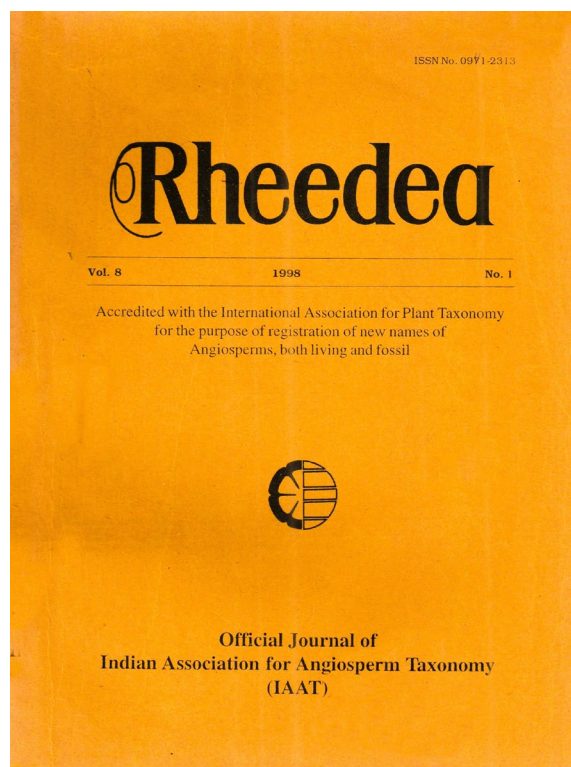




Revision of the Family Berberidaceae of India – I

Rao R.R., Tariq Husain, Bhaskar Dutt & Arti Garg



How to cite:

Rao R.R., Husain T., Dutt B. & A. Garg. 1998. Revision of the Family Berberidaceae of India - I. *Rheedeia* 8(1): 1–66.

<https://dx.doi.org/10.22244/rheedeia.1998.08.01.01>

Published in print: 30.06.1998

Published Online: 01.01.2022

Revision of the Family Berberidaceae of India - I

R.R. Rao, Tariq Husain, Bhaskar Dutt and Arti Garg
National Botanical Research Institute, Rana Pratap Marg
Lucknow - 226 001, India

Abstract

The genus *Berberis* with 55 species in India is revised. A key to the Indian species of the genus is provided. For each species the correct binomial, basionym if any, and synonyms, followed by a complete description, phenology, distribution and ecological notes are provided. Specimens examined and the approved acronyms of the names of herbaria where the specimens are deposited are cited. Discussion on nomenclature, wherever necessary, is also provided. The taxonomic and nomenclatural problems related to the complex taxa namely *Berberis lycium*, *B. insignis*, *B. petiolaris* and *B. macrosepala* have been solved. The present part of the article contains the above details of 35 species. The details of rest of the species will be published in the second part of the article.

INTRODUCTION

The family Berberidaceae is represented by ca 12 genera and 600 species, of which as many as 500 species belong to *Berberis* L.. The family is distributed both in Old and New World. In India, the family (*s.s.*) is represented by 55 species distributed predominantly in the Himalayan region. Only four species are extra Himalayan with distribution from Nilgiri hills in South India to Bihar and Madhya Pradesh, and where one species is endemic.

The nature of the species of *Berberis* varies with the place. For instance, *Berberis* of the Eastern Himalaya are mostly evergreen while those of the Western Himalaya are generally deciduous. The plants are straggling bushes and can be used for hedges or planted in pleasure grounds for their ornamental leaves and bunches of succulent acid berries with which they are loaded in the summer and autumn. The branches of these bushes are covered with sharp spines some of which are divided into 3 or 5 or even more. The leaves are bordered with spiny teeth and from the midst of the leaf cluster appear yellow flowers in drooping racemes or fascicles. The twigs are either rotundate or sulcate.

Berberis together with *Mahonia* or commonly the barberry, had found a remarkable place in ancient Hindu medicine for their efficacious medicinal properties. The old literature records manifold uses of the extract of either stem or root of *Berberis*, which is known as

R.R. Rao et al.

Rasaut (Ras=juice; out = frothing and forming when boiling; hence Rasaut means concentrated juice). The specific uses of Rasaut in eye diseases and indolent ulcers earned a great name for it. In the *British Pharmacopoeia*, the active principle of several species of *Berberis* and *Mahonia* – the alkaloid berberine – has been incorporated for its successful use in the treatment of oriental sore. In fact, Messrs May and Baker have patented a drug 'orisol', a 2% solution of berberine bisulphate, for the treatment of oriental sore.

For the past one hundred or more years, the barberry has interested both chemists and horticulturists. The former have isolated a number of alkaloids and have attempted to study their constitution, while the latter were interested in multiplying the species of *Berberis* by easy hybridisation. The barberry plants as straggling shrubs are planted for hedges by gardeners in Europe, mostly because of their ornamental thorny leaves and twigs. The genus *Berberis* is also known for its negative aspects. As an alternate host for *Puccinia* which have devastating effect on crops, *Berberis* contributes to destruction of crop plants.

The leaves exhibit great variations. In some species the leaves are entire, oblong or oblong-lanceolate, and again in some species linear-lanceolate or oblong-obovate. The leaves of the species are simple, mostly serrate or dentate, and rarely entire; they are almost in fascicles. The leaves are mostly glaucous beneath; papillose in some cases. They are more or less sessile.

The inflorescence is either simple or compound raceme, rarely umbellate or subcorymbose. Flowers are either solitary or fascicled; pedicels prominent. Sepals are in series. Petals are usually obovate, emarginate or entire. Stamens are produced. The berries are either coloured red or blue, with or without style.

The family Berberidaceae was first established by A.L. Jussieu in 1789 as 'Berberides' and was considered one of the most primitive of Angiosperms having a high number of disjunct or discontinuous genera. There is a general agreement among botanists (Kumazawa, 1938; Hutchinson, 1959; Airy-Shaw, 1966; Takhtajan, 1969; Meacham, 1980; Nowicke & Skvarla, 1981, etc.) that the genera of this family are not closely related but are separable into 4 distinct families, namely Lardizabalaceae (*Decaisnea*, *Holboellia*, *Parvatia*), Nandinaceae (*Nandina*), Podophyllaceae (*Podophyllum*) and Berberidaceae (*Berberis*, *Mahonia*, *Epimedium*). Bentham and Hooker (1862), and Engler and Prantl (1891) placed this family in the order Ranales; Cronquist (1968), Takhtajan (1969) and Dahlgren (1975) placed it in the order Ranunculales, while Hutchinson (1959) and Thorne (1968) included this family under a separate order Berberidales.

The first taxonomic account of the family Berberidaceae for the Indian subcontinent was published by Hooker (1872). He included 6 genera and 17 species under this family. This treatment was considered to be too general and subsequent workers split up the 17 taxa and also added many more new taxa. A revision of the genus *Berberis* was made by Schneider during 1905-08 and recorded 13 new species and one variety from Indian region. Subsequently in

Revision of Berberidaceae of India

1942 he published a monograph of section *Wallichianae* in which he recognised 71 species in 8 subsections. Chatterjee (1953) included 68 species of *Berberis*, 11 species of *Mahonia*, 1 species of *Epimedium* and 2 species of *Podophyllum* in his account. Ahrendt (1941-45) surveyed the *Berberis* spp. from Bhutan, Assam, South Tibet, Upper Burma and N.W. Yunnan, and later Ahrendt (1961) published a detailed world revision of *Berberis* and *Mahonia* species. He included 52 species and ca 43 infraspecific categories under *Berberis* and 11 species under *Mahonia* from Indian region. In a more recent study, Chamberlain and Hu (1985) again revised and the species under section *Wallichianae* and treated 11 species, including one new species (*B. victoriana*) from the Indian region. Jafri (1975) while dealing with the Berberidaceae for the *Flora of West Pakistan* included only 1 species of *Mahonia* and 15 species of *Berberis* from Kashmir region. Rao and Hajra (1993) while treating the family for the *Flora of India* included 54 species of *Berberis*, 1 species of *Epimedium* and 13 species of *Mahonia* from the Indian region. The conclusion of most of the above workers are primarily based on previous herbarium collections and often on solitary collections scattered in different herbaria. Study of the live plants in the natural habitat is rarely attempted.

Therefore, in spite of the two major revisions, the taxonomy of Indian Berberidaceae still remains in utter confusion. Added to this, perhaps because of difficulty in their correct identification and also because of the immense difficulty for their collection, this family has mostly remained neglected even by other experimental botanists in India.

Singh *et al.* (1974, 1978) have discussed the significance of epidermal structure and leaf architecture in the taxonomy of Berberidaceae. They have studied hardly 5-6 species of the family. Palynologically only 5 species of *Berberis* have been attempted (Nair, 1965) and chromosome numbers in only 9 species and 5 infraspecific categories of *Berberis* and 3 species of *Mahonia* have been reported (Kumar & Subramaniam, 1986). Population studies and genetic diversity studies in the family is almost non-existent, revealing the neglect status and the extent of gap in the knowledge of the family.

The present investigation therefore aims to solve the correct identity and taxonomy of all taxa of *Berberis* based on extensive field studies as well as study of herbarium specimens including types from various Indian and foreign herbaria. Taxonomic problem of several species-complexes have been solved. Distribution maps are provided along with the illustration of the respective species. Detailed palynological investigations have also been carried out to supplement the morphotaxonomy of the complex genus and the data will be incorporated in the second part of the article that would be published later.

R.R. Rao *et al.*

BERBERIS Linnaeus

Sp. Pl. 330. 1753; Gen. Pl. ed. 5:153. 1754; Boiss., Fl. or. 1:102. 1867; Schneid in Bull. Herb. Boiss. Ser. 28, 5:33. 48, 133-148, 391-403, 449-464, 655-670 and 800-812. 1905; *ibid.* 8.192. 1908; Ahrendt in J. Linn. Soc. Bot. 57: 1-410. 1961; Fedtsch. in Kom., Fl. U.S.S.R. 7: 553. 1937; Chatterjee in Rec. Bot. Surv. India 16(2): 1-86. 1953; Parker, For. Punjab ed. 3: 11. 1958; Jafri in Nasir & Ali, Fl. W. Pakistan 87: 4-31. 1975; Grierson & Long in Fl. Bhutan 1(2): 322-327. 1984; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinburgh 42(3): 529-557. 1985; Rao & Hajra in Sharma *et al.*, Fl. India 1: 352. 405. 1993.

Spiny shrubs, often evergreen and armed, gregarious or sporadic; wood yellow; stem or branches red-brown or pale or whitish, sulcate to almost smooth. Leaves simple, but usually show a joint where blade meets petiole in fascicles or whorls, usually obovate to oblong-elliptic, often crowded, margin denticulate-spinulose to entire, petiolate to sessile. Inflorescence short on lateral branches, umbellate, fascicled or paniced, rarely 1 or few flowered, often deflexed or hanging. Bracteoles often present, 3. Flowers yellow to orange 3-merous, pedicellate. Perianth segments usually in 3 whorls; outer 2 whorls forming the sepals; inner whorl forming the petals, each beset with 2 basal glands. Stamens 6 or 3 usually shorter than petals, sensitive; anther-locules opening by recurved valves. Ovary simple; stigma peltate, sessile or on a short style; ovules few, basal, erect. Berry few-seeded.

Distribution: INDIA, PAKISTAN, W.C. ASIA, JAPAN, S.E.ASIA AND E. AFRICA.

Key to the Indian species of *Berberis*

1. Evergreen shrubs.
 2. Fruits red, dark red or red purple (Sect. 1. *Tinctoriae*).
 3. Ovules usually 1-2.....(subject. 1. *Eutinctoriae*).
 4. Stems dark-red, when mature and terete; leaves green, epruinose below1. **B. petiolaris**
 4. Stems pale yellow, sulcate or angled; leaves below pruinose grey-white.
 5. Petals shorter than inner sepals.
 6. Stems glabrous; racemes 12-20-fld; pedicels 5-10 mm long 2. **B. tinctoria**
 6. Stems puberulous; racemes 6-12-fld; pedicels 8-18 mm long3. **B. wightiana**

Revision of Berberidaceae of India

5. Petals longer than or as long as inner sepals.
7. Petals emarginate, longer than inner sepals; stems glabrous4. **B. nilghiriensis**
7. Petals entire and as long as inner sepals; stems puberulous5. **B. huegeliana**
3. Ovules 4-5.
8. Style conspicuous 0.5-1.5 mm (subsect. 2. *Chitriae*).
9. Stems pubescent or puberulous at any rate at first6. **B. chitria**
9. Stems always quite glabrous.
10. Petals emarginate; inner sepals 8-10 mm long; racemes stiff; pedicels 2-5 mm long; fruits 12-13 mm, bright red, epruinose7. **B. coriaria**
10. Petals entire; inner sepals 4.5-8 mm long; racemes open; pedicels 6-10 mm long; fruits 9-11 mm, dark-red or with blue bloom.
11. Leaves narrow, 1:4; spines 4-6 mm solitary 8. **B. affinis**
11. Leaves broader 1: 2-2.5; spines 5-30 mm long.
12. Spines solitary, 5-10; innersepals 5-6 mm; fruits oblong.....
..... 9. **B. floribunda**
12. Spines 3-fid, 1-3 cm, inner sepals 7-8 mm, fruits ovoid.
13. Shoots green; leaves entire (or with 3-8 marginal spinules, mostly 5-9 cm long; fruit bright red pruinose blue.....
.....10. **B. aristata**
13. Shoots purple; leaves with 8-15 spinules, mostly 2-4.5 cm long; fruit dark red, pruinose blue 11. **B. macracantha**
8. Style absent.
14. Inflorescence 2-10-fld, subumbellate; or subfascicled (subsect. 3. *Umbellatae*).

R.R. Rao et al.

15. Stems puberulous12. **B. thomsoniana**
15. Stem glabrous.
16. Leaves closely reticulate, margins spinulose; subsessile or with petiole 5-8 mm14. **B. umbellata**
16. Leaves openly reticulate, entire; petiole 8-20 mm 13. **B. brandisiana**
14. Inflorescence 10-25-fld, racemose (subsect. 4. *Lindleyanae*)15. **B. kashmirana**
2. Fruits black, pruinose.
17. Flowers fascicled (Sect. 2. *Wallichianae*).
18. Stems always without spines (subsect. 1. *Insignes*).
19. Stems glabrous; anthers obtuse or truncate.
20. Petals emarginate; ovules 416. **B. insignis**
20. Petals entire; ovules 5-718. **B. incrassata**
19. Stems pubescent; anthers apiculate.
21. Stems dark red; usually without spines; leaves nitid above, leaf serrations 2-3 mm long; inflorescence usually up to 6-fld; pedicels 6-12 mm long17. **B. dasyclada**
21. Stems yellow or yellow-brown; spines 3-fld, rigid; leaves distinctly white pruinose above, dull; leaf serrations 1-1.5 mm long; inflorescence up to 13-fld; pedicels 13-15 mm long19. **B. sanei**
18. Stems always with spines.
22. Ovules 6-15 (subsect. 2. *Hookerianae*) 20. **B. Hookeri**
22. Ovules 1-5.
23. Leaves thick, rigid or stiff.

Revision of Berberidaceae of India

24. Internodes 2-8 cm long; spines 3-6 cm long; leaves scarcely revolute (subsect. 3. *Euwallichianae*).
25. Ovules 1-4.
26. Pedicels 3-4 mm long; petals shorter than outer sepals21. **B. micropetala**
26. Pedicels 6-10 mm long; petals shorter than outer sepals22. **B. wallichiana**
25. Ovules solitary, rarely 223. **B. victoriana**
24. Internodes 1.5-2.5 cm long; spines upto 2 cm long, leaves very revolute (subsect. 6. *Replicatae*)
27. Petals rounded at apex.27. **B. praecipua**
27. Petals emarginate.
28. Leaves glaucous below, not strongly revolute; shoots angled 28. **B. griffithiana**
28. Leaves distinctly white below, strongly revolute; shoots slender, terete 29. **B. replicata**
23. Leaves thin, flexible.
29. Ovules solitary (rarely 2) (subsect.4.*Sublevis*).....24. **B. sublevis**
29. Ovules 4-5 (subsect. 5. *Manipuranae*).
30. Leaves greenish, pruinose beneath 25. **B. manipurana**
30. Leaves whitish pruinose beneath 25. **B. wardii**
17. Flowers racemose-umbellate, rarely paniced. (sect. 3. *Asiaticae*).
31. Leaves thickly, fairly rigidly coriaceous30. **B. asiatica**
31. Leaves thinly subcoriaceous.
32. Stems terete.

R.R. Rao et al.

33. Young leaves with truncate base; petiole up to 4 cm long ..31. **B. hainesii**
33. Young leaves without truncate base; petiole up to 6 cm long.
34. Petals longer than inner sepals 32. **B. glaucocarpa**
34. Petals shorter than inner sepals.
35. Petals emarginate 33. **B. lycium**
35. Petals entire 34. **B. ahrendtii**
32. Stems sulcate 35. **B. parkeriana**
1. Usually deciduous shrubs.
36. Flowers large, 14-20 mm in diam.....(sect. 4. *Angulosae*).
37. Ovules 6-12 (subsects. 1&2 *Diaphanae, Euangulosae*) 36. **B. virescens**
38. Pedicels and stems pubescent; fruits globose 37. **B. angulosa**
38. Pedicels glabrous; stems pubescent or glabrous; fruits narrow.
39. Stems pubescent at any rate at first..... 40. **B. macrosepala**
39. Stems always glabrous.
40. Fruits ovoid, with bent stylose apex.
40. Fruits oblong, estylose.
41. Leaves epruinose below 41. **B. everestiana**
41. Leaves white pruinose below 38. **B. concinna**
37. Ovules 3-5 (subsect. 3 & 4 *Jaeschkeanae, Subangulosae*) ... 47. **B. orthobotrys**
42. Leaves narrowly elliptic.
43. Inflorescence 4-7-fld; berries oblong, estylose 42. **B. lambertii**
43. Inflorescence 1 rarely 2-fld; berries stylose43. **B. osmastonii**

Revision of Berberidaceae of India

42. Leaves obovate or spatulate.
44. Leaves entire or rarely spiny 44. **B. hamiltoniana**
44. Leaves spinulose.
45. Leaves 3-5; flowers 3-545. **B. jaeschkeana**
45. Leaves 6-10. flowers 5-1046. **B. apiculata**
36. Flowers usually 4-12mm in diam.
46. Inflorescence 15-30-fld. (sect. 5. *Vulgares*)48. **B. pachyacantha**
46. Inflorescence 2-10-fld.
47. Berries usually pink to red (sect. 6. *Polyanthae*, subsect. 1 *Subpolyanthae*).
48. Leaves grey pruinose below; panicles 8-17 cm long49. **B. koehneana**
48. Leaves epruinose; panicles up to 4 cm long 50. **B. kunawurensis**
47. Berries usually black sometimes blue or white.
49. Leaves fairly broad; usually entire (sect. *Heteropodae*).
50. Style conspicuous (subsect. 1. *Creticae*).
51. Inflorescence fascicled; pedicels 2-5 mm long 51. **B. cretica**
51. Inflorescence subfascicled-racemose; pedicels 5-12 mm long.....
.....52. **B. calliobotrys**
50. Style absent (subsect. 2. *Pseudumbellatae*).
52. Inflorescence umbellate or subumbellate 53.**B. pseudumbellata**
52. Inflorescence subfascicled to racemose 54. **B. royleana**
49. Leaves linear with 1-5 spinules at margins (sect. 8. *Ulicinae*)55. **B. ulicina**

R.R. Rao *et al.*

DESCRIPTION OF SPECIES

1. ***Berberis petiolaris*** Wall. ex G. Don, Gen. Syst. 1: 116. 1831; Ahrendt in J. Bot. Lond. 80(suppl.): 82. 1942; et in J. Linn. Soc. Bot. 57: 94. 1961; Chatterjee in Rec. Bot. Surv. India 16(2): 16. 1953; Rao & Naithani in Sharma *et. al.*, Fl.India 1: 385. 1993.

Type: Nepal :1818, *Wallich 1475*, part (BM).

Large shrubs; stems glabrous, terete, sublustrous, mature stems deep red, red-brown or purplish-brown; internodes 3-5 cm long; spines often absent, occasionally solitary or 3-fid, 3-13 mm long. Leaves 1.5-7 x 1.5-3 cm, obovate, ovate or obovate- oblong, apex acute or mucronate, base attenuate, petiolate; petiole 0.5-2 cm long; light green on both sides, spinous-serrate, nerves raised on both surfaces. Inflorescence racemose, 8-15 fld. ; peduncle 6-10 mm long; bracts 2.5-3 mm long. Flowers yellow; outer sepals 3.5-5 x 2-2.5 mm, ovate; inner sepals 6.5-7 x 4.5-5 mm, obovate; petals 6.5 -8 x 4-5 mm, obovate, entire, base clawed with a pair of lanceolate glands, conspicuously veined; glands 1.25 mm long. Stamens 5.5 mm long, not produced; style 1-1.5 mm long.

Notes: In Ahrendt's (1961) key to vars. of *Berberis petiolaris* the inflorescence of var. *garhwalana* has been mentioned as umbels whereas the other specimens studied have racemose inflorescence with 12-14 flowers. Ahrendt (*l.c.*) and Jafri (1975) have quoted "leaves thick in *B. petiolaris* of Nepal and comparatively thinner in *B. pachyacantha* whereas the specimens studied by us have very thin and papery leaves.

Berberis petiolaris var. *petiolaris* is reported from Nepal. The Type specimen from BM (*Wallich 1475*) quoted by Ahrendt (*l.c.*) for var. *petiolaris* has two twigs mounted side by side, the right hand twig with a few inflorescences seems to be *B. angulosa* Wall. ex Hook.f. et. Thoms. var. *fasciculata* Ahrendt but the identity of the left hand twig cannot be confirmed as it is in a very bad condition. It is possible that there might be some other specimen with the same field number (*Wallich 1475*) in BM which might be the type of *B. petiolaris* var. *petiolaris*. There is every possibility that the holotype of this taxon may consist of more than one specimen mounted on the same sheet. The specimen examined by us (*Wallich 1475*) bears an annotation slip on which is written Isotype of *B. angulosa*. *B. petiolaris* var. *petiolaris* has not been discussed in this account as it is a Nepalese species.

Key to the varieties

1. Inflorescence 8-15 flowered; glands on petals 1.25 mm long ***B. petiolaris* var. *extensa***
1. Inflorescence 3-7 flowered, umbellate; glands on petals 2mm long
 ***B. petiolaris* var. *garhwalana***

R.R. Rao *et al.*

DESCRIPTION OF SPECIES

1. ***Berberis petiolaris*** Wall. ex G. Don, Gen. Syst. 1: 116. 1831; Ahrendt in J. Bot. Lond. 80(suppl.): 82. 1942; et in J. Linn. Soc. Bot. 57: 94. 1961; Chatterjee in Rec. Bot. Surv. India 16(2): 16. 1953; Rao & Naithani in Sharma *et. al.*, Fl.India 1: 385. 1993.

Type: Nepal :1818, *Wallich 1475*, part (BM).

Large shrubs; stems glabrous, terete, sublustrous, mature stems deep red, red-brown or purplish-brown; internodes 3-5 cm long; spines often absent, occasionally solitary or 3-fid, 3-13 mm long. Leaves 1.5-7 x 1.5-3 cm, obovate, ovate or obovate-oblong, apex acute or mucronate, base attenuate, petiolate; petiole 0.5-2 cm long; light green on both sides, spinous-serrate, nerves raised on both surfaces. Inflorescence racemose, 8-15 fld. ; peduncle 6-10 mm long; bracts 2.5-3 mm long. Flowers yellow; outer sepals 3.5-5 x 2-2.5 mm, ovate; inner sepals 6.5-7 x 4.5-5 mm, obovate; petals 6.5 -8 x 4-5 mm, obovate, entire, base clawed with a pair of lanceolate glands, conspicuously veined; glands 1.25 mm long. Stamens 5.5 mm long, not produced; style 1-1.5 mm long.

Notes: In Ahrendt's (1961) key to vars. of *Berberis petiolaris* the inflorescence of var. *garhwalana* has been mentioned as umbels whereas the other specimens studied have racemose inflorescence with 12-14 flowers. Ahrendt (*l.c.*) and Jafri (1975) have quoted "leaves thick in *B. petiolaris* of Nepal and comparatively thinner in *B. pachyacantha* whereas the specimens studied by us have very thin and papery leaves.

Berberis petiolaris var. *petiolaris* is reported from Nepal. The Type specimen from BM (*Wallich 1475*) quoted by Ahrendt (*l.c.*) for var. *petiolaris* has two twigs mounted side by side, the right hand twig with a few inflorescences seems to be *B. angulosa* Wall. ex Hook.f. et. Thoms. var. *fasciculata* Ahrendt but the identity of the left hand twig cannot be confirmed as it is in a very bad condition. It is possible that there might be some other specimen with the same field number (*Wallich 1475*) in BM which might be the type of *B. petiolaris* var. *petiolaris*. There is every possibility that the holotype of this taxon may consist of more than one specimen mounted on the same sheet. The specimen examined by us (*Wallich 1475*) bears an annotation slip on which is written Isotype of *B. angulosa*. *B. petiolaris* var. *petiolaris* has not been discussed in this account as it is a Nepalese species.

Key to the varieties

1. Inflorescence 8-15 flowered; glands on petals 1.25 mm long ***B. petiolaris* var. *extensa***
1. Inflorescence 3-7 flowered, umbellate; glands on petals 2mm long
 ***B. petiolaris* var. *garhwalana***

Revision of Berberidaceae of India

B. petiolaris var. **garhwalana** Ahrendt in J. Bot.Lond. (Suppl.) 41, 80: 82. 1942; et in J. Linn. Soc. Bot. 57: 94. 1961; Chatterjee in Rec. Bot. Surv. India 16(2): 15. 1953. (Fig.1).

Type: Garhwal: Tunghasi, 8000 ft., *Strachey & Winterbottom 5* (holo -BM).

Fl. & Fr.: May-June.

Distribution: INDIA: Uttar Pradesh (Endemic).

Ecology: 2400-3000 m altitude.

Specimens examined: Uttar Pradesh: Garhwal, Uttar Kashi Dist., Near Yamnotri, 3000 m, 7.6.92, *B.Datt & B.Lal 212280* (LWG).

Notes: Ahrendt (1961) while distinguishing the varieties of *Berberis petiolaris* mentions that the inflorescence in the var. *garhwalana* is an umbel with 3-7 flowers and peduncles 7-15 mm long whereas our specimens studied (*Datt & Lal 212280*) revealed that the inflorescence is racemose-subumbellate with up to 13 flowers and up to 4 cm long peduncles.

B. petiolaris var. **extensa** Ahrendt ex Rao, Husain et B.Datt in Bot. Bull. Acad.Sin. 35:229-232. 1994.

Type: Nepal : Sialgarhi, Bhauahabisa, Khola, 300m, 19.5.1952, Polunin, *Sykes & Williams 2066* (holo-BM).

Fl.: May.

Distribution: INDIA: Uttar Pradesh; Nepal

Specimens examined: Uttar Pradesh: Tehri Garhwal, Tali, *A.K.Goel 66624* (LWG, BSD).

Notes: Var. *extensa* closely resembles var. *garhwalana* but differs in having mostly evergreen leaves, uniform pedicels, racemose inflorescence, bracts with one or two distinct serrations, and with a pair of broad ovate glands at the base of petals within.

2. Berberis tinctoria Lesch. in Mem. Mus. Paris 9:306. 1822; Fyson. Fl. South Indian Hill. St. 2: t. 10. 1932; Chatterjee in Rec. Bot. Surv. India 16(2): 15.1953; Ahrendt in J. Linn. Soc. Bot.57: 38. 1961; Rao & Naithani in Sharma et al., Fl.India 1:387.1993. (Fig.2).

Type: ?.

R.R. Rao et al.

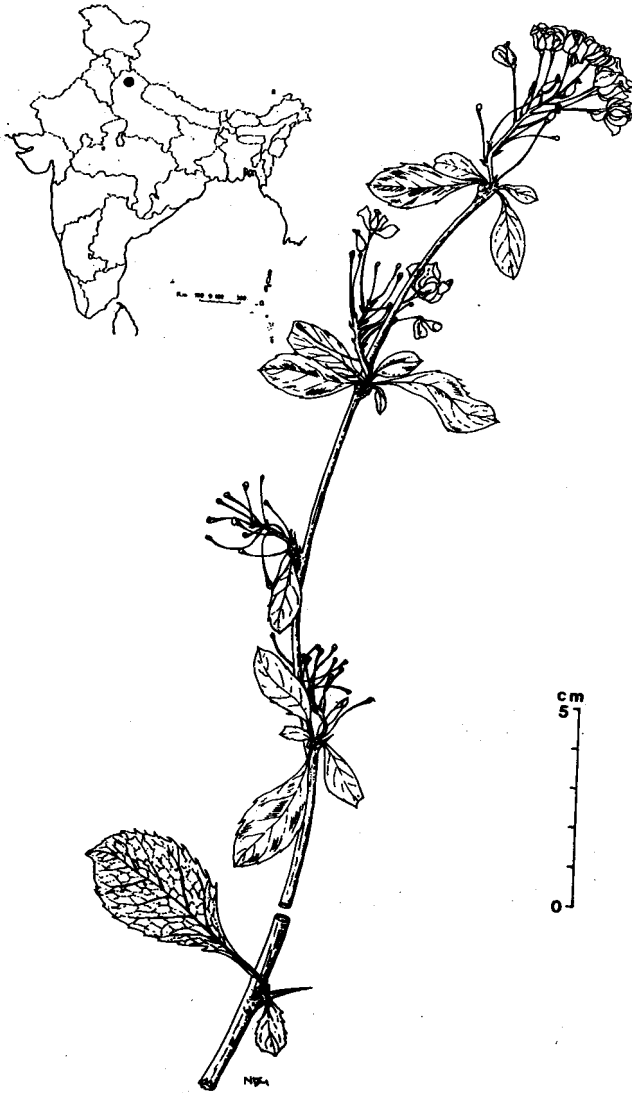


Fig. 1. *Berberis petiolaris* Wall. ex G. Don var. *garhwalana* Ahrendt
(Based on Datt & B. Lal 212280).

Revision of Berberidaceae of India

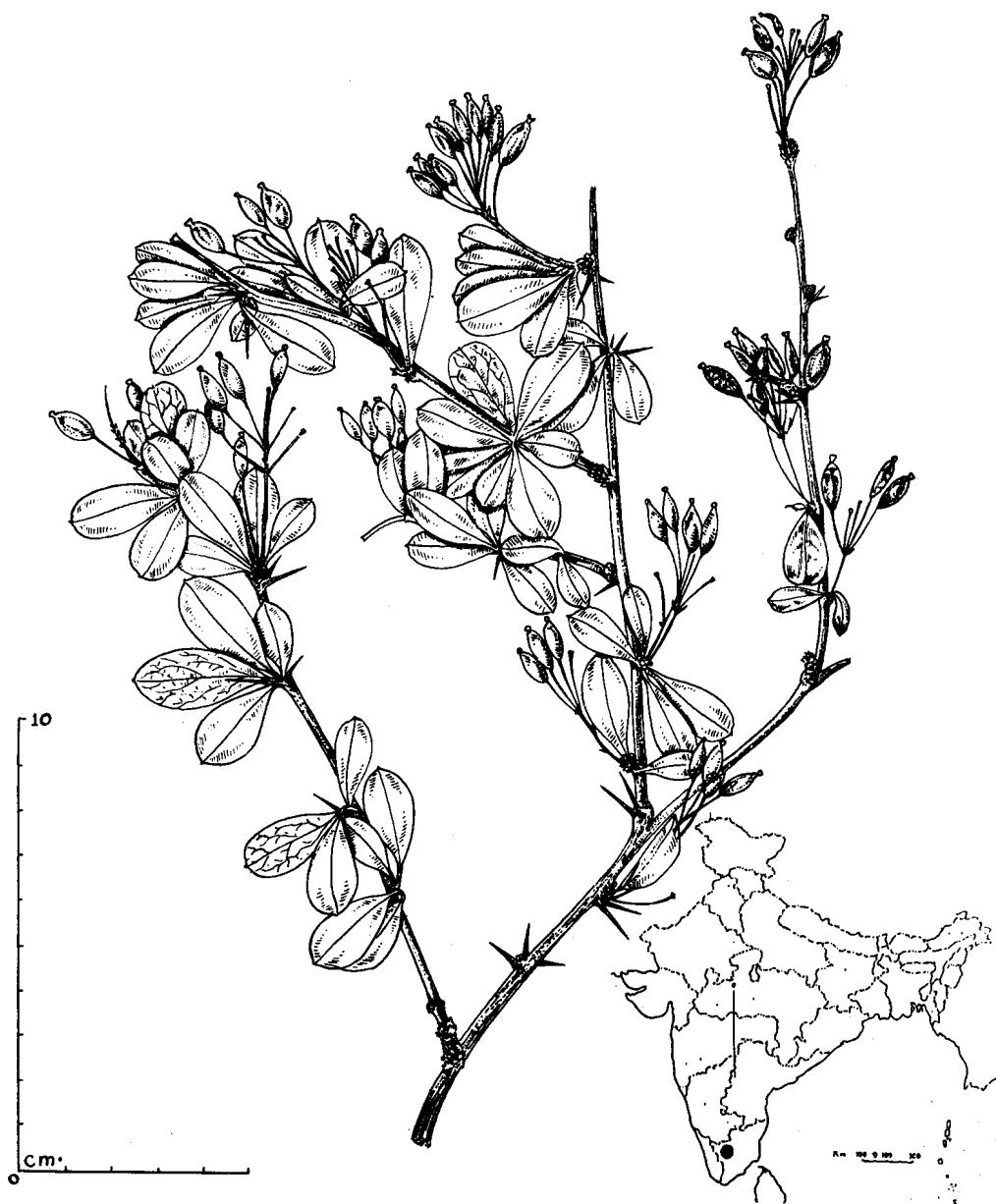


Fig. 2. *Berberis tinctoria* Lesch. (Based on K.N. Subramanian 442)

R.R. Rao *et al.*

Shrubs 1.25-5 m tall; stems glabrous, very sulcate, yellow; internodes 2-4 cm long; spines 3-fid, 1-3 cm long. Leaves 1.5-3.7 x 0.8-1.8 cm, thick, obovate, apex obtuse, mucronate, base cuneate, margins entire, rarely with 1-2 marginal spinules, veins conspicuous, dull above, papillose below; shortly petiolate. Inflorescence 8-20 flowered, racemose, 3-7.5 cm long, drooping. Pedicels 5-15 mm long, slender; prophylls 1-2 mm long. Outer sepals 2.5 x 1 mm, ovate, acute; median sepals 4 x 2.5 mm, ovate, obtuse; inner sepals 7 x 5 mm, obovate. Petals 6 x 4.5 mm, obovate, clawed with glands 1 x 0.4 mm, situated towards the base of the claw. Stamens 5 mm, shortly apiculate. Berries 9-10 x 5 mm, oblong, pruinose blue, pinkish or red, style 0.5-1 mm long.

Fl. & Fr.: Feb.-June.

Distribution: INDIA: Tamil Nadu (Nilgiri hills).

Chromosome No.: n=5 (Sobha & Ramchandran, Taxon 29: 165. 1980).

Specimens examined: Tamil Nadu: Nilgiris, Shantoor, Kelte, 20.6.1981, Z.Abraham 12405 (LWG, CDRI); Nilgiri Dt: Kiel Kundah, Pegumbu Holla; Madanad R.F., 1725 m, 3.5.1971, E.Vajravelu 38214 (MH); Upper Bhavani to Banginalla, 2200m, 7.4.1972, K.Vivekananthan 40737 (MH); Lambs rook-coonor, 1750 m, 28.4.1971, N.C.Rathakrishan 38110 (MH); Mullimund-Avalanche, 2000 m, 26.12.1970, B.V.Shetty 37600 (MH); Slope near Kodanad, 2200 m, 19.7.1970, E.Vajravelu 34906 (MH); Gymkhana forest, 1766 m, 24.3.1957, K.M.Sbastina 2605 (MH); Coonor, 900m, April 1883, Gamble 11219 (BSD); Nilgiris, Ootacamund, 12.2.1924, R.N.Parker s.n. (BSD); Nilgiri, Kodanad Forest, 7.5.1963, K.N.Subramanian 442 (BSD); Dodabetta-Ootacamund, 2400 m, 12.2.1924, R.N.Parker 2148 (BSD); Ootacamund, Near Shola Forest, 2340 m, 15.1.1951, S.K.Jain & R.C.Bharadway s.n. (BSD).

Notes: There are two specimens mounted on one sheet (*R.N.Parker s.n.*, BSD) one specimen is of *Berberis tinctoria* and the other specimen of *B.wightiana*. *Berberis tinctoria* is often confused with *B. aristata* but can be distinguished from *B. aristata* by the slender drooping pedicels and in the shape of the berries, which are sauge-shaped or eventually top-shaped, purplish and turning to dark blue with glaucous bloom and with conspicuous style and stigma.

Alkaloids like berberine and jatroridizine have been reported in this species (Chatterjee, 1953).

3. *Berberis wightiana* Schneid. in Bull. HerB. Boiss. 2(5): 452. 1905; Chatterjee in Rec. Bot. Surv. India 16(2):16.1993; Ahrendt in J. Linn. Soc. Bot. 57: 95. 1961; Rao & Naithani in Sharma *et al.*, Fl. India 1: 387. 1993. (Fig. 3).

Revision of Berberidaceae of India

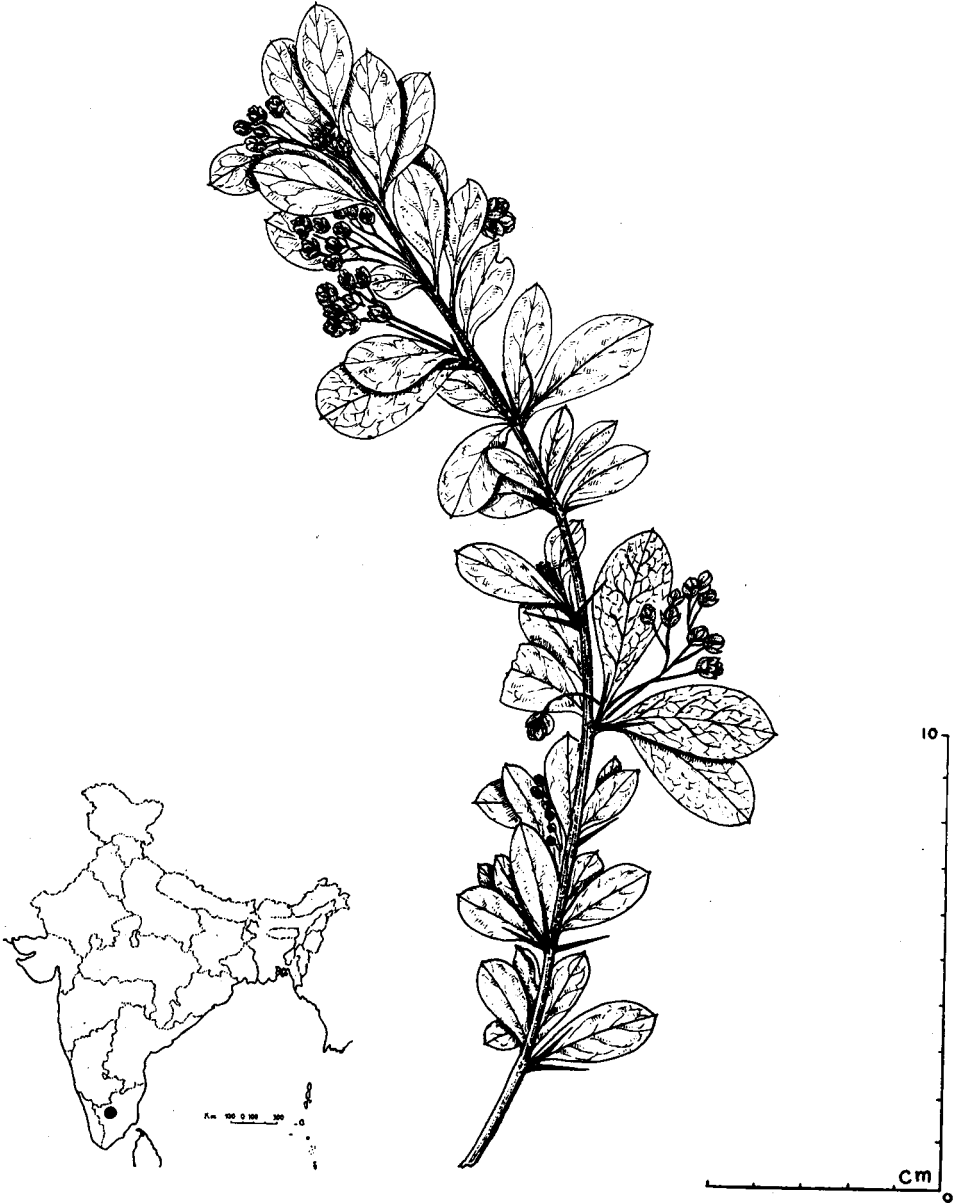


Fig. 3. *Berberis wightiana* Schneid. (Based on *R.N. Parker 2149*)

R.R. Rao et al.

Type: South India: Nilgiri Hills, Wight 50 (K).

Shrubs ca 2 m tall; stems very sulcate, pale yellow, puberulose; internodes 2-4 cm long; spines 3-fid, 1-3 cm long, sulcate. Leaves 2-4 x 1-1.5 cm, oblong-obovate, apex obtuse, sessile, thick, veins distinct, light green above, grey pruinose below, rarely with 1-2 marginal spinules. Inflorescence 7-15-fld, racemose to subumbellate-racemose, 2-4 cm long; pedicels 6-18 mm long; prophylls 1-1.2 mm long, acuminate. Outer sepals 2.5-3 x 1.25-1.5 mm, oblong-ovate, apex acute; inner sepals 4.5-5 x 2.5-3 mm, obovate, apex obtuse. Petals 4-5 x 2.5-3 mm, obovate, obtuse, glands on petals, ovate, pointed. Stamens apiculate; anthers 1.5 mm long; filaments 2.5 mm long. Ovules 2, rarely 3. Berries 8-9 x 3-4 mm narrowly obovoid, epruinose; style 1 mm long.

Fl. & Fr.: Feb. - July

Distribution: INDIA: Tamil Nadu, Nilgiri hills; SRI LANKA.

Specimens examined: Tamil Nadu, Ootacamund, Nilgiris, 480m, 12. 2. 1924, R.N.Parker 2149 (BSD); Conoor, 1650m, 18. 5. 1992, Brij Lal 210117 (LWG).

4. *Berberis nilghiriensis* Ahrendt in J. Asiat. Soc. Beng. (Sci.) (3) 11: 1. 1945; et in J.Linn. Soc. Bot. 57:94. 1961; Chatterjee in Rec. Bot. Surv. India 16(2): 17. 1953; Rao & Naithani in Sharma et. al., Fl. India 1:385. 1993. (Fig.4)

Type: South India: Nilgiri Hills, 7000 ft., 7 March 1870, Clarke 10504 (holo - K).

Shrubs; stems glabrous; internodes 1.5-3 cm long; spines 1.5-3.5 cm long. Leaves 3-4 x 1-1.5 cm, oblong - obovate, entire, reticulate, grey - pruinose below. Inflorescence racemose, 10-15 fld., including peduncle 5-8 cm long; pedicels 5-10 mm long. Prophylls 3 x 1.75 mm, red, ovate, obtuse. Outer sepals 4.25 x 2.5 mm, elliptic; inner sepals 6 x 4 mm, obovate. Petals 7 x 4 mm, obovate, acutely emarginate with rounded lobes, base clawed with linear-lanceolate glands; glands 2-3 x 0.5 mm. Stamens not produced.

Fl. & Fr.: March - June

Distribution: INDIA: Tamil Nadu, Nilgiri hills (Endemic).

Notes: This endemic species is clearly distinguished from the two other South Indian species, namely *Berberis tinctoria* and *B. wightiana* in having emarginate petals which are conspicuously longer than inner sepals. The authors were unable to locate any collections of this species in any Indian herbaria. But one of the authors had a chance to examine the type in K.

Revision of Berberidaceae of India

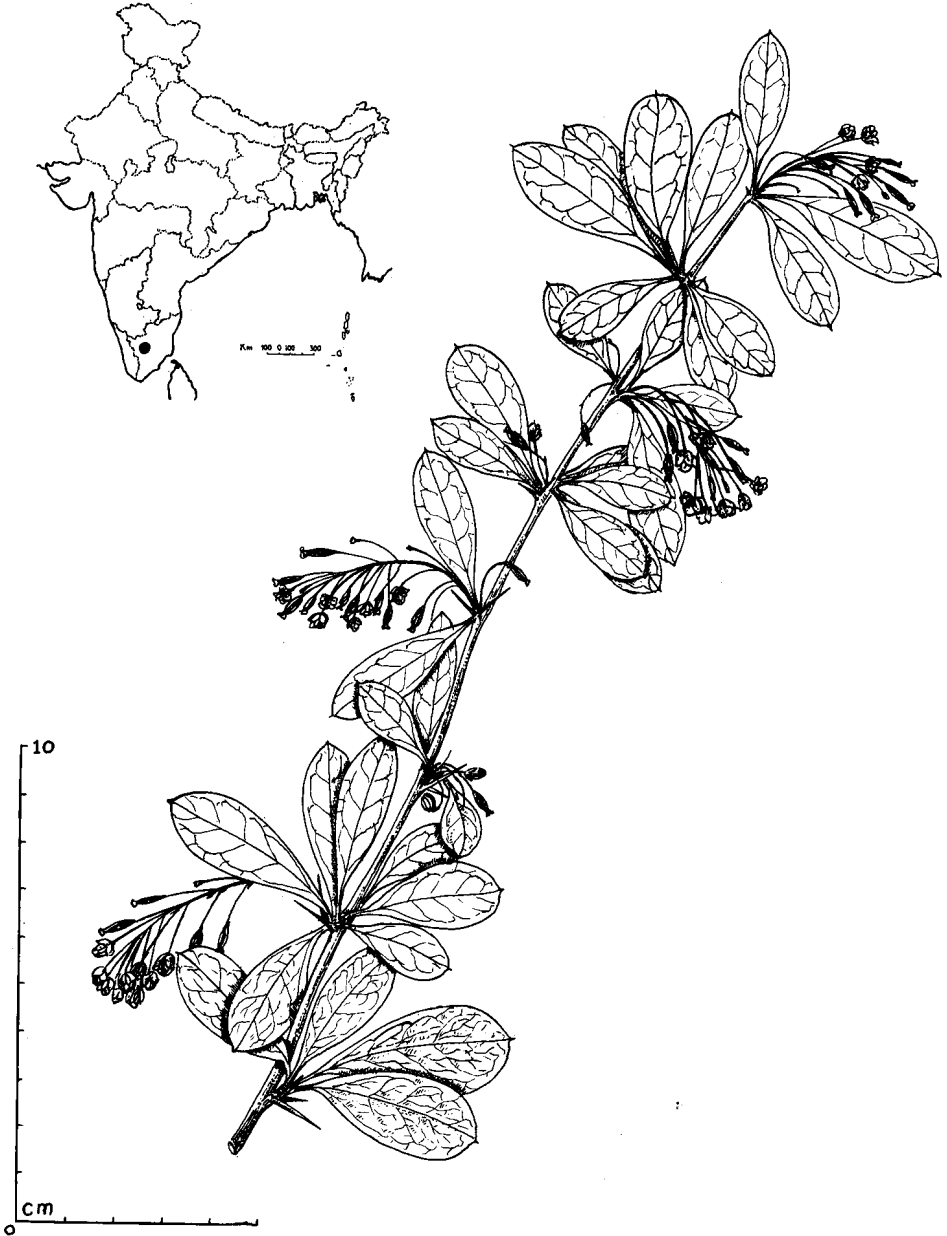


Fig. 4. *Berberis nilghiriensis* Ahrendt (Based on Type)

R.R. Rao *et al.*

5. ***Berberis huegeliana*** Schneid. in Bull. Herb. Boiss. Ser. 2, 5: 451.1905; Chatterjee in Rec. Bot. Surv. India 16(2): 15. 1953; Ahrendt in J. Linn. Soc. Bot. 57: 94. 1961; Jafri in Nasir & Ali, Fl. W. Pak. 87: 13. 1975; Singh & Kachroo, Fl. Srinagar 163. 1976; Rao & Naithani in Sharma *et al.*, Fl. India 1:384. 1993.

Type : Kashmir: *Huegel 4030* (W).

Shrubs, stems angled, puberulous, terete or subterete, pale yellow; internodes ca 2 cm long; spines 1-2 cm long, slender. Leaves 3-4.5 x 1.2-17 cm, subcoriaceous, oblong - obovate, subsessile or shortly petioled, cuneate to decurrent at base, subacute at apex, 1-4 spinulose along margins, occasionally entire. Inflorescence racemose, sometimes compound below, 10-18 fld.; peduncle ca 1 cm long. Pedicels 5-10 mm long; bracts ca 2 mm long. Inner sepals and petals both 6 mm long, entire. Style distinct. Berries not seen.

Fl.: April - May

Distribution: INDIA: Kashmir (Endemic).

Ecology: 1700-2000 m.

Specimens examined: Kashmir: Dachigam, *G.Singh 107* (Univ. of Kashmir).

Notes: According to Jafri *et al.* (1975) "this species resembles *Berberis lycium* in stem and to some extent in leaf characters, but with only 1-2 ovules, inflorescence racemose - paniculate and berries red". Further, Jafri (l.c.) following Ahrendt, mentions the colour of fruits as red in the key whereas in description says "Fruits unknown".

6. ***Berberis chitria*** Lindl. in Bot. Reg. 9:t.729. 1823; Chatterjee in Rec. Bot. Surv. India 16(2): 18. 1953; Parker, For. Fl. Punj. (rep.ed.) 12. 1958 (partly); Ahrendt in J. Linn. Soc. Bot. 57: 97. f. 15 1967. Jafri in Nasir & Ali, Fl. W. Pak. 87: 14. f. 4,A-B. 1975; Banerjee in Sharma *et al.*, Fl. India 1: 381. 1993. (Fig. 5)

B. aristata sensu (auct. non DC.) Hook.f. & Thoms., in Hook. f., Fl. Brit. India 1: 110. 1872.

B. chitria Lindl. var. *occidentalis* Ahrendt in J. Bot. Lond. 80 (suppl.): 85. 1942; et in J. Linn. Soc. Bot. 57: 38. 1961.

Type: ?

Shrubs 2-4 m tall; stems terete or angled; shoots pubescent, dark reddish-brown, mature puberulous or subglabrous; internodes 3-5 cm long; spines 3-fid, rarely 1-fid, 1-2 cm long, stout. Leaves 4.5-10 x 2-3 cm, obovate or elliptic, subsessile, apex mucronate, base cuneate, both surfaces papillose, and with with elevated venation, dull green above, usually 3-9

Revision of Berberidaceae of India

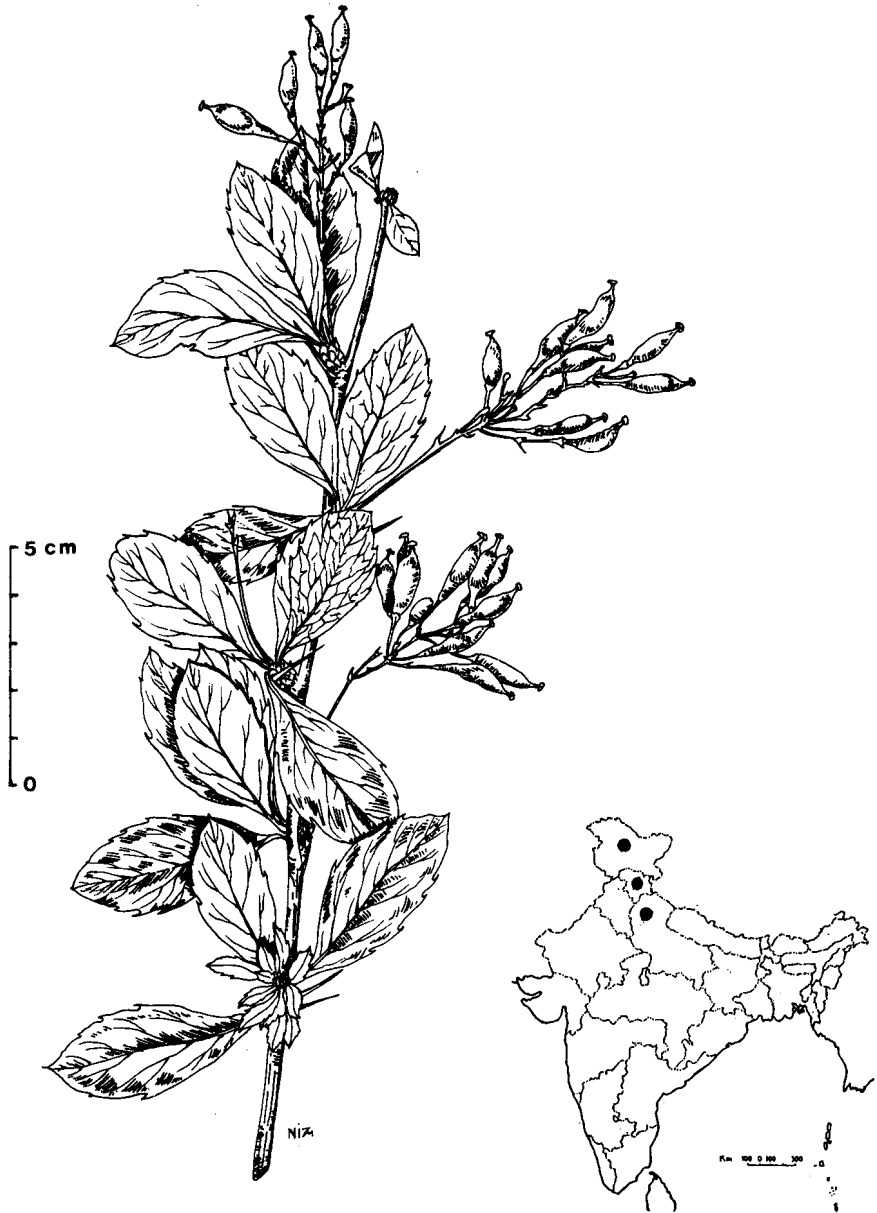


Fig. 5. *Berberis chitria* Lindl. (Based on B.N. Mahrotra 66)

R.R. Rao et al.

spinulose at the margin. Inflorescence 8-20-flowered, loosely corymbose paniculate, with flowers formally in groups of three; 5-13 cm long, including peduncle 1.5-6 cm, drooping, glabrous; bracts 1.5-3 mm long. Flowers yellow, 12-18 mm across, pedicels 8-15 mm long, drooping. Outer sepals 6-7 x 5-6 mm, obovate; inner sepals 9-10 x 7.5-9 mm, obovate. Petals broadly elliptic, 8-9 x 6-7 mm, apex subacutely emarginate with rounded lobes; base cuneate with oblong-elliptic glands, 1.2 x 0.6 mm. Stamens 7 mm, subapiculate at apex. Ovules 4-5, with longer stipes. Berries 10-12 x 14-6 mm, dark red-brown or red, narrowly ovoid or oblong-ellipsoid, epruinose, excluding 1-1.5 mm long style.

Fl. & Fr.: May-Sept.

Distribution: INDIA: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh; NEPAL.

Ecology: 900-3000 m in W. Himalaya.

Specimens examined: Jammu & Kashmir: Mashadi, 11.8.1986, *P.K.Hajra* 82395 (BSD). Himachal Pradesh: Sirmaur dist. (Rajgarh): 29.7.1986, *R.S. Karki* 82069 (BSD); Solan Dist. (Brog), 25.5.1986, *P.C. Pant* 80748 (BSD); Sarhan, 1850m, 25.5.1962, *N.C. Nair* 21866 (BSD); Nankheeri, 8.6.1952, *G.S. Puri* 21024 (BSD); Shimla, 2100 m, 6.8.1977, *Gamble* 4329 D (CAL.). Uttar Pradesh: Mussoorie, Mossy fall, 12.8.1978, *G. Panigrahi & B.M. Wadhwa* 64933 (BSD); Pithoragarh Dist., Dafia Dhoorh top, 2500 m, 22.5.1979, *C.M.Arora* 66181 (BSD); Tehri-Garhwal, Magra, 1800 m, 31.5.1978, *A.K.Goel* 63941 (BSD); Garhwal, Anusuryia Deris, 2700 m, 24.5.1971, *B.D.Naithani* 44003 (BSD); Kumaon: Daffia top, 2500 m, 5.8.1972, *C.M.Arora* 49606 (BSD); Rathi, 2500m, 29.4.1962, *U.C.Bhatt* 21307 (BSD); Askote, 1800m, 3.5.1972, *U.C.Bhatt* 21372 (BSD); Girgaon-Kalamuni, 14.6.1963, *P.C.Pant* (BSD); Chamoli, Diwalikhal, 2000m, 18.9.1985, *H.J.Chowdhury* 73167 (BSD); Pauri Dist., Bubakhet, 1750m, 5.6.1975, *B.S.Aswal* 55422 (BSD); Tehri Dist., Nagtibba, 3200 m, 3.6.1978, *A.K.Goel* 64033 (BSD); Almora Dist., Ranikhet, *B.M.Wadhwa* 57247 (BSD); Chamoli, 20.6.1979, *B.D.Naithani* 68040 (BSD); Kumaon; Nainital: way to CHina peak, 16.5.1965, *s.l.* 695 (LWG, CDRI); way to China Peak, 2400m. 22.10.1963, *B.N.Mehrotra* 66 (LWG, CDRI) Loharkhet/Khathi, 20.9.1957, *T.A. Rao* 4237 (BSD); Champawat, 7.5.1961, *U.C.Bhatt* 14960 (BSD); Cheena Peak, 14.3.1961, *M.A.Rao* 14130 (BSD); Sirkha, 2100 m, 18.6.1960, *T.A. Rao* 11939 (BSD); Pithoragarh, Kalamuni pass, 3000 m, *C.L.Malhotra* 72597 (BSD); Garhwal: Mussorie (Jabbarkhet), 1900m, 21.4.1966, *U.C.Bhatt* 34885 (BSD); Lal Tibba, 2160m, 5.6.1967, *P.Pradhan* 94 (BSD); Lohajung, 27.9.1963, *U.C.Bhatt* 30828 (BSD); Anantganga, 28.4.1971, *B.D.Naithani* 47914 (BSD); Pauri-Garhwal. Pauri-Khirsu, *S.K. Murti* 78659 (BSD); Tehri Garhwal. Chuthi, 9.6.1972, *B.D.Naithani* 48659 (BSD); Mussoori, 200m, 12.8.1963, *H.Santapau* 28549 (BSD); Paridar Katli, 264m, 11.6.1913, *A.E. Osmaston* 211 (BSD); Kedarnath Valley, 2400-3000m, *Sadanand s.n.* (BSD); Molla kaliphat, 2250 m, 23.10.1914. *Hira Singh* 278 (BSD); Jaunsar-Deaoban, 2400 m, *N.L.Bor* 13069 (BSD); Uttarkashi; below Dodital,

Revision of Berberidaceae of India

25.6.1956, *K.C. Sahni 24796* (BSD); Near- Biph Yamuna Forest Div., 2400 m, 31.5.1960, *K.C. Sahni 26873* (BSD); Chamoli: Dougalvitta, 2500m, 7.9.1988, *A.K.Goel 17979* (LWG, CDRI) Pauri, Binsar forest 7.9.1984, *M.P. Sharma 15065* (LWG, CDRI), Jaunsar-Deoban, 2550 m, 29.5.1914, *R.S. Hole s.n.* (BSD); Podyar, 2460 m, 28.5.1936, *C.E.Parkinson 23636* (BSD); Mussoorie, 1950 m, June 1898, *Duthie s.n.* (BSD); Mussoorie, 4.5.1959, *M.B. Raizada s.n.* (BSD): Mussoorie, on Mossey fall, 1620 m, 24.5.1960, *H.O. Saxena 613* (BSD); Mussoorie, Camel's back, June 1933, *C.E. Parkinson 16* (BSD); Amritganga valley, 29.6.1971, *B.D.Naithani 44063* (CAL); Sitapur, 21.5.1972, *B.D. Naithani 47914* (CAL); Bahri Udyar, Baicha, 6.8.1972, *M. Arora 49638* (CAL); Dalia top, 5.8. 1972, *C.M. Arora 49606* (SIKKIM); Deoban, Ashar Hasain 6 (CAL); below Bakriudyardt, 8.8.1972, *C.M.Arora 49724* (CAL); Tehri Garhwal, Chutter, 9.6.1972, *B.D.Naithani 48214* (CAL); Mandakini valley, Batwalchari 900 m, 18.4.1973, *B.N.Mehrotra 3917* (LWG) Jaunsar, Lokar, 225 cm, 1891, *J.S. Gamble 22800* (CAL); Tehri Garhwal, between Semidiardiard & Aura, May 1879, 1500-1800 m, *Duthie 1014* (CAL); Jaunsar-Bawar, Deoban, 2100-2400m, 19.5.1979, *s.l. s.n.* (CAL); Kumaon: Sirkla, 10.6.1960, *T.A. Rao 11723* (CAL); Pithoragarh, 25.9.1900, *Inayat 24217* (BSD); Pindar valley Almora, 2280m, 9.6.1935, *C.E.Parkinson 4373* (BSD): above Bhimtal, 1500 m, 10.9.1883, *Duithie 3812* (BSD); Nanital, Laria-Kanta, 2310m, 1.6.1913, *U. Dutt 57* (BSD);

Notes: Ahrendt (1961) had separated var. *occidentalis* from the variety proper based on only characters of leaf and fruits which might be variable; lateron Ali (1975) has merged the var. *occidentalis* under var. *chitria* stating that the "var. *occidentalis*, which also includes Kashmir plants and is said to have smaller, entire leaves (2-4.5 cm long) and broader fruits (12 x 6 mm) is not different from it. While examining the Indian material it could be concluded that the two varieties are not much different except for the above mentioned characters, thus they have been kept under one.

7. *Berberis coriaria* Royle ex Lindl. in Bot. Reg. 27: t. 46. 1841; Ahrendt in J. Bot. Lond. 80 (Supl.): 89. 1942; et in J. Linn. Soc. Bot. 57: 102. f. 16. 1961; Chatterjee in Rec. Bot. Surv. India 16(2): 20. 1953; Banerjee in Sharma et. al., Fl. India 1:382; 1993.

Shrubs ca.2.5-3 m tall; stems glabrous, angled, mature yellow; internodes 2.2-3 cm long; spines 3-fid, 1-1.7 cm long, stout, central one longer than the laterals. Leaves 5-8 at each node, 1.9-3.4 x 0.6-1 cm, elliptic or obovate-oblong, apex acute or mucronate, cuneate, subsessile, margins entire; veins raised on the upper surface, subcoriaceous. Inflorescences 5-20- fld., racemose, with 1-2 additional flowers at the base; peduncle 0.6-0.9 cm long. Flowers 1-1.5 cm in diam., sepals in two whorls; outer sepals 6-7 x 3-4 mm, oblong to obovate, subacute; inner sepals 7.5-8.5 x 4-6.5 mm, obovate, subacute. Petals 6-7 x 3-5 mm, oblong, emarginate, base clawed with a pair of glands, conspicuously 3-veined. Anthers 2 mm long, apiculate; filaments 2 mm long. Ovules 4-5. Berries bright red, epruinose, oblong, stylose; style 1-1.5 mm long, ash coloured.

R.R. Rao *et al.***Key to the varieties**

1. Racemes dense, rigid, 4-5 cm; pedicels 3-5 mm; bracts dentate; leaves slightly coriaceous **B. coriaria** var. **coriaria**
1. Racemes lax, 5-8 cm; pedicels 6-12 mm; bracts entire; leaves thickly coriaceous **B. coriaria** var. **patula**

B. coriaria var. **coriaria***Type: ?**Fl. & Fr.:* May - Oct.*Distribution:* INDIA: Himalayas, 2200 - 3000m, Himachal Pradesh, Uttar Pradesh; NEPAL.*Ecology:* 2200-3000 m in the Himalayas.

Specimens examined : Himachal Pradesh : Pangi, 2850m, 7.6.1962, *N.C. Nair* 22548 (BSD); Shimla, 2400 m, June, 1881, *D. Brandis* s.n. (DD); Nagkanda, 2700m, 1.6.1878, *J.S.Gamble* 6131B (DD); Simla, 11.7.1877, *J.S.Gamble* 4583B (SIKKIM). Uttar Pradesh: Garhwal: Chamoli, Mangr area, 2500m, May, 1973, *B.D.Naithani* 481114 (LWG, BSD); Uttarkashi Dist., near Yamnotri, 3000m, 7.6.1992, *B. Datt & B. Lal* 212279 A (LWG); Anantgang Valley, 3000m, 11.10.1970, *B.D.Naithani* 42141 (BSD); Tehri, way to Kushkalayan, 2700-2800 m, 24.9.1994, *M.V.Vishwanathan* 54917 (BSD); Near Wan, 2200 m, 1.5.1967, *U.C.Bhattacharyya* 137222 (BSD); Tehri Garhwal, way to Ghuthu, 2500m, 8.6.1972, *B.D.Naithani* 48205 (BSD); Jaunsar, May 1894, 1894, *F.W.Forster* 17019 (Sikkim); Tehri Garhwal 20.5.1893, *Duthie* 17165 (Sikkim); Jaunsor Bodyer, May, 1892, *J.S.Gamble* 27822 (Sikkim); Deoban, May, 1892, *J.S.Gamble* 27822 (Sikkim); Deoban, May, 1892, *J.S.Gamble* 23802 (Sikkim); Jaunsor, Badya, April, 1892, *J.S.Gamble* 93822 (Sikkim); Kumaon: Pithoragarh, Chaudans, 13.7.1886, *J.F.Duthie* 5310 (DD); Nainital, Kalingot, 2400m, 28.5.1914, *Hira Singh* 184 (DD);

B. coriaria var. **patula** Ahrendt in *J. Bot. Lond.* 80 (Suppl.): 91. 1942; et in *J. Linn. Soc. (Bot.)* 57 (369): 102. 1961; Banerjee in Sharma *et al.*, *Fl. India* 1:382. 1993.

*Type: ?**Distribution:* INDIA: Himalayas, Uttar Pradesh; Endemic

Specimens examined: Uttar Pradesh: Garhwal: Uttarkashi Dist., near Naradchatti on way to Yamnotri, 2300 m, 8.6.1992, *B.Datt & B.Lal* 212275 (LWG); Uttarkashi Dist. Near

Revision of Berberidaceae of India

Yamnotri, 3000 m, 7.6.1992, *B.Datt & B.Lal 212279B* (LWG); Harkidun, June, 1893, *J.S.Gamble 24329* (SIKKIM); Bodyar, April, 1892, *J.S.Gamble 23549* (SIKKIM); Kumaon: Sosa, 13.7.1886, *Duthie 5310* (SIMMIM).

Notes: Ahrendt (p. 102. 1961) mentions stem yellow in *Berberis coriaria* under the description, whereas Chatterjee (p.17 1953) mentions stem dark purple under key. The specimens examined by us clearly show the mature stems yellow or greyish supporting Ahrendt (l.c.). In var. *patula* lower leaves are distinctly serrate on the terminal portion.

8. ***Berberis affinis*** G.Don, Gen. Syst. 1:115. 1831; Chatterjee in Rec. Bot. Surv. India 16(2): 19. 1953; Ahrendt in J.Linn. Soc. Bot. 57: 100. 1961; Banerjee in Sharma et al., Fl. India 1:380. 1993.

B. floribunda Wall. ex G. Don var. *affinis* Ahrendt in J.Bot. Lond. 80 (Suppl): 89. 1942.

Type: ?

Stems glabrous, terete or subangled, pale yellow; internodes upto 5 cm long; spines 1-3, upto 5 mm long, absent or very weak. Leaves 4-7 x 1-2 cm, oblanceolate, attenuate and shortly petioled at base, narrowly acuminate at apex, entire, soft spinulose at apex. Inflorescence racemose, 10-25- fld, upto 7.5 cm long, including peduncle 1-2 cm long. Pedicels 6-8 mm long; bracts 2-3.5 mm, linear. Flowers 8-9 mm in diameter. Berries 9-11 mm in diameter, linear, ovoid, stylose; style 1 mm long.

Fl.: March-July.

Distribution: INDIA: Uttar Pradesh (Endemic).

Ecology: 2300-3200 m in W. Himalaya.

Specimens examined: Uttar Pradesh: E. Kumaon: Lili, 3150 m, March 1920, *W.J.Lambert 21739* (DD); Almora, Dwali, 2700 m, July 1920, *W.J. Lambert s.n.* (DD); Namik, 2310 m, 17.1.1844, *Strachey & Winterbottom 4* (SIKKIM)

9. ***Berberis floribunda*** Wall. ex G.Don, Gen. Syst. 1:115. 1831; Chatterjee in Rec. Bot. Surv. India 16(2): 19. 1953; Ahrendt in J. Linn. Soc. Bot. 57:101. 1961; Benerjee in Sharma et al., Fl. India 1:381. 1983.

B. umbellata Lindl. in Bot. Reg. 30: t. 44 1844, (non Wall. ex G.Don, 1831); Hook . f. & Thoms. in Hook. f., Fl. Brit. India 1: 110. 1872.

Type: Wallich 1474 (4A, 5B) (K)

R.R. Rao et al.

Shrubs; stem glabrous, pale yellow, terete or subterete, sparsely and distinctly verruculose; nodes swollen; internodes 2.5-4 cm long; spines 4-10 mm long, absent or solitary, rarely upto 2 at the base. Leaves 3-5.2 x 1.5-2.3 cm, 5 at each node, unequal, obovate, lanceolate to elliptic, attenuate at base, entire or rarely with a few spinules along margins, subacute to obtuse at apex, distinctly reticulate on both surfaces, papillose on both the surfaces. Inflorescence racemose, 10- 25-fld; mostly sessile. Pedicels ca 6 mm long; bracts 1-2 mm long acuminate. Outer sepals 2.5 x 1.5 mm, oblong - ovate, subacute; median sepals 4 x 3 mm, elliptic; inner sepals 6 x 4.5 mm, obovate oblong - elliptic. Petals entire, clawed at base, glandular. Stamens 3-4 mm long, truncate or rounded - truncate. Ovules 4-5. Berries 6.5 - 7.5 x 4.5-5 mm, broadly oblong - ellipsoid, dark red, finally almost purple, pruinose blue, stylose; style 0.5 mm long.

Fl. & Fr.: May - Sept.

Distribution: INDIA: Himachal Pradesh, Uttar Pradesh. NEPAL

Ecology: Himalayas, 2700-3500 m.

Specimens examined: Uttar Pradesh: Garhwal: Chamoli, Bheyandar valley, 2700 m, 23.9.1963, *U.C.Bhattacharyya* 29650 (BSD); Thinigaon, Muktinatn, 24.6.1954, *Stainton, Sykes & Williams* 1378 (SIKKIM).

10. *Berberis aristata* DC., Syst. Nat. 2: 8. 1821; Hook.f. & Thoms. in Hook. f., Fl. Brit India 1:110. 1872, p.p.; Ahrendt in J. Bot. Lond. 80 (Suppl.) 91. 1942; et in J. Linn. Soc. Bot. 57: 101. 1961; Chatterjee in Rec. Bot. Surv. India 16(2): 20. 1953; Grierson & Long, Fl. Bhutan 1(2): 326. 1984; Banerjee in Sharma et al., Fl. India 1:381. 1993. (Fig. 6).

B. sikkimensis (Schneid.) Ahrendt in J.Bot. Lond. 80 (Suppl.): 85. 1942; Sealy in Bot. Mag. 168, N.S., t. 173. 1957; Ahrendt in J.Linn. Soc. Bot. 57: 99. 1961; Banerjee in Sharma et al., Fl. India 1:383. 1993. Type: Sikkim: Larhoery, 9000 ft, 27 Aug. 1849, *Hooker & Thomson s.n.* (K).

B. chitria Lindl. var. *sikkimensis* Schneid. in Fedde, Report. Spec. Nov. 46: 248. 1939.

B. micrantha (Hook. f. & Thoms.) Ahrendt in Gard. Illus. 64: 426. 1944; et in J. Linn. Soc. Bot. 57: 96. 1961; Rao & Naithani in Sharma et al., Fl. India 1: 383. 1993. Type: Bhutan: 1838, *Griffith 1744* (K).

B. aristata var. *micrantha* Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1:110. 1872, p.p.

B. ceratophylla G. Don, Syst. Gard. 1: 115. 1831; Ahrendt in J. Asiat. Soc. Beng. (Sci.) (3) 11, 1945.

Revision of Berberidaceae of India

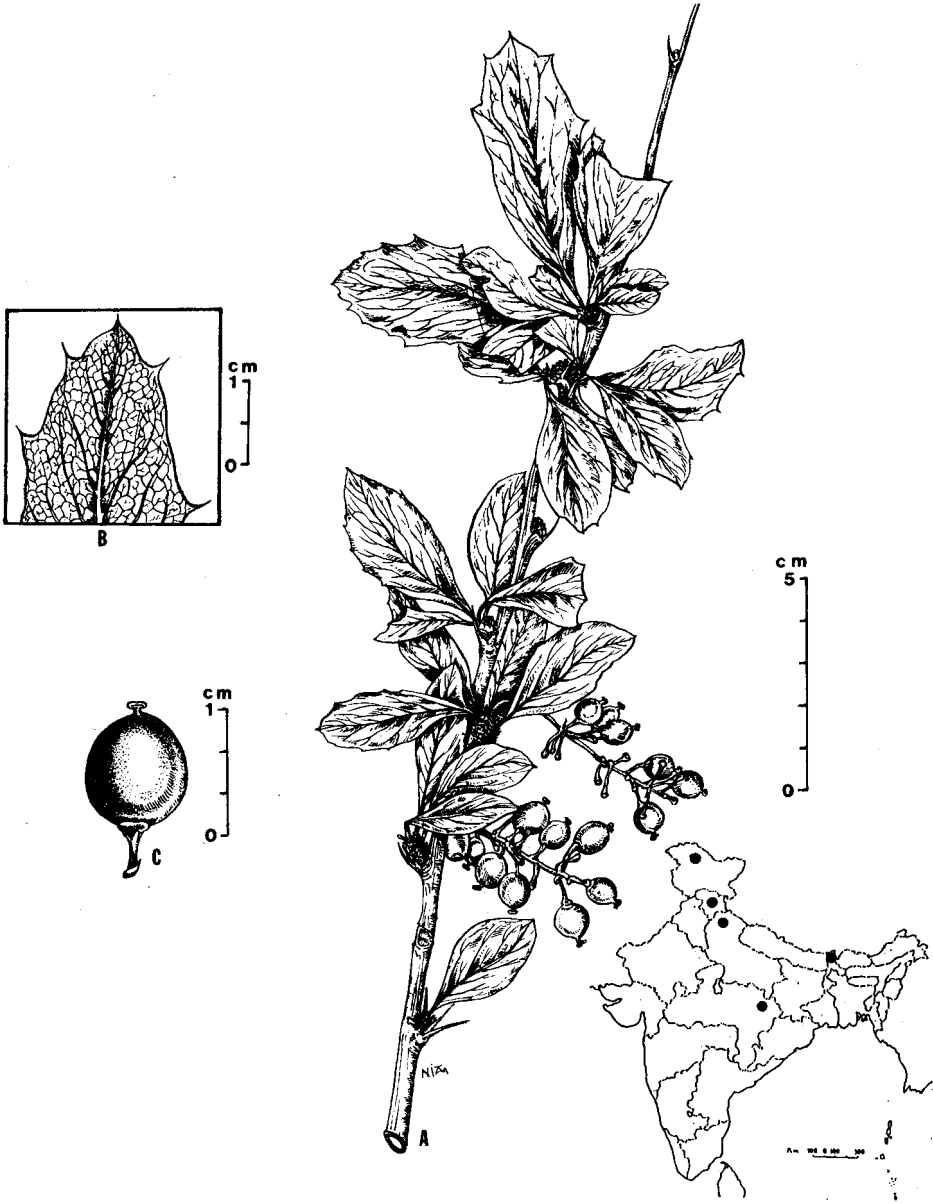


Fig. 6. *Berberis aristata* DC. A. Fruiting branch; B. A portion of the leaf enlarged; C. Fruit (from K.P. Janardhanan 48496)

R.R. Rao et al.

Type: ?

Shrubs 1-3 m, deciduous, stems grooved glabrous, pale yellow, terete; internodes 3-6 cm long; spines fairly stout, 1-3 cm, solitary towards apex of stems, 2-3-fid at base. Leaves 2-8 x 0.7-3 cm, obovate to obovate-elliptic, mucronate, at apex subacute to acute, base cuneate, coriaceous, shortly petiolate, petiole 3-4 mm long, margins entire or with a few spinous teeth near apex, prominently veined. Racemes 8-25-fl., 4-10 cm long, including peduncle 1-5 cm long. Pedicels 5-10 mm long; bracts 3 x 0.8 mm. Flowers 11-14 mm in diam; outer sepals 1.5-3 x 1 mm, ovate; median sepals 5-6 x 2-3 mm, narrowly ovate to elliptic, inner sepals 5-8 x 3-5 mm, obovate. Petals 6-7 x 3-4 mm, obovate to oblong-obovate, entire, base cuneate; glands 1.2 x 0.4 mm, non marginal. Stamens 4.5-5.5 mm, shortly apiculate. Ovules 4-5. Berries 7-11 x 6-7 mm, ovoid to oblong-ovoid, bright red, slightly pruinose blue, stylose; style 1 mm long.

Fl. & Fr.: May - Oct.

Distribution: INDIA: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim, Madhya Pradesh, Tamil Nadu, NEPAL and BHUTAN.

Specimens examined: Jammu & Kashmir: Kashmir Ranikhet, R.A. Quzi s.n. (KASHMIR)- not seen); Dras valley, 3000-3300m, 1.7.1892, J.F. Duthie 11713 (SIKKIM). Himachal Pradesh: Sangla, above P.W.D. Rest house, 6.8.1973, K.P. Janardhanan 48496 (BSD); Sarahan, 2400 m, 26.5.1962, N.C. Nair 21894 (BSD); Simla (Kolagarh), 13.6.1911, R.S. Hole 3257 (DD); Chambre, Kajar, 1890 m, 4.6.1919, R.N. Parker s.n. (DD); Chamba, June, 1898, J.H. Lace 1798 (CAL); Chamba, June, 1899, J.H. Lace 2095 (CAL); Simla, Oct., 1907, A. Meebold 5083 (CAL); Chamba, 17.6.1969, D. Brandis 3424 (CAL). Uttar Pradesh: Garhwal: Tehri Garhwal: Sanchatti, 2000 m, 12.6.1961, M.A. Rao 15676 (BSD); Uttarkashi: Bhairoghati, 3000 m, July 1988, B.D. Naithani 70787 (BSD); Hanumanhatti, 2400 m; 27.6.1957, Y.K. Sarin & M.A. Rao 2828 (BSD); Near Beeph village on way to Jamnotri, 2500 m, 16.6.1961, M.A. Rao 15768 (BSD); Phulchatti (on way to Jamnotri), 13.6.1961, M.A. Rao 15686 (BSD); Chamoli: Bhyunder valley, 2400 m, 1.10.1962, U.C. Bhatt 24234 (BSD); near Okhimath, 4.6.1978, A.S. Rao 58441 (BSD); Pauri: Buwaknal, 1650 m, 26.5.1980, A.A. Ansari & Ghana Nand 69059 (BSD); Chamoli: Bhyunder Valley, 2100 m, 29.4.1914, A.E. Osmaston 295/8886 (DD); Trijuginarain, 2250 m, 7.11.1914, A.E. Osmaston 623 (DD); Jhelam Dhauri Valley, 3150 m, 10.6.1914, A.E. Osmaston 351 (DD); Mussoorie, 20.6.1870, s.l. 16992 (CAL); June, 1869, G. King s.n. (CAL); Jamnotri, Phulchatti, 13.6.1961, Stainton Sykes & Williams 15686 (Sikkim); Mussoori, 21.5.1900, M.A. Rao (Sikkim); 10.9.1885, Duthie 3811 (CAL); Mussoorie, 2.8.1963, H. Santapau 28549 (CAL); Tehri Garhwal, Shanchatti, 12.6.1961, H. Santapau 15663 (Sikkim); Kumaon: Furkia-Dwali, 3000-3500 m, 25.9.1957, T.A. Rao 4608 (BSD); Ranikhet, 1680 m, 1.10.1963, B.M. Wadhwa 57263 (BSD); Pithoragarh, Byan-Budhikali Valley, 25.5.1913, I.H. Lyall 58 (DD); Pithoragarh, 15.9.1900, Inayat 24217 (CAL); Sirkha, 18.6.1969, T.A. Rao 939 (CAL). Sikkim: Lachen, 2250m, 7.7.1909,

Revision of Berberidaceae of India

Smith & Cave 976 (Sikkim). Madhya Pradesh: Pachmarhi: 18.2.1891, *Duthie 10302* (CAL). Tamil Nadu: Nilgiris, Dhumkini, 24.2.1978, *D.K.Hore 506* (CAL).

Notes: Grierson & Long (1984) have merged *Berberis sikkimensis* under this species even Ahrendt (1961) was not sure when he kept these two species separate. Further Grierson & Long (l.c.) were not sure whether *B. micrantha* (Hook.f. & Thoms.) Ahrendt under *B. aristata* or it should be treated as a distinct species thus they have put a question mark while citing *B. micrantha* under *B. aristata*. We have cited *B. micrantha* as a synonym of *B. arisaema*.

11. ***Berberis macracantha*** Schrandner in *Linnaea* 12: 366. 1838; Schneid. in *Mitt. Dtsch. Dendr. Ges.* 14: 176. 1907; et in *J. Arn. Arb.* 4: 200. 1923; Ahrendt in *J. Linn. Soc. Bot.* 57: 101. 1961. (Fig. 7)

Shrubs 1.5-2 m in height, evergreen; stem stout, sulcate, pale yellow, slightly angular; young shoots purplish; internodes 1.5-3.5 cm long; spines 1.5-3.5 cm long, 3-fid, sulcate, fairly stout. Leaves usually 6, evergreen, 2-4.5 x 1-2 cm, obovate-elliptic, obtuse, mucronate, base attenuate, margins entire or with 5-15 spinose serrations (spines 0.5-1.5 mm), below dull green, above bright green. Inflorescence racemose, loose, 8-25-fld; peduncle 1-1.5 cm long, glabrous, pale purplish. Pedicel about 5 mm long, glabrous. Flowers not seen. Ovules 2-4. Berries 8-12 x 5-6 mm, dark red, ellipsoid to ovoid stylose; style short upto 0.5 mm long, slightly pruinose.
Fr.: Oct.

Distribution: INDIA: Uttar Pradesh.

Specimens examined: Uttar Pradesh; Chamoli Distt., Tungnath, 2700 m, 17.10.1992, *T. Husain & B. Datt 210593* (LWG).

Notes: This specimen collected from Tungnath (Chamoli) at altitude 3600 m seems to be a hybrid between *B. chitria* and *B. vulgaris* which is growing in natural conditions very luxuriantly. This species forms a first report in India.

Petiole in our specimen seems to be much shorter than as mentioned by Ahrendt (1961) i.e., petiole upto 1 cm long.

12. ***Berberis thomsoniana*** Schneid. in *Bull. HerB. Boiss. Ser.* 2, 5: 8. 1905; Chatterjee in *Rec. Bot. Surv. India* 16(2): 23. 1953; Ahrendt in *J. Linn. Soc. Bot.* 57: 106. 1961; Grierson & Long, *Fl. Bhutan* 1(2): 327. 1984; Sur in *Sharma et al., Fl. India* 1: 38. 1993.

Type: Sikkim: Tonglo, 10,000 ft, *Hooker & Thomson 29* (K).

Stems glabrous, very sulcate, yellowish and strongly grooved; internodes 1.5-4 cm long spines 3-fid, 6-13 mm long. Leaves 3-6 x 1.25-1.75 cm, narrowly oblong- obovate, cuneate

R.R. Rao et al.

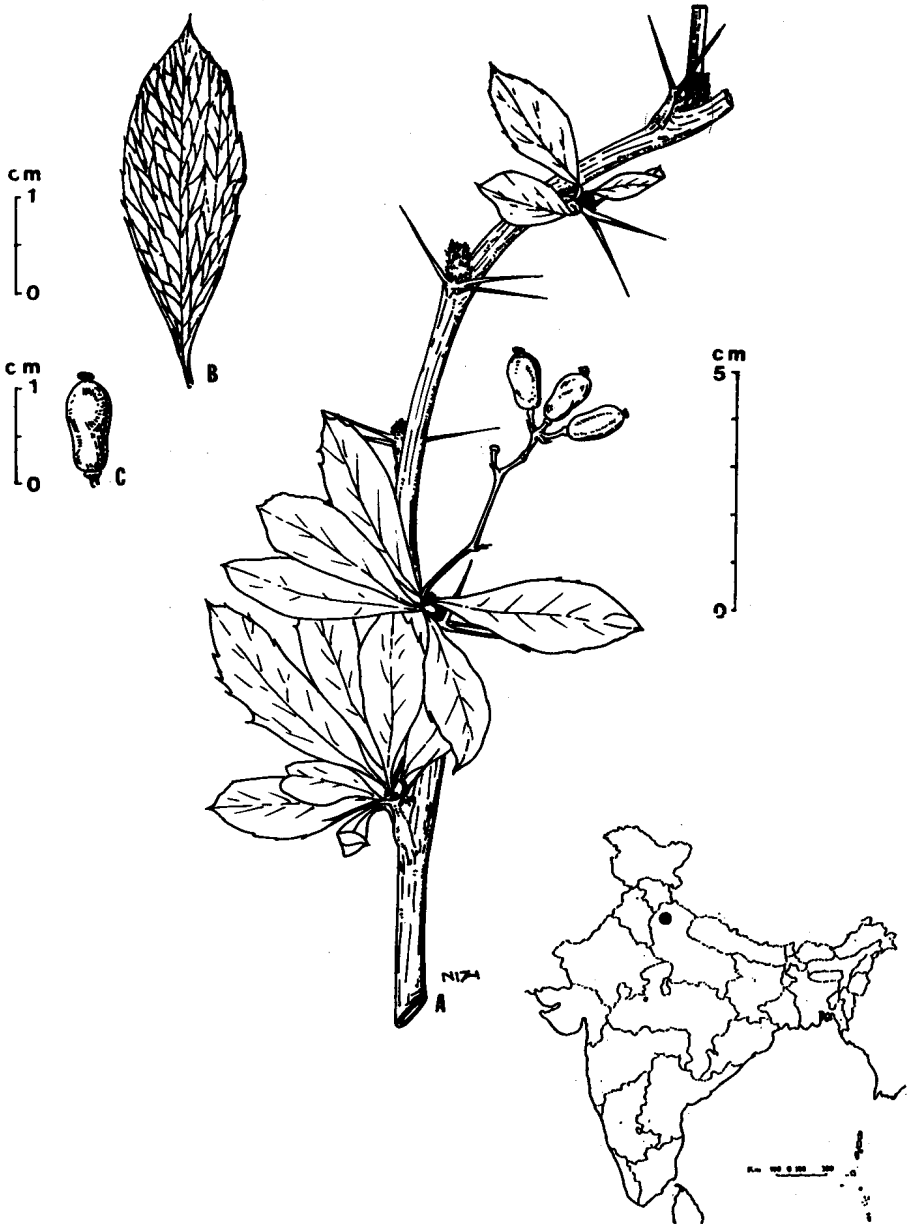


Fig. 7. *Berberis macracantha* Schrand. A. Fruiting branch; B. Leaf showing venation; C. Fruit (Based on T. Husain & B. Datt 210593)

Revision of Berberidaceae of India

to decurrent at base, obtuse - mucronate at apex, usually entire; sometimes spinose - dentate; paler below, papillose. Inflorescence umbellate - racemose, 5-12 fld.; peduncle 1-1.5 cm long; pedicels 1-2 cm long. Outer sepals 5 x 2 mm, narrowly elliptic, acute, carinate; median sepals 4.5 x 2.5 mm, ovate - elliptic, obtuse; inner sepals 5-6 x 3-4 mm, obovate. Petals 4-5 x 3-4 mm, obovate. Ovules sessile. Berries 8-10 x 5-6 mm, oblong - ellipsoid.

Fl. & Fr. : June - Sept.

Distribution: INDIA: West Bengal, Sikkim; NEPAL; BHUTAN.

Ecology: Open hillsides; 3000-4000 m.

Notes: Grierson and Long (1984) have remarked that this species is similar to *Berberis aristata* DC. except for leaf, inflorescence, sepals, petals and fruit characters.

13. *Berberis brandisiana* Ahrendt in J. Asiat. Soc. Beng. (Sc.) (3), 11: 2. 1945; et in J. Linn. Soc. Bot. 57: 106. 1961; Chatterjee in Rec. Bot. Surv. India 16(2): 21. 1953; Jafri in Nasir & Ali, Fl. W. Pak. 87: 14. f. 4, c. 1975; Sur in Sharma *et al.* Fl. India 1:389. 1993.

Type: Punjab Himalaya: Narkanda, Fr. 1876, *Brandis 1229* (K).

Stems dark-red, lustrous, subsulcate, glabrous; internodes 1.5-2.5 cm long; spines absent to simple or 3-fid, weak, 3-10 mm long. Leaves 2-4 x 1-3 cm, obovate, entire to 8-15 spinulose at margin, dull on both surfaces, apex obtuse, mucronate, venation open but hardly reticulate, petiolate; petiole 5-20 mm long. Inflorescence umbellate-racemose, 3-6-fld, 3.5 - 4 cm long; pedicels 1-1.5 mm long. Ovules 4-5, sessile. Berries 9-10 mm long, obovoid, red, firm, estylose, epruinose.

Fl. & Fr. : April - July

Distribution : INDIA: Himachal Pradesh; PAKISTAN; NEPAL.

Notes: According to Jafri *et al.* (1975) this species differs from *Berberis pachyacantha* Koehne primarily by its 4-5 ovuled ovary. Some forms are very close to *B. orthobotrys* Aitch. ex Koehne, but the leaves are broader and the berries are larger and obovoid.

14. *Berberis umbellata* Wall. ex G. Don, Gen. Syst. 1:116. 1831; Hook. f. & Thoms. in Hook. f., Fl. Brit. India 1:110. 1872; Chatterjee in Rec. Bot. Surv. India 16(2): 21. 1953; Ahrendt in J. Linn. Soc. Bot. 57:104. 17. 1961; Sur in Sharma *et al.*, Fl. India 1:389. 1993. (Fig.8)

R.R. Rao et al.

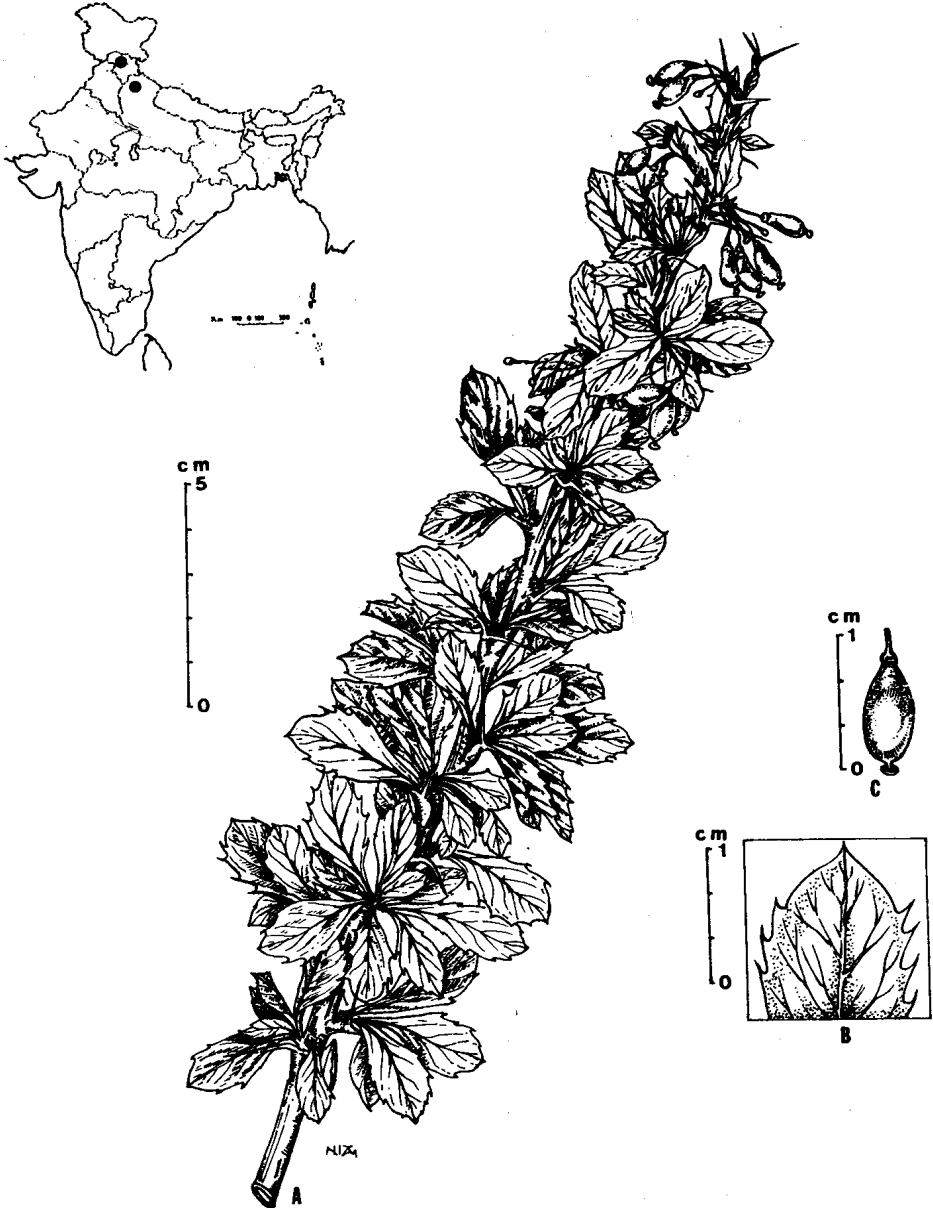


Fig. 8. *Berberis umbellata* Wall. ex G. Don. A. Fruiting branch; B. Portion of the leaf enlarged; C. Fruit (from U.C. Bhattacharyya 74943)

Revision of Berberidaceae of India

Stems with young shoots deep red, sulcate; mature red-brown, smooth; spines mostly 3-fid, 7-17 mm long, sometimes absent, central spine longer than the laterals. Leaves 1.5-4.5 x 0.6-1.6 cm, obovate or elliptic-obovate, subacute to mucronate, shortly cuneate to decurrent at base, 5-20 spinulose and subserrulate along margins, thinly coriaceous, slightly lustrous above, below grey, densely papillose. Inflorescence subumbellate or fascicled, 3-6-fld., rarely 10-fld., 1.5-3.5 cm long, including 1-15 cm long peduncle; pedicels 0.5-2 cm long; bracts 2x1.8 mm, ovate, acute. Flowers yellow. Sepals 6, in 2 series. Outer sepals 3, 3.5-4.5 x 2.5-3 mm, ovate, acute; inner sepals 3, 5-6 x 4-5 mm, obovate, entire; glands 1x0.4 mm. Stamens 6. Ovary simple; ovules stipitate. Berries 8-12 x 4-6 mm, bright red, oblong - ellipsoid, pruinose. Seeds dark brown.

Key to the varieties (after, Sur, 1993)

1. Internodes 1-2 cm long; stems distinctly stoloniferous **B. umbellata** var. **brainii**
1. Internodes 2-2.5 cm long; stems not stoloniferous **B.umbellata** var. **umbellata**

B. umbellata var. **umbellata**

Type: Nepal:1818, *Wallich 1475*, in part (?)

Fl. & Fr.: May-Aug.

Distribution: INDIA: Himachal Pradesh; NEPAL, BHUTAN.

Ecology: 2850-4000 m.

Specimens examined: Himachal Pradesh: Kalpa hill slope above hospital, 3125 m, 4.6.1972, *K.P.Janardhanan 47682* (BSD); Simla, 2850, 24.5. 1928. *R.N. Parker 2882* (BSD). Uttar Pradesh: Uttarkashi Dist., Garhwal: Bhojbasa-Chirbasa, 3400m, 5.9.1983, *U.C. Bhattacharyya 74943* (BSD); Bhojbasa, 3700m, 4.9.1983, *U.C. Bhattacharyya 74834* (BSD); Tehri Garhwal, Panwali, 3100m, *B.D. Naithani 48183* (BSD); Badrinath valley, 3500 m, *M.A. Rao 3884* (BSD); Kumaon: Farkia-Swali, 3000-3500m, 25.9.1957, *T.A. Rao 4604* (BSD).

B. umbellata var. **brainii** Ahrendt, J. Bot. London 80 (Suppl.): 94. 1942.

Type: From cultivated plant raised from Pradhan's seed, Fl. 21 May 1942; Fr. 20 Oct. 1940, *L.A. 113* (O, BM).

Fl. & Fr. May - Aug.

Distribution: INDIA: Sikkim (Endemic).

R.R. Rao et al.

Ecology: 2000-3500 m.

15. ***Berberis kashmirana*** Ahrendt in J. Bot. Lond. 80 (Suppl.): 97. 1942, et in J. Linn. Soc. Bot. 57: 107. 1961; Chatterjee in Rec. Bot. Surv. India 16(2) : 23. 1953; Jafri in Nasir & Ali, Fl. W. Pak. 87: 16. 1975; Rao & Kumar in Sharma *et al.*, Fl. India 1: 388. 1993. (Fig. 9)

Type: Kashmir: Mantnar valley, near Desu, 11,500 ft. 22 June, 1939, Ludlow 122 (BM).

Shrubs 1-2 m tall; stem terete to subsulcate, pale yellow, glabrous; internodes 2-3 cm; spines 3-fid, 1-1.5 cm long. Leaves 3-6 x 1-1.8 cm, narrowly obovate-oblong, apex acuminate or acute, base attenuate, membranous, petiolate; petiole very short upto 6 mm long; margins with 15-25 spinose-serrate, distant, 1.5-3 mm, not or scarcely papillose. Inflorescence racemose, 8-10- fld, Flowers yellow; pedicel 8-17 mm long, glabrous; bracteole 3 x 0.5 mm, acute; outer sepals 4 x 2.25 mm, ovate, acute; inner sepals 5.25 x 2 mm, obovate. Petals 5.5 x 3.75 mm, apex subentire, base not clawed with a pair of notched glands, 0.9 mm long. Anthers 1.75 mm long; filaments 2.25 mm long. Ovules 4; stigma 1 mm long; style 0.5 mm long.

Fl. & Fr.: May - Aug.

Distribution: INDIA: Jammu & Kashmir (Endemic).

Ecology: 3500 - 4000 m.

Notes: Apparently this species resembles *Berberis petiolaris* Wall. ex G. Don var. *extensa* Ahrendt ex Rao et al. in the texture of leaves and inflorescence pattern but greatly differs in the number of ovules (2 in *B. petiolaris* var. *extensa* whereas 4 in *B. kashmirana*), colour of stem (distinctly pale yellow in *B. kashmirana* whereas in *B. petiolaris* var. *extensa* it is red or red-brown) shape of corolla lobe glands (notched at the top in *B. kashmirana* whereas entire in *B. petiolaris* var. *extensa*).

16. ***Berberis insignis*** Hook. f. & Thoms., Fl. Ind. 226. 1855; Chatterjee in Rec. Bot. Surv. India 16(2): 7. 1953; Ahrendt in J. Linn. Soc. Bot. 57: 36. 1961; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42 (3): 536. 1985; Das Gupta in Sharma et al., Fl. India 1: 399, f. 61. 1993.

B. insignis Hook. f. & Thoms. var. *tongloensis* Schneid. in Mitt. Deutsch. Dendr. Ges. 55: 45. 1940. *Type*: India: W. Bengal, Darjeeling, Lacey 2243 (iso - E).

B. insignis Hook. f. & Thoms. var. *elegantifolia* Ahrendt in J. Linn. Soc. Bot. 57: 37. 1961.

Type: N. India: Sikkim, Yaldong, 1849, Hooker f. s.n. (holo - K).

Revision of Berberidaceae of India

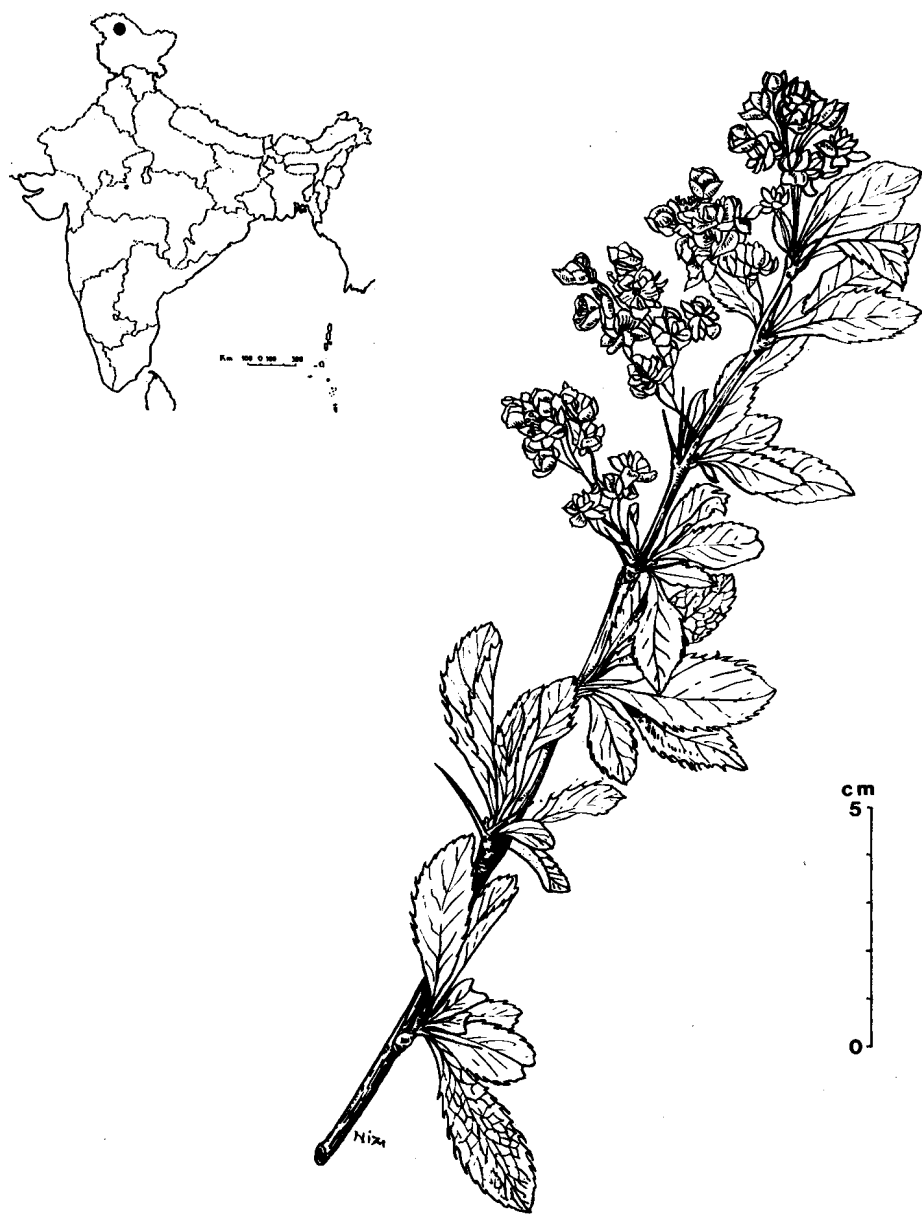


Fig. 9. *Berberis kashmirana* Ahrendt (Based on Ludlow 122)

R.R. Rao et al.

Shrubs, 1-2 m high; stems terete, yellowish or purplish to dark red, glabrous, not spiny or spines from only on lower nodes. Leaves 1-5 at each node, 4-16 x 2-4 cm, elliptic - lanceolate, attenuate and subpetiolate at base, acute to acuminate at apex, spiny with 2-4 mm long spines along margins, coriaceous. Inflorescence fascicled, 5-14-fl'd; pedicels thick, 0.7-1.5 cm long. Sepals 6, 5-7 x 3-5 mm, broadly oblong, entire and ovary along margins; gradually increasing in size inwards. Petals 6, broadly oblong or obovate, emarginate, with a few parallel veins; nectary glands elongate. Filaments 1-2 x 0.5-1 mm, oblong; anthers 1-1.2 mm across ovoid. Ovary oblong, 1.5-2 x 0.7-1 mm; style inconspicuous; stigma 1x1.5 mm, umbrella like. Berries 6-8 x 3-4 mm, obovoid, black, uneven and irregularly reticulate on surface; style ca 0.5 mm long.

Notes: *Berberis insignis* Hook.f. & Thomson var. *tongloensis* Schneid. has been kept under the typical subsp. *insignis* by Chamberlain & Hu (l.c.) but Ahrendt (l.c.) is justified in keeping var. *tongloensis* as a distinct variety under *B. insignis* as the stems are pale yellow, yellow or grey and there are more number of flowers per fascicle. We have treated var. *tongloensis* as a synonym of *B. insignis* as we had no chance of observing this variety either in the herbarium or in the field.

Key to the varieties

1. Leaves coriaceous **B. insignis** var. **insignis**
 1. Leaves papery..... **B. insignis** var. **shergaonensis**

B. insignis var. **insignis**

Type: Sikkim: 7000-10,000 ft, 23 May, 1849 *Hooker f. s.n.* (K).

Fl. & Fr.: May - Oct.

Distribution: INDIA: W. Bengal, Sikkim, Arunachal Pradesh, Nagaland; NEPAL; BHUTAN; CHINA (Tibet).

Ecology: In mixed forest and amongst rhododendrons; 2100-3600 m.

Specimens examined: West Bengal: Darjeeling, 2100m, 28.3.1961. *S. K. Mukerjee 4753* (CAL). Darjeeling Bot. Gard., 2400 m, 9.11.1944, *Raizada 18872* (BSD); Sandakphoo, 3000 m, 18.4.1961, *s.l. 154* (CAL); Sikkim: *R. Seshagiri Rao 217* (CAL) Tanglu, 3000 m, 28.9.1902, *J.H.Lace 2243* (BSD); Tanglu, 3600 m, 1890, *C.G. Royers s.n.* (BSD). Arunachal Pradesh: West Kameng, 3 Km. from Bomdilla, 3.4.1984, *A.K. Goel 14236* (LWG). Kameng F.D., Parila, *G. Panigrahi 16095* (CAL); Chakoo, *Panigrahi 6324* (ASSAM). Nagaland: *S. K. Mukerjee 2312* (CAL); E. Bhutan: *Balakrishnan 44488* (ASSAM).

Revision of Berberidaceae of India

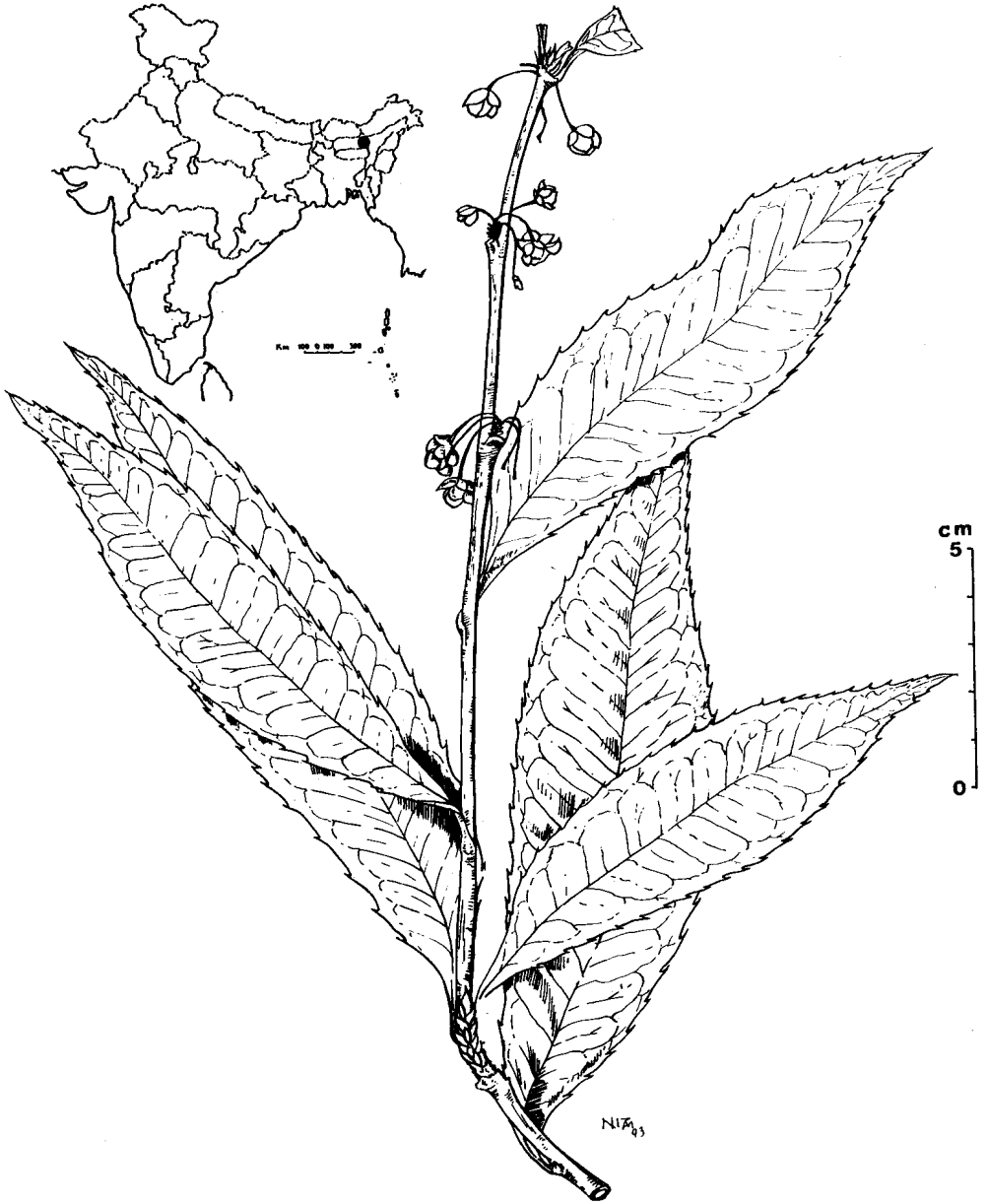


Fig. 10. *Berberis insignis* Hook. f. & Thoms. var. *shergaonensis* Ahrendt (Based on Kingdon-Ward 13617)

R.R. Rao et al.

B. insignis var. **shergaonensis** Ahrendt in J. Bot. 79, Suppl. 8 1941; et in J. Linn. Soc. Bot. 57: 37. 1961; Chatterjee in Rec. Bot. Surv. India 16(2) 8. 1953. (Fig.10).

Type: N.E.India: Assam Himalaya, Rages north of Shergaon, in woods, 8000-9000 ft, 1938, *Kingdon-Ward 13617* (holo - BM).

Notes: Under Notes on the Type sheet it is remarked that "An erect shrub 10 ft high, growing in forest where there is a good deal of undergrowth". After examining the Type specimen (*Kingdon-Ward 13617*) of var. *shergaonensis* it is clear that this variety should be kept as a distinct variety under *B. insignis* as the leaves are membranous in var. *shergaonensis* whereas var. *insignis* has coriaceous leaves.

17. Berberis dasyclada Ahrendt in J. Bot. Lond. 79 (Suppl.): 12.1941; et in J.Linn.Soc. Bot.57:36.1961; Chatterjee in Rec. Bot. Surv. India 16(2) 8. 1953. Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42(3): 536. 1985; Das Gupta in Sharma et al., Fl. India: 1: 397. 1993. (Fig.11)

B. insignis Hook.f. & Thoms. var. *zelaica* Ahrendt in J.Bot.Lond. 79 (Suppl.) 9. 1941. *Type:* N.E.India, Assam, Himalaya Shergaon, Monyul, 2700-3000m, 28.5.1935 *Kingdon-Ward 11544* (holo - BM).

Type: N.E.India: Assam Himalaya, Poshing La, 3000m, 24.5.1938, *Kingdon-Ward 13700* (holo - BM).

Low growing gregarious shrubs, forming dese thickets, up to 60 cm high; stems terete, pubescent on the upper surface, dark red, usually without spines; internodes 1.5-4 cm long. Leaves 2-4 from each node, 4-12 x 1.2-3.5 cm, narrowly elliptic or lanceolate, coriaceous, acute at apex, attenuate at base, petiolate; petiole 2 mm long; with 10-18, 2-3 mm long serrations along margins, epruinose, lateral nerves depressed on the upper surface, raised on the lower, shining, dark green above. Inflorescence fascicled, 3-8 fld. Flowers golden yellow, fragrant; pedicels 6-12 mm long, slender; bracts 3-5 x 1 mm, lanceolate acuminate. Prophylls 3, 3.5-5 mm long, deltoid or lanceolate, acuminate. Outer sepals 3, 5 x 3 mm elliptic, concave, obtuse; inner sepals 4, 7-8 x 5-6 mm, obovate, obtuse, entire. Petals 6, 4.5 - 5 x 4 mm, obovate, clawed at base, emarginate at apex; nectary glands 1 mm long, lanceolate. Stamens 4 mm long; filaments 2.5 mm long; anthers 1 mm long, apiculate. Ovary oblong, ca 4 x 1.5 mm, estylose; ovules 3-4. Berries epruinose.

Fl.: May-June.

Distribution: INDIA: Arunachal Pradesh (Endemic).

Ecology: In pine and rhododendron forest; 2700-3600 m.

Revision of Berberidaceae of India

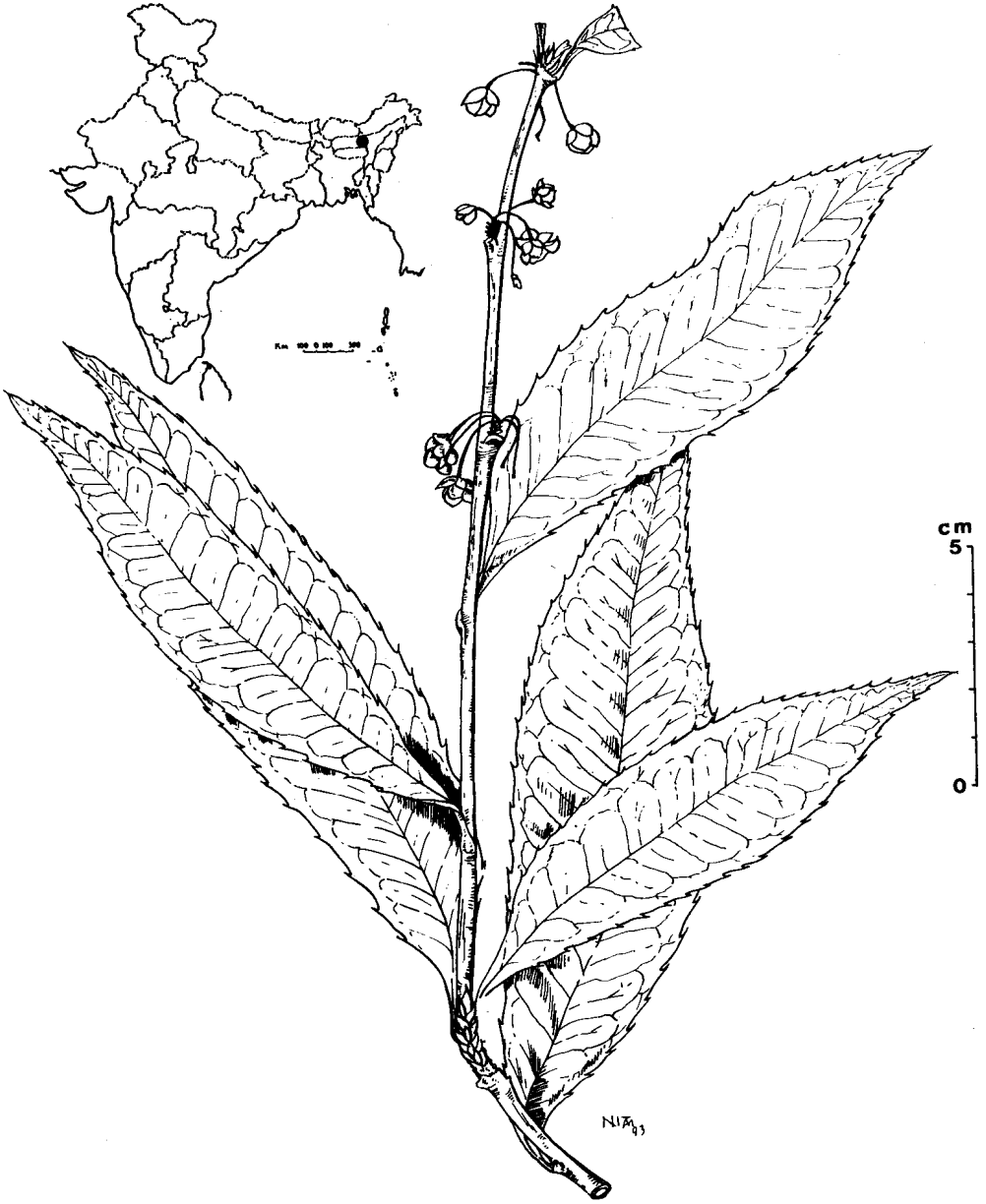


Fig. 10. *Berberis insignis* Hook. f. & Thoms. var. *shergaonensis* Ahrendt (Based on Kingdon-Ward 13617)

Revision of Berberidaceae of India

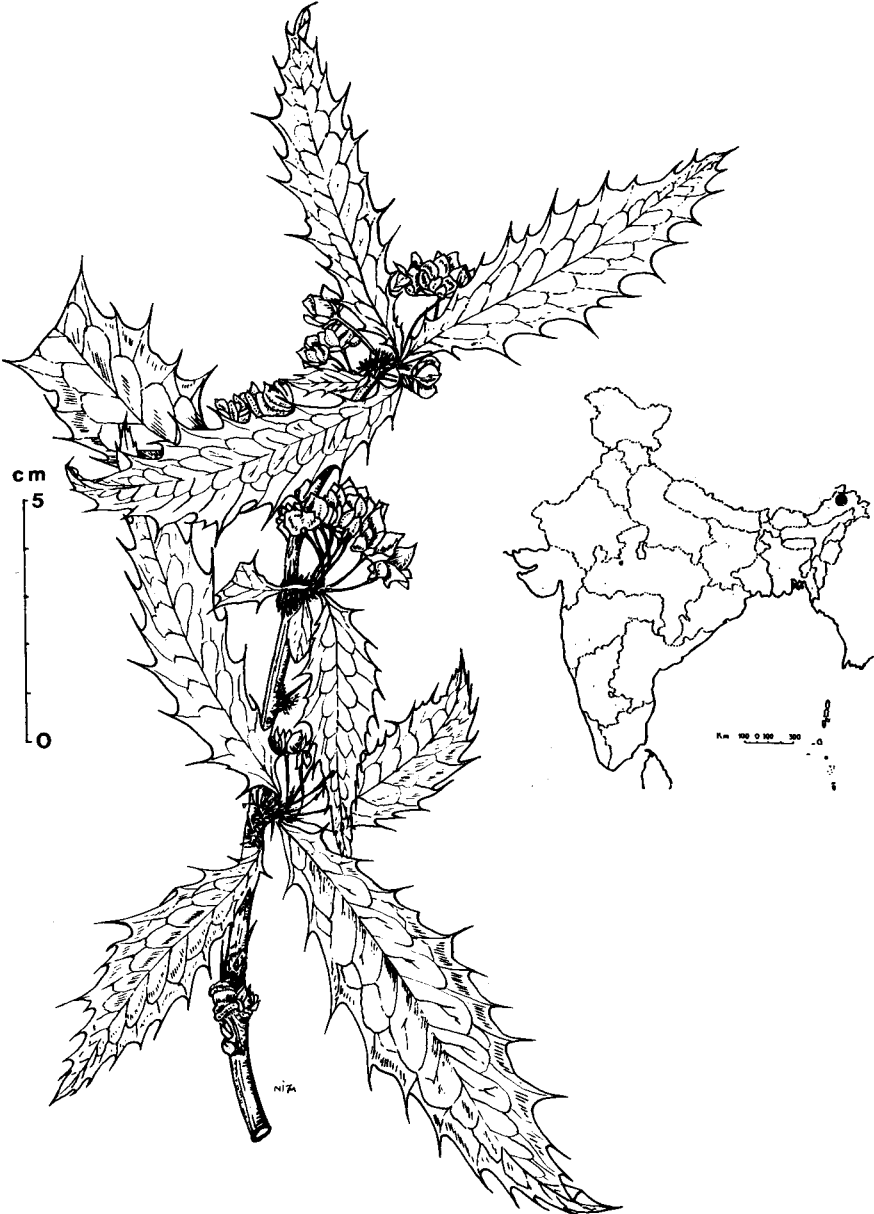


Fig. 11. *Berberis dasyclada* Ahrendt (Based on *Kingdon-Ward 13700*)

R.R. Rao et al.

Specimens examined: Arunachal Pradesh: Hotspring, K. Haridasan s.n. (LWG); Kameng, Senge Dzang, 21.5.1957, R.S.Rao 7650 (CAL).

Notes: Details of this species have been sent to the Red Data Book for inclusion.

18. *Berberis incrassata* Ahrendt in Gard. Chron. 3, 105:371. 1939; et in J.Bot. Lond. (Suppl.) 79: 10. 1941; et in J.Linn. Soc. Bot. 57: 38. 1961; Mulligam in Gard. Chron. 3, 108: 41. f. 19. 1940; Schneid. in Mitt. Dtsch. Dendr. Ges. 55: 45. t. 6. 1942. (Fig. 12).

B. insignis Hook.f. & Thoms. subsp. *incrassata* (Ahrendt) Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42(3): 537. 1985.

Type: Upper Burma : Adung valley, 2100m, *Kingdon-Ward 9358* (holo - BM).

Small shrubs up to 2-2.5 m; stem dark red, glabrous; internodes 3-5 cm long; spines almost absent or 3-fid. Leaves 5-15 x 1-3 cm, lanceolate to elliptic lanceolate, rigidly coriaceous, epruinose below, pruinose white above, apex mucronate or ending in a spine, base attenuate: margins with 12-14 spinose serrations; spines 1.5-3 mm long, 5-8 mm apart; dull grey-green above; slightly lustrous paler yellow-green below; lateral nerves raised on both surfaces. Inflorescence fascicled, 15-30 flowered; pedicles 10-15 mm long, slender at base, thickened to 1.5 mm at apex. Flowers bright yellow; outer sepals 4 x 3.5 - 3.75 mm, ovate, acute; median sepals 5.5-6 x 4-5 mm, ovate-elliptic, obtuse; inner sepals 7.5 -8 x 5-6 mm, obovate, obtuse; Petals 6 x 4 mm, obovate, entire, base cuneate; glands oval-shaped 0.8-1.25 mm long. Stamens truncate, produced; anthers 1 mm long; filaments 2 mm long. Ovules 5-7. Berries black epruinose.

Fl.: April-May

Distribution: INDIA: Sikkim; Arunachal Pradesh; NE UPPER BURMA; CHINA.

Ecology: In thickets, under bamboos and on cliffs; 1200-2300 m.

Specimens examined: Sikkim: On way to Ralang, 9.1.1983, *D. Banerjee 2533* (BSHC, LWG). Arunachal Pradesh: W. Kameng. Dt., 3 Km away from Bomdila on way to Dirang, 2300 m, 4.5.1993, *T.S.Rana & B.Datt 210334* (LWG).

Notes: Ahrendt (1961) had separated *Berberis incrassata* from *B. insignis* based on, a) entire petals, b) 5-7 ovules, c) globose fruits and d) leaves without hypoderm, are sufficient to segregate *B. incrassata* from *B. insignis* and these characters appear to be static and sufficient. The statement of Chamberlain and Hu (1985) "that the differences between the two subsp. are too slight to maintain them as separate species" is not tenable. One important field identification character between these two species is that the lateral

Revision of Berberidaceae of India



Fig. 12. *Berberis incrassata* Ahrendt (Based on Kingdon-Ward 9358)

R.R. Rao et al.

nerves are very prominent in *B. incrassata*, whereas they are not so prominent in *B. insignis*.

Remarkable variations with regard to nature of spines can be observed in the species from almost spineless (as in Type) to sturdy 3-fid spines in one specimen (*T.S.Rana & B.Datt 210334*). The lower leaves are much larger and whitish beneath, a character clearly observed in the field.

A note on the type specimens (*Kingdon-Ward 9358*) written by the collector himself clearly mentions This species to be close to *Berberis insignis* and *B. hypokerina* but the above two species have much smaller flowers and leaves are different from *B. incrassata*.

Berberis incrassata has been reported for the first time from Sikkim and Arunachal Pradesh.

19. *Berberis sanei* Husain et al. in Adansonia 17 (1-2): 69-73. f. 1. 1995.

Type: India, Arunachal Pradesh, Bomdila, Palit Hills, ca 3300m, 5 May 1970, *Mehrotra & Party 2439* (holo - LWG; iso - CDRI).

Erect shrubs ?; stems yellow or yellow brown, often with warty hairs; spines 3-fid, 1.7-2.3 cm long, stout. Leaves 8-12.5 x 2.5-4.2 cm, elliptic to obovate-elliptic, apex ending into a spine, base tapering, distinctly white pruinose above, dull, shining below, margins 13-18 spinose; spines 1-1.5 mm long, up to 6 mm distant; petioles 2-3 mm long. Inflorescence fascicled, upto 13-fld., Flowers yellow; pedicels 13-15 mm long. Outer sepals 4-5 x 3-3.5 mm, obovate, obtuse, entire; gland on petals 1.5-1.75 mm long, lanceolate. Anthers 1 mm long; connective apiculate; filaments 2 mm long. Ovary shortly stylose; ovules 4-5. Berries not seen.

Fl. & Fr.: April - Sept.

Distribution: INDIA: Arunachal Pradesh (Endemic).

20. *Berberis hookeri* Lemaire, Illus. Hort. 6: 207. 1859; Chatterjee in Rec. Bot. Surv. India 16(2) 8. 1953. Ahrendt in J.Linn. Soc. Bot. 57:39. 1961; Grierson & Long, Fl. Bhutan 1 (2): 326. 1984; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42 (3): 533. 1985; Das Gupta in Sharma et al., Fl. India 1: 395, f. 59. 1993.

B. wallichiana sensu Hooker, Bot. mag. 77: t.4656. 1852, non DC. 1824.

B. hookeri Lemaire var. *viridis* Schneid. in Bull. Herb. Boiss. ser. 2, 8: 197. 1908. *Type*: N. India, Sikkim, Lachen valley, May. 1849, *Hooker s.n.* (K).

Revision of Berberidaceae of India

B. hookeri Lemaire var. *microcarpa* Ahrendt in J.Linn.Soc.Bot. 57:40.1961. Type: N.India, Sikkim, Oct., 1874, *Clarke 25561* (K).

B. hookeri Lemaire var. *platyphylla* Ahrendt in J.Linn.Soc. Bot. 57:40.1961. Type: N.India, Sikkim, *Hooker 40* (K).

Type: ?

Erect shrubs, ca 1 m high; stems terete, angled, gland-dotted, mature yellow; internodes 2-6 cm long; spines 3-fid, upto 2.5 cm long. Leaves 3-6 x 1-2 cm, elliptic, oblong or broadly elliptic-lanceolate, acute or obtuse at apex, attenuate at base to a short petiole, 5-19 spinose-dentate along margins, lustrous dark green above, white-pruinose beneath; veins prominently reticulate. Inflorescence fascicled, 3-8 fld.; pedicels 1.5-2 cm long. Prophylls 2.5-3.5 x 1.5-2 mm, ovate, concave, acute, thickened at middle. Outer sepals 3x1.5 mm, ovate; innermost sepals 8 x 4.5 mm, elliptic. Petals 5-6 x 3.5 - 4.5 mm, obovate, obtuse at apex. Stamens 3-4 mm long; filaments ca 2.2 mm long; anther 1.2-1.7 mm across. Ovules 6-8; stigma 1.2-2 mm broad. Berries 2-2.5 x 0.4-0.7 cm, oblong, purplish black, estylose.

Fl. & Fr.: March - Oct.

Distribution: INDIA: West Bengal, Sikkim, Arunachal Pradesh, Nagaland, Manipur; NEPAL, BHUTAN; CHINA.

Ecology: 2250-3000 m.

Specimens examined: West Bengal: Darjeeling, 2700m, 13.3.1919, *G.H.Cave s.n.* (CAL), Darjeeling Botanic garden, J.H.Naskar s.n. (CAL); Darjeeling, East of Phallna, 3000 m, 21.10.1904, *I.H.Burkill 25321* (CAL). Sikkim: 3000 m, May, 1885, *G. King s.n.* (CAL) *S.K.Mukerjee 2758* (CAL). Manipur: Sirohi, 2250 m, 20.4.1948, *s.l. s.n.* (CAL).

Notes: According to Chamberlain & Hu (1985) *Berberis hookeri* is a variable species, especially in leaf shape, size and colour, thus there is no justification for maintaining the varieties distinguished by Ahrendt on the size of the fruit and density of the teeth on the leaf margins.

21. *Berberis micropetala* Schneid. in Fedde Repert. Spec.Nov. 46:266.1939; Ahrendt in J. Linn. Soc. Bot. 57: 67.1961; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42 (3):549. 1985; Guha Bakshi in Sharma et al., Fl. India 1:393. 1993.

Type: NE India, Naya Hills, Saramati Ridge, 2800 m, *Bor 2921* (holo - K).

Shoots sulcate; internodes 2.5-3.5 cm long; spines 1-2 cm long, sulcate. Leaves

R.R. Rao et al.

2.5-4.5 x 0.9-1.8 cm, oblong-elliptic, acute, 1-4 spinulose-toothed on either side, openly veined greyish, pruinose below. Inflorescence fascicled, 4-5-fld.; pedicels 3-4 mm long. Sepals in 3-series; outer sepals 4.5-3 mm, ovate acuminate; median sepals 7-8 x 5 mm, oblong-obovate; inner ones 8-9 x 5 mm. Petals 4 x 2.5 mm, white, emarginate. Stamens apiculate. Ovules 2, sessile. Berries estylose.

Fl. & Fr.: March-June

Distribution: INDIA: Nagaland (Endemic).

Ecology: Open grassy ridge; 3000 m.

22. *Berberis wallichiana* DC., Prodr. 1: 107. 1824; Wall., Pl. As.Rar. 3: 23. t. 243. 1832; Chatterjee in Rec.Bot. Surv. India 16(2): 10. 1953; Ahrendt in J. Linn. Soc. Bot. 57:71. 1961; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42(3): 549. 1985; Guha Bakshi in Sharma et al., Fl. India 1:395, f. 58.1993.

Type: Nepal, Mt. Sheopur, *Wallich 1478* (iso - BM, K).

Shrubs 2-3 m tall; stems subangled, glabrous; internodes 3-4 cm long; spines 1.5 - 2 cm long, slender. Leaves 4-8 x 0.9-2.5 cm, oblong - lanceolate or lanceolate, apex mucronate or acute to subacute, base attenuate, subsessile, epapillose, margins 12-25 spinose, sublustrous above, thickly coriaceous. Inflorescence fascicled, 10-20-fld; pedicels 6-10 mm long, stout. Outer sepals 3 x 1.5 mm, oblong-obovate; inner sepals 4.5 - 5 x 3 mm. Petals 4.75 - 5.25 x 2.5 mm, obovate, entire; glands on petals separate lanceolate. Ovules solitary, shortly stipitate. Stamens 3.5 - 4 mm. Berries 8-9 x 4-5 mm, excluding style 0.5-0.75 mm, ovoid, black, epruinose.

Fl. & Fr.: April-Oct.

Distribution: INDIA: Arunachal Pradesh, Manipur; Meghalaya; NEPAL; BHUTAN.

Ecology: On ridges, in rhododendron and oak scrub; 1410-3300m.

Specimens examined: Arunachal Pradesh: Subansir F.D., 30/9/1959 *G. Panigrahi 19815* (CAL); Kameng, 16/5/1958, *G. Panigrahi 15709* (CAL); NEFA, *R. Seshagiri Rao 1565* (CAL); Subansiri Dist, Ziro to Tamen, 14/6/1961, *G.V. Subba Rao 25009* (CAL); Kameng, Senge Dirong, *R.S. Rao 7653* (ASSAM); Senge Dirong, Kingdon-Ward 19282 (ASSAM); Parila *R.S.Rao 16095* (ASSAM); Subansiri, Zoram village, *Panigrahi 19815 C* (ASSAM); Tamen, Subba Rao 29009 (ASSAM). Meghalaya: Shillong peak, near Governor House, 6.4.1969, *B.P. Uniyal s.n.* (BSD); Lyndoh forest, Maphlong, 1800 m, 22.10.1914, *U.N. Kanjilal 4661* (DD); Shillong, 1800 m,

Revision of Berberidaceae of India

30.3.1895, *King's Coll. s.n.* (DD); K. & J. Hills, 1410 m, *G. Panigrahi 4539* (CAL); K. & J. Hills, Peak forest, *P.C. Kanjilal 10041* (ASSAM); Elephant falls, *H. Deka 23046* (ASSAM); Shillong, *U. Kanjilal 7954* (ASSAM); Shillong peak, *G.K. Deka 21396* (ASSAM); Lake garden, *P.C. Kanjilal 9009* (ASSAM); Nongpoh, *P.C. Kanjilal 8908* (ASSAM); Dumpep, *R.N. De -19841* (ASSAM), Maphlong, *V. Kanjilal 2494* (ASSAM).

Notes: Ahrendt (1961) had mentioned *Wallich 1819* (K) as the Type of *Berberis wallichiana* but later on Chamberlain & Hu (1985) have cited *Wallich 1478* (K) as the iso incassata of this species. Another specimen, *Wallich 1478* from BM showed very thick rigid leaves, with a lustrous nature on the upper surface. This could also be another isotype of the species.

23. *Berberis victoriana* Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42(3): 554. 1985.

B. wallichiana DC. var. *gracilipes* Ahrendt in J. Bot. 79 (Suppl.): 17. 1941.

Type: India: Manipur Sirohifuros, *Watt 6449* (holo - K; iso - E).

Shrubs 2 mm tall; branches glabrous, distinctly sulcate; internodes 3.5-6 cm long; spines 1-2.5 cm long, 3-fid. Leaves 2.5-3.5 x 1.2-2.4 cm, elliptic or oblong-elliptic, acute or mucronate, petiolate; petiole 1 mm long; margins with 5-8 spinules. Inflorescence fascicled, 8-18-fld; pedicel 1.4-2.4 cm long, glabrous; bracteoles 2 x 1.5 mm, ovate-lanceolate. Outer sepals 3.5 - 4 x 2.5 - 3 mm, ovate-lanceolate; inner sepals 5.5-6.5 x 3-3.5 mm, apex rounded; petals 5 x 3.5 mm, obovate. Stamens 4 mm long, apex truncate. Ovule 1. Berries not known.

Distribution: INDIA: Manipur; NW UPPER BURMA.

Ecology: Forest margins; 2100-2700 m.

Notes: We have included *Berberis victoriana* in our account on the authority of Chamberlain and Hu (1985) who have described it as a new species, treating under it *B. wallichiana* var. *gracilipes* Ahrendt as a synonym, both having different Types. This is somehow not understandable to us. *B. wallichiana* var. *gracilipes* is a validly published name and we do not find any reason for its treatment as a synonym of a new species.

24. *Berberis sublevis* W.W. Smith in Notes RBG Edinb. 9.83.1916; Ahrendt in J. Linn. Soc. Bot. 57:58. 1961; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42 (3): 555. 1985; Guha Bakshi in Sharma et al., Fl. India 1:404. 1993.

B. sublevis W.W. Smith var. *grandiflora* Schneid. in Repert. Spec. Nov. Regni Veg. 46:253. 1939. *Type:* China, SW Yunnan, around Tengchong, *Rock 7930* (holo - A, n.v).

R.R. Rao et al.

B. sublevis W.W.Smith var. *gracilipes* Ahrendt in J.Bot. 79:17. 1941. Type: NE India, Meghalaya, Khasia Hills, Motling, *Simms 114* (holo - K).

B. sublevis W.W.Smith var. *exquisita* Ahrendt in J.Linn.Soc. Bot. 57:58 1961. Type: China, NW of Tengyueh (Tengchang), ii. 1925, *Forrester 26196* (holo - K., iso - E).

B. wallichiana DC. var. *microcarpa* Hook.f. & Thoms., Fl. Ind. 1: 226. 1855. Type: NE India, Meghalaya, Khasia, 5000-6000 ft, *Hooker & Thomson* (iso - E).

B. sublevis W.W.Smith var. *microcarpa* (Hook.f.&Thoms.) Ahrendt in J. Linn. Soc. Bot. 57:58. 1961.

Type: China, SW Yunnan, around Tengyueh (Tengchong), *Forrest 9559* (holo - E; iso - K).

Erect shrubs 1-2 m tall, stems more or less verruculose; spines 1.5 cm long; internodes 2-4 cm long. Leaves 2.5-8 x 0.5-4 cm, lanceolate, acuminate, subcoriaceous, with 10-18 subappressed spinules along margins, petiole 1-4 mm long; enervate or slightly veined. Inflorescence fascicled. 15-30- fld.; pedicels 7-15 mm long, slender. Prophylls 1.5 x 1 mm, ovate acute, red; outer sepals 2.5-2.75 x 2 mm, ovate, subacute, raddish; inner sepals 5 x 3 mm, obovate to oblong-elliptic. Petals 5-5.5 x 3 mm, clawed; glands 1.5 x 0.5 mm. Stamens 3-3.5 mm long, obtuse; anthers 1.25-1.5 mm long; filaments 1.5-1.75 mm long. Berries 6-7 x 3-3.5 mm, black, estylose.

Fl. & Fr.: April - Nov.

Distribution: INDIA: Manipur, Meghalaya; N.UPPER BURMA; W.CHINA (SW Yunnan).

Specimens examined: Manipur: Sirwhifurar, 2100-2400 m, April, 1882, *G. Watt 6449* (MH, CAL); Sirwhifurar, 2100-2400 m, April, 1882, *G. Watt 6428* (CAL). Meghalaya: Shillong peak, 6/3/1990, *D.M.Verma 38402* (CAL).

Notes: According to Chamberlain and Hu (1985) "this species is unique in sect. *Wallichiana* in its long funicle".

25. *Berberis manipurana* Ahrendt in Kew Bull. 1939:262. 1939; et in J. Linn.Soc.Bot. 57:47. 1961; Chatterjee in Rec.Bot.Surv. India 16 (2): 10. 1953; Chamberlain & Hu in Notes Roy.Bot.Gard. Edinb. 42 (3): 549. 1985; Das Gupta in Sharma et al., Fl. India 1: 401, f. 62. 1993.

Type: India: Manipur, Ching Sow, NE ranges, 2400 m, Watt 6533 (holo - K; iso - E).

Shrubs 2-3 m tall; stems angled, glabrous, lower branches terete; internodes 2-6 cm long; spines 2-6 from a node, 5-30 mm long, concolorous, sulcate, middle ones longer. Leaves

Revision of Berberidaceae of India

5-8.5 x 1-3 cm, oblong to ovate-elliptic, acute - mucronate at apex, attenuate at base forming a 2-4 mm long petiole, margins 10-20 spinose, lustrous above, epruinose. Inflorescence fascicled, 6-15- fld.; pedicels 12-20 mm long, slender. Prophylls 3 x 1.5 mm, lanceolate, red. Outer sepals 5 x 3 mm, ovate or oblong-ovate, acute or subacute; median sepals 8 x 6 mm; inner sepals 10 x 8 mm, obovate. Petals 5-8.5 x 2.5-7.5 mm, obovate, emarginate, glandular. Stamens 3-5.5 mm long; anthers 1.5 mm long, connective 2-dentate. Ovules 2-5. Berries 7-10.5 x 5-6 mm, oblong, pruinose blue.

Fl. & Fr.: March - Oct.

Distribution: INDIA: Manipur, Meghalaya.

Specimens examined: Meghalaya: Shillong, Khasia Hills, 1800 m, June, 1890, *H. Collett s.n.* (CAL); 24.11.1956, *G.Panigrahi 4539* (CAL).

26. *Berberis wardii* Schneid. in Fedde, Report. Spcc. Nov.46:262. 1959; Ahrendt in J. Linn. Soc. Bot. 57: 49. 1961; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42 (3): 549. 1985; Das Gupta in Sharma et al., Fl. India 1:403. 1993.

Type: N.E. India, Japvo, Naga Hills, 2.12.1927, *Kingdon-Ward 7729* (holo - K).

Bushy shrubs; stems angled; shoots purple, finally yellow; internodes 1-1.5 cm long; spines 1 cm long. Leaves 6-8 from each node, 2-3 x 1-1.5 cm, elliptic to ovate-elliptic, 5-9 spinulose along margins, deep greyish green, pruinose or waxy white beneath; lateral and marginal veins and a few veinlets elevated. Inflorescence fascicled, 2-5 fld.; pedicels 1.5-2.5 cm long, red. Prophylls small; outer sepals 4x3 mm, ovate, obtuse; inner sepals 7-8 x 4-5 mm, oblong-elliptic to oblong-ovate, subentire. Petals ca 8 cm long, obovate oblong, emarginate; glands oblong; stamens slightly produced; apex crenulate with shortly apiculate centre. Ovary ellipsoid; stigma sessile; ovules sessile. Berries shortly stylose, blue black.

Fl. & Fr.: Aug.-Dec.

Distribution: INDIA: Nagaland (Endemic).

Ecology: Open grassy places, amongst *Ilex* and *Rubus*, 3000-3200 m.

Notes: Details of the species have been sent to the *Red Data Book* for inclusion as a rare species.

27. *Berberis praecipua* Schneid. in Fedde Rep. Sp. Nov. Regni Veg. 46: 248. 1939; Mitt., Dtsch. Dendr. Ges. 55: 14. 1942; Chatterjee in Rec. Bot. Surv. India 16 (2): 11. 1953; Ahrendt in J. Linn. Soc. Bot. 57: 42. 1961; Chamberlain & Hu in Notes Roy. Bot.

R.R. Rao *et al.*

Gard. EdinB. 42 (3): 548. 1985; Banerjee in Sharma *et al.*, Fl. India 1: 404 1993. (Fig. 13).

B. subteroclada Ahrendt var. *minoripes* Ahrendt in J.Linn. Soc.Bot. 57. 73. 1961; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42 (3): 548. 1985. Type: Bhutan: Ha Dzong, 2700 m, Ludlow, Sherriff & Hicks 16015 (holo - BM; iso - E).

B. poluninii Ahrendt in J. Linn. Soc. Bot. 57. 73. 1961; Chamberlin & Hu in Notes Roy. Bot. Gard. Edinb. 42(3): 548. 1985. Type: C. Nepal: Compaling; 3 miles E. of Timure, 3200 m, *Polunin 746* (holo - BM)

Type: Bhutan; 13 Aug., 1914, Phajudin Jimpu, *Cooper 2524* (E).

Shrubs 1-1.5 m tall; stems sulcate, yellow; internodes 1.5-3.5 cm long; spines 3-fid, 7-25 mm long, sulcate. Leaves 2-6 x 0.5-1.2 cm, narrowly oblong-elliptic, to elliptic -lanceolate, apex mucronate with a spine on top, base attenuate, 3-15 spinose-serrate, slightly lustrous, thick, rigid, dull above, pruinose below, with a few veins elevated on both surfaces. Inflorescence fascicled, 3-10-fl'd; pedicel 5-10 mm long, slender, sulcate. Outer sepals 2.5-1.5 mm long, ovate subacute; inner sepals 4.5-3.25 mm long, obovate. Petals 3.5 x 2 mm, obovate, entire. Stamens truncate. Ovules solitary. Berries 6 x 3 mm, pruinose blue, style 0.5 mm long.

Fl. & Fr.: April - Oct.

Distribution: INDIA: Arunachal Pradesh, Meghalaya, Assam; NEPAL, BHUTAN.

Specimens examined: Meghalaya: Shillong peak, 1900 m, 24.4.1993, *T.S.Rana, B. Datt & Brij Lal 210301* (LWG). Assam: J. & K. hills, holy forest, 19.5.1958, *B.K. Nayar & Party 50625* (LWG).

Notes: Ahrendt (1961) had kept *B. praecipua* under section *Wallichianae*, subsect. *Replicatae* in which stems are terete or subterete, yellow and fruits pruinose, whereas Chamberlain and Hu (1985) have merged *B. poluninii* Ahrendt and *B. subteroclada* var. *minoripes* Ahrendt of the subsect. *Leavis* under section *Wallichiana* which have according to Ahrendt (l.c.) characters such as sulcate stems and pruinose blue berries. Another important character by which subsections *Replicatae* and *Leavis* are separated by Ahrendt (l.c.) is based on leaves which are very revolute in subsection *Replicatae* but not or scarcely so in subsection *Leavis*. Chamberlain and Hu (1985) have segregated *B. praecipua* from *B. griffithiana* on the basis of the following characters: 1) Flowers 3-7 per fascicle; 2) pedicels 20-23 mm long; 3) Ovules 2-4 and 4) leaves dull green above in *B. griffithiana* whereas in *B. praecipua* 1) Flowers 5-15 per fascicle; 2) Pedicels 7-17 mm long; 3) ovules 1-2 and 4) leaves slightly lustrous. We follow Chamberlain and Hu (1985) in keeping *B. poluninii* and *B. subteroclada* var. *minoripes* under *B. praecipua* though there are a lots of differences between these

Revision of Berberidaceae of India

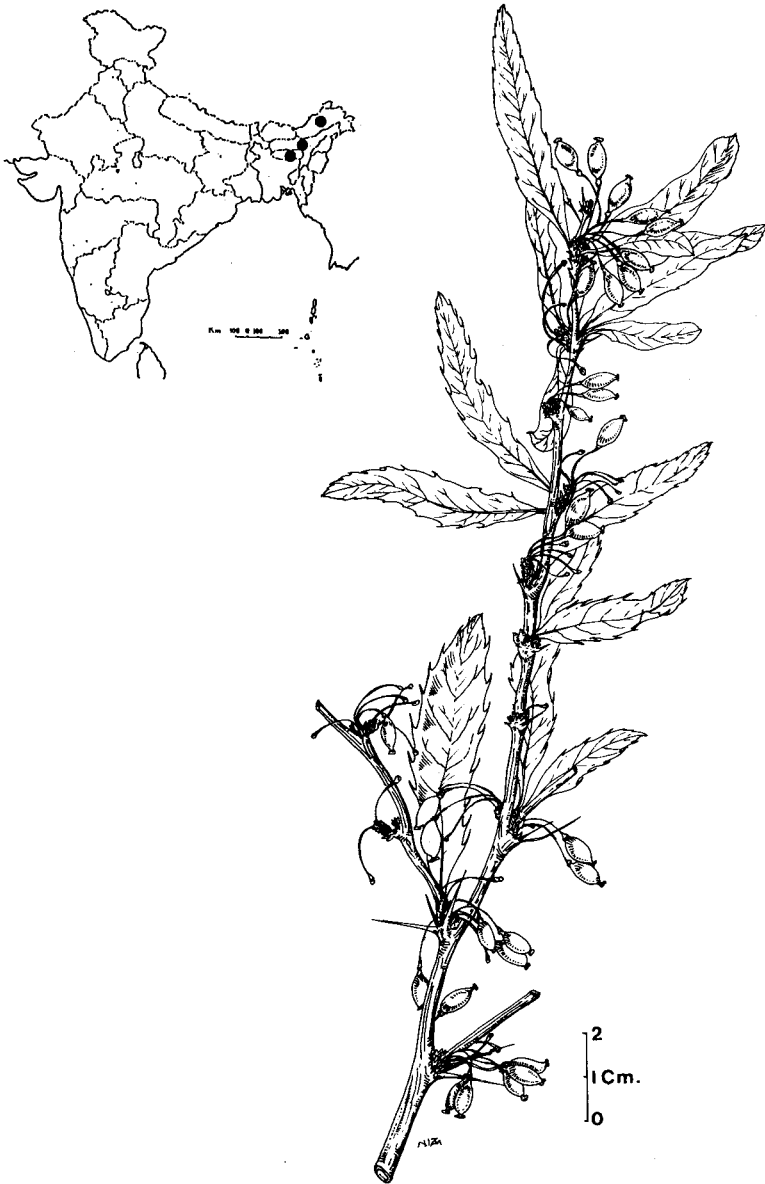


Fig. 13. *Berberis praecipua* Schneid. (Based on: T.S. Rana & Party 210301).

R.R. Rao et al.

species as already discussed above. But without looking at the Types we cannot derive at any definite conclusion.

28. **Berberis griffithiana** Scheid. in Bull. Herb. Boiss. ser. 2, 5: 403.1905; Chatterjee in Rec. Bot. Surv. India 16(2): 9. 1953; Ahrendt in J. Linn. Soc. Bot. 57: 43.1961; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42(3): 547. 1985; Banerjee in Sharma et al., Fl. India 1: 403. 1993. (Fig. 14).

B. subteroclada Ahrendt in J. Bot. 79 (Suppl.): 21. 1941. Type: Bhutan, Chendebi, 2800 m, 14.5.1937, Ludlow & Sherriff 3046 (holo - BM).

B. subteroclada Ahrendt. var. *impar* Ahrendt in J. Bot. 79, (Suppl.): 21. 1941. Type: Bhutan, Chendebi, 2800 m, 14.5.1937, Ludlow & Sherriff 3045 (Holo - BM).

Evergreen shrubs 1-3 m tall; stems verruculose, yellow, sulcate; spines 3-fid, 1-2.5 cm long. Leaves 1.5-6 x 0.3-1.3 cm, lanceolate, oblong-elliptic or elliptic-lanceolate, apex acute or mucronate, decurrent, sessile, margins with 3-10 appressed spinules, lateral veins clearly visible, dull grey-green below. Inflorescence fascicled, 4-20-fld; pedicels 16-25 mm long, slender. Prophylls 1.5- 2 x 1-1.5 mm. Outer sepals 4-5 x 3-4 mm, ovate to obovate, apices rounded; inner sepals 6.5-9 x 4-6 mm, elliptic or obovate. Petals 5.25- 7.5 x 3.5 - 4 mm, obovate, emarginate; glands 1.5-2 mm long, lanceolate, acuminate. Anthers 1 mm long; filaments 2.5 mm long; apices of stamens truncate with a long connective. Berries 8-10 x 3-4 mm, reddish, epuinose, estylose.

Key to the varieties (after Chamberlain & Hu, 1985)

1. Leaves green, epruinose below **B. griffithiana** var. **griffithiana**
 1. Leaves glaucous, (pruiunose below) **B. griffithiana** var. **pallida**

B. griffithiana var. **griffithiana**

Type: Bhutan, Griffith 125 (syn. - W); Bhutan, Griffith 1742 (syn. - E, K, CAL).

Fl.: April-May

Distribution: INDIA: Arunachal Pradesh, Meghalaya; BHUTAN; CHINA (S.E. Tibet)

Ecology: In Tsuga, Rhododendron and bamboo forest, 2500-3300 m.

Specimens examined: Arunachal Pradesh: Lower Subansiri Distt.: Ziro, 1650 m, 1.5.1993, T.S.Rana & Party 210330 (LWG); 1 Km from Hapoli, 1650m, 1.5.1993, T.S.Rana & Party 210325 (LWG); 1 Km from Hapoli, 1650 m, 1.5.1993, T.S.Rana & Party

Revision of Berberidaceae of India

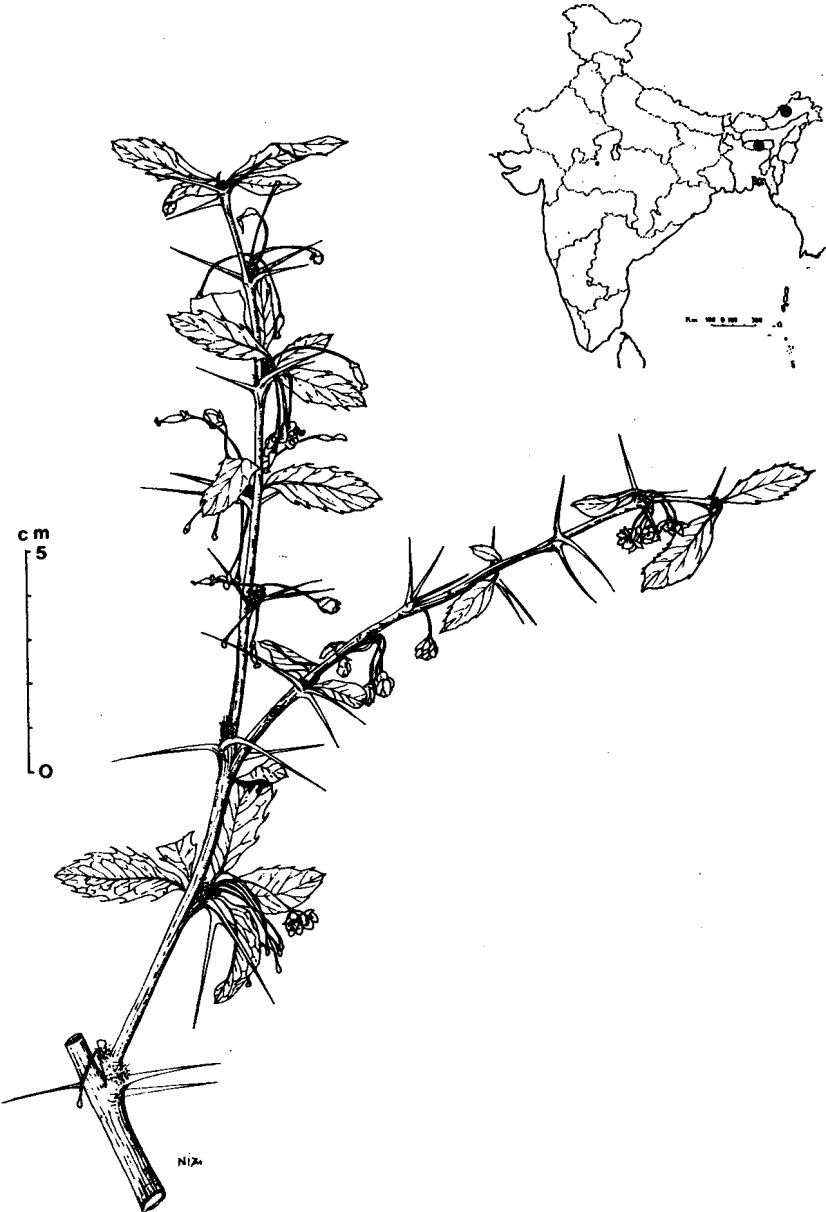


Fig. 14. *Berberis griffithiana* Schneid. (Based on T.S. Rana & Party 210330)

Revision of Berberidaceae of India

29. *Berberis replicata* W.W.Smith in Notes Roy. Bot. Bot. Gard. Edinb. 11: 200. 1920; Stapf in Bot. Mag. 151:t. 9076. 1925; Ahrendt in J. Linn. Soc. Bot. 57: 43. 1961; Chamberlain & Hu in Notes Roy. Bot. Gard. Edinb. 42 (3): 547. 1985.

Type: China, Yunnan, N of Tengyueh (Tengchong), *Forest 7785* (holo - E; iso - K).

Shrubs 1-1.5 m tall; stems glabrous, terete, distinctly verruculose; spines 1-2.6 cm long, 3-fid. Leaves 2-3.5 x 0.3-0.9 cm, elliptic, oblong-elliptic to oblong lanceolate, apex ending into a spine, base attenuate, coriaceous, dull green above, pruinose white below, margins entire or with 1-3 spinose serrate, margins revolute. Inflorescence fascicled, 2-12-fld, bracts 1.5 mm long. Outer sepals 4-5x3 mm, acute or subacute; inner sepals 5.5-6x3.5 mm obovate. Petals 5-6 x 3.75-4 mm, obovate, acutely emarginate; glands 0.5-2 mm long. Stamens 4-4.5 mm long, truncate. Ovules 2, sessile. Berries 6-8 x 3-5 mm, oblong; style 0.25 mm long.

Notes: *Berberis replicata* var. *replicata* is reported from China (SW Yunnan) and hence not included in this account, the other variety, var. *dispar* though previously reported from Tibet and Bhutan has extended its Distribution to Arunachal Pradesh in NE India. This is evident from our own collections.

Berberis replicata* var. *dispar Ahrendt in J. Bot. 79 (Suppl.) 20. 1941; Chatterjee in Rec. Bot. Surv. India 16(2): 11. 1953.

Type: S. Tibet: between Pangchen and Le, Nyam Jang Che, 7500 ft, 4.4.1936, *Ludlow & Sherriff 1274* (holo - BM).

Inflorescence 2-6-fld; outer sepals 4-5 mm long, acute; glands on petals 1.5-2 mm long.

Fl. & Fr.: April - July.

Distribution: INDIA: Arunachal Pradesh; TIBET; BHUTAN.

Ecology: Open scrub jungle; 2250-2500 m.

Specimens examined: Arunachal Pradesh: Bomdila on way to Dirang, 4.5.1993, *T.S.Rana & Party 210335* (LWG).

Notes: The identity of *Berberis replicata* var. *dispar* has been discussed by Husain *et al.* (1994). They have concluded that *B. replicata* var. *dispar* is closer to var. *replicata* than it is to *B. griffithiana*, thus contradicting Chamberlain and Hu (1985) who had placed *B. replicata* var. *dispar* under *B. griffithiana* var. *pallida*.

R.R. Rao *et al.*

30. **Berberis asiatica** Roxb. ex DC., Syst. Nat. 2:13. 1821, non Griffith, 1847; Hook.f. & Thoms. in Hook.f., Fl. Brit. Ind. 1:110. 1872; Duthie, Fl. Upper Gang. Pl. 1:32. 1903; Haines, Bot. Bihar & Orissa 1:20. 1921; Chatterjee in Rec. Bot. Surv. India 16(2): 13. 1953; Ahrendt in J.Linn. Soc.Bot.57:86. 1961; Uniyal & Rao in Sharma *et al.*, Fl. India 1:370. 1993. (Fig.15).

Vern.: Kilmora (Kumaon)

Shrubs up to 3 m tall; stems yellowish, young ones sulcate, and puberulous, mature stems terete, glabrous; internodes upto 4 cm long; spines 3-fid, 0.9-3 cm long, central spine longer than the lateral ones. Leaves 1.1-7.5 x 0.8-3.5 cm, obovate, oblong-obovate or elliptic, apex mucronate, base attenuate, shortly petiolate; petiole 1-5 mm long, thickly coriaceous, entire or distinctly 2-6-spinose along margins, upper surface distinctly reticulate, lower surface papillose but reticulations less distinct. Inflorescence fascicled, racemose or umbellete-racemose, 15-25-fl'd; pedicels 0.5-2.5 cm long, glabrous, reddish; bracts 2.5-3 x 2-2.5 mm. Outer sepals 2-4 x 2-3 mm, broadly ovate; inner sepals 6-8 x 4-5 mm obovate. Petals 7-8 x 5.5-6 mm, obovate, emarginate; glands obovate. Stamens 3.5-5 mm long, truncate; anthers 2-3 mm long; filaments 1.5-2 mm long. Ovary ellipsoid; ovules 2-5. Berries 8-10 x 7 mm, oblong-ovoid to ellipsoid, pruinose, young ones green or pinkish green mature ones pinkish, turning reddish and finally dark purple or black, stylose; style 0.5-1.5 mm long.

Notes: Ahrendt (1961) recognised two varieties, viz. *B. asiatica* var. *asiatica* and var. *clarkeana* but the characters on which he had segregated these two varieties could be observed in both the varieties, even in one and the same specimen one can see both entire as well as spinose leaves and umbellate-racemose as well as fascicled inflorescences. Although these two varieties are geographically isolated and distinct, at least morphologically these varieties do not deserve the segregation. The authors could not examine the Type specimen of var. *clarkeana* (Clarke 3417 - B, K) and therefore no definite conclusion could be drawn. Therefore, Ahrendt's (1961) treatment is followed.

Key to the varieties (after Uniyal & Rao, 1993)

1. Leaves usually with 2-5-spinulose margins; flowers in umbellate-racems **B. asiatica** var. **asiatica**
1. Leaves usually with entire margins; flowers in fascicles **B. asiatica** var. **clarkeana**

Berberis asiatica var. **asiatica**

Type: Nepal: 1819, Wallich 1477 (Holo - K).

• *Fl. & Fr.* March-May.

Revision of Berberidaceae of India

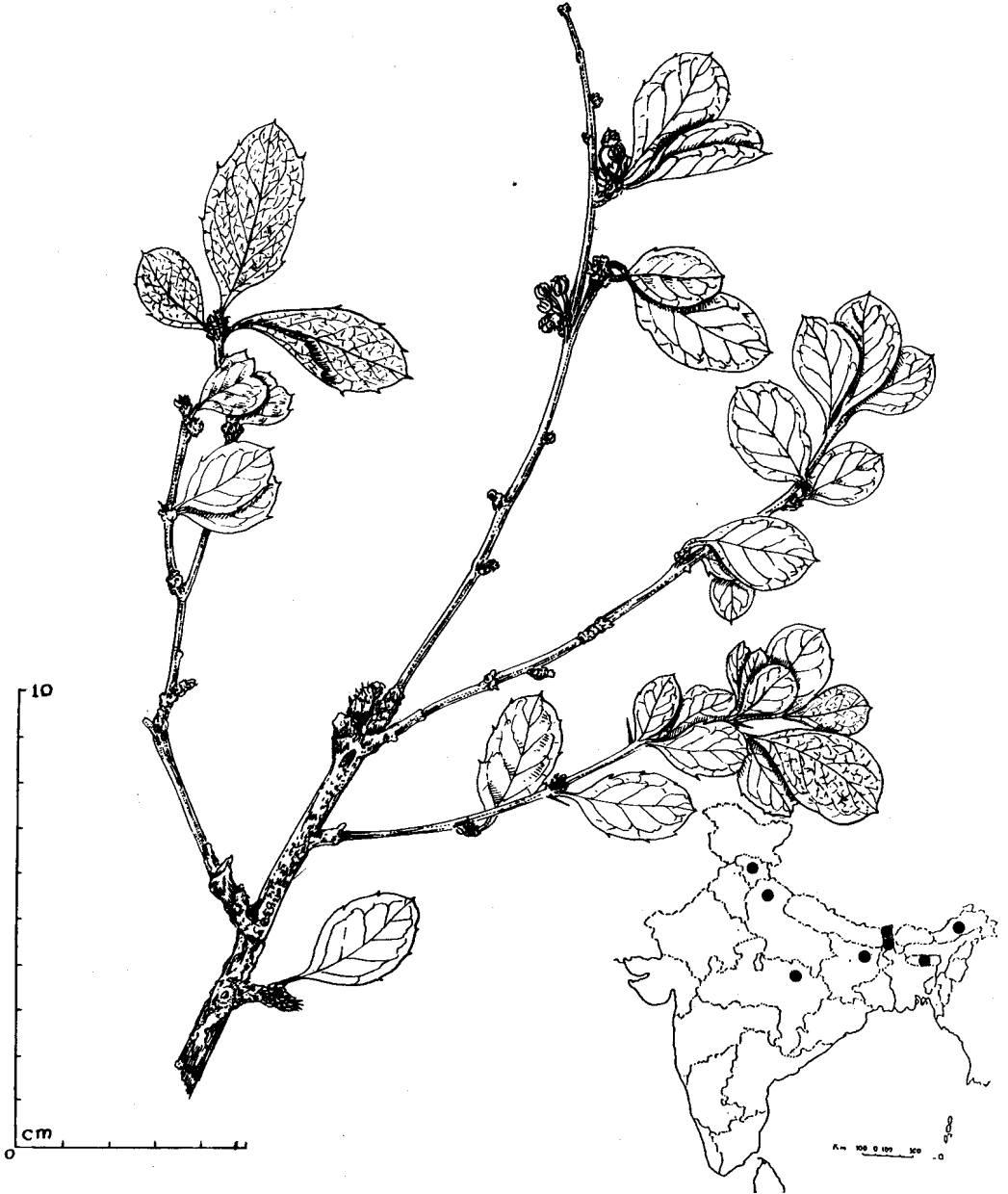


Fig. 15. *Berberis asiatica* Roxb. ex DC. var. *asiatica* (Based on J.N. Vohra 11199)

R.R. Rao et al.

Distribution: INDIA: Himachal Pradesh, Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Meghalaya, Bihar, Madhya Pradesh; AFGHANISTAN; NEPAL; BHUTAN; CHINA.

Ecology: Sub-Himalayan ranges, hillsides and valleys, sometimes associated with *Quercus* and *Rhododendron*; 900-2500 m.

Chromosome No.: n = 14 (S.B. Mall *et al.*, in *Taxon* 24:509. 1975)

Specimens examined: Himachal Pradesh: Janila hills, 1300m, 24.3.1957, *M.A.Rao* 2089 (BSD). Uttar Pradesh: Pithoragarh Dist: Naini Saini, 1560 m, 16.4.1992; *T. Husain* 212336 (LWG); Naini Saini, Bhangali Bunga Jungle, 1950m, 18.4.1992, *T. Husain* 212337 (LWG); On way to Kenalichina, Dhwaj, 1950m, 19.4.1992, *T. Husain* 212339, 212340 (LWG); On way to Kenalichina 1800m, 19.4.1992, *T.Husain* 212341, 212342 (LWG); Chandak, 1950m, 20 4.1992, *T.Husain* 212346, 212347 (LWG); On way from Tejam to Sungdum, 1980m, 24.4.1992, *T.Husain* 212361 (LWG); Tejam, 1980 m, 24.4.1992, *T. Husain* 212362 (LWG); Sobla, 1980m, 25.4.1992, *T.Husain* 212364 (LWG); On way from Sobla to Narayan Ashram, 2100m, 26.4.1992, *T. Husain* 212365 (LWG); Narayan Ashram, 2100 m, 27.4.1992, *T.Husain* 212366 (LWG); Bhatkot, 1680m, 4.5.1992, *T. Husain* 212369, 212370, 212371, 212372, 212372 (LWG); Mushtmanu, 1950m, 5.5.1992, *T. Husain* 212374, 212375, 212376 (LWG); Suvakot, near Wadda, 1650m, 6.5.1992, *T.Husain* 212377, 212378, 212379, 212380, 212381, 212382 (LWG); Almora Dist.: Ranikhet Chaubatia, 17.3.1961, *M.A.Rao*. 2.10.1912, *D.Hooker* 39034 (Sikkim) Jageshwar, 1980m, 7.5.1992, *T.Husain* 212384 (LWG); Nainital Dist, Jeolikot, 1250m, *T.Husain* & *B.Datt* 211443 (LWG); Naukuchia Tal, 16.3.1961, *s.l.* 14199 (BSD); Dehra Dun, 900m, 12.3.1957, *Y.K.Sarin* & *T.A.Rao* 1928 (BSD); Sahastradhara, 29.1.1964, *S.K.Malhotra* 30793, 31218 (BSD); Mussoorie, Barlowganj, 1500m, 27.12.1956, *Y.K.Sarin* 1485 (BSD); Pauri Garhwal: Lansdown, 1500m, 25.2.1960, *J.N.Vohra* 11199 (BSD); Nagdeoarea, 1800m, *R.P.Srivastava* 57012 (BSD); Khirsu 2100 m, 25.2.1980, *A.A.Ansari* & *Gharianad* 69081 (BSD); Tehri Garhwal: Rani chauni, 2000m, 28.2.1979, *A.K.Goel* 65801 (BSD); Garhwal; N Range tharali, 900-1800m, 22.3.1914, *Daulat Singh* 11 (BSD); Labha, 1650m, 23.3.1914, *A.E. Osmaston* 261 (BSD); Ameli Forest, 1800m, 6.4.1913, *A.E. Osmaston* 125 (BSD); Mussorie, 10.2.1900, *P.W. Makinnone s.n.* (SIKKIM). West Bengal: Darjeeling Bot. Gard., 8.3.1958, *Vaid* & *Thaphiyal* 25198 (DD). Arunachal Pradesh: Kameng F.D., 10.5.1957, *R. S. Rao* 7264 (SIKKIM); Kameng F.D., 5.4.1957, *G.Panigrahi* 6538 (SIKKIM). Kameng, Jabrang, *R.S.Rao* 6538, 7264 (ASSAM); Kameng, 1650 m, 16.4.1964, *K.C.Sahni* 5187 (DD). Bihar: Chotanagpur, 1884, *Schlich* 7231 (SIKKIM). Madhya Pradesh: Pachaurli - Hoshangabad, *s.l. s.n.* (BSD). E. Nepal: Khenji Bahadur Valley, *R.S. Rao* 17226 (ASSAM).

Revision of Berberidaceae of India

Berberis asiatica var. **clarkeana** Schneid. in Bull. Herb. Boiss. Ser. 2,5:457. 1905; Ahrendt in J. Linn. Soc. Bot. 57:87. 1961; Uniyal & Rao in Sharma *et al.*, Fl. India 1:370. 1993.

Type: Bengal: Clarke 3417 B (holo - K).

Fl. & Fr.: April - Aug.

Distribution: INDIA: Arunachal Pradesh, Bihar, Madhya Pradesh, NEPAL; BHUTAN.

Ecology: Open hill sides; 1000-2000 m.

Notes: Although the authors could not examine any of the specimens of this variety, yet it seems from the description that these two varieties should not be kept separately.

31. Berberis hainesii Ahrendt in J.Bot.Lond. 80 (Suppl.): 105. 1944; et in J.Linn. Soc. Bot. 57: 90. 1961; Chatterjee in Rec. Bot. Surv. India 16(2): 14. 1953; Uniyal & Rao in Sharma *et al.*, Fl. India 1:371. 1993. (Fig. 16)

Shrubs 1.5-2 m tall; stems pale yellow, terete; internodes 1.5-6 cm long; spines 6-12 mm long, sulcate. Leaves 4-6x2-3 cm, broadly oblong-elliptic, apex mucronate, base truncate, thin, petioled, entire, rarely 1-4 spinulose; above dull grey green; below pruinose grey, papillose; young leaves thinner. Inflorescence umbellate-racemose or subfascicled, 3-6-fl'd. Flowers 8-10 mm across. Petals 6 mm long, narrowly obovate. Berries oblong-ellipsoid, estylose or shortly stylose, pruinose.

Notes: According to Ahrendt (1961) "this species is interesting in its unusual habitat, and its character, it has some affinity with *Berberis* sect. *Tinctoriae*, subsect. *Umbellatae* but even more with Sect. *Heteropodae*". Ahrendt (l.c.) has recognised two varieties under this:

Key to the varieties (after Ahrendt, 1961)

1. Pedicels 1-2 cm long; fruits estylose **B. hainesii** var. **hainesii**
1. Pedicels 6-9 mm long; fruits shortly stylose **B. hainesii** var. **brevifilipes**

Berberis hainesii var. **hainesii**

Type: India: Central Provinces, Pachinaki, June 1911, Haines 2905 (holo - K).

Fl. & Fr.: June-Oct.

Distribution: INDIA: Madhya Pradesh (Endemic).

Ecology: On sandstones and rocks, ca 600-700 m.

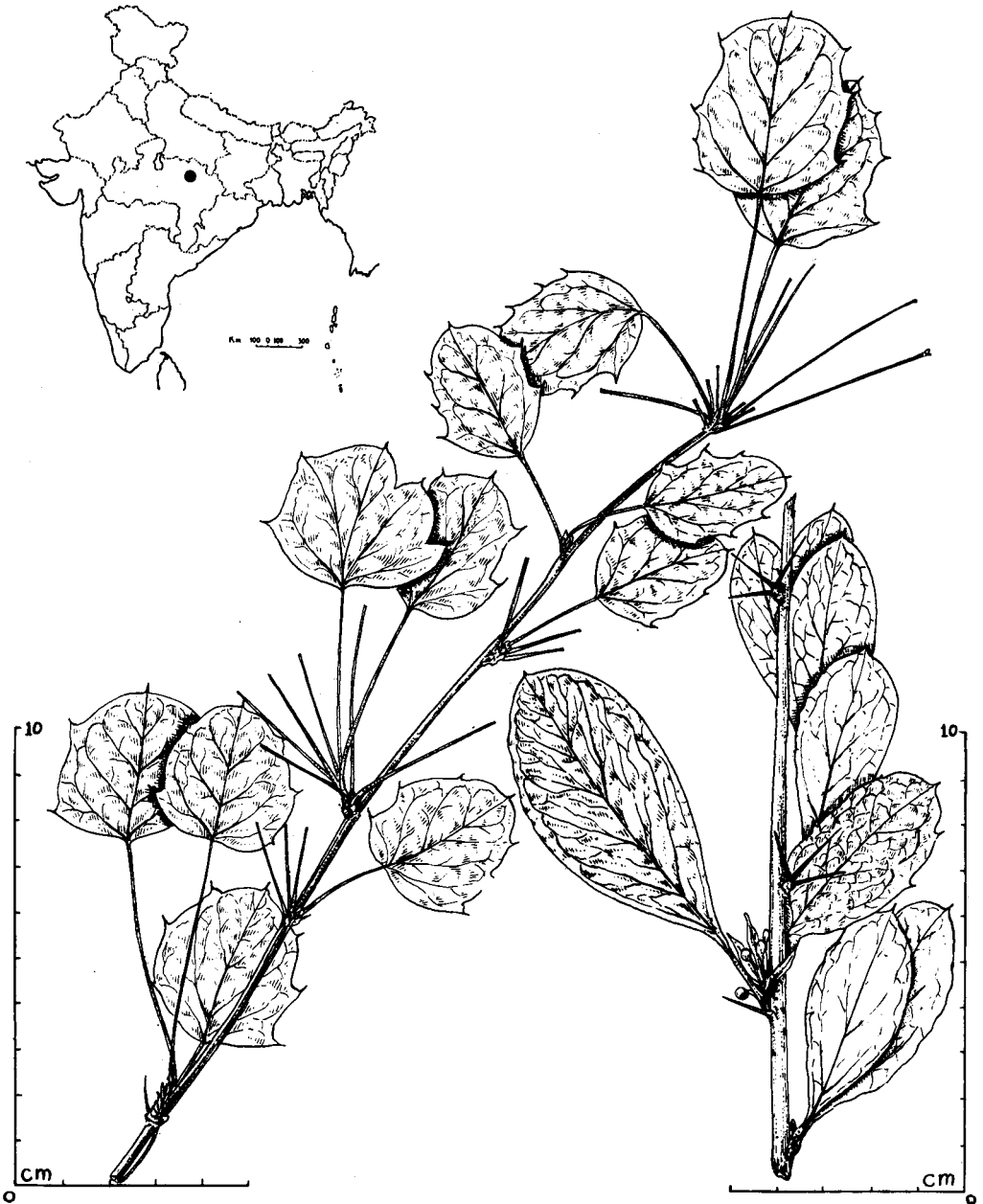
R.R. Rao *et al.*

Fig. 16. *Berberis hainesii* Ahrendt (Based on R.S. Hole 864)

Revision of Berberidaceae of India

Specimens examined: Madhya Pradesh: Jalgali (Pachmarhi), 16.12.1993, V. Nath & A.K. Asthana 205588 (LWG); Pachmarhi, 1908, R.S. Hole 864, 856 (DD).

Notes: The specimen collected by V. Nath and A.K. Asthana (No.205588) is in vegetative condition. Thus it was difficult to assign it to any variety.

Berberis hainesii var. **brevifilipes** Ahrendt in J.Bot.Lond.80 (Suppl.): 105. 1944; et in J. Linn. Soc. Bot. 57:91.1961; Chatterjee in Rec. Bot. Surv. India 16 (2): 15. 1953; Chatterjee in Rec. Bot. Surv. India 16 (2): 15. 1953; Uniyal & Rao in Sharma *et al.*, Fl. India 1:372. 1993.

Type: India: Central Provinces, near Bes falls; 18 Feb., 1891, *Duthie 13202* (holo - K).

Fl. & Fr.: Feb. - June.

Distribution: INDIA: Madhya Pradesh (Endemic).

Notes: The authors could not examine any specimen of this taxon.

32. Berberis glaucocarpa Stapf in Bot. Mag. 101, sub. t. 9102. 1926; Ahrendt in J. Bot. Lond. 80 (Suppl.): 101. 1943; et in J. Linn. Soc. Bot. 57: 90 f. 26 1961; Chatterjee in Rec. Bot. Surv. India 16 (2): 14. 1953; Jafri in Nasir & Ali, Fl. W. Pak. 87:13 .f. 3, C. 1975; Uniyal & Rao in Sharma *et al.*, Fl. India 1: 371. 1993.

Berberis coriaria auct. non Royle; Brandis ex Gamble, Man. Indian Timb. ed. 1, 14.1881; Collett, Fl. Siml. 22. 1902.

Berberis aristata auct. non DC; Parker, For. Fl. Punj. with Hazara and Delhi 15. 1918.

Type: Jaunsar: hills between Tons and Gisi rivers, 8000 ft., May 1875, *Brandis 746* (holo - K).

Shrubs 3-4 m tall; stems pale yellow, terete, glabrous, very minutely vemiculose; internodes 2.5-4 cm long; spines solitary or 3-fid, 5-16 mm long. Leaves 1.5 - 8 x 0.7 - 2.5 cm, obovate - elliptic, apex mucronate, base tapering, sessile or very shortly petioled, usually 4-8 spinose - dentate at margin, pale, venation clear on both surfaces. Inflorescence racemose, 15-25 - fld, 2-4 cm long, rigid, rarely slightly compound. Flowers 10-12 mm across, pale yellow; pedicels 5-10 mm long in fruit, stout. Prophylls ca 1 mm long. Outer sepals ca 2 mm long, ovate; middle ones 4 mm long; inner sepals 6 mm long, obovate. Petals 7 x 4.5 mm, obovate, apex retuse, base clawed; glands 2. Stamens 5.5 mm long, apices subapiculate. Berries 6-9 x 6-8 mm, oblong - globose, black, pruinose-white; style 1 mm long; seeds 3-4.

Fl. & Fr.: April - Sept.

R.R. Rao et al.

Distribution: INDIA: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh; PAKISTAN; NEPAL.

Ecology: In open shrubby places; 2100-3000 m.

Specimens examined: Himachal Pradesh: Pangi village, Kinnaur Dt., 2900 m, 3.9.1963, N.C.Nair 30433 (BSD); Chimu 2775m, N.C.Nair 22295 (BSD); Sibola, 11.7.1877, J.S. Gamble 4583 (CAL); Simla, 2400, 30.9.1876, Gamble 1484 C (CAL). Uttar Pradesh: Garhwal: Tehri Garhwal: Manumangauga valley, 2000 m, 28.4.1968, C.M. Arora 37860 (BSD); Nagtibba, 2600 m, 27.7.1964, U.C. Bhattacharya 33743 (BSD); Gangi, 3000 m, 11.8.1978, A. K. Goel 64382 (BSD); Jaunsar, Mundali, 2100-2400m, 4.6.1894, Duthie 21090 (DD); Tehri, 2400 m, May, 1891, J.S. Gamble 22772 (DD); Jaunsar: B. Odyar, 2100m, May, 1892, Gamble 93892 (DD); Deoban, 2400 m, s.l. 23802 (DD); Mundali, 22.9.1958, K.C. Sahni 26743 (DD); T. Garhwal Deola, 2550 m, May, 1896, Gamble 25762 (DD); Jaunsar, Mundali, 2340 m, April; 1894, J.F. Duthie s.n. (CAL); Tehri Garhwal, Deota, 25550 m, Gamble s.n. (CAL); Uttarkashi, Sullhi slopes, 14.9.1991, B.S.Aswal 18318 (LWG); Uttarkashi Jhale, 14.9.1991, B.S. Aswal 18321 (LWG); Gangi, A. K. Goel 64382 (LWG). Kumaon: Farkia - Dwali, 2500 - 3000 m, 25.9.1957, T.A. Rao 4608 (BSD).

Notes: Ahrendt (1961) distinguished *Berberis glaucocarpa* from *B. aristata* mainly on the basis of their distribution as he has clearly remarked that "I have seen no herbarium specimens from east Tehri and the references to Kumaon (Collett, 1902) and Nepal (Parker, 1918) may introduce confusion with *B. coriaria* and *B. aristata*". Ahrendt (l.c.) and subsequently Uniyal and Rao (1993) have distinguished *Berberis* section *Tinctoriae* from section *Asiaticae* on the basis of colour of fruit whereas in the description of *B. aristata* they have mentioned berries as pruinose blue.

We have also studied specimens from Kumaon and Himachal Pradesh and the segregation of *B. glaucocarpa* from *B. aristata* and *B. coriaria* is difficult and a clear cut picture would only emerge after the study of type specimens of all the 3 taxa. The stout nature of the pedicel and the rigid inflorescence in *B. glaucocarpa* may be a good character for distinguishing this species from the other two above mentioned species.

33. ***Berberis lycium*** Royle in Trans. Linn. Soc. Lond. 17:94.1834; Hook.f.&Thoms.in Hook.f., Fl. Brit. India 1: 110. 1872 (partly); Hook.f. in Bot. Mag. 115: t.7075. 1889; Collett, Fl. Siml. 22. 1902; Chatterjee in Rec. Bot. Surv. India 16(2): 13. 1953; Parker, For. Fl. Punj. rep. ed.: 14. 1958 (partly); Ahrendt in J. Linn. Soc. Bot. 57:87. 1961; Jafri in Nasir & Ali, Fl. W. Pak. 87: 10. 1975; Uniyal & Rao in Sharma et al., Fl. India 1: 372-373. 1993.

Revision of Berberidaceae of India

B. khasiana Ahrendt in J. Bot. Lond. 80 (Suppl.) 100. 1943; et in J. Linn. Soc. Bot. 57:89. 1961; Uniyal & Rao in Sharma *et al.*, Fl. India 1: 372. 1993. Type: Khasia Hills, 1844, Griffith *s.n.* (lecto - BM; isolecto - K.)

Shrubs upto 4 m high; stems terete or sulcate, ash grey, pale, glabrous or pubescent; internodes 1.5-3.5 cm long; spines 3-fid, 5-20 mm long, subterete. Leaves 2-7 x 0.5-1.2 cm, obovate or oblanceolate, attenuate at base, acute-mucronate at apex, entire or 2-4 spinulose along margins, papillose, greyish or whitish below. Inflorescence racemose, 10-25-fl., 3-6 cm long, rarely shorter and subfascicled. Flowers 6-8 mm across, usually pale-yellow; pedicels upto 2 cm long, slender, thin, glabrous; bracts 2-2.5 mm long. Prophylls 1 mm long, ovate. Sepals in 3 whorls; outer ones 2 x 1 mm, ovate, obtuse; median ones 3.5-3.75 x 2-2.5 mm, ovate, obtuse; inner ones 4.5-5 x 3 mm, obovate. Petals 4 x 2-2.5 mm, obovate, emarginate, with lanceolate basal glands. Stamens 2.5-3.25 mm, apiculate; anthers 1.25 mm long; filaments 1.25-1.5 mm long. Ovules usually 4, shortly stipitate. Berries 7-9 x 5 mm, ovoid to ellipsoid, blue or black with heavy grey white bloom, stylose; style 1 mm long.

Notes: Chiefly employed in making Rasout. Jafri *et al.* (l.c.) has remarked "a very variable species said to have replaced *Berberis ceratophylla* G. Don in Kashmir and Western Himalaya and itself to be replaced by *B. parkeriana* Schneid. in the bordering areas of Kashmir and Pakistan".

In one of our unpublished paper the authors have found the distinguishing characters of *B. lycium* and *B. khasiana* not only overlap but also vary from population to population and often on the same plant. Thus after the types of both the species at K and BM the authors have concluded that both these species are conspecific and therefore the species *B. khasiana* is merged under *B. lycium*.

Key to the varieties

1. Stems sulcate.
 2. Leaves whitish below **B. lycium** var. **lycium**
 2. Leaves dull green below **B. lycium** var. **subvirescens**
1. Stems terete.
 3. Inflorescence subfascicled **B. lycium** var. **subfascicularis**
 3. Inflorescence racemose **B. lycium** var. **simlensis**

Revision of Berberidaceae of India

B. khasiana Ahrendt in J. Bot. Lond. 80 (Suppl.) 100. 1943; et in J. Linn. Soc. Bot. 57:89. 1961; Uniyal & Rao in Sharma *et al.*, Fl. India 1: 372. 1993. Type: Khasia Hills, 1844, Griffith *s.n.* (lecto - BM; isolecto - K.)

Shrubs upto 4 m high; stems terete or sulcate, ash grey, pale, glabrous or pubescent; internodes 1.5-3.5 cm long; spines 3-fid, 5-20 mm long, subterete. Leaves 2-7 x 0.5-1.2 cm, obovate or oblanceolate, attenuate at base, acute-mucronate at apex, entire or 2-4 spinulose along margins, papillose, greyish or whitish below. Inflorescence racemose, 10-25-fl., 3-6 cm long, rarely shorter and subfascicled. Flowers 6-8 mm across, usually pale-yellow; pedicels upto 2 cm long, slender, thin, glabrous; bracts 2-2.5 mm long. Prophylls 1 mm long, ovate. Sepals in 3 whorls; outer ones 2 x 1 mm, ovate, obtuse; median ones 3.5-3.75 x 2-2.5 mm, ovate, obtuse; inner ones 4.5-5x3 mm, obovate. Petals 4 x 2-2.5 mm, obovate, emarginate, with lanceolate basal glands. Stamens 2.5-3.25 mm, apiculate; anthers 1.25 mm long; filaments 1.25-1.5 mm long. Ovules usually 4, shortly stipitate. Berries 7-9 x 5 mm, ovoid to ellipsoid, blue or black with heavy grey white bloom, stylose; style 1 mm long.

Notes: Chiefly employed in making Rasout. Jafri *et al.* (l.c.) has remarked "a very variable species said to have replaced *Berberis ceratophylla* G. Don in Kashmir and Western Himalaya and itself to be replaced by *B. parkeriana* Schneid. in the bordering areas of Kashmir and Pakistan".

In one of our unpublished paper the authors have found the distinguishing characters of *B. lycium* and *B. khasiana* not only overlap but also vary from population to population and often on the same plant. Thus after the types of both the species at K and BM the authors have concluded that both these species are conspecific and therefore the species *B. khasiana* is merged under *B. lycium*.

Key to the varieties

1. Stems sulcate.
 2. Leaves whitish below **B. lycium** var. **lycium**
 2. Leaves dull green below **B. lycium** var. **subvirescens**
1. Stems terete.
 3. Inflorescence subfascicled **B. lycium** var. **subfascicularis**
 3. Inflorescence racemose **B. lycium** var. **simlensis**

R.R. Rao et al.

Berberis lycium var. lycium

Type: Kashmir: Royle s.n. (K, LIV, not seen).

Fl. & Fr.: March-Sept.

Distribution: INDIA: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Tamil Nadu; PAKISTAN; NEPAL.

Ecology: Open hill sides; 600 m- 2700 m.

Chromosome No.: n = 14 (Singhal et al., in *Taxon* 29: 355. 1980).

Specimens examined: Jammu & Kashmir: Loran-sultanpathee, 2000-2500m, 17.9.1985, *Vohra & Naithani 74348* (BSD); Ramnagar, Udampur, 23.3.1986, *Ajaiswami 540* (BSD); Bhaderwah, 2000 m, 29.5.1959, *T.A.Rao 9071* (BSD); Patani Top, 2300-2500 m, 11.9.1958, *T.A.Rao 7486* (BSD); Gulmarg, 29.6.1956, *T.A.Rao 187* (BSD); Srinagar, 1680m, 8.5.1892, *J.F. Duthie 10835* (DD); Jhelan valley, 1680m, 3.5.1892, *J.F. Duthie 10907* (DD); Tangmarg, 2100 m, 5.6.1968, *H.D. Thaphiyal 26436* (DD); Srinagar, 6.7.1891, *G.A. Gammie s.n.* (CAL); June 1905, *Meebold 3976* (CAL); Jammu Pr., Kishtwar, Doda, 17.7.1956, *G. Saran & Party 30055* (LWG); Baramulla, 30.6.1955, *Kaul & Party 23588* (LWG); Kud, 1500m, 12.5.1954, *Ram Lakhan 9818* (LWG); Sankaracharya Rocks, 19.5.1954, *L.D. Deo 10366* (LWG). Himachal Pradesh: Rainuka Lake, 14.4.1960, *M.A. Rau 11398* (BSD); Kalka, 31.3.1961, *M.A. Rau 14556* (BSD); Manali, 1800 m, 15.7.1972, *U.C.Bhattacharya 48537* (BSD); Dalhousie, 13.7.1963, *C.L. Malhotra & V.J.Nair 27351* (BSD); Lahul, Naggar, 24.7.1938, *N.L. Bor s.n.* (DD); Kullu valley, 8.6.1950, *S.K.Jain & R.C. Bhardwaja s.n.* (DD); Kullu, Parbathi valley, 23.5.1934, *C.E.Parkinson 3919* (DD); Kangra, 7.8.1928, *Bis Ram 319* (DD); Nagkanda, 2100 m, Jun. 1878, *J.S. Gamble 6128A* (DD); Manali, 15.7.1972, *U.C. Bhattacharya 48537* (SIKKIM); Chamba Dist., *B.M.Wadhwa 51076* (LWG, DD); Kathli local, 7.6.1959, *J.G. Srivastava & Party 61059* (LWG); from Aut to Panjain, 19.5.1959, *J.G. Srivastava & Party 58548* (LWG); Vashisht Kund, beyond Mand, Kangra Kullu Valley, 27.5.1959, *J.G.Srivastava & Party 60330* (LWG); Dalhousie, 3.6.1959, *J.G. Srivastava & Party 60667* (LWG); Bharatpur Road, Simla, 4.6.1954, *Ram Singh 12860* (LWG); On way to Taradevi hill, Mandi, 15.5.1959, *J.G. Srivastava & Party 59880* (LWG). Uttar Pradesh: Garhwal: Dehra Dun: Sahashradhara, 24.5.1963, *S.K. Malhotra 27672* (BSD); Robers cave, 24.4.1964, *C.R.Babu 35232* (BSD); Raipur, 1000 m, *U.C. Bhattacharyya 14816* (BSD); Chakrata, 2600 m, 18.4.1957, *M.A. Rau 2225* (BSD); Chakrata, 20.7.1968, *O.P. Misra 38105* (BSD); Agastmani, 21.4.1963, *C.L. Malhotra 26834* (BSD); Nandprayag, 23.6.1959, *M.A. Rau 10398* (BSD); Mandal Area, 1650 m, 21.5.1971, *B.D. Naithani 43941* (BSD); Pauri - Garhwal: Khirsu, 1700 m, 17.4.1977, *A.S. Rao 56469* (BSD); Khirsu Garden, 1800m, 4.5.1976, *R.P. Srivastava*

Revision of Berberidaceae of India

57033 (BSD); Nagdev Area, 1800 m, 22.4.1976, *R.P. Srivastava* 57012 (BSD); Mussoorie: 1600m, 2.4.1966, *C.L. Malhotra* 36803 (BSD); Mall Road, 1950m, 19.12.1956, *T.A. Rao* 1331 (BSD); Tehri, Suki to Thala, 2400-2700 m, *J.F. Duthie* 599 (DD); Jaunsar, Kotikansor, 1800 m, 1.6.1936, *C.E. Parkinson* 7041 (DD); Chakrata, 2190m, 27.5.1953, *M.B. Raizada* 23614 (DD); Uttarkashi, 1020m, 24.5.1956, *K.C. Sahni* 24774 (DD); Saharsdhara, 600 m, 30.6.1960, *R.K. Issar* s.n. (DD); Uttarkashi Dist.: Near NIM, 1.6.1992, *B. Datt & B. Lal* 212233 (LWG); Gangori, 1200 m, 30.5.1992, *B. Datt & B. Lal* 212233 (LWG); Kalyani, 1550m, 30.5.1992, *B. Datt & B. Lal* 212231, 212226, 212227 (LWG); Barkot, 1200m, 6.6.1992, *B. Datt & B. Lal* 212273 (LWG); Dehra Dun: Bhuderwala, 17.8.1962, *J.N. Vohra* 379 (SIKKIM); Mussoorie, 1869, *G. King* s.n. (SIKKIM). Madhya Pradesh: Panchmarhi, 1200m, Aug., 1949, *R.C. Bharadwaja* s.n. (DD).

Berberis lycium var. **subfascicularis** Ahrendt in J. Linn. Soc. Bot. 57:88. 1961; Uniyal & Rao in Sharma et al., Fl. India 1:374. 1993.

Type: Kashmir, Kistwar Dist., Tsingana, 6500ft, *Ludlow & Sherriff* 9105 (holo - BM).

Fl. & Fr.: April - July.

Distribution: INDIA: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh.

Ecology: 1550 m - 2200 m.; Common in drier exposed places and in forest clearings.

Chromosome No.: $n = 14$ (V.K. Singhal et. al., in Taxon 29: 355. 1980).

Specimens examined: Jammu & Kashmir: Kashmir, Qazigurd, 1650m, 15.5.1954, *G.S. Srivastava* 10244 (LWG). Uttar Pradesh: Garhwal: Uttarkashi Dist., Bhankoli village, 2000m, 30.5.1992, *B. Datt & B. Lal* 212229, 212228 (LWG); Uttarkashi Dist., Kalyani, 1550m, 30.5.1992, *B. Datt & B. Lal* 212230 (LWG).

Berberis lycium var. **simlensis** Ahrendt in J. Asiat. Soc. Beng. (Sci.) 11.1.1945; et in J. Linn. Soc. Bot. 57:88.1961; Uniyal & Rao in Sharma et al., Fl. India 1:373. 1993.

Type: Punjab Himalaya: Simla, 7000 ft., July 1885, *Collett* 234 (holo - K).

Fl. & Fr.: March - July.

Distribution: INDIA: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh.

Ecology: 1200m - 2100m, in exposed drier place.

R.R. Rao et al.

Specimens examined: Jammu & Kashmir: Khajpura, 2100m, 24.10.1953, *Kaul & Party s.n.* (LWG). Himachal Pradesh: Dalhousie, 1800m, 18.5.1971, *K.K. Singh & Party 3417* (LWG); Nagar, Kullu valley, 25.5.1959, *J.G. Srivastava & Party 60315* (LWG). Uttar Pradesh: Garhwal: Uttarkashi Dist.: Barkot, 1200 m, 6.6.1992, *B. Datt & B. Lal 212274* (LWG); Kalyani, 1550 m, 30.5.1992, *B. Datt & B. Lal 212225* (LWG); Kuthnor vill., 9.6.1992, *B. Datt & B. Lal 210588* (LWG).

Notes: Uniyal and Rao (1993) have mentioned that "this variety may be distinguished from all the other varieties of the group mainly by the pubescent nature of the stem", but this is not true as all the other varieties of *Berberis lycium* also have pubescent stems either while young or mature, a view also expressed by Uniyal and Rao (l.c.).

Berberis lycium* var. *subvirescens Ahrendt in J. Linn. Soc. Bot. 57: 88. 1961; Uniyal & Rao in Sharma et al., Fl. India 1:374. 1993.

Type: Kashmir: Gandarbal, Sind valley, 5200 ft., 31 May, 1940, *Ludlow & Sherriff 8095* (holo - BM)

Fl. & Fr.: April - June

Distribution: INDIA: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh.

Ecology: 1500 - 1700m, common in village area on banks of streams.

Specimens examined: Jammu & Kashmir Baramulla, 30.6.1955, *Kaul & Party 23588* (LWG). Himachal Pradesh: Chamba, 1500m, 30.4.1972, *K.K.Singh & Party 2746* (LWG). Uttar Pradesh: Garhwal: Uttarkashi Dist., Kuthor vill., 9.6.1992, *B. Datt & B. Lal 210588* (LWG); Kalyani, 1550m, 30.5.1992, *B. Datt & B. Lal 212232* (LWG).

Notes: Ahrendt (l.c.) and subsequently Uniyal and Rao (l.c.) stated that this variety is endemic to Jammu and Kashmir but our collections and present study show that this variety is also common in U.P. Himalaya especially Uttarkashi Dist. of Garhwal and also Himachal Pradesh.

34. *Berberis ahrendtii* R.R.Rao & Uniyal in Indian J. For. 8(4): 334. 1985; Uniyal & Rao in Sharma et al., Fl. India 1: 369. 1993.

B. lycioides Stapf in Bot. Mag. 151, t. 1902. 1926; Ahrendt in J. Linn. Soc. Bot. 57: 89. 1961, non Lowe, 1856, nec Linden & Planch, 1863.

Type: Cultivated: Fl. June, 1939; Fr. 27 Sept. 1939 (type - BM).

Shrubs, up to 3.5 m tall; stems pale yellow, glabrous, terete; internodes 3-5 cm long;

Revision of Berberidaceae of India

spines, 1-2 cm long, solitary. Leaves 1.5-7 x 0.5-1.8 cm, narrowly obovate, apex subacute or mucronate, base attenuate, sessile, entire or slightly spinulose, finely reticulate, epapillose. Inflorescence racemose, 10-20-fld, dense, drooping, sometimes compound below; peduncles 1-2 cm long; flowers 12-14 mm across; pedicels 7-10 mm long; bracts 2-3 mm. Sepals in 3 whorls; outer sepals 2.5 x 1.5 mm, ovate, acute; median ones 5x2.5 mm; inner ones ca 7.5-8 x 4.5-5 mm. Petals 6-5 x 4 mm, obovate-elliptic, entire, shorter than the inner sepals; marginal glands 6.5 x 4 mm. Stamens 5 mm long produced, apiculate. Berries 11 x 6 mm, oblong-ovoid, pruinose, grey-white; style 1-1.25 mm long.

Fl. & Fr.: April - Oct.

Distribution: INDIA: Uttar Pradesh (Endemic).

Ecology: not known.

Specimens examined: Uttar Pradesh: Chamoli, Sept. 1864, Brandis 3275 (CAL).

Notes: Rao and Uniyal (1985) proposed a new name for *Berberis lycioides* Stapf. as this name is a later homonym of *B. lycioides* Linden & Planch, 1863.

35. *Berberis parkeriana* Schneid. in Fedde Report. Sp. Nov. 11:162. 1912; Ahrendt in J. Bot. Lond. 80 (Suppl.): 105. 1944; et in J. Linn. Soc. Bot. 57:89. 1961; Chatterjee in Rec. Bot. Surv. India 16 (2): 14. 1953; Jafri in Nasir & Ali, Fl. W. Pak. 87:11 f. 2, G-J. 1975; Uniyal & Rao in Sharma et al., Fl. India 1:374. 1993. (Fig. 17)

Type: Pakistan: Hazara, Bagnolar Reserve, 1910, flower, *Parker s.n.* (syn. - W,K); Abbottabad, 1910, fruits, *Parker s.n.* (syn. - W).

Shrubs, upto 2.5 m high; stems sulcate; shoots puberulous; internodes 1.5-3 cm long; spines 1-2.1 cm long, 3-fid, slender, sulcate. Leaves 2-6 x 0.5-1.3 cm, narrowly obovate or lanceolate to oblanceolate, apex mucronate, base attenuate, entire, epapillose, petioles very short, concolorous green. Inflorescence subfascicled, racemose, 4-18-fld; pedicels 8-14 mm long, lower flowers with longer pedicels; prophylls 1x0.5 mm. Outer sepals 2.5x1.5 mm, oblong-elliptic, reddish; inner sepals 5x4 mm, obovate-elliptic. Petals 4.5-5x2-3 mm, narrowly oblong-elliptic, cuneate, subentire, glands 0.8x0.2 mm. Stamens 4 mm long, Shortly apiculate. Ovules 4. Berries 8-9 x 5-7 mm, broadly obovoid to suborbicular; bright blue, pruinose, stylose; style 1 mm long.

Fl. & Fr.: April - July.

Distribution: INDIA: Jammu & Kashmir, Himachal Pradesh; PAKISTAN; IRAN.

Ecology: 1000 - 2000 m.

R.R. Rao et al.

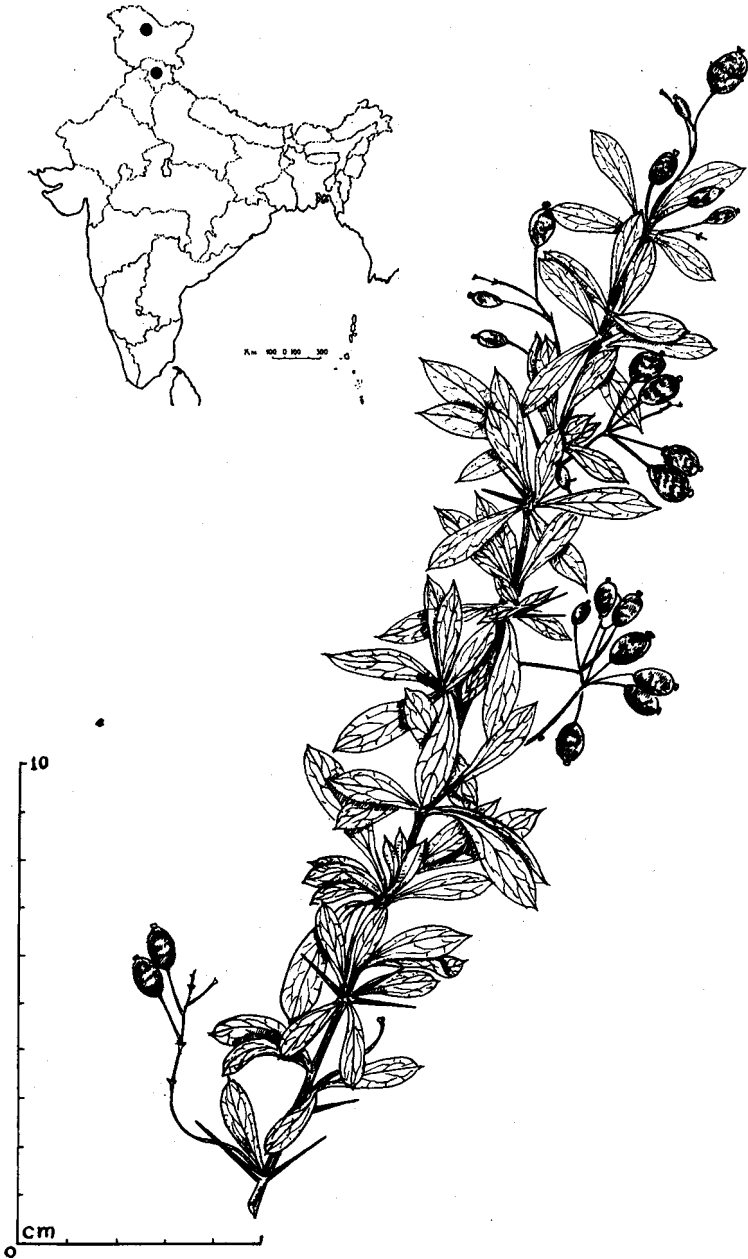


Fig. 17. *Berberis parkeriana* Schneid. (Based on U.C. Bhattacharyya 44890)

Revision of Berberidaceae of India

Specimens examined: Himachal Pradesh: Manali, 2000 m, 31.7.1917, U.C. Bhattacharyya 44890 (LWG, BSD).

Notes: Ahrendt (1961) had mentioned *Parker 4435* as the Type of this species but Jafri *et al.* (1975) had cited two specimens of Parker without number deposited at W and K as syntypes but as we could not examine the Types mentioned by the above authors it is difficult to say on which specimen Schneider had actually based his description of this species. Till such time when it is contradicted Jafri's (l.c.) typification is followed. Further according to Jafri *et al.* (l.c.) this species is very close to *Berberis lycium*.

Literature cited

- Ahrendt, L. W. A. 1941-45. A survey of the genus *Berberis* L. in Asia. New and old species from Bhutan, Assam, South Tibet, Upper Burma and Northwest Yunan in their relation to the analytical frame work of the genus. *J. Bot.* 79: Suppl. 1-64. 1941; 65-80. 1942; 80: 81-88. 1942; 89-96, 97-104. (1942) 1943; 105-112. (1942) 1944; 113-116 (1942) 1945; 1-116.
- Ahrendt, L. W. A. 1945. Some new or little known *Berberis* from India. *J. Roy. Asiat. Soc. Bengal* II.11: 1-5.
- Ahrendt, L. W. A. 1961. *Berberis* and *Mahonia* a taxonomic revision. *J. Linn. Soc. (Bot.)* 57: 1-410.
- Airy Shaw, H. K. 1966. *Willis' A Dictionary of Flowering Plants and Ferns*. 7th ed. Cambridge Univ. Press, Cambridge.
- Bentham, G. & J. D. Hooker. 1862. *Genera Plantarum* 1(1): 40-45. London.
- Chamberlain, D. F. & C. M. Hu. 1985. A synopsis of *Berberis* section *Wallichianae*. *Notes Roy. Bot. Gard. Edinb.* 42(3): 529-557.
- Chatterjee, R. 1953. Studies on Indian Berberidaceae from botanical chemical and pharmacological aspects. *Rec. Bot. Surv. India* 16(2): I-V, 1-86. Illus.
- Collet, H. 1902. *Flora Simlensis*, (IIIrd impr., repr. 1971). Bishen Singh Mahendra Pal Singh, Dehra Dun.
- Cronquist, A. 1968. *The Evolution and Classification of Flowering Plants*. Houghton Mufflin, Boston.
- Dahlgren, R. 1975. A system of Classification of the Angiosperms to be used to demonstrate the distribution of characters. *Bot. Notis* 128: 119-147.
- Engler, A. & K. Prantl. 1891. *Die Natürlichen Pflanzenfamilien* III. 2: 70-77.
- Grierson, A. J. C. & D. G. Long. 1984. Berberidaceae. In: *Flora of Bhutan*. 1(2): 322-328.

R.R. Rao et al.

- Hooker, J. D. & T. Thomson 1872. Berberidaceae. In: J. D. Hooker (Ed.), *The Flora of British India* 1: 107-113.
- Husain, T., B. Datt & R. R. Rao. 1994. On the identity of two taxa of *Berberis* (Berberidaceae) from Tibet. *Sida* 16(1): 17-21.
- Hutchinson, J. 1959. *The families of Flowering Plants*, 3rd ed. Vol. 1. Oxford Univ. Press, London.
- Jafri, S. M. H. 1975. In: E. Nasir & S.I. Ali (Eds.), *Flora of West Pakistan*. 87: 1-31.
- Kumar, V. & B. Subramaniam. 1986. *Chromosome Atlas of Flowering Plants of Indian Subcontinent*. Vol. I. BSI, Calcutta, pp.89-90.
- Kumazawa, M. 1938. Systematic and Phylogenetic consideration of Ranunculaceae and Berberidaceae. *Bot. Mag. Tokyo* 52: 9-15.
- Meacham, C. A. 1980. Phylogeny of the Berberidaceae with evolution of classification. *Syst. Bot.* 5: 149-172.
- Nair, P. K. K. 1965. Pollen grains of Western Himalayan Plants Asia Monographs, India 1(5): 1-102.
- Nowicke, J. W. & J. J. Skvarla. 1981. Pollen morphology and phylogenetic relationship of the Berberidaceae. *Smiths. Contr. Bot.* 53: 1-83.
- Rao, R. R. & P. K. Hajra. 1993. *Berberis*. In: B. D. Sharma et al. (Eds.), *Flora of India*, 1: 325-404.
- Schneider, C. K. 1905. Die Gattung *Berberis* (Euberberis). *Mitt. Deutsch. Dendr. Ges.* 14: 11-124.
- Schneider, C. K. 1905. Die Gattung *Berberis* (Euberberis). Vorarbeiten für eine Monographie. *Bull. Herb. Boiss.* II. 5: 33-48, 133-148, 391-403, 449-464, 655-670, 800-812.
- Schneider, C. K. 1908. Weitere Beiträge zur Kenntnis der Gattung *Berberis* (Euberberis). *Bull. Her. Boiss.* II. 8: 192-204, 258-266.
- Schneider, C. K. 1942. Die Gattung *Berberis* (Euberberis). *Mitt. Deutsch. Dendr. Ges.* 55: 1-60.
- Singh, V., D. K. Jain & M. Sharma. 1974. Epidermal studies in Berberidaceae and their taxonomic significance. *J. Indian bot. Soc.* 53: 271-276.
- Singh, V., D. K. Jain & M. Sharma. 1978. Leaf architecture in Berberidaceae and its bearing on the circumscription of the family. *J. Indian Bot. Soc.* 57(3): 272-280.
- Takhtajan, A. 1969. *Flowering Plants: Origin and Dispersal*. Smithsonian Inst. Press, Washington.
- Thorne, R. 1968. Synopsis of a putatively phylogenetic classification of the flowering plants. *Aliso* 6(4): 57-66.