
**OBSERVATIONS ON SOME *SAUSSUREA*
(*COMPOSITAE*–*CARDUEAE*) OF W KUNLUN,
KARAKORUM AND W HIMALAYA**

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Three rare alpine, short-stemmed or stemless species of *Saussurea* DC. subgen. *Saussurea* are treated: *S. ovata* Bentham (W Kunlun Shan), *S. elliptica* C. B. Clarke (*S. kuschakewiczii* C. Winkler, syn. nov.; Tian Shan, Pamir, Karakorum, Zanskar) and *S. atkinsonii* C. B. Clarke (W Himalaya). The species are not closely interrelated and morphologically rather isolated. They are confined to different chains or mountain sections of Western High Asia, with their possible close relatives found in geographically far distant areas. Putative relationships of the taxa are discussed, revealing conflicts with the infrageneric classification proposed by Lipschitz (1979). *Saussurea candolleana* (DC.) Schultz Bip. (*S. clarkei* Hook. f., syn. nov.) is briefly discussed.

Keywords. Central Asia, Karakorum, phytogeography, *Saussurea*, taxonomy.

INTRODUCTION

Species of *Saussurea* DC., some of which display rather spectacular adaptations to extreme environments, are among the most characteristic elements of the alpine flora of the Tibetan Plateau. The genus has been dealt with in considerable detail by Lipschitz (1979), who accepted approximately 390 species. The great majority of these is confined to the mountains and piedmonts of Central and Eastern Asia, with 9–10 species extending into Europe (five of which are confined to Russia) and 5–6 into N America (only two outside Alaska). Morphological variation of the genus is centred around the Tibetan Plateau, with all subgenera, most sections and approximately more than two thirds of the species confined to that area.

This paper dealing with three species of *Saussurea* is part of our on-going work on the *Flora Karakorumensis* (Dickoré, 1995). The Karakorum system, connecting the plateaux of Pamir and Tibet in the heart of the continent, is not only one of the most extreme environments on earth, but also an area of sharp boundaries, both phytogeographical and political. The biogeography of the Karakorum therefore presents all sorts of problems, even though species richness is relatively low, as a result of generally extreme thermohygric conditions. Restricted accessibility of the region together with often large distribution ranges of morphologically highly variable species, and marginal differentiation of certain large genera may be among the most important constraints. Phytogeographical considerations of the Karakorum flora are

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often hampered by vague geographical terms, such as ‘Kashmir’ or ‘Western Tibet’. Accordingly, discordant elements often blur unequivocal nomenclature as well as concise or even predictable distribution areas.

Saussurea is represented by c.20 species in the Karakorum, as delimited by Dickoré (1995), and is one of the largest genera in the area. A larger number of species is confined to the floristically richer, closely adjacent ranges of the Western Himalayas. Although many species of *Saussurea* seem to be of an unmistakable habit, remaining taxonomic problems in the genus, caused by morphological plasticity and recurrent variation patterns of the species, are numerous.

This paper aims to clarify taxonomic status and distributional features of *S. ovata*, *S. elliptica* (considered a synonym of the former by Lipschitz, 1979), and *S. atkinsonii*. Relationships of these stemless or short-stemmed alpine species of Western High Asia are tackled. The proposed affinities conflict with the intraspecific classification of Lipschitz (1979). Reduction of the stem or scape, a character he placed much weight on, is a recurrent pattern or syndrome in several distantly related species groups of *Saussurea*.

***Saussurea atkinsonii* C. B. Clarke, Compos. Ind.: 226 (1876). Fig. 1.**

Type: Kashmir [sine loc., ‘in convalle Warda’ (Wardwan Vy.)], *W. S. Atkinson in C. B. Clarke* 24161 (K! holo., iso. LE).

Icon.: Blatter (1928), *Beautif. Flow. Kashmir* 1: 183, pl. 32, figs 4, 5. Stainton (1988), *Fl. Himalaya, Suppl.*, pl. 251.

Perennial rhizomatous rosette herb. *Rhizome* short, creeping, thick, 4–8(–15)mm diam., densely and regularly rooting. *Primary roots* \pm 1mm wide, almost black. *Stem* absent or very short, up to 2cm; annual shoots with 8–10 leaves in a dense rosette appressed to the ground. *Leaves* petiolate, coriaceous, runcinate, with prominent midrib and impressed lateral veins; the margin, petiole, rhachis and (predominantly abaxially) lateral veins densely covered with stout, rigid, brown, multicellular hairs, surfaces glabrescent; petiole not winged, 0.5–5cm; lamina (elliptic-)ovate, 2.5–10 \times 1.2–6cm, base cuneate to subcordate, margin coarsely dentate-serrate, with 10–16 mucronate teeth on either side, mucro cylindrical, \pm 1mm long, dark, leaf tip triangular or rounded, shortly acuminate. *Calathidia* solitary, or up to three together, subsessile in centre of rosette, 20–40-flowered. *Receptacle* with subulate, to 5mm long scales (originally described as naked). *Involucre* cylindrical, 15–25 \times 8–15mm. *Phyllaries* \pm triseriate, pale greenish, \pm blackish purple at tip and upper margin, faces almost glabrous, margins minutely scabrid, hirsute or slightly arachnoid, the outer phyllaries \pm foliaceous, ovate-lanceolate, reflexed at tip, obtuse or acuminate-mucronate, the middle triangular-lanceolate, the inner linear-oblong, subacute, with a short \pm triangular, dark, scarious appendage. *Corolla* blue, glabrous, 17mm; tube 10mm, narrowly cylindrical; cup of limb campanulate, 2mm; lobes linear-lanceolate, 5mm. *Anther tube* 7mm long, anthers with fimbriate basal appendage. *Style* 18mm. *Cypselae* (not mature?) glabrous, brown, 3.5 \times 1.2mm, longitudinally striate. *Pappus*

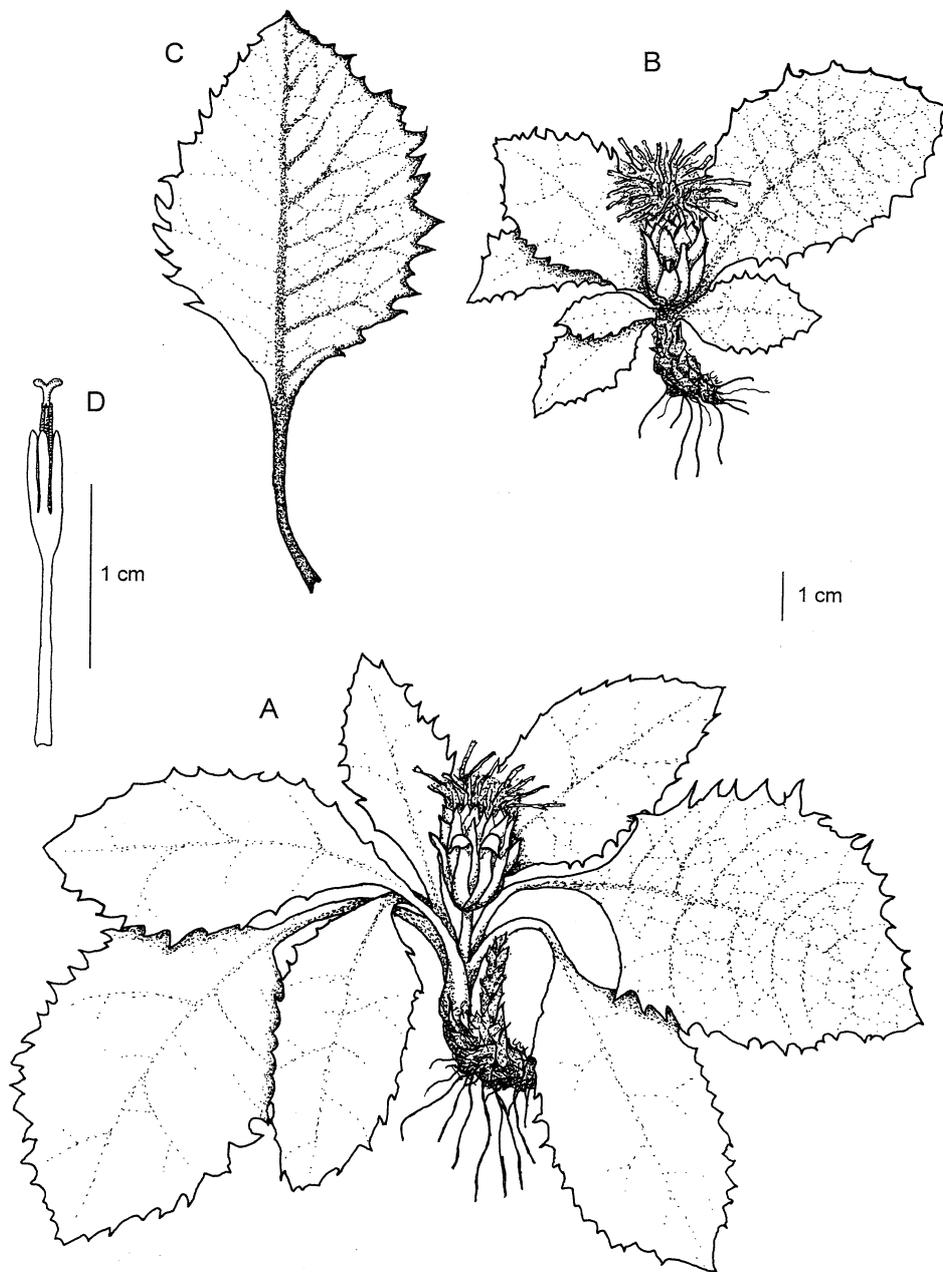


FIG. 1. *Saussurea atkinsonii* C. B. Clarke. A, habit (Dickoré 13163); B, habit (Schickhoff 90/1335); C, leaf, abaxial surface (Dickoré 13163); D, flower (Dickoré 13210).

brown, outer setae few, very short, scabrid, deciduous, inner setae c.30, long plumose, 11–13mm long.

Specimens seen and literature records. PAKISTAN. NORTHERN AREAS: [Hazara], Kaghan Vy., 14,400ft, *Inayat* 19673 (K!). Kaghan Vy., Makra, 3550m, 24 viii 1990, *Schickhoff* 90/1335 (GOET!). Mt Makra NW slope (34°34'N, 73°30'E), 3760m, 14 ix 1995, *Dickoré* 13163 (GOET!). Mt Makra top (34°34'N, 73°30'E), 3880m, 14 ix 1995, *Dickoré* 13210 (GOET!). [Astor/Deosai], Burzil P., 13,000ft, 14 ix 1893, *Duthie* 14044 (K!). Burzil P., 14,000ft, 27 viii 1940, *R. R. Stewart* 19047 (NY, Lipschitz, 1979). [Astor/Kashmir], Kamri P., 12,000–13,000ft, 26 viii 1892, *Duthie* 12577 (E!, K!). Pakistan [Deosai], Deosai Camp to Gulteri, *R. R. Stewart* 22208 (RAW!); Deosai Camp to Gultere, Deosai region W of Dras, 12,000–13,000ft, 6 viii 1946, *R. R. Stewart* 2208 (NY, Lipschitz, 1979). Deosai 14,000ft, *Siddiqi, Nasir & Ali* 4188 (BM!).

INDIA. JAMMU & KASHMIR: Kashmir [sine loc.], *W. S. Atkinson in C. B. Clarke* 24161 (K! type). Kashmir [sine loc.: above Gulmarg (Stewart, 1972)], 10,500–13,000ft, *Aitchison* 5 b (K!). Gulmarg, 11,000ft, *H. H. Rich* 1287 (K!). Khelanmarg, 11,300ft, *O. Polunin* 56/286 (B!, BM!, E!). Tragbal, 10,000ft, *Giles* 723 (K!). Tragbol Pass, 12,000ft, *R. R. & I. D. Stewart* 4898 (RAW!). Sonamarg, 13,000ft, 11 viii 1921, *R. R. Stewart* 6642 (NY, Stewart, 1972; Lipschitz, 1979). Wurdwan, *Lance* 162 (K!). Palgam, 12,000ft, 4 ix 1876, *C. B. Clarke* 31048 (BM!). Pahlgam, Dum Pattar Mt, *R. R. & I. D. Stewart* 5802 (RAW!). Khem Sar Pass N, 30 ix 1913, *M. A. Evershed* s. n. (BM!). Chitta Katha Sar, 4000–4500m, *F. Schmid* 658 (BM!). Baltal–Sangam, 3100m, *B. M. Sharma* 16274 (Sharma & Jamwal, 1998). Sheshnag–Panchtarni, 3500m, *B. M. Sharma* 16248 (Sharma & Jamwal, 1998). HIMACHAL PRADESH: Kulu, Seri Nal, 14,000ft, *R. E. Cooper* 5634 (E!, RAW!). Rohtang Pass, *Rau* 12696 (BSD, Aswal & Mehrotra, 1994). Hampta P., 4000m, *R. McBeath* 2205 (E!). Chamba, Sach P., Satrundi, 12,000ft, *J. H. Lace* 1465 (B!, E!). UTTAR PRADESH: Gurhwal, *Falconer* s. n. (K!). Garhwal, Kedarnath, 11,500ft, *Strachey & Winterbottom* 11 (K!).

Distribution. W Himalaya (Astor, Kashmir–Uttar Pradesh). Endemic (Fig. 2: total area).

Ecology. Within its limited distribution area in this relatively humid region on the outer edge of the W Himalaya, *S. atkinsonii* seems to be locally ‘common on alpine meadows’ (Stewart, 1972), ‘on the drier slopes’ (Sharma & Jamwal, 1998) or ‘amidst boulders’ (Hajra *et al.*, 1995), ranging in altitude from (3050–)3350–4390(–4500)m. The author collected the species at 3760–3880m near the top of Mt Makra (Hazara, Kaghan Vy.), in an intensely grazed mosaic of alpine turf, *Juniperus squamata* dwarf-scrub, among boulders, and on open, slightly inclined sandstone scree, preferably in the latter habitat. *Saussurea atkinsonii* seems to profit from disturbances of the often rather dense turf-sod and may not withstand being overgrown by tall forbs or shrubs. It also does not seem to be adaptable to colonize the steeper gelifluction slopes. Companion species on Mt Makra were, e.g. *Carex cruenta*, *Chorispora sabulosa*, *Kobresia nepalensis*, *Leontopodium himalayanum*, *Phleum alpinum*, *Poa stapfi-ana*, *Poa supina*, *Pseudomertensia primuloides*, *Saxifraga moorcroftiana*, *Tanacetum dolichophyllum*.

Taxonomic affinity. Lipschitz (1979) placed *S. atkinsonii* and *S. kuschakewiczii* in sect. *Depressae* C. B. Clarke, with the E Himalayan *S. andersonii* C. B. Clarke as lectotype species, admitting the very artificial character of this section. The receptacle

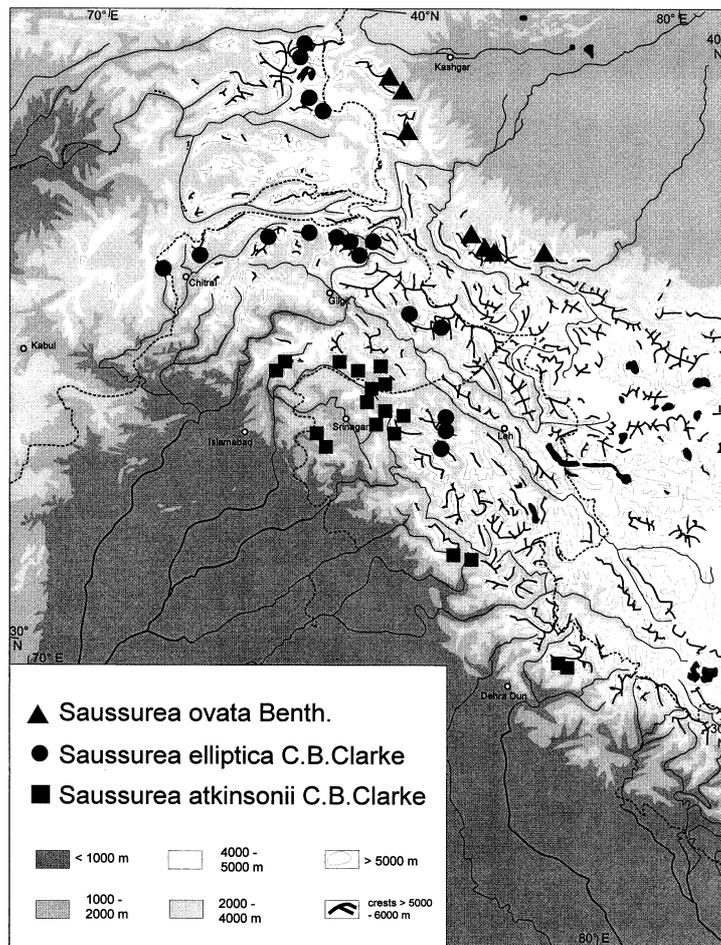


FIG. 2. Distribution of *Saussurea atkinsonii* (total area), *S. elliptica* (partial area) and *S. ovata* (total area).

of *S. atkinsonii* is conspicuously paleaceous, and this character clearly conflicts with a key character of sect. *Depressae* ('receptacle glabrous'). Furthermore, *S. atkinsonii* does not seem to have any close relative in this section. Excluding *S. atkinsonii* and *S. kuschakewiczii* (see below) from sect. *Depressae* results in an entirely E Tibetan/E Asiatic, although still heterogeneous group.

The only species comparable with *S. atkinsonii* may be *S. katochaete* Maxim. (sect. *Acaules* C. B. Clarke sensu Lipschitz, 1979). This is a species similar in gross habit (stemless or with a short scape, with one to few large calathidia, with the same type of brown glandular hairs, and with similar subulate receptacle scales), but with the leaves adaxially remaining white arachnoid-tomentose, with conspicuously black margined phyllaries and a unique, reflexed outer pappus. *Saussurea katochaete* is widely distributed in the E part of the Tibetan Plateau (Qinghai, Gansu, Shaanxi,

Sichuan, Yunnan, E & SE Xizang (Tibet)). It occupies largely the same altitudinal level and similar habitats (alpine *Kobresia* turf), as compared with *S. atkinsonii* of the W Himalaya. Furthermore, *S. katochaete* seems to be morphologically isolated from all other *Saussurea* species of E Tibet as well.

Depauperate forms of *S. candolleana* (DC.) Schultz Bip. (sect. *Saussurea* sensu Lipschitz), a species occurring in a wider geographical area (SW Karakorum: Gilgit, W & C Himalaya: Hazara, Kashmir–Nepal, Bhutan), partly sympatric to *S. atkinsonii*, occasionally may approach the habit of that species. These short-stemmed plants are known as *S. clarkei* Hook. f. Apart from superficial similarities, there does not seem to be a closer relationship to *S. atkinsonii*.

Saussurea candolleana (DC.) Schultz Bip., *Linnaea* 19: 331 (1846).

Syn.: *Saussurea clarkei* Hook. f., *Fl. Brit. India* 3: 372 (1881), **syn. nov.** Types designated by Lipschitz (1979). Lectotype: Kashmir, 1864, *Falconer* s. n. (K!, Herb. East India Company). Paratype: Kashmir, Tilail, 13,250ft, 28 viii 1876, *C. B. Clarke* 30807 A (K!).

Saussurea elliptica C. B. Clarke in Hook. f., *Fl. Brit. India* 3: 372 (1881). **Fig. 3.**

Type: Karakorum, 14,000ft, 12 viii 1876, *C. B. Clarke* 30444 (holo. K!, photo LE). Syn.: *Saussurea kuschakewiczii* C. Winkler, *Acta Horti Petrop.* 11 (1): 170 (1889), **syn. nov.** Type: Pamir: Ad fontes fl. Kysil-art, 8 ix 1878, *Kuschakewicz* s. n. (holo. LE, iso. K!).

Saussurea alpina var. *kuschakewiczii* C. Winkler ex O. Fedtsch., *Acta Horti Petrop.* 21 (3): 358 (1903).

Saussurea kuschakewiczii var. *caulescens* O. Fedtsch. et var. *acaulis* O. Fedtsch., *Acta Horti Petrop.* 28 (1): 170 (1908).

Saussurea ovata auct. non Bentham in Henderson & Hume: Lipschitz (1979). Icon.: Lipschitz (1979): pl. 19 (as *S. ovata*). Rechinger (1979): pl. 162 (as *S. kuschakewiczii*).

Perennial rhizomatous herb. *Rhizomes* long creeping, thin, 2–4(–6)mm diam., usually sparsely branched, with runcinate bark, loosely covered with foliaceous remains of petioles. *Roots* few, thin, in fascicles. *Plant* thinly appressed ± grey araneose-floccose and with minute globose, yellowish glands. *Stem* usually short, often almost absent, or sometimes elongate, ascending, 1–10(–20)cm, 1.5–3mm diam., striate-subterete, with 5–7(–16) crowded or (on elongate stems) laxly disposed leaves. *Leaves* petiolate, membranous or subcoriaceous, veins obscure, floccose indumentum more dense abaxially; petiole narrowly winged, 0.8–4.5cm, lamina lanceolate to elliptic-ovate, 1.5–7 × 0.5–3cm, cuneate or subtruncate at base, margin denticulate, with few shallow teeth (4–10 on either side), the teeth with dark mucro, 0.5–1mm long, leaf tip triangular, apiculate-acuminate. *Synflorescence* consisting of 2–10(–20) calathidia densely congested in a terminal dense or lax corymb, often subtended by 2–3 smaller leaves. *Calathidia* subsessile or shortly pedunculate (peduncle to 7mm, occasionally

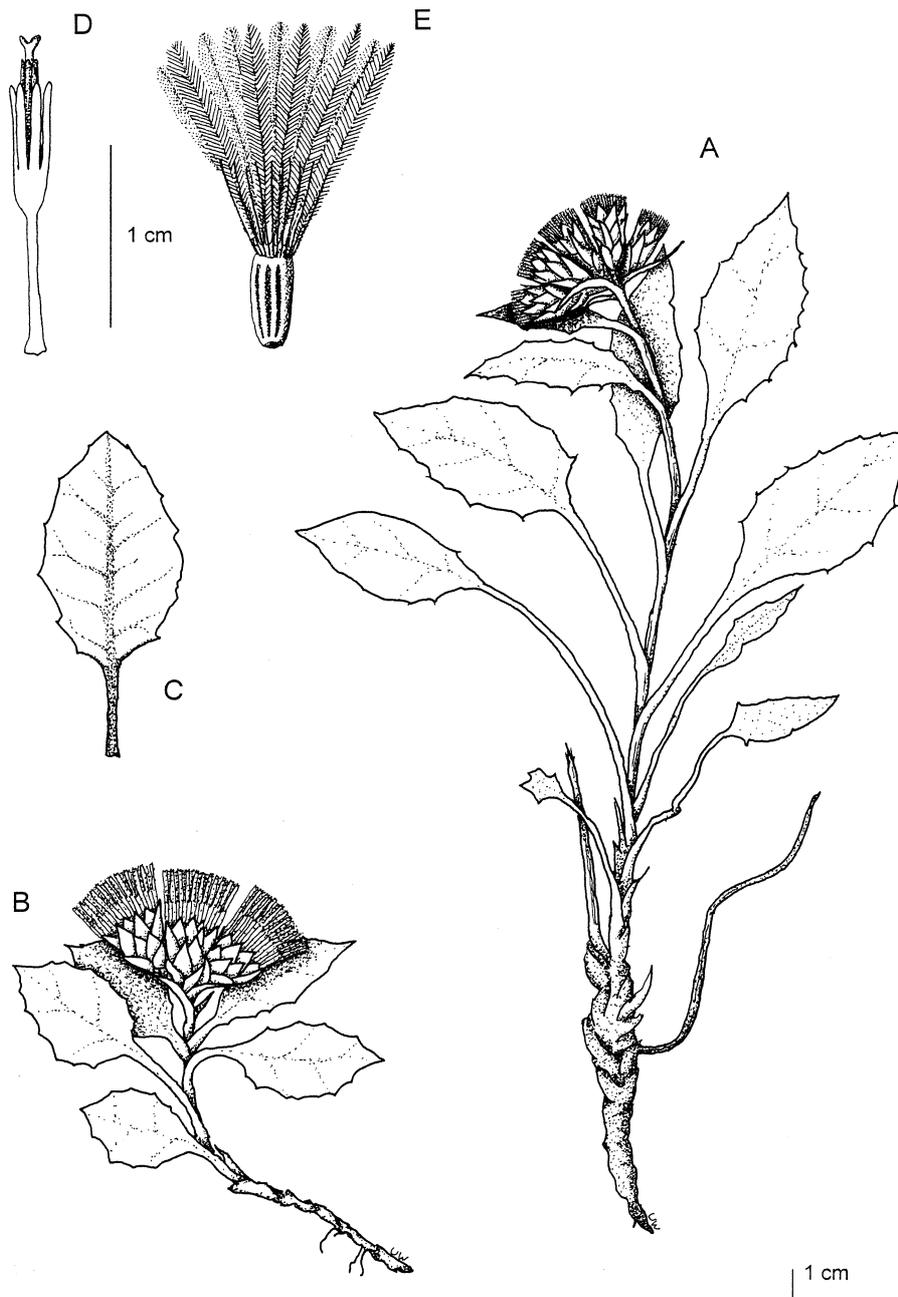


FIG. 3. *Saussurea elliptica* C. B. Clarke. A, habit (Eberhardt 2086); B, habit (Eberhardt 3053); C, leaf, abaxial surface (Eberhardt 3053); D, flower (Eberhardt 1754); E, cypselas with pappus (Miehe 2586).

much longer in single calathidia at base of synflorescence), c.15-flowered, receptacle glabrous. *Involucre* conical to campanulate, rounded at base, 12–18 × 9–13mm. *Phyllaries* regularly imbricate, ± triseriate, ochraceous or ± suffused with purple, arachnoid-tomentose, hirsute or glabrescent, the outer ± 3mm wide, ovate-acuminate with conspicuous midrib, the middle oblong-ovate, the inner oblong-linear, subacute. *Corolla* mauve, 15–16mm; tube glabrous, 8mm, narrowly cylindrical, slightly widened at base; cup of limb campanulate, 2.5mm, minutely glandular pilose; lobes linear-lanceolate, 5mm. *Anther tube* bluish, 7.5mm, anthers with fimbriate basal appendage. *Style* 17mm. *Cypselae* 5 × 1.8mm, ± rectangular, flattened ovoid in cross-section, with c.3–6 longitudinal ridges, yellowish brown, the furrows darker, with thin black stripes, minutely glandular with yellowish globose glands. *Pappus* biseriate, outer setae 1–3mm long, scabrid, white, deciduous, c.15–30, inner pappus setae c.12–18, united at base, persistent, brownish below, white above, long plumose, 11–14mm long.

Specimens seen and literature records. KIRGHIZIA. Inner Tian Shan, Sarydzhaz Vy., 24 viii 1960, *N. Kozhevinkova & N. V. Trulevich* s. n. (W!).

TADZHIKISTAN. E Pamir: Kizil-art, 8 ix 1878, *Kuschakewicz* (K! isotype *S. kuschakewiczii*). Kizil-Art S slope, 14,000ft, 10 viii 1901, *B. & O. Fedtschenko* (Fedtschenko, 1903 as *S. alpina* var. *kuschakewiczii*). Chon-Su River, 7 viii 1878, *Kuschakewicz* (Fedtschenko, 1903 as *S. alpina* var. *kuschakewiczii*). Ak-Baytal, *Ovczinnikov & V. Zapryagaeva* (Rasulova, 1991 as *S. kuschakewiczii*). Unlocalized: 'Pamir and Thian Shan Journey', *Appleton* 600 (K!).

PAKISTAN. CHITRAL: Utak An W of Chitral, 14,000ft, *Stainton* 3232 (BM!). Tirich Mir, Camp 2 near Barum Glacier, 4500m, *Wendelbo* s. n. (veg., Fl. Iran.). NORTHERN AREAS: Karakorum [Yasin], Jud Bar 4290m, 16 ix 1991, *G. & S. Miehe* 7031! veg. (GOET!). [Ishkoman], 'Deux versants de l'Ishkoman Aghost', 4210–4540m, 15/16 viii 1954, *F. Schmid* 2468 (RAW!). [Batura], Upper Hunza, Khaibar (36°35'N, 74°43'E), 3800m, 20 viii 1990, *G. & S. Miehe* 2586 (GOET!). E of Morkhoon 4260m, 6 viii 1989, *A. Bosshard, F. Klötzli & R. Schaffner* 101.6 (GOET!). Middle Batura Vy., 3450–4590m, *E. Eberhardt* 1754!; 1906!; 1919!; 1927!; 4356! cf.; 4460!; 4723! cf.; 4897! cf.; 98-215!; (all GOET). Upper Batura Vy. 3850–4400m, *E. Eberhardt* 2036! cf.; 2086!; 2093!; 2131!; 2230!; 2242!; 3053!; 3077!; 3899! cf. (all GOET). 'Karakorum' [Biafo], 14,000ft, 12 viii 1876, *C. B. Clarke* 30444 (K! holotype, see Hooker, 1881; Pampanini, 1930). [Saltoro], Masherbrum Region, Dum Sum, 2 days N of Hushe, 10,000ft, 1982, *F. G. Davies* s. n. (K!).

INDIA. JAMMU & KASHMIR: [Zanskar], Ladakh, Bragnag, 1931, *W. Koelz* A 67 (RAW!); 2799 b; 2800 h; (NY: Stewart, 1972). Zanskar, 1km from Kangi, 12,900ft, vernac.: 'Reeshaw', all except roots used for vomiting, cuts, esp. baby vomiting, *A. R. Brown & M. A. Rothera* 70 (K!). Haluma P., 14,000ft, *Stainton* 8422 (BM!).

Distribution. (?)Dzhungarian Alatau, C. Tian Shan, E Pamir, Chitral, W & C Karakorum, NW Zanskar. Fig. 2 (partial area).

Ecology. Extensive recent collecting in the valley of the Batura Glacier by E. Eberhardt, and other data indicate that *S. elliptica* grows in sparsely vegetated dry alpine habitats, with a possibly typical heavy gelifluction activity, such as 'debris pioneer vegetation', 'dwarf-scrub' and 'alpine forbs'. Most of the common companion species (*Calamagrostis stoliczkae*, *Carex nivalis*, *Comarum salesovianum*, *Dasiphora dryadanthoides*, *Dracocephalum stamineum*, *Epilobium latifolium*,

Oxytropis humifusa, *Poa attenuata*, *Potentilla venusta*, *Psychrogeton olgae*, *Rhodiola fastigiata*, *Silene falconeri*, *Waldheimia tridactylites*) also seem to be characteristic of steep, rapidly moving shale slopes. *Saussurea elliptica* is also reported from dry pasture, 'stony fossilized moraine', rocky slopes, rock ledges and crevices, which may provide relatively stable growing conditions. The altitudinal distribution of *S. elliptica* extends between (3050–)3450 and 4400(–4590)m. The species is probably rare everywhere: only two localities are mentioned by Fedtschenko (1903), none in the supplements to his 'Flore du Pamir'. Although there has been plenty of recent collecting in the Karakorum, a very limited number of records, confined to a small strip of territory, is known from the C Karakorum S slope and NW Zanskar.

Notes. Resembling terminology of the epithets and the apparent geographical proximity may have led Lipschitz (1979) to the erroneous inclusion of *S. elliptica* into *S. ovata*. The holotype of *S. elliptica* contains relatively large plants up to 20cm tall. The precise type locality can be inferred only from C. B. Clarke's itinerary, as evidenced by his collecting dates and numbers. After crossing the Skoro La to the N of Skardu/Shigar (8/9 viii 1876), Clarke stayed for two days at 'Ashkoley' (Askole) in the Biafo Glacier region, Central S Karakorum (10/11 viii 1876). The type of *S. elliptica* was probably collected on his way back to Shigar the next day (12 viii 1876). The exact return route of Clarke is unknown. Proximity of time and relatively high altitude of collecting (4270m), probably indicate that he again went over Skoro La, and *S. elliptica* was probably gathered on the N slopes of that pass. Clarke collected at Shigar on 15 viii 1876, but may have arrived there already one or two days earlier. *Saussurea elliptica* has apparently never been recollected in that area, although the region is botanically comparatively well known, mainly from Japanese expeditions (Kitamura, 1964), and especially by the detailed investigations of Hartmann (1966). The species seems to be absent from the Wakhan (Podlech & Anders, 1977), connecting the E Pamir, Chitral and W Karakorum localities.

Taxonomic affinity. The placing by Lipschitz (1979) of *S. elliptica* as a synonym of *S. ovata* in sect. *Laguranthera* (C. A. Meyer ex Endl.) Lipschitz, and of *S. kuschakewiczii* in sect. *Depressae* are unjustified by character combinations and species inventories of the respective groups.

Saussurea elliptica is closely related to *S. alpina* L., the type species of the genus, and certainly is a member of sect. *Saussurea*. Fedtschenko (1903) already reduced *S. kuschakewiczii* to a variety of *S. alpina*. In habit and in all investigated characters, including flower dimensions, pappus formation, and the minute yellowish globose glands, *S. elliptica* is so close to the European Western Alpine *S. depressa* Gren. (*S. alpina* subsp. *depressa* (Gren.) Nyman), that some forms probably could not be distinguished if the provenances were unknown. Only the wide geographical disjunction, and a possibly slightly different spectrum of variation, could possibly prevent both taxa from being combined. More or less typical representatives of the widespread *S. alpina* L. occur in W Pamir-Alai (Zeravshan) and Tian Shan. Although the few specimens seen by the author are not conclusive, *S. elliptica* may be more

readily separated from the usually rather tall plants of *S. alpina* of the Pamirs, than *S. depressa* and *S. alpina* in the Western Alps. *Saussurea elliptica* does not occur in the extreme high-altitude deserts of the Karakorum N slopes (Dickoré, 1991), nor is there probably any species of closer relationship to *S. alpina* on the Tibetan Plateau.

Saussurea ovata Benth. in Henderson & Hume, Lahore to Yarkand, 325 (1873). **Fig. 4.**

Type: Near Sanju Pass, Yarkand, 12,000–14,000ft, *Henderson* s. n. (holo. K!).

Syn.: *Saussurea pseudocolorata* Danguy, J. Bot. Paris 21: 52 (1907). Type: C Asia, contreforts du Mouz-tag, vallée de Tor-Bachi, rochers, 3800m, 31 vii 1906, *Lacoste* s. n. (P, photo LE).

(Excluding syn. *S. elliptica* C. B. Clarke in Hook. f., Fl. Brit. India 3: 372 (1881))

Icon.: Henderson & Hume (1873), Lahore to Yarkand, fig. opposite p. 326.

Perennial rhizomatous herb. *Plant* thinly arachnoid-tomentose, glandular villous and hirsute, usually \pm glabrescent except for (often inconspicuous) arachnoid tufts at margins of lower petiole bases. *Rhizomes* long creeping, thin, 2–3mm diam., sparsely or fasciculately branching, with rugulose bark and thin \pm membranous remains of leaf-bases. *Roots* fasciculate, few, thin. *Stem* short, simple, ascending, 2–15cm, \pm purplish, striate-angular, with 6–10 leaves. *Leaves* petiolate, glabrescent or remaining arachnoid villous and with multicellular glands at margin, thickish, membranous, petiole and rhachis usually dark red coloured adaxially; petiole \pm winged, 1–5cm; lamina broadly ovate to suborbicular, 1.5–5.5 \times 1.2–4cm, base cuneate, truncate to subcordate, margin dentate-serrate, with 8–10, small to relatively large, apiculate teeth on either side, leaf-tip rounded to subacute, mucronate. *Synflorescence* consisting of 4–15(–25) calathidia arranged in a dense globose head or a loose corymb, subtended by 2–3 smaller leaves. *Calathidia* c.10–12-flowered, sessile or pedunculate to 5mm. *Receptacle* glabrous. Involucre broadly campanulate, 9–12 \times 8–9mm. *Phyllaries* densely hirsute with straight hairs on faces and arachnoid or crisp-villous on margins, often glabrescent except for the margins, pale green, \pm purplish in upper part, the outer broadly triangular, the middle ovate, the inner lanceolate, subacute. *Corolla* mauve or red-purple, glabrous, 12–13mm; tube 6mm, narrowly cylindrical, widened at base; cup of limb campanulate, 3mm; lobes linear-lanceolate, 3mm. *Anther tube* 7.5mm, anthers with fimbriate basal appendage. *Style* 14mm. *Cypselae* (not mature?) glabrous, brown, 2.5 \times 1mm, with c.8 longitudinal ridges. *Pappus* biseriate, outer setae 5mm long, scabrid, brown, free, deciduous, c.15–25 (possibly more), inner setae c.12–18, long plumose, 10mm long, united at base, persistent.

Specimens seen and literature records. (?)TADZHIKISTAN. E TADZHIKISTAN: Kara-Shur (Rasulova, 1991).

CHINA. XINJIANG: [Kongur:] Akto Xian, Wuyitage, 2800m, *Picea* forest, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei* 4809 (KUN!). Atojnagh Vy. (38°57'N, 75°10'E), 3200m, scree/*Hippophae-Potentilla-Juniperus*-scrub, 5 viii 1998, *U. Wündisch* 892 (GOET!). Upper Kansiver Valley, between Kongur and Mustagh Ata (N 38° E 75°), 14,500ft, sand dunes, *W. J. Budenberg & S. T. Meech* 55 (K!). [W Kunlun:] Yecheng Xian, Qipan Village, 3000m,

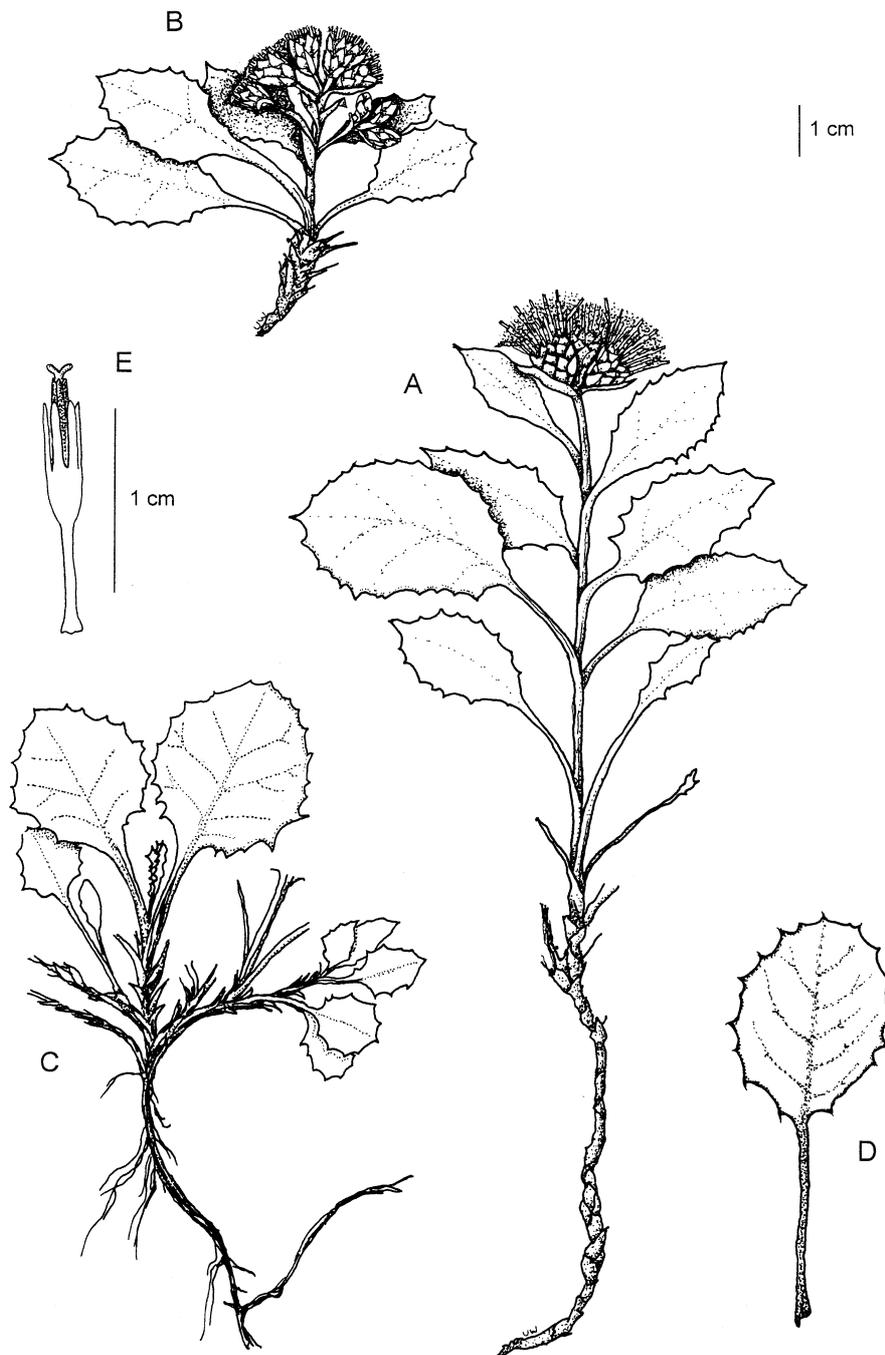


FIG. 4. *Saussurea ovata* Bentham. A, habit (Wündisch 892); B, habit (Miehe 8511); C, vegetative rosette (Miehe 7505); D, leaf, abaxial surface (Wündisch 892); E, flower (Wündisch 892).

S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 4664 (KUN!). Tiznap Vy., W of Kudi (36°51'N, 76°57'E), 3300–3480m, moist bed of rivulet, 14 vi 1992, *Miehe* 7505 (GOET! cf., veg.); 3500–3700m, 9 vii 1992, *Miehe* 8511 (GOET!); 4140m, 9 vii 1992, *Miehe* 8460 (GOET! cf., veg.). Upper Tiznap Vy., SE of Kudi (36°37'N, 77°08'E), 4280m, 17 vi 1992, *Miehe* 7566 (GOET! cf., veg.). Yarkand, S of Sanyu Pass, 12,000ft, 10 viii 1870, *Henderson* 356 (K! holotype). [Localities illegible: ?W Kunlun], 2420m, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei* 274 (KUN!); 3000m, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei* 672 (KUN!); 3700m, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei* 819 (KUN!); 2700–3300m, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei* 1052 (KUN!).

Distribution. Kongur, W Kunlun. (Fig. 2: total area?, north-westward extension of distribution area through Alai Valley to E Tadjikistan possible, but not sufficiently documented).

Ecology. Based on label information, *S. ovata* grows in a variety of \pm azonal habitats such as scree, scrub, sand dunes, beds of rivulets, and *Picea (schrenkiana)* forest. The distribution of the species seems to be intimately linked to a relatively humid belt on the upper edge of the massive loess deposits of the Kunlun N slope. The rhizome system of *S. ovata* seems to be adaptable to permanent loess (or sand) accumulation rather than to unstable scree slopes. Relict forests of *Picea schrenkiana* and *Juniperus semiglobosa* locally extend in northern exposures between 3000 and 3400m in the Kongur area of the westernmost Kunlun, whereas to the E, towards the Tiznap and Karakash valleys, a narrow belt of *Juniperus pseudosabina* shrub at around the same altitude is the last trace of subhumid montane vegetation. *Saussurea ovata* is usually found at somewhat higher altitudes, (2420–)3000–4280(–4420)m, in open, subhumid (montane to) subalpine–alpine vegetation, apparently nowhere common. Companion species of recently collected populations (leg. Miehe, Wündisch) included: *Koeleria litwinowii*, *Sisymbriopsis mollipila*, *Neotorularia korolkowii*, *Carex tangulashanensis*, *Oxytropis melanocalyx*, *Kobresia capillifolia*, *Calamagrostis tianschanica*, *Stipa concinna*, *Braya rosea*, *Puccinellia hackeliana*, *Dracocephalum stamineum*, and *Comarum salesovianum*.

Taxonomic affinity. We must largely refrain from discussing the systematic position of *S. ovata* because limited material of this and putatively related Central Asiatic species was available for comparison. The species was probably correctly placed in sect. *Lagurathera* (C. A. Meyer ex Endl.) Lipschitz, comprising numerous \pm halophytic species of Central Asia (Lipschitz, 1979). The sectional character, ‘floc-cose-lanate’ anther-tails, however, does not seem to differ in any way from the usual type in the genus. The group around *S. salsa* (Pallas) Spreng., and others, could possibly also be considered in this relationship. Of the species placed in sect. *Lagurathera* by Lipschitz (1979), *S. famintziniana* Krassn. from E Pamir and Tian Shan, and *S. pulvinata* Maxim., distributed in the Far Eastern Kunlun Shan and in the NE part of the Tibetan Plateau (Xinjiang, Qinghai, Gansu), may be most closely related. The latter is a densely tufted alpine species which, however, has a very

different habit. Similarities may exist in the arachnoid petiole bases (although much more conspicuously so in *S. pulvinata*) and in the texture of the leaves.

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Contrary to species of *Saussurea* subgen. *Eriocoryne*, which mostly characterize the free gelifluction or highest (upper alpine or subnival) vegetation belt of the Tibetan Plateau, the species treated in this paper, and species of subgen. *Saussurea* almost generally, do not ascend to the highest levels of phanerogamic plant life. The three species concentrate in what may be defined plainly as the alpine belt. They occupy very similar altitudinal levels and are perfectly allopatric. Underlying geo-ecological constraints possibly contribute to relatively small distribution areas in discrete mountain systems.

The range of *S. atkinsonii*, like that of many W Himalayan taxa (*Carex duthiei*: Dickoré, 1995; *Cardamine loxostemonoides*) and a few Kashmir endemics (*Aster falconeri* subsp. *falconeri*: Grierson, 1964; *Oxytropis cachemiriana*), occupies a rather wide area of (sub)humid climatic conditions in the mountains around the Kashmir basin. The eastward extension of this distributional area is linear or punctually disjunct, apparently according to an extremely narrowed zone of 'intermediate' thermohygrical conditions E of Kashmir. Steep gradients from warm-humid to cold-arid conditions along the C Himalaya, approximately from Uttar Pradesh or W Nepal eastwards to SE Tibet, supposedly are responsible for quite a number of E-W disjunctions or vicariants in the flora of the Himalaya. A putatively more continuous temperate-subhumid zone along the Himalayas during early stages of the paleogeographical evolution of that range, also points to the possible relationship of *S. atkinsonii* to the SE & E Tibetan *S. katochaete*.

Saussurea elliptica is probably a rare plant. Nevertheless, its few localities (including *S. kuschakewiczii*) link up to a characteristic Y-shaped range, indicating probable climatic, geological and paleo-biogeographical constraints. Although comparable distribution types seem to be uncommon in the flora of the Karakorum, almost linear or punctual, often highly disjunctive ranges or area extensions along the inner Himalaya eastwards occur in taxa characterized as Irano-Turanian, Pamiran or Central Asiatic elements (*Carex karoii*, *C. melanantha*, *Puccinellia minuta*, *Stipa pennata* subsp. *kirghisorum*: Dickoré, 1995). The distribution of *S. elliptica* apparently coincides with the climatically determined boundaries of the Central Asiatic, Irano-Turanian and Sino-Himalayan floristic regions. On the other hand, there are obvious geological and paleo-biogeographical components. In terms of the geotectonic properties of the Karakorum region (Searle, 1991), the occurrences of *S. elliptica* in E Pamir, NW Hindukush, W and C Karakorum are exclusively situated on the Eurasiatic/Central Asiatic side, N of the plate boundary system (Shyok Suture Zone), although apparently excluding the interior drainage area of Central Asia (towards Tarim basin). The species appears to be also completely absent from the island arc areas (Kohistan Batholith, Ladakh Batholith), although it re-occurs, in prolongation

of the Karakorum partial area, in a small area in NW Zaskar. These few Zaskar localities, S of the Indus (Indus Suture Zone), are possibly the only occurrences of *S. elliptica* in the W Himalaya, tectonically part of the Indian plate. Recurrent patterns in the (although inconspicuous) 'Trans-Indus disjunction' (W & C Karakorum–Zaskar) are remarkable. *Carex borii* (Dickoré, 1995), for instance, displays a local disjunction somewhat similar to that of *S. elliptica*. In the 'Karakorum Gap' distribution types (*Poa tibetica*, *Stipa mongholica*, etc.: Dickoré, 1995), connecting localities between E Pamir and SW Tibet apparently diminished completely. Many of these distributional features seem to be intimately linked to the Pleistocene (glacial and interglacial) environmental evolution of the Karakorum system. Details of the geological and earlier tectonic components, however, remain enigmatic.

Saussurea ovata seems to be entirely confined to the Central Asiatic declivities of the W Kunlun Shan towards the Tarim basin. The distribution area is apparently connected to a narrow belt of locally higher humidity influenced by the Alai depression to the NW (Richter *et al.*, 1999), allowing for local outposts of *Picea schrenkiana* (Skrine, 1925), and a related humid alpine sequence. The otherwise depauperate species inventory of the Kunlun Shan is, to a much higher degree than that of the Himalayas, 'squeezed' between perarid conditions at the bottom and extremely cold conditions on the top of the profile, thus probably limiting the distribution of *S. ovata* to the E. The middle altitudes of the westernmost Kunlun contain some endemics (e.g. *Carex alajica*: Dickoré, 1995), isolated outposts of northern species (*Picea schrenkiana*, *Taphrospermum altaicum*) and puzzling disjunctive taxa (e.g. *Carex tangulashanensis*: Dickoré, 1995).

In conclusion, the major ranges of the W Kunlun–Karakorum–W Himalaya system have been colonized at about the same altitudinal level by different species of *Saussurea* with similar habit, but apparently representing independently isolated taxonomic entities. It seems that the taxonomic relationship of each taxon lies, geographically, rather in the far prolongation of the respective mountain chains. A future phylogenetical approach to the genus combined with a refined phytogeography of *Saussurea* could at the same time contribute to a better understanding of the geo-ecological history of the high mountains of Central Asia.

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