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A REVISION OF *CAUTLEYA* (ZINGIBERACEAE)

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Cautleya (Royle ex Benth.) Hook.f. (Zingiberaceae) is revised. Two species are recognised, one of them with two varieties. They are found in northern India, Nepal, Bhutan, southern China, Burma, Thailand and Vietnam. A key is given and all taxa are described. Preliminary conservation assessments are made.

Keywords. Cautleya, taxonomic revision, Zingiberaceae.

Introduction

Cautleya (Royle ex Benth.) Hook.f. is a small genus in the family Zingiberaceae, subfamily Zingiberoideae, found in northern India, Nepal, Bhutan, southern China, Burma, Thailand and Vietnam. Both species are cultivated and can be grown outside in northwest Europe.

Royle originally intended to honour his friend Capt. Cautley F.G.S. with a genus, spelled *Cautlea*, in which he would combine *Roscoea lutea* Sm. This was to be published in his *Illustrations of the Botany of the Himalayan Mountains* (Royle, 1833–1839) but, in that work, he wrote that botanical friends advised him to keep this species in *Roscoea*. It was left to Bentham to take up this name for his section *Roscoea* sect. *Cautlea* Royle ex Benth. (Bentham & Hooker, 1883), where he included *Roscoea gracilis* Sm. and *R. spicata* Sm. Hooker (1888) regarded the spelling of *Cautlea* as an error, to be corrected to *Cautleya*, the spelling that has been used ever since. Support may be found in the International Code of Botanical Nomenclature (McNeill *et al.*, 2006) for retaining the original spelling, on the grounds that Royle had consciously latinised Cautley's name to '*Cautleus*', dropping the letter 'y' which doesn't occur in Latin. We prefer to follow paragraph 10 of the preamble to the ICBN which advises that 'In the absence of a relevant rule or where the consequences of rules are doubtful, established custom is followed'. Nobody has used the spelling *Cautlea* since 1883 and to do so now would be contrary to the aim of stability in nomenclature.

Hooker (1888) raised Bentham's section to genus rank for *Cautleya lutea* (Royle) Hook.f. Not long afterwards, Baker (1890) recognised five species: *Cautleya lutea*

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(Royle) Hook.f., *C. cathcartii* Baker, *C. spicata* (Sm.) Baker, *C. robusta* Baker and *C. petiolata* Baker. Then, Schumann (1904) described two varieties, *Cautleya lutea* var. *gracilior* K.Schum. and *C. lutea* var. *robusta* K.Schum. Dandy (1932) subsequently confirmed what is implicit in Hooker (1888), namely that *Roscoea lutea* Royle and *Roscoea gracilis* Sm. are one species. *Roscoea gracilis*, having been published earlier than *Roscoea lutea*, takes priority and *Roscoea lutea* is a synonym of it. The type species of *Cautleya*, *C. gracilis* (Sm.) Dandy, was selected by Burtt & Smith (1972).

At the beginning of this study, there were six names at species rank and four at varietal rank in *Cautleya* which had not been revised throughout its range since Schumann's account of 1904. Smith (1994), revising Bhutanese *Cautleya*, suggested that *C. cathcartii* might be a robust form of *C. gracilis* and that *C. robusta* might be synonymous with *C. spicata* but she left these questions to be resolved later. In this treatment, we recognise two species, one of which has two varieties.

Relationships

All species of *Cautleya* have previously been classified in *Roscoea* and, indeed, these two genera are very close to each other in morphology (Burtt & Smith, 1972). They consist of perennial, rhizomatous herbs which lose their above-ground parts during winter. New shoots arise each spring from the overwintering rhizome and the inflorescences are borne terminally on these shoots. In most Zingiberaceae the leaf sheath is open opposite the leaf blade but, in *Cautleya* and *Roscoea*, the sheaths are tubular up to the point where the ligule and blade divide from them. The inflorescence in both genera bears bracts which subtend a single, ebracteolate flower. The flowers of *Cautleya* and *Roscoea* resemble each other too, though those of *Roscoea* are generally larger. Crucially both genera have versatile anthers with the basal portions of the thecae sterile and forming a pair of spurs, very like the anther of *Salvia* (Labiatae) and presumably similar in function. The lateral staminodes are borne erect behind the anther and the labellum is conspicuously bilobed. Ngamriabsakul *et al.* (2000) confirmed, using molecular systematic techniques, that *Cautleya* was monophyletic and sister to *Roscoea.*

The differences between *Cautleya* and *Roscoea* are that *Cautleya* usually has inflorescences of many flowers which are yellow while *Roscoea* has inflorescences of few flowers which are usually purple or white. In addition, the ovary and early-dehiscent fruit of *Cautleya* is short while *Roscoea* has an elongate ovary and tardily-dehiscent fruit.

Cytology

Sharma & Bhattacharyya (1959) published a somatic chromosome number of $2n = 34$ for *Cautleya spicata*, indicating that they had also seen variants with $2n = 27$ & 36. These numbers have not been reported again and, as no voucher slides are

available, it is difficult to interpret these results. Haploid chromosome numbers of $n = 12$ and $n = 13$ have been reported in *Cautleya* (Ngamriabsakul, 2004). Unfortunately, it is not possible to say how these counts relate to the taxa described below, particularly the varieties of *Cautleya gracilis*, because voucher specimens are not cited. Mehra & Sachdeva (1979) stated that

> *C. lutea* (= *C. gracilis*) has been investigated for the first time. Two cytological races with $n = 12$ and $n = 13$ were found to occur in [the] Darjeeling hills. Meiosis in both taxa was found to be normal. Plants with $n = 13$ were shorter, possessed small-sized leaves and bracts and had lesser [*sic*] flowers per spike, in comparison to plants with $n = 12$. However, the size of the flower was almost the same in both the cases. It may be pointed out that the plants with $n = 13$ were always found to be occurring at higher altitudes (2,250–2,500 m) in contrast to those with $n = 12$ which occurred between 2,000–2,200 m.

This is a strong indication that there may be a chromosomal basis to the varieties of *Cautleya gracilis* but further work on material determined to variety will be needed.

IUCN Conservation Assessments

The species and varieties of *Cautleya* are not threatened globally. Each taxon occurs over a wide range and has been collected at many localities. Thus, the global IUCN conservation assessment is Least Concern in each case. Nonetheless, there are areas within the range of distribution which are undercollected, particularly Arunachal Pradesh and Burma, so national IUCN conservation assessments of these taxa may indicate a higher degree of threat.

Materials and Methods

The present revision is based on a study of approximately 260 dried herbarium specimens from A, BM, E, ECON, GH, HBG, K, K-W, L, LINN-SM, LIV, MICH, NY, P and UC. Unless otherwise stated, the measurements in the descriptions are taken from dry herbarium specimens.

The presence of a distinct petiole almost always distinguishes the two species of *Cautleya* though it can be difficult to assess this character. The petiole is usually longer at the apex of the pseudostem than at the base and it is the presence of a petiole at the apex which is important.

The principal distinction between the two species of *Cautleya* lies in the length and colour of the bracts. The length is measured by comparison to the calyx at anthesis so the real question is whether the apex of the calyx is included in the bract or exserted from it. *Cautleya gracilis* has green bracts which are shorter than or equal to the calyx while *C. spicata* has red bracts which are longer than or very rarely equal to the calyx. A few specimens do not fit well in this system, the most significant being the type of *Cautleya petiolata* (see discussion under *C. spicata*). The colour of the

bracts may still be seen in recent herbarium collections but older material is more ambiguous.

The extent to which the aril covers the seed is believed to be of taxonomic significance but could not be assessed on the majority of herbarium specimens seen. Preliminary results, such as a survey of published photographs, indicate that the aril of *Cautleya gracilis* is very small. The dehisced fruit appears to contain a tight ball of black seeds (Larsen & Larsen, 2006: 63) and the aril only becomes visible, near the connection with the placenta, when the seeds are picked apart. The aril of *Cautleya spicata*, by contrast, seems to cover the seeds so that the open fruit contains a white mass of seeds. In this species, the black colour of the seeds is only revealed when the aril is removed. More study of living collections, especially in the field, is required to ascertain the use of this character across the genus.

Another character which merits attention when more living material is available is the presence and size of the anther crest. Photomicrographs taken of the dissected flower of *Cautleya gracilis* var. *robusta* (*Škorničková* 71478, SING) show a distinct, rounded anther crest while R. M. Smith's drawing of *C. spicata* (Burtt & Smith, 1972, fig. 15) shows no crest at all.

The Taxa and their Ranks

Three taxa of *Cautleya* are recognised here, confirming the results of an unpublished study of *Cautleya* carried out at the Department of Botany, Smithsonian Institution (Namgyel, 1998). The characters used to delimit the taxa are mostly the same but we place two taxa at rank variety, while Namgyel placed all three at species rank. *Cautleya gracilis* and *C. spicata* are not in doubt but the third taxon may be a result of hybridisation between them. If it is recognised as a species, then *Cautleya cathcartii* is the only name available. *Cautleya gracilis* var. *robusta* (K.Schum.) Sanjappa cannot be raised to species rank because *C. robusta* Baker (= *C. spicata*) already exists. Only further experimental taxonomy can resolve the question of the origin of *Cautleya gracilis* var. *robusta* leading to a decision on the rank at which it should be placed.

Systematic Treatment

Cautleya (Royle ex Benth.) Hook.f., Bot. Mag. 114: t.6991 (1888). – *Roscoea* sect. *Cautleya* Royle ex Benth., Gen. Pl. 3: 641 (1883), as '*Cautlea*'. – Lectotype species: *Cautleya gracilis* (Sm.) Dandy, designated by Burtt & Smith (1972).

Perennial, rhizomatous herbs, often epiphytic, when terrestrial then usually in steep, rocky places. *Pseudostems* deciduous, breaking away from the rhizome by an abscission zone before the winter. *Leafy shoots* 20–100 cm tall; leaf sheaths tubular, ligules bilobed, leaf blades few, usually elliptic, sometimes dark purplish red below,

alternate. *Inflorescence* a terminal spike; bracts green or red, open to the base, subtending and enfolding one yellow flower; bracteoles absent. *Calyx* bilobed, split down one side, colour variable, from light green to dark red; floral tube about as long as calyx, dorsal corolla lobe boat-shaped, curved, mucronate, lateral corolla lobes narrowly acute at apex, connate to each other and to base of labellum; lateral staminodes petaloid, oblanceolate and erect, forming a helmet with the dorsal corolla lobe above the fertile anther; labellum deeply bilobed, lobes rather broad and rumpled with toothed margins; anther versatile, L-shaped when viewed from the side, with two orange spurs at base, anther thecae dehiscing longitudinally, anther crest small or lacking; style held between thecae of fertile stamen, stigma white, club-shaped, ostiole transverse, ciliate; ovary trilocular with axile placentation, epigynous glands 2, subulate. *Fruit* a globose, septifragal capsule with persistent calyx, dehiscing by 3 valves; seeds black with white aril, either small or covering seed in dehisced fruit.

Distribution. Two species, one with two varieties, from northern India, Nepal, Bhutan, southern China, Burma, Thailand and Vietnam.

Key to the taxa

1a. Leaves with a short petiole; bracts red, longer than the calyx ___ **2. C. spicata**
1b. Leaves sessile; bracts green, mostly shorter than the calyx _____ 2

2a. Inflorescence lax or with solitary flowers, flowers usually < 10, bracts covering 1/2–2/3 of the calyx, leaves lanceolate _____ **1a. C. gracilis** var. **gracilis**
2b. Inflorescence dense, flowers ≥ 10, bracts covering $> 2/3$ of the calyx, leaves lanceolate or oblong _____ **1b. C. gracilis** var. **robusta**

1. Cautleya gracilis (Sm.) Dandy, J. Bot. 70: 328 (1932). – *Roscoea gracilis* Sm., Trans. Linn. Soc. London 13: 460 (1822). – Type: Nepal, 1818, *E. Gardner* (J.E. Smith's collection, 9.7(1)) (lecto LINN-SM, designated here).

Roscoea elatior Sm., Trans. Linn. Soc. London 13: 460 (1822). – Type: Nepal, 1819, *E. Gardner* (J.E. Smith's collection, 9.9) (lecto LINN-SM, designated here).

Roscoea lutea Royle, Ill. Bot. Himal. Mts. 1: 361 (1839). – *Cautleya lutea* (Royle) Hook.f., Bot. Mag. 114: t.6991 (1888). – Type: India, Mussoorie, *J.F. Royle* 13191x(1) (lecto LIV, designated here).

Cautleya lutea var. *gracilior* K.Schum., Pflanzenr. IV, 46 (Heft 20): 124 (1904). – *Cautleya gracilis* var. *gracilior* (K.Schum.) Sanjappa, Fl. Ind. Enum., Monocot. 291 (1989). – Type: India, Uttarakhand, Kumaon, *N. Wallich* 6531B (lecto K-W, designated here; isolecto BM, E).

1a. Cautleya gracilis var. **gracilis. Fig. 1.**

Leafy shoots 20–65 cm tall. *Leaves*: lamina sessile, lanceolate, rather narrow, 6.5–24 × 0.5–3(–4) cm. *Ligules* to 5 mm long. *Flowers* solitary or in a lax inflorescence,

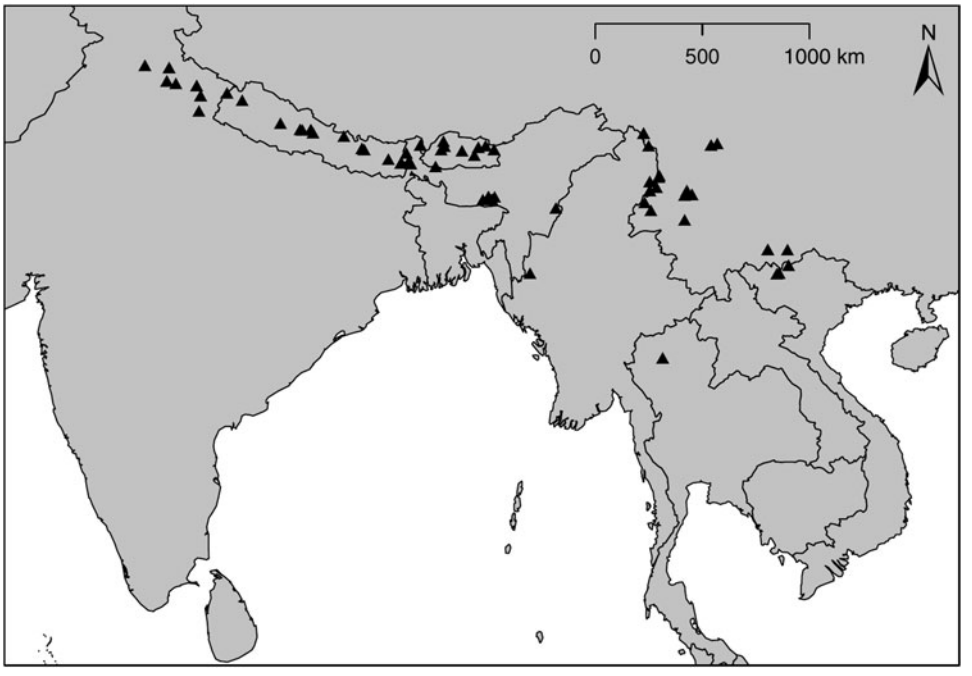

FIG. 1. Distribution of *Cautleya gracilis* (Sm.) Dandy var. *gracilis*.

4–11 cm long, of 2–10 (rarely more) flowers. *Bracts* green, lanceolate to obovate, 0.5–2 cm long, covering 1/2–2/3 of the calyx. *Calyx* tubular, 1.5–2.5 cm long, with small teeth, including at least half of the floral tube. *Capsule* red, globose, to 0.5–1 cm diameter. *Seeds* black, angular, aril greatly reduced, at base of seeds.

Distribution. Bhutan, Burma, China, India, Nepal, Thailand, Vietnam.

Habitat and ecology. Recorded from 1060–3940 m.

Proposed IUCN conservation assessment. Least Concern (LC). This variety is known from many localities across a wide area and there are no significant threats.

Additional specimens examined. NEPAL. s.l., *N. Wallich* s.n. (P); *N. Wallich* 6531 (K, P); *N. Wallich* 6531A (E, NY); Dakcho, 1930, *L. Dhwoj* 7 (E); Bajhang, 23 vii 1953, *J.B. Tyson* 109 (P); Central Nepal, 24 vi 1973, *C. Grey-Wilson & Phillips* 118 (K); Darchula, Dhaulakot, 18 viii 1952, *O.V. Polunin, W.R. Sykes & L.H.J. Williams* 490 (E); Dolakha, 16 vii 1973, *C. Grey-Wilson & Phillips* 286 (K); East Nepal, 5 vi 1972, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 723608 (E); Ilam, 26 vi 1992, *S. Noshiro, S. Akiyama & N. Acharya* 9241112 (E); Kaski District, 28 viii 1994, *M. Mikage, N. Fujii, T. Kajita, N. Kondo, S. Noshiro & K. Yoda* 9485567 (A); Kosi, Sankhuwasabha, 31 vii 1990, *M. Minaki, C. Yonebayashi, F. Miyamoto, H. Takayama, H. Sugita, H. Yagi, M.N. Subedi & H. Ikeda* 9080073 (A); Kosi, Sankhuwasabha, Arun Valley, 11 ix 1956, *J.D.A. Stainton* 1632 (E); Lamjung, Pasgam, 25 vi 1954, *J.D.A. Stainton, W.R. Sykes & L.H.J. Williams* 5928 (E); Langtang, 27 vi 1937, *F.M. Bailey* (E); Parbat District, 10 vii 1983, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki & S.*

Akiyama 8310201 (A, E); Ramechhap, 17 viii 1985, *H. Ohba, T. Kikuchi, M. Wakabayashi, M. Suzuki, N. Kurosaki, K.R. Rajbhandari & S.K. Wu* 8530859 (A); ibid., 4 viii 1985, *H. Ohba, T. Kikuchi, M. Wakabayashi, M. Suzuki, N. Kurosaki, K.R. Rajbhandari & S.K. Wu* 8571261 (A, E); ibid., 5 vii 1985, *H. Ohba, T. Kikuchi, M. Wakabayashi, M. Suzuki, N. Kurosaki, K.R. Rajbhandari & S.K. Wu* 8580075 (A).

INDIA. s.l., *H.F.C. Cleghorn* (E); viii 1886, *D. Prain* 10 (K); *V.V. Jacquemont* 2406 (P). **Uttarakhand**: x 1969, *Pant & Nainthani* 39537 (K); Garhwal District, viii 1917, *J. Marten* (E); Garhwal District, Mussoorie, 1869, *G. King* (P); ibid., 30 viii 1937, *R.R. Stewart* 16098 (GH, NY); ibid., 1 ix 1843, *W. Jameson* 693 (NY); Garhwal District, Tehri, 25 viii 1944, *R.R. Stewart* 21184 (NY); Kumaon, Nainital, *R. Strachey & J.E. Winterbottom* 3 (GH, K, P); Uttarkashi, Kidarkanta, 26 vi 1904, *J.R. Drummond* 22729 (E, UC). **Himachal Pradesh**: Simla, 29 vii 1831, *C. Brown* (E); ibid., 24 viii 1889, *G. Watt* 9549 (E). **West Bengal**: Darjeeling, *J.M. Cowan* (E); ibid., *J.M. Cowan* (E); ibid., vii 1968, *Anon.* 1350 (ECON); ibid., vii 1874, *J.S. Gamble* 8129 (K); ibid., 4 viii 1972, *H. Kanai, H. Ohashi, H. Hara, K. Iwatsuki & H. Ohba* 721460 (E); Darjeeling, Mongpu, 9 v 1884, *P.E. Boissier & W. Barbey-Boissier* (P). **Sikkim**: *J.D. Hooker* (GH, P); 25 vi 1945, *N.L. Bor & K. Ram* 20746 (K); v 1878, *J.L. Lister* (P); 4 vii 1983, *B.N. Starling, E.M. Upward, C.D. Brickell & B. Mathew* 292 (K); Chhokha–Yuksum, 31 v 1990, *G. Kirkpatrick* 66 (E).

BHUTAN. 12 vi 1949, *F. Ludlow, G. Sherriff & J.H. Hicks* 16528 (A); 15 ix 1998, *H.J. Noltie, R. Pradhan, Sherub & T. Wangdi* 213 (E); Dotena Chu, 5 ix 1984, *I. Sinclair & D.G. Long* 4848 (E); Gyasa Dzong, 12 vi 1949, *F. Ludlow, G. Sherriff & J.H. Hicks* 16528 (E); Khoma, 22 vii 2000, *S.B. Lyon* 13041 (E); ibid., 23 vii 2000, *S.B. Lyon* 13054 (E); Phuntsholing, 26 vi 1975, *A.J.C. Grierson & D.G. Long* s.n. (E); Punakha, 24 vii 1983, *C. Sargent* 19 (E); Tobrang, 5 vii 1949, *F. Ludlow, G. Sherriff & J.H. Hicks* 20836 (E).

CHINA. **Sichuan**: *P.G.E. Bonvalot & H. d'Orléans* (P); vii 1922, *G. Forrest* 21951 (K); 1 viii 1908, *Legendre* 464 (P); Muli Zangzu Zizhixian, 8 viii 1915, *H.R.E. Handel-Mazzetti* 7534 (E). **Yunnan**: Wen-shan-hsien, Loa-jiun-shan, 12 viii 1947, *K.M. Feng* 11156 (A); Ghi Shan, E of Tali Lake, vii 1917, *G. Forrest* 15495 (E, K); Yangbi Yizu Xian, W side of Diancang Shan, vicinity of Xueshanhe, above Zhongshan village, 16 vi 1984, *B.M. Bartholomew, D.E. Boufford, H.W. Li, C.G. Ma, D.H. Nicolson, T.S. Ying & S.W. Yu* 160 (A); NW Likiang, Tsze-kou on Yangtze, 4 ix 1939, *R.C. Ching* 21433 (A); W Likiang, on the way from Tamichung to Tuchi, 20 viii 1939, *R.C. Ching* 21556 (A); *E.B. Howell* 332 (E); Shang-pa Hsien, 16 ix 1933, *H.T. Tsai* 54256 (A); Che-tse-lo (Zhiziluo), 11 ix 1934, *H.T. Tsai* 58497 (A); 1910–1919, *G. Forrest* 7009 (K); Mengsheng, Dah-meng-lung, Che-li Hsien, ix 1936, *C.W. Wang* 78404 (A); Dajiuping, 30 vi 1984, *B.M. Bartholomew, D.E. Boufford, H.W. Li, C.G. Ma, D.H. Nicolson, T.S. Ying & S.W. Yu* 601 (A, E); Dali range, *H.D. McLaren* B144 (E, K); ibid., viii 1906–ix 1906, *G. Forrest* 1890 (E, K); ibid., v 1906, *G. Forrest* 4805 (E); ibid., vii 1910, *G. Forrest* 7009 (E); Dulong Jiang, 28 vii 1938, *T.T. Yu* 19512 (E); ibid., 28 vii 1938, *T.T. Yu* 19512 (A); ibid., 2 viii 1938, *T.T. Yu* 19580 (A, E); Mengzi, *A. Henry* 9480 (NY); ibid., *A. Henry* 9480A (E, K); Longling Xian, 26 viii 2003, *H. Li, Z. Dao, R. Li, Z. Jiang, B.M. Bartholomew & L. Zhou* 17918 (E); Longyang Qu, 24 viii 2003, *H. Li, Z. Dao, R. Li, Z. Jiang, B.M. Bartholomew & L. Zhou* 17742 (E); ibid., 2 ix 2003, *H. Li, Z. Dao, R. Li, Z. Jiang, B.M. Bartholomew & L. Zhou* 18613 (E); Lushui County, 22 viii 2005, *H. Li* 27970 (E); Nujiang Lisu Autonomous Prefecture, Gongshan Co., Qi Qi Nature reserve, 17 vii 2000, *H. Li* 12935 (E); Shunning, 14 vi 1938, *T.T. Yu* 16237 (A); Tengyueh, 4 ix 2003, *H. Li, Z. Dao, R. Li, Z. Jiang, B.M. Bartholomew & L. Zhou* 18685 (E); ibid., 4 ix 2003, *H. Li, Z. Dao, R. Li, Z. Jiang, B.M. Bartholomew & L. Zhou* 18736 (E); ibid., 4 ix 2003, *H. Li, Z. Dao, R. Li, Z. Jiang, B.M. Bartholomew & L. Zhou* 18769 (E); ibid., 28 v 2006, *H. Li* 30753 (E); lava bed W of Tengyueh, vi 1912, *G. Forrest* 8435 (E, K); Yangbi Yizu Zizhixian, viii 1922, *J.F.C. Rock* 6500 (E); Yao Jia Ping Forest Station, 28 x 1996, *Anon.* 8206 (E); Yungning, vii 1922, *G. Forrest* 21951 (E).

BURMA. **Chin State**: Mount Victoria, 1924, *R.E. Cooper* 6045 (E). **Kachin State**: 5 vii 1914, *F. Kingdon-Ward* 1726 (E); Chimi-li, vi 1925, *G. Forrest* 26953 (E, NY); Hpare, 11 vii 1919, *R.J. Farrer* 1085 (E); Laktang, 16 vi 1919, *F. Kingdon-Ward* 3220 (E); ibid., 20 vii 1919, *F. Kingdon-Ward* 3345 (E).

THAILAND. **Chiang Mai**: Doi Inthanon, 17 vii 1922, *A.F.G. Kerr* 6319 (K); ibid., 20 ix 1995, *K. Larsen, S.S. Larsen, C. Tange & D. Sookchaloem* 46744 (L); Doi Inthanond, Pha Ngaem, 5 ix 1927, *H.B.G. Garrett* 439 (K).

VIETNAM. **Lao Cai**: Man mei, *A. Henry* 9480 (E, K); Sa Pa, 16 viii 1926, *E. Poilane* 12960 (P); ibid., vii 1927, *P.A. Pételot* 3106 (P); ibid., 19 vii 2004, *D.E. Atha* 4910 (NY); ibid., viii 1930, *P.A. Pételot* 7527 (P).

1b. Cautleya gracilis var. **robusta** (K.Schum.) Sanjappa, Fl. Ind. Enum., Monocot. 291 (1989). – *Cautleya lutea* var. *robusta* K.Schum., Pflanzenr. IV, 46 (Heft 20): 125 (1904). – Type: Sikkim, *J.D. Hooker* s.n. (neo K, designated here). **Figs 2, 3.**
Cautleya cathcartii Baker in Hook.f., Fl. Brit. India 6: 208 (1890). – Type: Sikkim, *J.D. Hooker* s.n. (lecto K, designated here).

Leafy shoots 36–80 cm tall. *Leaves*: lamina sessile, lanceolate to oblong, 10–26 × 1–7 cm. *Ligules* to 5 mm long. *Inflorescence* 7–16 cm long, dense, of 10 to more than 20 flowers. *Bracts* green, 1–2 cm long, covering at least 2/3 of the calyx. *Calyx* tubular, 1–2.5 cm long, with small and sharp teeth, including at least half the floral tube. *Capsule* red, globose, to 0.5–1 cm diameter. *Seeds* black, angular, aril greatly reduced, at base of seeds.

Distribution. Bhutan, China, India, Nepal.

Habitat and ecology. Recorded from 1520–3940 m.

Proposed IUCN conservation assessment. Least Concern (LC). This variety is known from many localities across a wide area and there are no significant threats.

Additional specimens examined. NEPAL. East Nepal, Taplejung District, 16 v 1974, *J.D.A. Stainton* 7023 (E); ibid., 13 v 1992, *M. Suzuki, N. Acharya, S. Akiyama, H. Koba, S. Noshiro & K.R. Rajbhandari* 9240057 (A); ibid., 15 vi 1992, *S. Noshiro, S. Akiyama & N. Acharya* 9240828 (A); Kosi, Sankhuwasabha, 9 vii 1988, *M. Suzuki, N. Naruhashi, N. Kurosaki, Y. Kadota, M.N. Subedi, M. Minaki, S. Noshiro & H. Ikeda* 8820326 (A, E); ibid., 9 vii 1988, *M. Suzuki, N. Naruhashi, N. Kurosaki, Y. Kadota, M.N. Subedi, M. Minaki, S. Noshiro & H. Ikeda* 8880232 (A, E); Kosi, Sankhuwasabha, Arun Valley, 11 ix 1956, *J.D.A. Stainton* 1632 (E); ibid., 24 v 1981, *J.D.A. Stainton* 8302 (E); Kosi, Sankhuwasabha, Milke Danda, 1 x 1971, *Beer* BLM7 (K); Langtang, vii 1939, *O.V. Polunin* 1339 (E); Ramechhap, 5 vii 1985, *H. Ohba, T. Kikuchi, M. Wakabayashi, M. Suzuki, N. Kurosaki, K.R. Rajbhandari & S.K. Wu* 8570129 (A).

INDIA. s.l., *G. Watt* 5617 (E). **Uttarakhand**: Kumaon, 25 vi 1948, *W.N. Koelz* 20830 (NY). **West Bengal**: Batasi, 20 v 1965, *F.d. Vos & E.G. Corbett* 187 (E); Darjeeling, 26 vii 1886, *F.J. Harmand* (P); ibid., 9 vi 1874, *W.J. Treutler* 184 (K); ibid., *C.B. Clarke* 26841 (K); ibid., *W. Griffith* 5673 (K, NY, P); ibid., *W. Griffith* 5786 (K); ibid., 24 v 1975, *J.S. Gamble* 680A (K); ibid., 24 v 1975, *J.S. Gamble* 680B (K); ibid., 19 v 2004, *J. Škorničková* 71478 (K); ibid., vii 1875, *J.S. Gamble* 8126 (K); Mamreng, 13 viii 1913, *G.H. Cave* (E); ibid., 13 viii 1913, *G.H. Cave* (E); Sonada, 8 vi 1913, *G.H. Cave* (E); Tongloo, 1857, *T. Thomson* 76 (K). **Sikkim**: s.l., *J.D. Hooker* (E); *J.D. Hooker* (GH); *J.D. Hooker* (K); 21 v 1879, *G. King* (K); *D. Brandis* (HBG); Rimbi Chhu, 19 v 1913, *G.H. Cave* (A, E); ibid., 13 viii 1913, *G.H. Cave* (A, E).

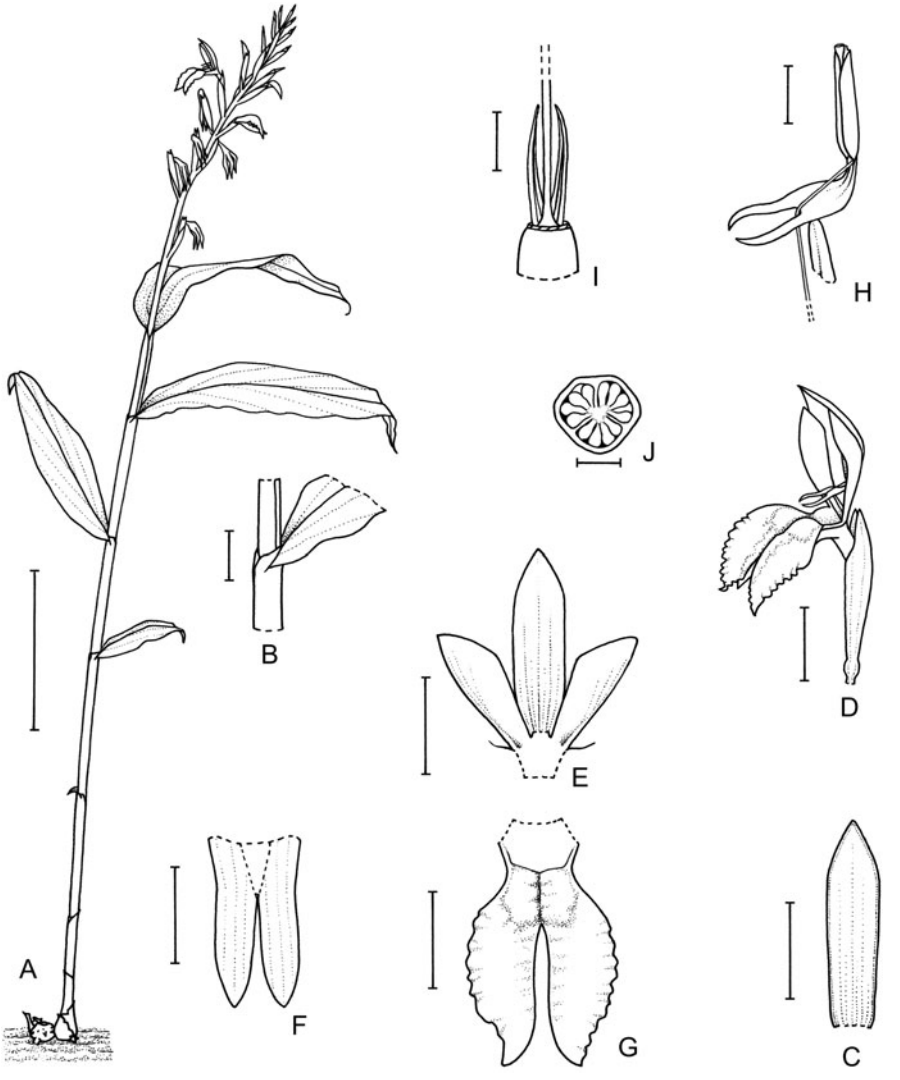

FIG. 2. *Cautleya gracilis* (Sm.) Dandy var. *robusta* (K.Schum.) Sanjappa. A, habit; B, ligule; C, bract; D, flower; E, dorsal corolla lobe and lateral staminodes; F, lateral corolla lobes; G, labellum; H, anther; I, epigynous glands; J, ovary T.S. Scale bars: A = 10 cm; B–G = 1 cm; H = 3 mm; I = 2 mm; J = 1 mm. Drawn from RBGE living accession 19920038, originally collected in the Arun Valley, Nepal, 2000 m.

BHUTAN. Punakha, 17 viii 1914, *R.E. Cooper* 2679 (E); Thimphu, 19 vii 1987, *J.R.I. Wood* 5596 (E).

CHINA. **Yunnan**: Shunning, 14 vi 1938, *T.T. Yu* 16237 (E).

Schumann (1904) lists only one collection in the protologue of *Cautleya lutea* var. *robusta*: 'Var. β. Sikkim zwischen 2300 u. 2600 m ü. M. (Hooker f.)'. We have been

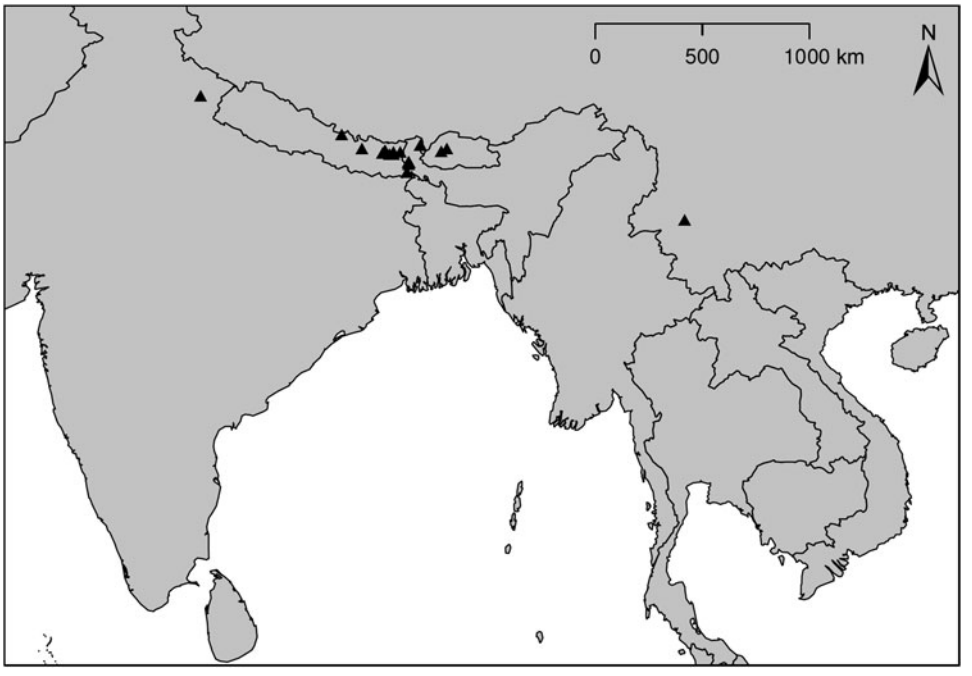

FIG. 3. Distribution of *Cautleya gracilis* (Sm.) Dandy var. *robusta* (K.Schum.) Sanjappa.

unable to find a collection of Hooker's which bears any indication that Schumann saw it or which matches the altitudinal range. For this reason, we assume that no original material is extant and choose a neotype for *Cautleya lutea* var. *robusta* (ICBN Art. 9.9, 9.11, McNeill *et al.*, 2006).

J. F. Cathcart of the Bengal Civil Service had a folio of drawings made by local artists which he presented to J. D. Hooker when Hooker stayed with Cathcart in India. Back in London, Hooker engaged W. H. Fitch to make lithographs of these drawings and published them (Hooker, 1855). Baker (1890) honoured Cathcart's contribution with a new species, now reduced to synonymy. The lectotype of *Cautleya cathcartii* selected above bears a label in Hooker's hand, 'F of drawings', i.e. Cathcart's folio of drawings, and a determination in Baker's hand which reads 'Cautleya cathcarti, Baker'.

Further work is required to ascertain whether two varieties should be recognised in *Cautleya gracilis*. *Stainton* 1632 (E, 2 sheets) raises some doubt since one sheet belongs to each variety. This suggests that the varieties may be merely ecological forms, one growing more strongly than the other, or that they are cytological races, or that it could even be a hybrid, as discussed above.

2. Cautleya spicata (Sm.) Baker, Fl. Brit. India 6: 209 (1890). – *Roscoea spicata* Sm., Trans. Linn. Soc. London 13: 461 (1822). – Type: Nepal, 1819, *E. Gardner* (J.E. Smith's collection, 9.5) (lecto LINN-SM, designated here). **Figs 4, 5.**

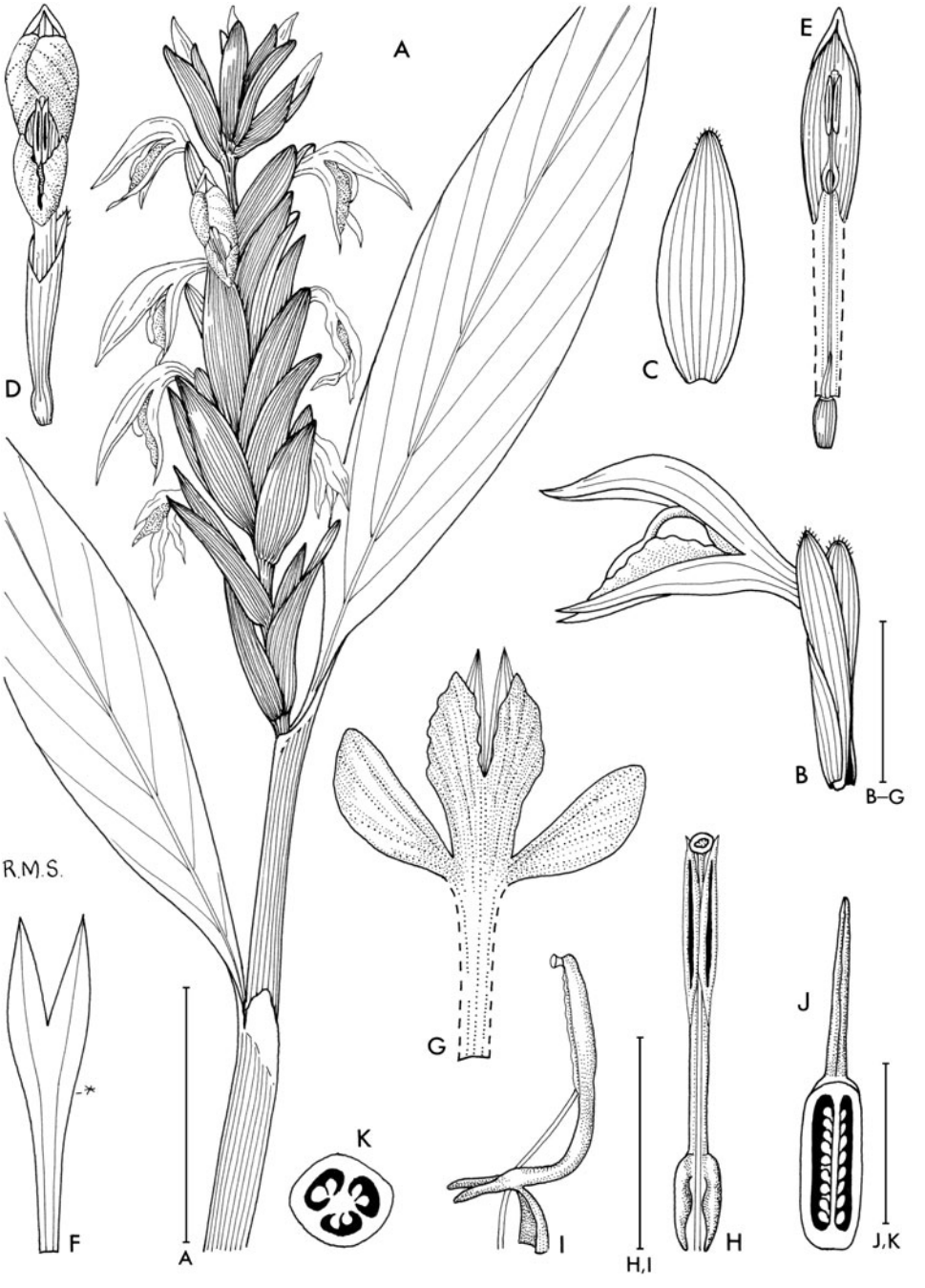

FIG. 4. *Cautleya spicata* (Sm.) Baker. A, habit; B, flower with bract; C, bract; D, flower; E, corolla in L.S. showing dorsal petal, anther and tube; F, lateral petals, * indicating position of lateral staminodes; G, labellum and lateral staminodes; H–I, anther; J, ovary in L.S. and epigynous glands; K, ovary in T.S. Scale bars: A = 5 cm; B–G = 2 cm; H, I = 2 cm; J, K = 5 mm. From fig. 15 in Burtt & Smith (1972).

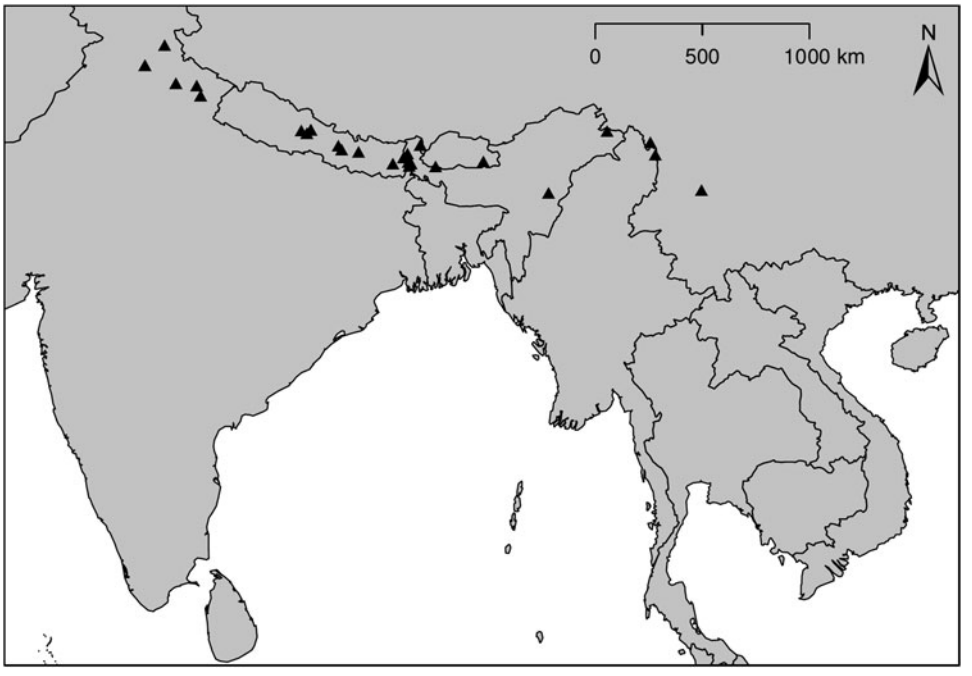

FIG. 5. Distribution of *Cautleya spicata* (Sm.) Baker.

Cautleya petiolata Baker, Fl. Brit. India 6: 209 (1890). – Type: India, Uttarakhand, Garhwal District, *J.F. Royle*, icon, RBG Kew Library Archive (holo K). **Fig. 6.**
Cautleya robusta Baker, Fl. Brit. India 6: 209 (1890). – Type: India, West Bengal, Darjeeling, Kurseong, 11 x 1884, *C.B. Clarke* 36527 (lecto K, designated here).

Leafy shoots 40–100 cm tall. *Leaves* petiolate, lamina lanceolate, relatively broad, 11–38 × 2–11 cm. *Ligules* to 1.5 cm long. *Inflorescence* 7–24 cm long, dense, of 6 to more than 30 flowers. *Bracts* red or reddish, oblong to obovate, 1.5–4 cm long, longer than or equalling the calyx length. *Calyx* tubular, 1.5–3 cm long, with small margins, including at least half the floral tube. *Capsule* red, globose, to 1.5 cm diameter. *Seeds* black, globose, aril white, completely covering seed.

Distribution. Bhutan, Burma, China, India, Nepal.

Habitat and ecology. Recorded from 1210–3640 m.

Proposed IUCN conservation assessment. Least Concern (LC). This variety is known from many localities across a wide area and there are no significant threats.

Additional specimens examined. NEPAL. s.l., *N. Wallich* 6530 (E, NY, P); 20 vii 1973, *C. Grey-Wilson & Phillips* 315 (K); Dakcho, 1930, *L. Dhwoj* 7 (E); Bagmati, Rasuwa, 24 vi 1985, *J.B. Hankay Rai & P. Kumar Rai* 103 (A); Central Nepal, Khimti, 5 vii 1974, *J.D.A. Stainton* 7179

FIG. 6. Holotype specimen of *Cautleya petiolata* Baker.

(E); Kaski District, 26 vii 1996, *T. Hoshino, M. Amano, H. Koba, K.R. Rajbhandari, M. Sato, R. Shrestha & S. Takatsuki* 9662022 (A); Katmandu, 3 ix 1966, *D.H. Nicolson* 2251 (MICH); Mahabharat Lekh, 14 ix 1967, *J.D.A. Stainton & L.H.J. Williams* 8489 (K); Patan District, Phulchoki, 27 vii 1965, *A.D. Schilling* 574 (K); Seti Khola, 26 vii 1954, *J.D.A. Stainton, W.R. Sykes & L.H.J. Williams* 6503 (A, E); Singalila, 22 vii 1969, *H. Hara, S. Kurosawa & H. Ohashi* (E); Solukhumbu District, Phaplu, 1930, *L. Dhwoj* 82 (E).

India. s.l., *T. Thomson* (P), *V.V. Jacquemont* (P), *K.P. Biswas* 3524 (GH), *W. Griffith* 5689 (P). **Uttarakhand**: 9 vii 1923, *R.N. Parker* 2060 (K); Garhwal District, Dhunoultee, 1830, *J.F. Royle* 13190x(1) (LIV); Garhwal District, Tehri, 25 viii 1944, *R.R. Stewart* 21172 (K, NY); Kumaon, *R. Strachey & J.E. Winterbottom* (GH); ibid., x 1969, *Pant & Nainthani* 39509 (K). **Himachal Pradesh**: 1844, *M.P. Edgeworth* (K); 28 vii 1888, *J.R. Drummond* 23186 (K); 10 viii 1886, *H. Collett* 346 (K); Bashahr, 28 ix 1891, *J.H. Lace* 1044 (E); Simla, 1884, *J.R. Drummond* 1943 (E); ibid., 1887, *J.R. Drummond* 20950 (E); ibid., 1887, *J.R. Drummond* 20951 (E, K). **West Bengal**: Darjeeling, 10 x 1884, *C.B. Clarke* 36477 (K); Darjeeling, 6 viii 1893, *J.M. Cowan* (E); ibid., 3 ix 1912, ? *G.H. Cave* s.n. (K); ibid., 3 xi 1974, *B.M. Bartholomew* 249 (E, UC); ibid., *W. Griffith* 5664 (K); Darjeeling, Kurseong, 25 ix 1884, *C.B. Clarke* 35867A (K); Darjeeling, Mongpu, 10 x 1884, *C.B. Clarke* 36456 (K); Darjeeling, Rambi, 29 viii 1912, *Anon.* s.n. (K). **Sikkim**: *J.D. Hooker* (GH); 20 viii (year unknown), *J.D. Hooker* (K); *J.D. Hooker* (P); *J.D. Hooker* (P); 7 x 1884, *C.B. Clarke* 36328 (K); Rathang Chhu, 27 vii 1992, *D.G. Long, R.J.D. McBeath, H.J. Noltie & M.F. Watson* 772 (E).

Bhutan. Phuntsholing, 26 vi 1975, *A.J.C. Grierson & D.G. Long* s.n. (E); Tshilingor, 26 vi 1979, *A.J.C. Grierson & D.G. Long* 2268 (E).

China. **Yunnan**: *P.J.M. Delavay* (P); Binchuan Xian, 17 vii 1909, *F. Ducloux* 6565 (P); Dulong Jiang, 9 i 2006, *H. Li* 34421 (E).

Burma. **Kachin State**: Nyitadi, 28 vii 1920, *R.J. Farrer* 1767 (E).

Royle 13190x(1) (LIV) is labelled *Roscoea petiolata* in Royle's hand but in the protologue Baker (1890) says that *Cautleya petiolata* is 'known only from an unpublished figure of Royle's artist'. Thus, the figure is the sole original material and holotype, even though it may have been painted from 13190 (LIV) which Baker didn't see.

Both *Royle* 13190x(1) (LIV) and Royle's painting of *Cautleya petiolata* at K possess bracts that are a little shorter than the calyx and rather long petioles, at least for the upper leaves. Thus, they would key out to *Cautleya gracilis*. The overall *Gestalt* of the plant, however, leads us to regard it for now as a synonym of *Cautleya spicata*. Garhwal District of Uttarakhand, the origin of this material, has been relatively well-collected by botanists but no other collection has been made. The existence and nature of this rare variant will require further field research.

Dhwoj 7 (E) from Dakcho, Nepal consists of three sheets, two matching *Cautleya spicata* and the third matching *C. gracilis* var. *gracilis*.

Acknowledgements

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consult their herbarium specimens and library archives. At the Royal Botanic Gardens, Kew, Nicholas Hind gave us valuable advice on the Wallich collection and Julia Buckley helped us to find the illustration shown in Fig. 6, which is reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew. Our thanks go to Claire Banks, who made the illustration in Fig. 2, and to Jana Leong-Škorničková (SING) for sending us photomicrographs of her collection *Škorničková* 71478. Mark Watson (E) has explained the history of collecting in Nepal to us, allowing us to attribute the types in J. E. Smith's herbarium to the correct collector.

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