

***Draba alshehbazii* (Brassicaceae), a new species from extreme altitudes of eastern Ladakh (Jammu and Kashmir, India)**

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The new species *Draba alshehbazii* Klimeš & D.German **sp. nov.** (Brassicaceae) from eastern Ladakh, India is described and illustrated. The species grows from 5310 to 6000 m in the subnival zone on solifluction soils. It resembles *Draba oreades*, with which it often occurs but is distinguished from all other *Draba* species in Ladakh by its yellow petals and tomentose indumentum. Differences from the eastern Tibetan *Draba involucrata* are discussed. A simplified key for the identification for *Draba* species in Ladakh is provided. © 2008 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2008, 158, 749–754.

ADDITIONAL KEYWORDS: Cruciferae – Pangong – Rupshu – taxonomy.

INTRODUCTION

Within the family Brassicaceae, *Draba* with *c.* 350 species currently accepted (Appel & Al-Shehbaz, 2002; Koch & Al-Shehbaz, 2002) is one of the largest genera, with most species occurring in alpine and arctic regions. The notorious taxonomic complexity of the genus, caused by autogamy and polyploidy (Brochmann, 1992; Scheen, Elven & Brochmann, 2002), is shared with other groups confined to harsh environments. There is a paucity of diagnostic characters because of the dwarf habit of plants and reduction in the number, size and complexity of individual plant organs. In Central Asia, the Himalayas and Tibet, *Draba* has also been undercollected because of the limited accessibility of the high altitudinal areas, which are often situated close to politically sensitive national borders. Consequently, new collections from the Himalayas and neighbouring mountains still include undescribed species (e.g. Al-Shehbaz, 2002b, 2004).

The number of *Draba* species accepted in the literature focusing on individual regions of the Western

Himalayas is about 30. For example, in the recent treatment of *Draba* in Jammu and Kashmir State, 21 species were listed (Rajeswari, Uniyal & Singh, 2002). Similarly, Jafri (1974) reported 23 *Draba* species from Pakistan and Kashmir. For all of India, Henry & Janarthanan (1993) included 33 species, of which 21 are known from Jammu and Kashmir. Records of several species are based on few specimens or even only one, and misidentifications are relatively frequent in herbaria. The entire genus urgently requires revision. In spite of these difficulties, distinct and well-delimited species can still be found in the Western Himalayas (e.g. Al-Shehbaz, 2002b).

While working on the *Flora of Ladakh*, several novelties were recorded at extreme altitudes of eastern Ladakh (e.g. Al-Shehbaz, 2002a), an area geographically belonging to the Tibetan plateau. Some of the new or rarely recorded species are common at altitudes between 5600 and 5900 m, but rarely descend below 5500 m. So far, about a dozen flowering plant species have been recorded in Ladakh at altitudes above 5500 m. However, recent field studies revealed that at least 120 species occur at these altitudes (L. Klimeš, unpubl. data). This indicates that collecting effort at the high altitudes of Ladakh and in neighbouring

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areas of western Tibet has been too low to provide satisfactory estimates of species composition and diversity. Therefore, it is not surprising that undescribed species can still be found in these remote areas. Here, we report a striking yellow-flowering cushion *Draba* species, discovered in eastern Ladakh by the first author in July 2000 and repeatedly observed in the field in 2001, 2002 and 2003. Comparisons with specimens in the herbaria BSD, K, LE, WII, P, W and WU and studies of original descriptions showed that the collected specimens can be recognized as a new species.

***DRABA ALSHEHBAZII* KLIMEŠ & D.GERMAN SP. NOV.**

Description: Herba perennis 1–1.5 cm alta, pulvinata, scaposa, flavovirescens-canescens, pilis molliusculis longistipitatis ramosis cum radiis pro more etiam ramosis tomentosa. Folia omnia rosularia, breviter (ad 4 mm) petiolata vel sessilia, oblanceolata vel oblonga, 4–7 × 1.2–2 mm, integerrima, basi attenuata, apice acuta vel obtusata, pilis stipitatis, furcatis vel substellatis triradiatis, radiis pro more ramosis (rami extremi numero 4–8) dense tomentosa; basi supra haud dense tomentosa vel glabrescens, margine pilis 1–2-furcatis ciliata. Scapi erecti, simplices, aphylli, pilis patentis stipitatis 1–2-furcatis, 3-radiatis substellatis et simplicibus intermixtis moderate obtecti. Racemi subumbellati, 3–6-flori, ebracteati; ei fructiferi folia aequantes vel paulo longiores, pedicelli fructiferi 3–4.5 mm longi, ab axis patentis, pubescentia. Sepala ovata, c. 1.3–1.8 mm longa, purpurea, pilis ramosis tomentosa, persistentia, non saccata, pallide luteo-marginulata. Petala flava, obovata, (2–)2.3–2.5 × 0.8–1.0 mm, apice rotundata. Filamenta 1.5–1.8 mm longa, antherae ovatae, 0.25 mm longae. Ovarium 4–6-ovulatum. Siliculae ellipticae, (2.8–)3.5–4.8(–5.6) × (1.5–)1.8–2.6(–2.8) mm, planae, apice et basi acutae vel subacutae, pilis 1–2-furcatis, raro simplicibus solitariis admixtis hirsutae; stylus 0.2–0.3 mm longus. Semina atrobrunnea, late elliptica, c. 1.1 × 0.75 mm.

Type: Rupshu: Tso Moriri, Luglung Valley, upper part, 5750 m a.s.l., 9 Aug 2002, 33°2.4'N, 78°26.6'E, *L. Klimeš 2071* (holotype: PRA, isotype: HEID).

Description: PERENNIAL HERBS 1–1.5 cm tall, pulvinate, scapose, greenish-yellowish canescent, tomentose throughout, except for basal parts of petioles and basal parts of stems, which are subglabrous, with rather soft, long-stalked, branched trichomes predominantly with finally branched rays. Caudex covered with petiolar remains of leaves of previous years, many branched, ultimate branches

terminating in rosettes. STEMS erect, simple, leafless, moderately pubescent with patent, stalked, forked trichomes with both branches simple or one branch forked, mixed with stalked, 3-rayed substellate and simple ones. LEAVES rosulate; petiole absent or up to 4 mm long, ciliate with stalked, 1–2-forked, trichomes; leaf blade obovate to oblanceolate or oblong, 4–7 × 1.2–2 mm, throughout uniformly tomentose except for proximal adaxial part, which is glabrous to sparsely tomentose with long-stalked, forked and 3-rayed, substellate trichomes with mostly branched rays, thus trichomes with 4–8 terminal rays appearing dendritic, base attenuate, margin entire, apex acute to subobtusate. Older leaves sometimes subglabrous, except for ciliae along leaf margin and distally tomentose, abaxial part of leaf blade. RACEMES subumbellate, (2–)3–6-flowered, somewhat elongated or not (1–2 lowermost fruits rarely somewhat apart), in fruit only slightly taller than or completely hidden in rosette. Fruiting pedicels 3–4.5 mm long, divaricate-ascending, straight or slightly curved, pubescent as stems. Sepals ovate, 1.3–1.8 mm, purplish, abaxially tomentose as leaves, persistent in fruit maturity, base of lateral pair not saccate, margin pale yellowish-membranous. Petals yellow, obovate, (2–)2.3–2.5 × 0.8–1.0 mm, apex rounded. Filaments 1.5–1.8 mm, anthers ovate, 0.25 mm long. Ovules 4–6 per ovary. FRUIT elliptic, (2.8–)3.5–4.8(–5.6) × (1.5–)1.8–2.6(–2.8) mm, not inflated, latisepate, not twisted; valves hirsute with comparatively short, stalked, forked trichomes with one or rarely both rays forked, sometimes with not inconsiderable admixture of simple trichomes, apex and base acute to subacute, not veined; style 0.2–0.3 mm. Seeds dark brown, broadly elliptic, c. 1.1 × 0.75 mm.

Phenology: flowering June–October, fruiting July–October.

Paratypes: India: NW India, Jammu and Kashmir State, Ladakh: Rupshu: Tso Moriri, Luglung valley, upper part, 5830–5840 m a.s.l., 15.xiii.2001, 33°4.9'N, 78°26.4'E, *L. Klimeš 1350* (PRA); Rupshu: Tso Moriri, Luglung valley, upper part, 5910 m, 15.xiii.2001, 33°5.6'N, 78°27.4'E, *L. Klimeš 1353* (PRA, MO, ALTB); Rupshu: Tso Moriri, Luglung valley, upper part, 5670–5810 m, 18.xiii.2001, 33°3.4'N, 78°26.1'E, *L. Klimeš 1356* (PRA); Rupshu: Tso Moriri, Mt. Lapgo, W slopes, 6000 m, 19.xiii.2001, 32°59.5'N, 78°27.8'E, *L. Klimeš 1361* (PRA); Rupshu: Tso Moriri, Lapgo River Valley, 5700 m, 12.vii.2000, 13.vii.2000, 33°0.3'N, 78°27.1'E, *L. Klimeš 908* (PRA); Pangong, Kuk Lungpa, upper part, 5500 m, 23.viii.2002, 33°29.4'N, 78°29.9'E, *L. Klimeš 2278* (PRA), Indus

valley: Zhung (Leh), Wari La, 5310–5340 m a.s.l., 14.ix.2001, 34°6.4'N, 77°50.1'E, *L. Klimesš 1810* (PRA).

Records: India: NW India, Jammu and Kashmir State, Ladakh: Pangong, Kuk Lungpa, upper part, 5470–5500 m, 23.viii.2002, 33°29.7'N, 78°29.4'E; Rupshu: Tso Moriri, Shurok Sumdo, slopes W of the site, 5900–5940 m, 9.viii.2002, 33°1.3'N, 78°28.1'E; Rupshu: Tso Moriri, Shurok Sumdo, slopes W of the site, 5800–5840 m, 9.viii.2002, 33°1.7'N, 78°27.3'E; Rupshu: Tso Moriri, Luglung Valley, upper part, 5790–5830 m, 9.viii.2002, 33°1.9'N, 78°26.9'E; Rupshu: Tso Moriri, Lunglung valley, upper part, 5780–5800 m, 12.ix.2003, 33°5'N, 78°26.5'E; Rupshu: Tso Moriri, Luglung valley to Lapgo valleys, upper parts, 5700–5780 m, 18.viii.2001, 33°1.2'N, 78°26.3'E; Rupshu: Tso Moriri, Luglung valley, upper part, 5900 m, 15.viii.2001, 33°5.6'N, 78°27.3'E; Pangong, Kuk Lungpa, upper part, Kaksas La, 5550–5570 m, 23.viii.2002, 33°29.8'N, 78°28.7'E; Rupshu: Tso Moriri, Shurok Sumdo, slopes W of the site, 5850–5890 m, 9.viii.2002, 33°1.5'N, 78°27.7'E; Rupshu: Tso Moriri, Lunglung valley, upper part, 5960 m, 11.ix.2003, 33°4.7'N, 78°26.6'E; Rupshu: Tso Moriri, Lapgo valley, upper part, 5720 m, 20.viii.2001, 33°0'N, 78°26.8'E.

Distribution and conservation status: So far known from two small areas north of the Indus River, about 90 km apart (Ladakh Range; border between Leh and Shyok regions according to Dickoré, 1995) and one larger area south of the Indus River and east of the Tso Moriri Lake (Rupshu region according to Dickoré, 1995), situated 45 km apart. Its presence in east Rupshu and western Tibet is expected. Most localities of the species are at altitudes above 5700 m, where grazing intensity is low (yaks, pikas) and presence of humans is infrequent (tourists, nomads crossing the mountain ranges). Therefore, the species does not seem to be under any threat.

Etymology: The species is named in honour of Ihsan A. Al-Shehbaz, an expert on Brassicaceae of the world, particularly Asian *Draba* species.

Iconography: Figure 1.

Habitat: *Draba alshehbazii* is a chamaephyte, restricted to the free solifluction subnival zone at altitudes of 5470 to 6000 m, with most localities situated above 5700 m. The only locality at a lower altitude (at 5310 m) is 90 km west of the other localities, where altitudinal belts are shifted towards lower altitudes as a result of lower continentality and higher precipitation. At altitudes above 5700 m, *D. alshehbazii* is a common species, forming relatively large

and compact cushions and colonizing flat areas and gentle slopes (usually <15°), growing on solifluction soils, often with some slate gravel, in outer parts of soil polygons, the soils being mesic, never waterlogged or very unstable. It is most frequently accompanied by *Alyssum klimesii* Al-Shehbaz, *Aphragmus oxycarpus* (Hook.f. & Thomson) Jafri, *Arenaria bryophylla* Fernald, *Desideria pumila* (Kurz) Al-Shehbaz, *Draba altaica* Bunge, *Draba oreades* Schrenk, *Eritrichium hemisphaericum* W.T.Wang, *Poa attenuata* Trin., *Potentilla pamirica* Th.Wolf, *Saussurea glacialis* Herder, *Saussurea gnaphalodes* (Royle) Sch.Bip., *Saussurea hypsipeta* Diels, *Saxifraga nanella* Engl. & Irmsch., *Stellaria decumbens* Edgew., *Thylacospermum caespitosum* (Camb.) Schischk. and *Waldheimia tridactylites* Kar. & Kir.

Draba alshehbazii often occurs together with one or several other species of *Draba*, most frequently with *Draba altaica*, *Draba glomerata* Royle, *Draba himachalensis* Al-Shehbaz and *D. oreades*, but sometimes also with *Draba lasiophylla* Royle and *Draba ludlowiana* Jafri (conspecific with *Draba stenobotrys* Gilg & O.E.Schulz, as suggested by I. Al-Shehbaz, unpubl. data). The simplified key on the next page can be used to identify *D. alshehbazii* in Ladakh:

Several other species are given in the literature from Ladakh: records of *Draba alpina* L. possibly belong to *D. oreades* Schrenk, from which it is not always separated (Nubra – Kachroo *et al.*, 1977; Suru valley – Chaurasia & Singh, 2001; Zuildo, Suru Valley – White, 1983). However, true *D. alpina* is distributed in northern Canada and Alaska, Europe, Siberia, the Far East and Mongolia (Zhou *et al.*, 2001). *Draba fladnizensis* Wulfen has been reported from Zaskar and Rupshu (Stewart, 1972) and from Nubra [Kachroo, Sapru & Dhar, 1977; synonym *D. glomerata* Royle]. True *D. fladnizensis* is likely to be absent in China (Zhou *et al.*, 2001) and its occurrence in the western Himalayas is also unlikely. *Draba incana* L. has been reported from the Lower Shyok valley (Chalunka) by Chaurasia & Singh (1996) and from Nubra and Zaskar by Kachroo *et al.* (1977). However, this species is restricted to Europe and North America (Zhou *et al.*, 2001). Records from Ladakh may belong to *D. lanceolata*, *D. lasiophylla* (cf. Zhou *et al.*, 2001) or *D. tibetica*. *Draba korshinskyi* Pohle was reported from Chang La by Singh, Singh & Uniyal (2002), based on H.J. Chowdhery & B.P. Uniyal 86140 (BSD!), which clearly belongs to *D. oreades*. Another record of this species from Nubra (Naqshi, Malla & Dar, 1989) is doubtful. The last species, *D. trinervis* O.E.Schulz, has been reported from Chang La by Singh *et al.* (2002), based on M. V. Viswanathan 55601 (BSD!). However, this specimen and its duplicate belong to *Stellaria decumbens* Edgew.

1. Annuals, caudex not developed, remains of rosettes from previous year absent.....
 *D. stenocarpa* Hook.f. & Thomson, *D. ellipsoidea* Hook.f. & Thomson
- Perennials with a caudex and remains of rosettes from previous year.....2
2. Flowering stems usually >10 cm tall, leafy, bearing usually more than two leaves, petals white; ovules 12–48(–56) per ovary.....
 *D. lasiophylla*, *D. lanceolata* Royle
- Flowering stems 1–25 cm tall, leafless or sometimes with 1–2 leaves, petals white or yellow; ovules 4–24 per ovary.....3
3. Ovules 18–24 per ovary, fruit (7–)9–17 mm long; flowering stems (6–)15–25 cm tall.....
 *D. tibetica* Hook.f. & Thomson
- Ovules 4–20 per ovary, fruit (3–)4–8(–9) mm long; flowering stems 1–12(–20) cm tall.....4
4. Petals white.....
 *D. altaica*, *D. ludlowiana*, *D. himachalensis*, *D. glomerata*, *D. winterbottomii* (Hook.f. & Thomson) Pohle
- Petals yellow.....5
5. Leaves covered with a mixture of simple and branched trichomes, branched trichomes with up to 4(–5) terminal rays, margin of leaf lamina base and petioles usually ciliate with simple trichomes.....
 *D. setosa* Royle, *D. oreades*, *D. cachemirica* Gand.
- Branched trichomes on leaves with up to eight terminal rays, simple trichomes on leaves absent.....
 *D. alshehbazii* sp. nov.

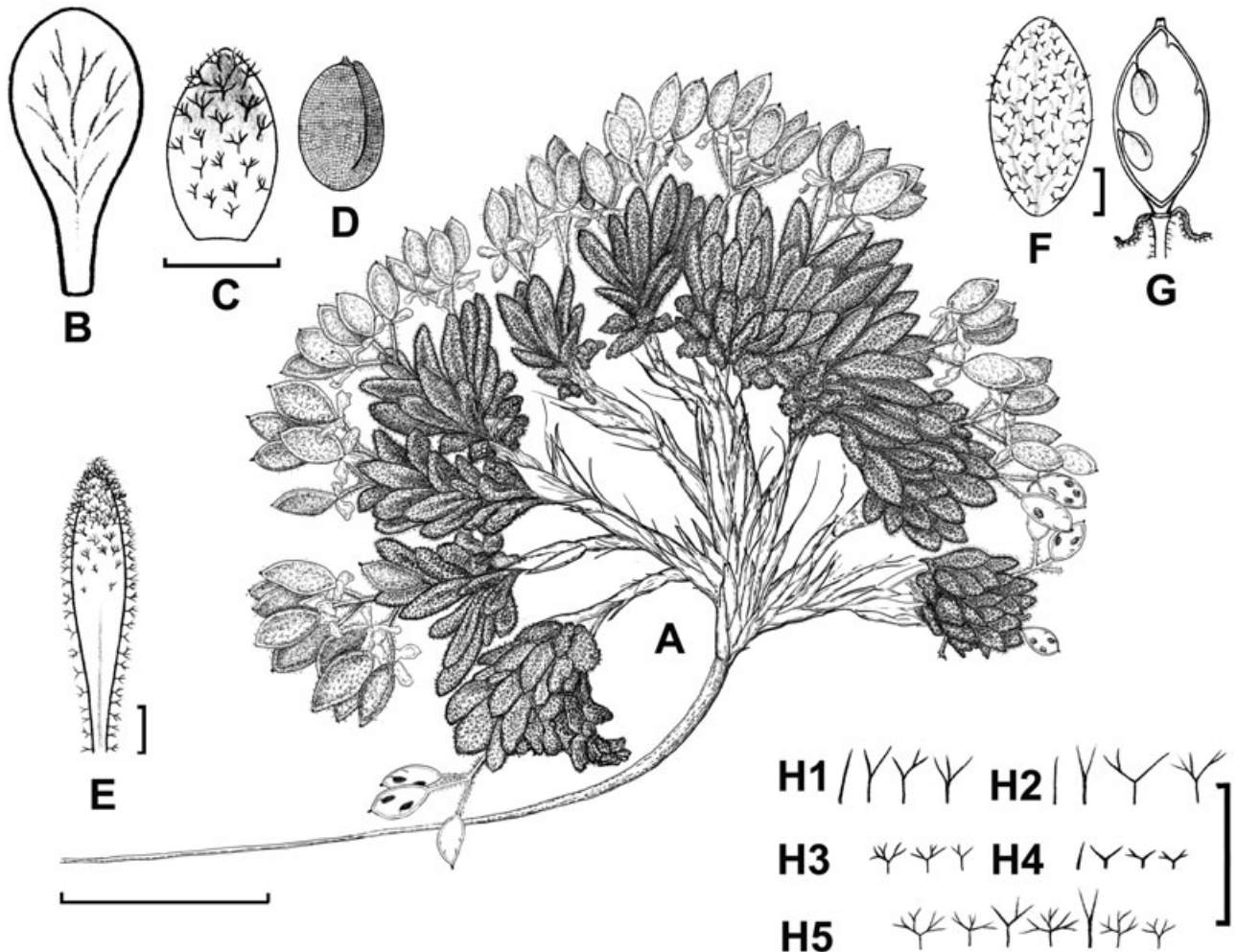


Figure 1. *Draba alshehbazii* (Brassicaceae). [Klimeš 2071; holotype (PRA)]. A, habit; B, petal; C, sepal; D, seed; E, leaf (adaxial surface); F, fruit valve; G, dehiscent fruit; H, trichomes: H1, stems; H2, pedicels; H3, sepals; H4, fruits; H5, leaves. Scale bars: A = 10 mm; B–H = 1 mm.

AFFINITIES

Although considerable problems in the infrageneric subdivision of *Draba* became obvious after molecular techniques were utilized to unravel phylogenetic relationships among species of this genus (Koch & Al-Shehbaz, 2002), it still seems useful to assess the affinity of the new species to the morphologically and geographically defined groups of species (series) proposed by Tolmatchev (1975). By the set of characters (yellow petals, leafless stem, few-flowered inflorescence, indumentum made up of forked and stalked, stellate trichomes, broad and short fruits with few-ovuled ovary), *D. alshehbazii* belongs to series *Alpinae* Tolm. (type species *D. alpina*), which comprises about a dozen species with a predominantly circumpolar distribution, some of which occur in the mountains of north and central Asia (*D. oreades*, *D. ochroleuca* Bunge etc.).

The new species resembles *D. oreades* in its life form, petal colour and, to some degree, in fruit shape, but is easily distinguished from it by the smaller size of nearly all parts, by the lack of simple trichomes on the leaves and the presence of soft, forked and substellate trichomes with branched rays (with 5–8 terminal rays) on leaves and sepals, compressed fruits, and persistent sepals. In contrast, trichomes on leaves and sepals of *D. oreades* are coarse, simple, forked and stellate with predominantly unbranched rays [with no more than 4(–5) terminal rays], fruits inflated at the base and caducous sepals. The indumentum density in the new species is considerably higher and the plant is greenish-yellowish canescent, whereas plants of *D. oreades* are always bright green.

In plant size and petal colour, *D. alshehbazii* resembles *D. involucrata* (W.W.Sm.) W.W.Sm. (southern China – Sichuan, eastern Xizang and Yunnan; Zhou *et al.* 2001), from which it differs in life form (compact cushion, not forming loose pleiocorms), in indumentum of the adaxial side of the leaves (uniformly tomentose throughout except for proximal, adaxial part, not glabrous or sparsely tomentose), structure of branched trichomes (soft, long-stalked, forked and 3-rayed substellate with branched rays, not rigid, short-stalked to sessile, forked or 3–4-rayed stellate), persistent (not caducous) sepals, petals (2–)2.3–2.5 × 0.8–1.0 mm, apex rounded (not 2.5–4.5 × 1.5–3 mm, apex emarginate), fruit apex and base acute to subacute (not obtuse), number of ovules (4–6, not 8–16 per ovary) and geographical distribution.

Draba alshehbazii can be readily distinguished from other *Draba* species in the field, even if sterile, by its greenish-yellowish colour, which contrasts with the bright green rosettes of *D. oreades* and *D. altaica* and the dense snow-white indumentum of *D. glomerata*, *D. himachalensis* and *D. ludlowiana*.

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- 27°25'N, *G. Forrest* 5732 (K). – Other specimens: *G. Forrest* 5829, 6138, 13969, 14086, 15164; *Schneider* 3578; *Handel-Mazzetti* 9499 (all at K), *Handel-Mazzetti* 3818 (WU).
- Draba oreades*: *lectotype* and *isolectotype* (for typification see (D. A. German & O. V. Cherneva, unpubl. data): *Dschabyk*, 12 Jul 1841, *A. Schrenk* (LE). Other specimens: *U.C. Bhattacharyya* 40890, 52132, 71653 (BSD); *M.V. Viswanathan* 55100 (BSD); *O. Šída & D. Vagnerová* 2322 (PRC); *H.J. Chowdhery & B.P. Uniyal* 86140 (BSD); *P.K. Hajra* 74228 (BSD); Taglungla [pass], *J. Vondrák* (CBFS); *W. Koelz* 2839a (K, LE); *Duthie* 11653 (LE).

APPENDIX

SPECIMENS EXAMINED BELONGING TO

D. INVOLUCRATA AND *D. OREADES*

Draba involucrata: *isotype*: Yunnan, W China, vi.1910, 11 000–12 000 ft. [3350–3660 m a.s.l.],