**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 cinerea var. brevior (as breviria) on the basis that it had shorter pedicels and narrower fruit than B. cinerea, with its type being from Nepal. Subsequently, Ahrendt (1961) provided the first full description of Berberis cinerea, 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. cinerea and Berberis var. brevior by having an umbellate infructescence.

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

**Key to Berberis varieties cinerea and extensiflora**

1a. Flowers solitary without bracts on the middle of pedicel. Inflorescence 0.8–1.5 cm long _____________________________ var. cinerea

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. cinerea and Berberis var. extensiflora in the Nepal Himalaya, while the second author (J. Harber) studied living collections of both varieties cinerea 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. cinerea 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. cinerea and Berberis var. extensiflora in two different clades (Kreuzer, 2017).

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

The Table summarises morphological differences between Berberis cinerea 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          | *B. concinna*               | *B. extensiflora*                      |
|--------------------|-----------------------------|----------------------------------------|
| 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. chrysophera 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 extensiflora appears to be a unique combination.

Taxonomic treatment

Berberis extensiflora (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 extensiflora has been collected in central and western Nepal.

Habitat and ecology. Berberis extensiflora 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).
A new rank for *Berberis concinna* var. *extensiflora*

*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 vii1954, 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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