had shorter pedicels and narrower fruit than *B. concinna*, with its type being from Nepal. Subsequently, Ahrendt (1961) provided the first full description of *Berberis concinna*, while also maintaining *Berberis* var. *brevior* and publishing a further variety, *Berberis* var. *extensiflora* Ahrendt, whose type and four additional specimens cited (all with berries) were from Nepal. *Berberis* var. *extensiflora* was distinguished from *Berberis* var. *concinna* and *Berberis* var. *brevior* by having an umbellate infructescence.

Adhikari et al. (2012), noting that the length of the pedicels of *Berberis concinna* is variable, synonymised *Berberis* var. *brevior* under *Berberis* var. *concinna*, while maintaining *Berberis* var. *extensiflora*. Adhikari's key distinguished the two varieties as follows.

Key to Berberis varieties concinna and extensiflora

- 1a. Flowers solitary without bracts on the middle of pedicel. Inflorescence 0.8–1.5 cm long _____ var. *concinna*
- 1b. Flowers 2–3 [sic], usually in umbels, if solitary subtended by bracteoles [sic] on the middle of pedicel. Inflorescence 2–5 cm long _____ var. *extensiflora*

The conclusion that *Berberis* var. *extensiflora* represents a separate species came from two independent morphological and molecular studies.

The first author (B. Adhikari) examined wild populations of *Berberis* var. *concinna* and *Berberis* var. *extensiflora* in the Nepal Himalaya, while the second author (J. Harber) studied living collections of both varieties *concinna* and *extensiflora* at Foster Clough, Mytholmroyd, West Yorkshire. In 2018, Harber observed that the flower structures of two plants from Nepal in his living collection, both grown from wild-collected seed, differed significantly.

Following Schneider's little-known observations (in German) on the importance of flower structures as key criteria in differentiating species of *Berberis* (Schneider 1916, 1939, 1942; reported in Harber, 2020), Harber concluded that despite some similarity of their leaves (Figure 1), these were in fact two separate species.

Quite independently, Kreuzer (2017) found that molecular analysis also showed *Berberis* var. *concinna* and *Berberis* var. *extensiflora* to be genetically distantly related. The phylogeny of *Berberis* from the Himalaya and Hengduan mountains, which was based on nuclear and plastid genes, placed *Berberis* var. *concinna* and *Berberis* var. *extensiflora* in two different clades (Kreuzer, 2017).

Morphological differences between *Berberis concinna* and *B. extensiflora*

The Table summarises morphological differences between *Berberis concinna* and *B. extensiflora*. It should be noted that the description of the apex of the petals of *Berberis*

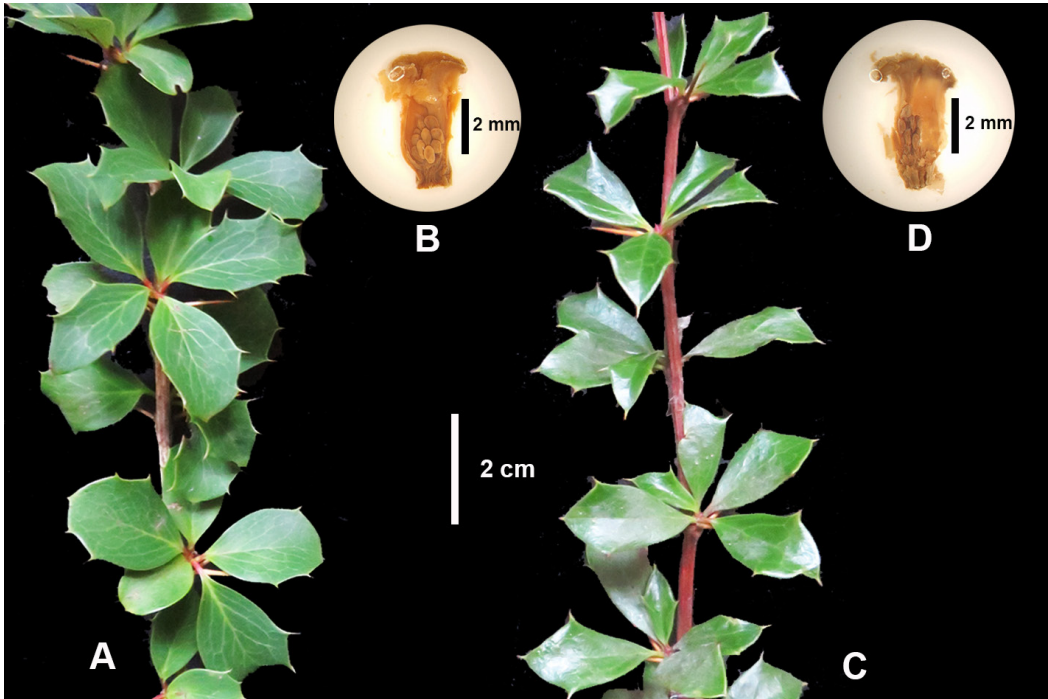


Figure 1. *Berberis extensiflora* (Ahrendt) Bh.Adhikari & Harber: A, branch, showing leaves; B, dissection of ovary, showing 10 ovules. *Berberis concinna* Hook.f.: C, branch, showing leaves; D, dissection of ovary, showing 7 ovules. Photographs: Julian Harber (A, C) and Bhaskar Adhikari (B, D). (B, *Stainton, Sykes & Williams* 6385; D, *Stainton, Sykes & Williams* 3352.)

Table. Morphological differences between *Berberis concinna* Hook.f. and *B. extensiflora* (Ahrendt) Bh.Adhikari & Harber.

Character	<i>B. concinna</i>	<i>B. extensiflora</i>
Height	To 1 m	To 2 m
Leaf colour	Adaxially shiny green	Adaxially dull green
Inflorescence	Solitary, rarely paired	2- or 3-flowered umbel, sometimes solitary
Bracts	Not present	Present, in solitary flowers near the middle of pedicels
Outer sepals	Narrowly oblong-ovate, 8–9 × 2.5–3.5 mm	Ovate, 6–8 × 4–5.2 mm
Median sepals	Obovate or broadly elliptic, 8–8.5 × 5–5.5 mm	Elliptic or elliptic-ovate, 7.5–9 × 5–5.5 mm
Inner sepals	Obovate or obovate elliptic, 7–9.2 × 5–6.5 mm	Elliptic, 8–10 × 5.5–6 mm
Petals	Obovate, 6.5 × 4.7 mm, base slightly clawed, apex obtuse, entire	Obovate or broadly obovate 5–7 × 4.5–7 mm, base cuneate, apex obtuse, entire or slightly crenate
Glands	Oblong	Orbicular or obovate orbicular
Ovules	5–9(–10)	(6–)10–13

concinna given in the [Table](#) is based on the flowers of *Stainton, Sykes & Williams* 3352, 5595 and 6222, and conforms to the line drawing in Hooker's protologue but differs from the description by Ahrendt (1961), which referred to the apex as being "acutely emarginate".

Only five additional Asian species of *Berberis* are recorded as having 10 or more ovules: *B. calliantha* Mulligan, *B. capillaris* Cox ex Ahrendt, *B. chrysophaera* Mulligan, *B. daiana* T.S.Ying and *B. tsangpoensis* Ahrendt, which all have solitary flowers. Thus, the two- or three-flowered umbel with up to 13 ovules per berry of *Berberis expansiflora* appears to be a unique combination.

Taxonomic treatment

Berberis expansiflora (Ahrendt) Bh.Adhikari & Harber, *stat. et comb. nov.* – *Berberis concinna* var. *extensiflora* Ahrendt, J. Linn. Soc. Bot. 57: 119 (1961). – Type: Nepal, Larjung, Kaligandaki, 17 x 1954, *Stainton, Sykes & Williams* 8175 (holotype BM! [BM 000551279]; isotype image A! [00969914], E! [E00465285]). [Figure 2](#).

Shrub, to 2 m tall. *Stems and branches* usually sulcate, glabrous, mature stems reddish brown, sparsely verruculose. *Spines* usually 3-fid, pale reddish or yellowish brown, terete, sometimes abaxially sulcate basally, strong, central spine 0.8–1.5 cm long, lateral spines 0.5–1.2 cm long. *Leaves* deciduous, slightly coriaceous. *Petiole* absent or to c.2 mm. *Leaf blade* abaxially slightly glaucous, densely papillose, adaxially dull green, obovate, sometimes obovate-elliptic or elliptic 1–3 × 0.5–1.5 cm, base cuneate, apex obtuse, sometimes acute, mucronate, margin with 1–3 widely separated spinose teeth on each side, venation reticulate, inconspicuous abaxially (conspicuous when dry), conspicuous adaxially. *Inflorescence* 3–4 cm long, usually an umbel of 2 or 3 flowers, rarely a solitary flower subtended by bracts. *Flowers* 1.5–2.5 cm in diameter. *Peduncle* 1.5–3 cm long, red; pedicel 1–2 cm long, glabrous, red, slightly swollen at the base of fruit. *Bracts* narrowly elliptic, 6–9 × 2–3.5 mm, in solitary flowers present near the middle of pedicels; bracteoles triangular or triangular ovate, 3.5–4.2 × 2 mm. *Sepals* yellow, in 3 whorls, outer sepals ovate sometimes with reddish tinge, 6–8 × 4–5.2 mm, median sepals elliptic or elliptic-ovate 7.5–9 × 5–5.5 mm, inner sepals elliptic 8–10 × 5.5–6 mm. *Petals* yellow, obovate or broadly obovate, 5–7 × 4.5–7 mm, base cuneate, apex obtuse, entire or slightly crenate, venation distinct, with 1 pair of lateral veins; glands orbicular or obovate orbicular, c.0.8 mm in diameter. *Stamens* 3.5–4 mm long, anther connective truncate or slightly apiculate. *Pistil* 3.5 mm long; ovules (6–)10–13. *Berries* red, oblong or ovoid, 12–15 × 6–8 mm; *style* deciduous or persistent.

Distribution. *Berberis expansiflora* has been collected in central and western Nepal.

Habitat and ecology. *Berberis expansiflora* is found among slash vegetation, in open areas on dry slopes, and in *Rhododendron* forests at 3150–3350 m. It has been collected in flower from June to August and in fruit in October.

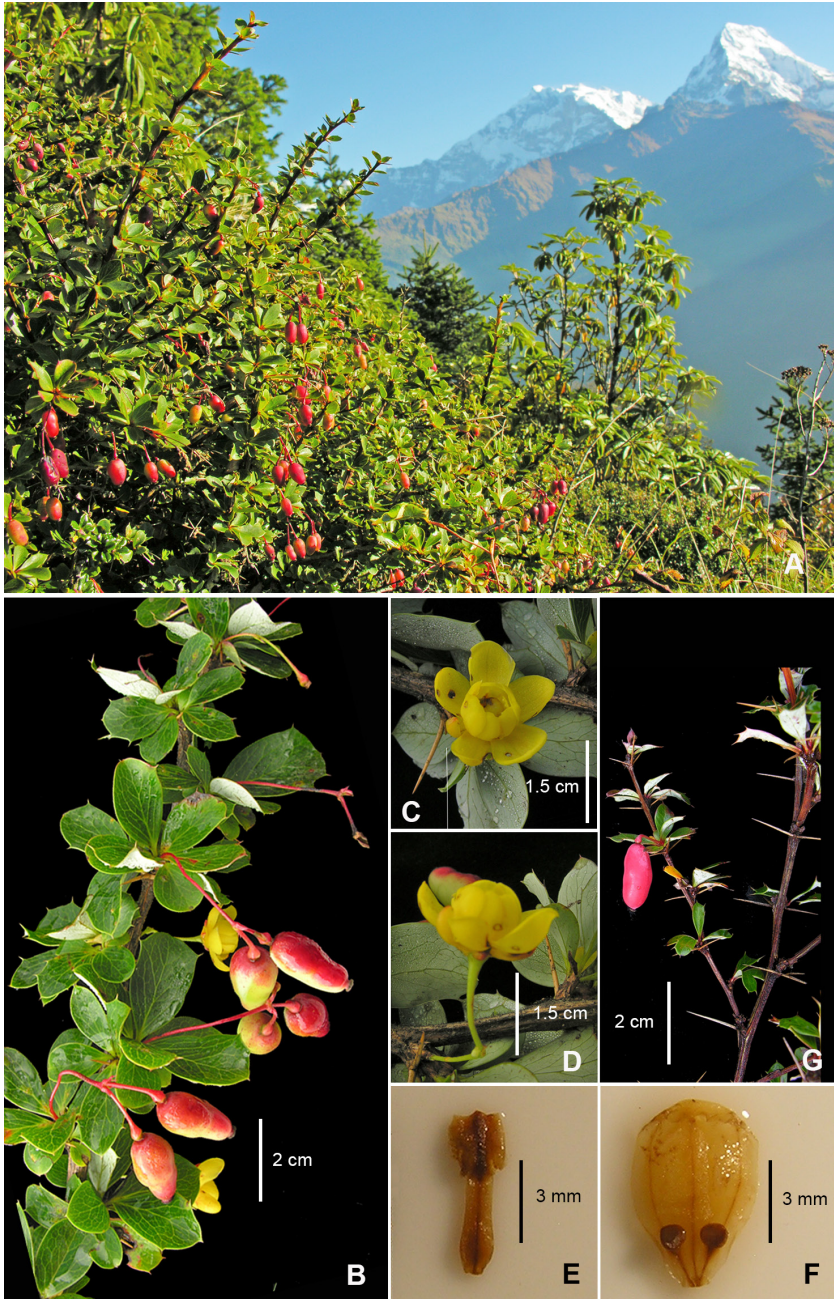


Figure 2. *Berberis extensiflora* (Ahrendt) Bh.Adhikari & Harber: A, habitat; B, fruiting branch; C, flower (front view); D, flower (lateral view); E, stamen; F, petal, showing glands. *Berberis concinna* Hook.f.: G, fruiting branch. Photographs: Bhaskar Adhikari (B–D, Pendry C.A., Milne R.I. & Adhikari B. EA 105; E and F, Ikeda et al., *Manaslu* 08 20812277; and G, Adhikari B. EL 125).

Additional specimens examined: Berberis extensiflora

NEPAL. Lamjung district: Rambrong, Lamjung Himal, 3330 m, 27 vi 1954, *Stainton, Sykes & Williams* 5964 (BM [BM000897088], E [E00663691]); Rambrong, Lamjung Himal, 3330 m, 16 vii 1954, *Stainton, Sykes & Williams* 6385 (BM [BM000897132], E [E00663692]); Rambrong, Lamjung Himal, 3330 m, 27 x 1954, *Stainton, Sykes & Williams* 9352 (BM [BM000897118], E [E00663694]). Manang district: Bimtang-Gho, 3280 m, 14 viii 2008, *Ikeda et al. Manaslu* 08 20812277 (E [E00667594], KATH). Myagdi district: Ghorepani, Poon hill, 28.3997°N, 83.6897°E, 3150 m, 4 x 2006, *Pendry, Milne & Adhikari* EA 104 (E [E00668356], KATH); Ghorepani, Poon hill, 28.3995°N, 83.6913°E, 3120 m, *Pendry, Milne & Adhikari* EA 105 (E [E00668355], KATH); West of Lumsum, 3350 m, 22 x 1954, *Stainton, Sykes & Williams* 9112 (BM [BM000897078], E [E00663693]).

CULTIVATED. Dawyck Botanic Garden, Stobo, Scotland, from *Pendry, Milne & Adhikari* EA 104; Exbury Gardens, Hampshire, and Foster Clough, Mytholmroyd, West Yorkshire, UK, collected from *Sine coll. s.n.*, Nepal Rolwaling Himal, Bagmail Pradesh, Autumn 2004.

Additional specimens examined: Berberis concinna

NEPAL: Lamjung district: Rambrong, Lamjung Himal, 3650 m, 29 vi 1954, *Stainton, Sykes & Williams* 6046 (BM [BM000897133], E [E00663701]). Mustang district: Kaligandaki, Lete, 3480 m, 4 vi 1954, *Stainton, Sykes & Williams* 5595 (BM [BM000897130], E [E00663699]). Rukum district: above Ranmagaon, 3640 m, 2 vii 1954, *Stainton, Sykes & Williams* 3352 (E [E00663698]).

CULTIVATED. Foster Clough, Mytholmroyd, West Yorkshire, UK, collected from *F. Carrie s.n.*, Nepal, Bagmati Province, Therapati, near Antang 3000 m, autumn 1995.

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