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NOTES RELATING TO THE FLORA OF BHUTAN: XXIV
Juncaceae

H. J. NOLTIE*

The following new taxa, combinations and synonymy in the genus *Juncus* from E Himalaya and SW China are proposed: *J. bryophilus* Noltie *sp. nov.*; *J. spumosus* Noltie *sp. nov.*; *J. glaucoturgidus* Noltie *sp. nov.*; *J. hydrophilus* Noltie *sp. nov.*; *J. longiflorus* (A. Camus) Noltie *comb. & stat. nov.*; *J. duthiei* (C.B. Clarke) Noltie *comb. nov.* of which the following are synonyms: *J. rohtangensis* Aswal & Goel, *J. sikkimensis* Hook.f. var. *monocephalus* Hook.f. and *J. harae* Miyam. & H. Ohba; *J. bhutanensis* Satake is reduced to synonymy of *J. leucomelas* Royle ex D. Don, *J. pseudocastaneus* (Lingelsh.) Sam. to that of *J. sikkimensis*; *J. tratangensis* Satake to that of *J. ochraceus* Buchenau, *J. unifolius* A.M. Lu & Z.Y. Zhang to that of *J. minimus* Buchenau; *J. phaeocarpus* A.M. Lu & Z.Y. Zhang to that of *J. grisebachii* Buchenau; *J. longibracteatus* A.M. Lu & Z.Y. Zhang to that of *J. kingii* Rendle; *J. luteocarpus* Satake, the illegitimate *J. albescens* Satake and *J. yoskisukei* Goel to that of *J. concinnus* D. Don and *J. bracteatus* Buchenau to that of *J. benghalensis* Kunth.

J. perpusillus Sam. is reported new to Sikkim and Nepal; *J. amplifolius* A. Camus new to Bhutan, Sikkim and Nepal; *J. trichophyllus* W.W. Sm. new to Nepal and Bhutan; *J. nepalicus* Miyam. & H. Ohba new to Sikkim. *J. uniflorus* W.W. Sm. is lectotypified. Notes on *J. spectabilis* Rendle and *J. biglumoides* Hara are given.

INTRODUCTION

The E Himalaya and SW China are rich in species of *Juncus*, with 37 occurring in the area covered by the *Flora of Bhutan*. These species have been relatively little studied since the monograph of Buchenau (1906), though Camus (1910) added significantly to our knowledge of the Chinese species, as did Samuelsson, who accurately determined many herbarium sheets and wrote the very useful account in Handel-Mazzetti (Samuelsson, 1936). There is a comprehensive treatment (in Chinese) in the *Flora of Tibet* (Lu & Zhang, 1987), but the genus has not yet been revised for the *Flora Reipublicae Popularis Sinicae*. The unattributed listing of Nepalese species (in Hara et al., 1978) does not pretend to be critical. The accounts for the E Himalaya by Satake (1966, 1971, 1975) are useful, but he, along with other recent authors, has unfortunately tended to describe new species without adequately investigating the literature and herbaria. Types of most of the species recently described from the area have been examined and many found to have been described previously.

Great difficulties are encountered in identifying herbarium specimens of Himalayan *Juncus*, especially those belonging to subgenus *Alpini* (sensu Buchenau). There are various reasons for this: many old sheets contain mixed gatherings (with up to four species on a single sheet!); the reliability of the much-used character of presence/absence of upper stem leaf is unclear, and is certainly variable in some species. Field trips to Nepal, Sikkim and Bhutan have been illuminating, though many problems still remain and will probably only yield to biosystematic

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methods. For instance, it is almost certain that hybridization (known to be common in the genus) occurs among these alpine species, with many species cohabiting (e.g. in a flush at Dzongri, Sikkim eight species were found growing in close proximity). Some species are difficult to identify in the field (where it is difficult to cut leaf sections) and it is essential to look at whole populations. It is not always possible to be certain of the identity of individual specimens due perhaps to hybridization or the existence of atypical forms (e.g. single-headed forms of normally multiple-headed species, stunted forms at high altitude, forms of species such as *J. concinnus* with highly compound inflorescences). Work is needed to explain this variation.

The following precursor notes necessary for the account in the *Flora of Bhutan* are arranged approximately in the order of Buchenau's monograph which, although very out-of-date (1906), is the most recent generic monograph and does not include the species described by Camus (1910). Much work is required to produce a usable infrageneric treatment, Buchenau's being largely informal with no names given to sections, and several of the taxa discussed below suggest that two of his subgenera are not clearly distinct.

SUBGENUS ALPINI

(A) Species with a single terminal 'capitulum' of white flowers and usually tubular septate leaves (corresponding to sections 46, 49 and 50 of Buchenau).

J. leucomelas Royle ex D. Don in Trans. Linn. Soc. Lond. 18: 319–20 (1840).
Syn.: *J. bhutanensis* Satake in J. Jap. Bot. 43: 382–4 (1968). Holotype: Barshong to Nala, 3100–3500m, 25 v 1967, *Kanai et al.* 6201 (TI!).

Examination of the holotype of *J. bhutanensis* shows it to be synonymous with the well-known, though apparently rare, Sino-Himalayan *J. leucomelas* Royle ex D. Don, typical in its leafless stem and leaf sheaths lacking apical auricles. It is atypical of mature *J. leucomelas* in having short filaments (about equalling the anthers), but as in all Junci the relative lengths of anther to filament depends on the age of the flower. In *J. leucomelas*, the characteristically long (over 2mm) anthers are completely exserted from the tepals at maturity — but this specimen is immature and the filaments have not yet lengthened. The characters given in the description distinguishing it from *J. thomsonii* Buchenau and *J. leucomelas*, viz. flowers pedicellate, long lowermost bract and broad tepals, are of no relevance, being as expected for *J. leucomelas*. Satake later (1971) identified fruiting specimens from Darjeeling District as belonging to *J. bhutanensis* and augmented his description; however, these belong to *J. benghalensis* Kunth. *Juncus benghalensis* and *J. leucomelas* are very similar, though the blunt, often brown leaf-sheath auricles are diagnostic of the former. The stem leaf is always absent in *J. leucomelas* but may be present or absent in *J. benghalensis*.

Juncus perpusillus Sam. in Hand.-Mazz., Symb. Sin. 7: 1237–8 (1936). Holotype: China, Sikang, Taofu (Dawo) District, Haitzeshan, ad rupes calcareas, 4400–4600m, 31 viii 1934, *H. Smith* 11684 (UPS!).

A dwarf alpine rush found at Chaunrikiang, Sikkim was discovered to belong to the little-known Chinese taxon *J. perpusillus* Sam. This species was based on a single gathering from Sichuan

(Sikang) China, representing a particularly reduced form with a 1–2-flowered inflorescence; it was also collected late in the season when the white tepals had (as in all the alpine species) become suffused with dark purplish pigmentation. The description and distribution can thus be expanded as follows.

Rhizomes very short, stout, covered with dark brown scales, plant densely tufted. *Flowering stems* 1.5–8cm, setaceous. *Leaves* bitubular, filiform, stem leaf sheaths with conspicuous, often reddish-brown auricles, upper stem leaf present or absent, basal stem leaf with dark, purplish-brown sheath. *Capitula* (1–)2–4-flowered. *Bracts* chestnut, lowermost often with leaf-like point exceeding inflorescence. *Tepals* 3–4.5 × 1mm, oblong, blunt, initially white, becoming suffused dark purplish. *Filaments* exceeding tepals at maturity, anthers 1.5–2mm. *Stigma lobes* c.0.5mm, spreading. *Capsule* 2.5–3 × 1.5–2mm, oblong-ellipsoid, abruptly contracted into beak, 1–1.5mm.

Very close to *J. benghalensis*, especially in its bitubular leaves, the usually long, leaf-like lowest bract and the conspicuous leaf-sheath auricles, but differing in its very dwarf stature (inflorescence sometimes reduced to 1 or 2 flowers) and its short, branched rhizomes giving rise to dense clumps, rather than having stems borne singly and spreading by very slender stoloniferous rhizomes.

Other specimens seen:

SIKKIM. Above Chuanrikiang, near foot of E Rathong Glacier, 4550m, 14 vii 1992, *ESIK* 375 (E).

NEPAL. Gosainkund Lake, 4250m, 14 viii 1974, *De Haas* 2252 (BM). Rocks N of Gosainkund Governmental House, 4500m, 12 viii 1974, *De Haas* 2222 (BM). Lau, 4600m, 25 vii 1974, *Yon* 243 (BM).

J. trichophyllus W.W. Sm. in Rec. Bot. Surv. India 6: 103 (1914).

A very distinctive species, bearing curious viviparous bulbils in the axils of the bract-like stem leaves. Until recently known only from the type collections from Sikkim, recently found in E Nepal and Bhutan. Related to *J. cephalostigma* Sam., with which it was possibly hybridizing at Dzongri.

Specimens seen:

NEPAL. Ridge near Kauma, S of Shipton La, 3540m, 26 ix 1991, *EMAK* 294 (E). Tributary on N side of Barun Khola opposite Shipton La, 4200m, 10 x 1991, *EMAK* 653 (E).

SIKKIM. Changu, 13,000ft, 16 vii 1910, *Smith* 3502 (K, isosyntype). Locality unknown, 1889, *King's Coll.* s.n. (K, isosyntype). Between Jamlinghang and Bikbari, 3800m, 11 vii 1992, *ESIK* 234 (E). Dzongri, 4000m, 16 vii 1992, *ESIK* 431 (E). Phedang and Laxmi Pokhri, *ESIK* — field records.

BHUTAN. Ridge above Phajoding, 4060m, 30 vii 1991, *Noltie* 66 (E). Above Ragyo, N of Paro, 3890–3960m, 3 viii 1991, *Noltie* 95A (E). Below Ju La, 4080m, 11 viii 1991, *Noltie* — field record.

J. spectabilis Rendle in J. Bot. Lond. 44: 46 (1906). Holotype: Tibet, Gyantse, *Walton* 69 (BM!; iso. K!).

Bhutanese specimens identified as *J. spectabilis* in the herbarium were found to belong to *J. allioides* Franch., in which the (normally present) upper stem leaf was lacking. The type of *J. spectabilis* was examined and found to be worth retaining as a species, despite a determination by Egorova on one of the specimens stating it to be *J. thomsonii* Buchenau. *J. spectabilis* has the appearance of a large *J. thomsonii* and agrees in its leaf morphology (pluritubular, with up to three

thin longitudinal septa and many weak transverse septa). The flowers, however, are much larger (tepals 5.8–6.5mm; anthers 2.2–2.5mm) and in this it resembles *J. allioides*.

Another Tibet specimen (Rongshar Valley, 13,000ft, *Hingston* 35, K) has characters intermediate between *J. thomsonii* and *J. allioides* (no upper stem leaf and anthers under 2mm as in the former; leaves unitubular with strong transverse septa and long tepals over 5.5mm as in the latter). These two specimens again raise the question as to whether hybridization might be occurring.

Juncus glaucoturgidus Noltie, **sp. nov.**

A *J. allioide* Franchet foliis caulibusque multo crassioribus, foliis turgidis erectis glaucis septis paucis distantibus debilibus in sicco externe haud manifestis, folii caulinis inferioris auriculis minutis, bracteis latioribus differt. **Fig. 1A–E.**

Rhizome system condensed, stems densely tufted. *Flower stems* 10–25cm; upper part of stem bearing a leaf-like bract (sheath 3.5–5cm, tubular, apex with membranous, subacute auricles to 2.2mm, blade bristle-like to 6.5 mm); lower part sheathed with numerous scale leaves. *Scale leaves* dull, straw-coloured, darker at centre, paler at margins, minutely apiculate. *Stem leaf* single, sub-basal, shorter than stem (5.5–12.5cm), 2–3.5mm diameter, suberect, glaucous, cylindric, hollow, constricted below the blunt apex, with few, distant, weak, transverse septa, not visible externally even when dry, sheath short, with minute auricles (under 1mm). *Non-flowering shoots* with a single leaf usually equalling stems and similar to stem leaf. *Inflorescence* a terminal c.12-flowered capitulum to 2cm diameter; bracts forming an 'involucre', subequal, longest 15–22 × 7–8mm oblong-ovate, acute, dark reddish-brown, paler at margins. *Flowers* shortly (to 3mm) pedicelled; tepals cream, outer 6–6.5 × 1.4–1.7mm, oblong-lanceolate, subacute, keeled, inner not keeled, otherwise similar or slightly longer. *Filaments* slightly shorter than tepals; anthers 2–3.4mm, narrowly oblong, pale yellow, exserted. *Ovary* 2.5–3 × 1.2–1.9mm, ellipsoid, abruptly contracted into style (2–2.7mm); stigma lobes 1–1.5mm, stout, cream, erect. *Capsule* 4–4.5 × 2.5mm, ellipsoid, golden brown, beak 1–1.5mm.

Type: Sikkim, Samiti Lake (Bungmoteng Chho), 4300m, 21 vii 1992, *ESIK* 572 (holo. E, iso. K).

Other specimens seen:

NEPAL. Kyangin Kharka area, 12–14,000ft, 18 vii 1967, *Malla* 9197 (BM).

BHUTAN. Kantanang, Tsampa, 13,000ft, 3 vi 1949, *Ludlow & Sherriff* 19042 (BM).

A very distinctive species due to its swollen, erect, glaucous leaves and large capitula with very wide bracts. In Sikkim it grew above the tree-line on an open, sandy, probably calcareous slope, with vegetation noticeably differing from its surroundings. Associated species — Dwarf shrubs: *Cotoneaster microphyllus*, *Cassiope fastigiata*, *Juniperus indica*, *Bistorta macrophylla*, *Ephedra gerardiana*, *Rhododendron lepidotum*, *Potentilla arbuscula*. Herbs: *Kobresia nepalensis*, *K. stiebritziana*, *Carex haematostoma*, *Fritillaria cirrhosa*, *Aletris pauciflora*, *Polygonatum hookeri*, *Lilium nanum* var. *nanum*, *Ponerorchis chusua*, *Corydalis ecristata*, *Chesnya* sp., *Androsace lehmannii*, *Acanthocalyx* sp.

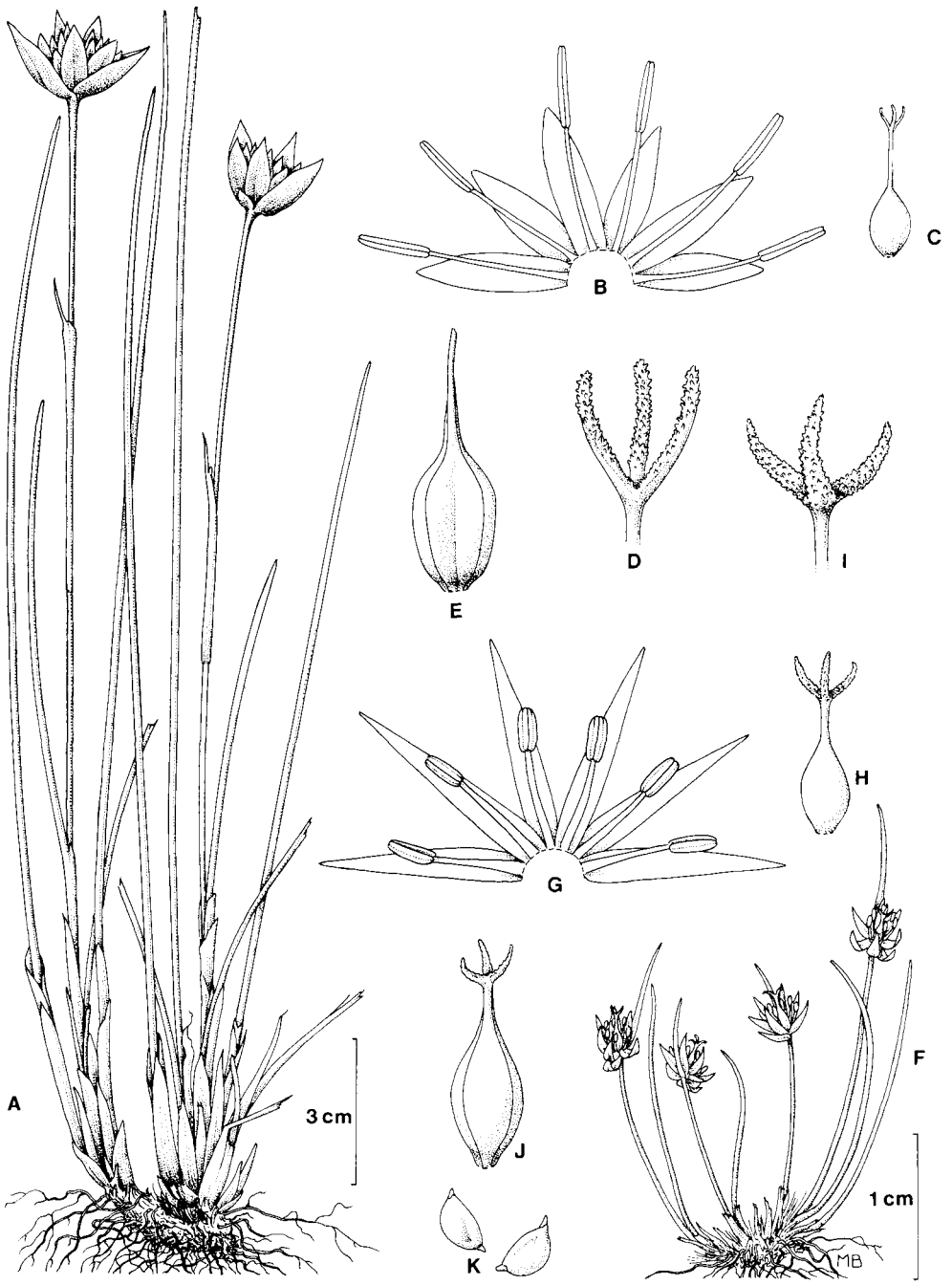

FIG. 1. *Juncus glaucoturgidus* Noltie (*ESIK* 572). A, habit; B flower (× 3); C, ovary (× 3); D, stigma (× 12); E, capsule (× 5). *J. bryophilus* Noltie (*Sinclair & Long* 5217b). F, habit (*ESIK* 698); G, flower (× 8); H, ovary (× 8); I, stigma (× 16); J, capsule (× 8); K, seeds (× 12).

(B) Species with brown flowers and tubular, septate leaves included under Buchenau's section 52 (i.e. *Juncus sikkimensis* and allies).

J. sikkimensis Hook.f., Fl. Brit. India 6: 399 (1892).

Syn.: *J. pseudocastaneus* (Lingelsh.) Sam. in Hand.-Mazz., Symb. Sin. 7: 1230 (1936).

J. pseudocastaneus was described as being distinct from *J. sikkimensis* in having visibly septate leaves, long stolons, persistent bases of old leaves and yellow-brown (rather than red-brown) leaf sheaths. On studying the types of *J. sikkimensis* and a large number of specimens from C Nepal to Sichuan it is found that none of these characters are consistently correlated, and *J. pseudocastaneus* must be regarded as a synonym of *J. sikkimensis*.

Juncus longiflorus (A. Camus) Noltie, **comb. & stat. nov.**

Basionym: *J. sikkimensis* Hook.f. var. *longiflorus* A. Camus in Notulae Systematicae 1: 283 (1910). Lectotype (chosen here): Lieux humides ou peu ombragés du Tsang-chan, alt. 4000m, 27 juin 1887, *Delavay* 2806 (P!).

J. sikkimensis var. *longiflorus* A. Camus described from Yunnan is clearly distinct from *J. sikkimensis* and should be raised to specific rank. It has much larger flowers, is always single-headed, has longer leaves (± equalling stems), and more slender, very densely tufted stems, with conspicuous fibrous remains of shining yellowish-brown leaf sheaths at the base. S.Y. Hu realised this and annotated the specimens at P accordingly but did not publish either the lectotypification or the new combination. It appears to be restricted to Yunnan, but is omitted from *Index Flora Yunnanensis* (Wu, 1984).

J. sikkimensis Hook.f. var. *monocephalus* Hook.f.

There has been much confusion over the Himalayan taxon described as *J. sikkimensis* Hook.f. var. *monocephalus* Hook.f. and referred to by Samuelsson (1936) in a note under *J. pseudocastaneus*, of which he took it to be a slender, few-flowered geographical race. Part of this confusion has come about due to the great variability in the plant's stature. From herbarium studies of a large range of specimens it became obvious that the taxon was worth recognizing at specific rank, and recent fieldwork has confirmed this. It has, in fact, been described three times at specific rank, the earliest being as the type of a genus in Cyperaceae! For further details of this confusion see Simpson & Noltie (1995).

The following new combination and synonymy is therefore necessary, and since the type represents a rather extreme, depauperate form, an amended description is provided.

Juncus duthiei (C.B. Clarke) Noltie, **comb. nov.**

Basionym: *Microschoenus duthiei* C.B. Clarke in Hooker, Fl. Brit. India 6: 675 (1894). Holotype: Uttar Pradesh, Rhudughera, Tihri Garhwal, 15–16,000ft, 20 vii 1882, *Duthie* 132 (K, iso. CAL).

Syn.: *J. rohtangensis* Goel & Aswal in Indian J. For. 10: 262 (1987). Holotype: Himachal Pradesh, Lahaul-Spiti District, Rohtang Pass, 4000m, 27 vii 1979, *Aswal* 10554A (CDRI n.v.); iso. *Aswal* 10554E (CAL!).

J. harae Miyam. & H. Ohba in J. Jap. Bot 68: 27 (1993). Holotype: E Nepal, Koshi Zone, Sankhuwa Sabha District, Sano Pokhari — Khongma, 3850m, 12 viii 1990, *Minaki et al.* 9020853 (TI!).

J. sikkimensis Hook.f. var. *monocephalus* Hook.f., Fl. Brit. India 6: 399 (1892) (as *monocephala*). Type: Sikkim, Lachen, 12,000ft, 20 vi 1849, *Hooker* Juncus 19 (K!).

Rhizomes short, slender, c.1.5mm diameter. *Flower stems* 2–25cm. *Scale leaves* pale brown, not shining, the upper apiculate, becoming fibrous on decay. *Stem leaf* usually 1, sub-basal; blade 1.5–7.5cm (tip reaching half-way up stem or more), 0.3–1.4mm wide, unitubular and septate (visible in well-developed specimens), slightly contracted below blunt apex, sheath with brownish membranous margins carried upwards as free auricles. *Auricles* 0.1–1.1mm long, blunt, oblong, transparent or sometimes brown, apparently sometimes decaying and so not visible. *Inflorescence* a single head of (1–)2–3 shortly pedicellate flowers (if flower single then sessile), which usually appear to be lateral. *Lowest bract* 0.5–3.5cm, leaf-like, exceeding to much longer than flowers, usually erect (sometimes spreading), with brown sheathing base. *Upper bract(s)* ovate to lanceolate. *Tepals* reddish-brown to blackish, sometimes with paler tips and greenish midribs, narrowly lanceolate, the inner narrower than the outer and with narrow membranous margins, all gradually tapered to acute apex, rather irregular in length even in a single specimen; (3–)5.0–7.7mm long. *Stamens* shorter than tepals; anthers linear, becoming twisted, cream 1.2–3.5(–4.0)mm, longer than filaments (0.4–1.2mm). *Ovary* ellipsoid- to oblong-trigonous, 1.3–2.2mm long; style stout, 1.5–4.0mm; stigma lobes very fine, ± erect, sometimes twisted, long, red (2–)5.0–9.0mm. Capsule (1.4–)2.5–3.5(+?)mm, narrowly ellipsoid-trigonous, contracted into short exserted beak 0.6–1mm. Seeds 0.6–0.7mm, with short tails at both ends, total length 0.7–0.8mm. Inflorescence occasionally reduced and proliferating.

Distribution and habitats: Himachal Pradesh, Uttar Pradesh, Nepal, Sikkim, Chumbi, Bhutan, SE Tibet. An alpine species occurring above the tree-line on open grassy slopes, streamsides, damp turf, rock ledges, wet sand and on rocks, 3000–4877m. June–July (fl.).

Other specimens seen:

KUMAON. Barji Kang Pass, 14,000ft, viii 1848, *Strachey* 7 (K).

C NEPAL. Lari, 4650m, 6 vii 1974, *Yon* 107 (BM). Muktinath, 3962m, 26 vi 1954, *Stainton, Sykes & Williams* 1451 (BM, E). Above Sauwala Khola, 3962m, *Stainton, Sykes & Williams* 3582 (BM, E). Langtang Valley, 4572m, vi 1949, *Polunin* 626 (BM). Dhudkund, 6 ml E of Timure, 4724m, 5 vii 1949, *Polunin* 810 (BM). 5 ml E of Timure, 4115m, 3 vii 1949, *Polunin* 801 (BM). Shiar Khola, W of Chumje, 3810m, 29 vi 1953, *Gardner* 1016 (BM). NE of Gosainkund, 4600m, 15 viii 1974, *De Haas* 2275 (BM). Tharepati, N of Kathmandu, 3200m, *Grey-Wilson & Phillips* 163 (K).

E NEPAL. Makalu Base Camp, 4728m, 8 vii 1974, *Emery* CH 25 (K). Bhalukhop, 4110m, 24 vii 1971, *Shrestha & Joshi* 292 (BM). By Hongu Khola, 4267m, 2 vii 1964, *McCosh* 353 (BM). Shipton La, 4030m, 27 ix 1991, *EMAK* 356b (E). Upper Barun Khola above Mera, 4460m, 4 x 1992, *EMAK* 532 (E). Base of Upper Barun Glacier above Makalu Base Camp, 4720m, 7 x 1991, *EMAK* 561 (E). Near Lapsang, Simbua Khola, 4270m, 19 ix 1989, *KEKE* 760 (E). Between Tamo La and Sinion La, 4000m, 15 ix 1989, *KEKE* 678 (E).

SIKKIM. Behind Tangu Bungalow, 4572m, 5 vii 1903, *Younghusband* T61 (K). Choktsu nr Jongri, 1887, *King's Coll.* s.n. (K). Dzongri, 4100m, 2 vii 1983, *AGSES* 268 (K). Above Changu, 3658m, 8 vii 1910, *Smith* 3202 (K, CAL, syntype of *J. uniflorus* — which is also on sheet). Chakung Chu, 3962m, 26 vii 1910, *Smith* 3854 (K, CAL, syntype of *J. uniflorus*). Tosa, 4267m, 2 viii 1910, *Smith* 4046 (CAL). Nathui La, 4267m, 14 vii 1910, *Smith* 3465 (CAL).

CHUMBI. NW Chumbi below Tang Kar La, 4267m, vi 1891, *Waddell* s.n. (K). N Chumbi (Upper Khangbu), 3962m, vi 1891, *Waddell* 73 (K). Dotha, 3962m, 20 vi 1945, *Bor & Ram* 20510 (K).

BHUTAN. Pajoding, above Thimphu, 3750m, 19 vii 1979, *Grierson & Long* 2785 (E). Above Phajoding, 3840m, 30 vii 1991, *Noltie* 62 (E). Below Darkey Pang Tso, N of Paro, 4020m, 4 viii 1991, *Noltie* 107 (E). Kemphu [Kamephu], 4267m, 14 vi 1938, *Gould* 463 (K). Above Laya, 4315–4480m, 21 ix 1984, *Sinclair & Long* 5203, 5229, 5217a (E). Koina [Kohina], 3000m, 28 vii 1983, *Sargent* 66 (E). Chesha [Kesha] La, 4267m, 27 vi 1949, *Ludlow, Sherriff & Hicks* 16647 (BM).

SE TIBET. Above Nyima La, 4877m, 4 vii 1938, *Ludlow, Sherriff & Taylor* 5128 (BM).

First collected in Sikkim, at Lachen by J.D. Hooker (Juncus 19, K and p.p. Juncus 13, K, mixed sheet with three other species). Fairly frequently recollected since that time in Nepal, Sikkim, Chumbi, Bhutan and SE Tibet, often correctly identified as *J. sikkimensis* var. *monocephalus* but very frequently misidentified as e.g. *J. sphacelatus*, *J. uniflorus*, etc.

Very variable in stature and in some respects intermediate between *J. sikkimensis* and *J. uniflorus*. Large specimens differ from *J. sikkimensis* in their more slender habit, the always single inflorescence with 3 or fewer flowers and above all in their long red (not yellow-green) stigmas. Dwarfed specimens differ from *J. uniflorus* in their flower(s) appearing lateral (due to lower bract usually being erect and conspicuously exceeding the inflorescence), usually more than one flower, but if only one then sessile (vs flower shortly pedicellate), leaves wider, erect, unitubular (vs filiform, often recurved, bitubular in section).

J. harae was recently described from E Nepal; examination of the type shows it to be a viviparous form of *J. duthiei*. Similar specimens were seen growing in Sikkim (*ESIK* 180, E) mixed with typical, non-viviparous, forms. It is not uncommon for the flowers of certain *Juncus* species (e.g. *J. wallichianus* Laharpe) to proliferate, though as stated by Miyamoto & Ohba (1993) the phenomenon has not been observed before in an 'alpine species'.

J. biglumoides Hara was based on fruiting material from C Nepal (Rambrong, Lamjung Himal, 12,000ft, 29 vi 1954, *Stainton, Sykes & Williams* 6029, holo. BM!). It resembles dwarf forms of *J. duthiei* but differs in flowering earlier, having smaller anthers (under 1.5mm), a creeping, linear rhizome and rather stout stems. Stigmas are unfortunately not present in the type specimen. The species is apparently a very local endemic; the other specimen (*Strachey* 7) tentatively referred to the taxon by Hara is here referred to *J. duthiei*.

J. uniflorus W.W. Sm. in Rec. Bot. Surv. India 6: 104 (1914). Lectotype (chosen here): Sikkim, Se-moo-do-ne about 2500ft below Zelep La, [3658m], 22 vi 1882, *King's Coll.* s.n. (K!).

J. uniflorus was first described informally (Smith, 1913) as 'sp. nov. vel forma minima *J. sikkimensis* Hook. f. var. *monocephalae*' and was stated 'to be connected to the variety *monocephala* by a series of intermediates'. All the syntypes have been examined with the exception of *Gammie* 202 (which could not be found at CAL) and all bear the name *J. uniflorus* in the hand of Wright Smith. Unfortunately the syntypes are found to contain two taxa. The identity of one of the elements with reduced forms of *J. duthiei* is clearly shown by the specimens on *Smith* 3465 at CAL which show a transition from very small single-flowered forms to typical *J. duthiei*.

Lectotypification is therefore needed, preferably to preserve the usage of the name *uniflorus* for the very dwarf, single, pedicellate-flowered, filiform-leaved plant which has been most commonly called *J. uniflorus* by subsequent workers (e.g. Samuelsson).

Unfortunately Wright Smith's initial description, and the later validating one (Smith, 1914), is confused and refers to both species (e.g. the descriptions of tepal colour and fruits refer to

the *J. duthiei* element). However, his statement (Smith, 1913) that it is the smaller plant that 'will have to be regarded as specifically distinct' and his annotations on the specimens are helpful since only two of the syntypes bear the annotation 'sp. nov. vel forma minima *J. sikkimensis* Hook. f. var. *monocephalae*', namely *King's Coll.* s.n. (K) and *Smith* 3202 (CAL). It thus appears that the taxon on these sheets represents the species he regarded as distinct and that he later broadened his concept too widely to include the other specimens. It cannot be coincidental that these sheets are the only ones of the syntypes which bear what I propose should be called *J. uniflorus* (though 3202 also bears *J. duthiei*). The other syntypes seen (*Smith* 3465, 3854, 4046) bear only *J. duthiei*. It therefore seems best to choose the King specimen as a lectotype.

J. uniflorus differs from reduced forms of *J. duthiei* in its paler (reddish-brown) tepals, pedicellate flowers, weak lower bract, recurved at flowering and filiform, recurved, bitubular leaves. It is almost invariably single-flowered but one specimen (*Bowes Lyon* 15098) has several two-flowered inflorescences.

Other specimens seen:

E NEPAL. S of Topke La, Arun-Tamur watershed, 3962m, 7 vii 1956, *Stainton* 872 (BM).

SIKKIM. Above Changu, 3658m, 8 vii 1910, *Smith* 3202 (K with *J. duthiei*). Sheradthang, 3658–3962m, 18 vii 1913, *Cooper* 307 (BM, E). Hills N of Changu, 4115m, 29 vi 1913, *Cooper* 73 (BM, E).

BHUTAN. Pajoding, above Thimphu, 3750m, 19 vii 1979, *Grierson & Long* 2783 (E). Above Phajoding, 3840m, 30 vii 1991, *Noltie* 63 (E). Penge La, Bumtang, 4110m, 26 vi 1969, *Bowes Lyon* 15098 (BM). Shingbe, Me La, 3658m, 3 vi 1949, *Ludlow, Sherriff & Hicks* 20693 (BM, E). Above Talukah Gompa, 4200m, 28 viii 1988, *Wood* 6615a (E).

SE TIBET. Lusha Chu, 3810m, 10 vi 1938, *Ludlow, Sherriff & Taylor* 4766 (BM, E).

It seems that *J. uniflorus* is of more restricted distribution and probably rarer than *J. duthiei*, occurring from E Nepal to SE Tibet. Interestingly — considering its minute stature — it has not been recorded from such high altitudes as *J. duthiei*.

Juncus bryophilus Noltie, **sp. nov.**

A *Junco unifloro* W.W. Smith lobis stigmaticis cremeis (haud roseis) brevioribus (minus quam 1.5mm, non 1.8–3.2mm), antheris minutis (0.7–0.9mm, non 1.2–1.5mm) quam filamentis minoribus, et bractea suberecta foliacea (flos ut videtur lateralis) differt. A *J. duthiei* (C.B. Clarke) Noltie formis nanis foliis bitubulosis, lobis stigmaticis brevibus cremeis, antheris minoribus quam filamentis brevioribus recedit. **Fig. 1F–K.**

Rhizomes short, stems loosely tufted. *Flower stem* filiform, 0.4–3cm, swollen at base and clothed with dark-brown, ribbed, scale leaves. *Stem leaf* single, sub-basal, filiform (c.0.3mm diam.), about equalling flower stem, bitubular. *Auricles* of sheath minute, membranous, blunt. *Inflorescence* a single, apparently lateral flower, lowest bract to 1.5cm, suberect, leaf-like. *Tepals* chestnut, linear-lanceolate, acute, subequal 2.5–3.9mm long. *Stamens* 6, shorter than tepals; anthers 0.7–0.9mm, shorter than the filaments 1–2.3mm. *Stigma lobes* short, 0.7–1.5mm, cream. *Capsule* ellipsoid-trigonous, tapered into short style 0.5–0.7mm. *Seeds* pale brown, ellipsoid, with very short membranous points at both ends, c.0.7mm long.

Type: Bhutan, Upper Mo Chu District, ridge above Laya, on wet rock ledge, 4450m, 21 ix 1984, *Sinclair & Long* 5217b (holo. E).

Other specimen seen:

SIKKIM. Dzongri, 4000m, 25 vii 1992, *ESIK* 698 (E).

Closest to *J. uniflorus* and dwarfed specimens of *J. duthiei*, but differing from both of these in its short style and short, cream (not pink) stigma lobes and anthers shorter than the filaments.

Known only from two collections, but this is probably merely a reflection of its minute stature. The specific epithet refers to the plant's habitat — growing among moss on wet boulders and rock ledges, and also honours the botanical affections of David Long, one of its discoverers.

(C) Grassy-leaved, white-flowered species of which Buchenau knew only *J. clarkei*, which comprised his section 54.

Juncus hydrophilus Noltie, **sp. nov.**

A *J. clarkei* Buchenau habitu et inflorescentia tenuiore, foliis caulinis superioribus inflorescentiam haud excedentibus, foliis plerumque minus quam 2.5mm latis (haud plerumque magis quam 3mm), inflorescentia ut videtur terminali (non laterali), bractea infima inflorescentiam breviore (haud eam multo excedenti), lamina setiformi (non foliacea), basi vaginali anguste membranacea hyalina (non rubrofusca), filamentis tepala excedentibus antheris sic omnino exsertis (non ea brevioribus antheris inclusis vel paene exsertis), fructibus in mensibus Julio sero-Augusto praecox (haud Augusto sero-Octobri). **Fig. 2I–O.**

Rhizomes stoloniferous; stolons short, slender (under 1mm diam.), dark brown, clothed with scales and fibrous remains of old scales. *Flowering stems* loosely tufted, 32–40cm, basal scale leaf single, 0.7–4cm. *Stem leaves* 3–4, evenly spaced, longest 14–17 × 0.2–0.33cm, leaf sheaths 2.5–4cm, reddish-brown, lacking auricles. *Non-flowering shoots* 3-leaved, blades shorter than stems, grass-like, tapering gradually to acute apex, margins extremely narrowly hyaline, midrib prominent on lower surface. *Inflorescence* usually of a single anthela with 3(–5) capitate partial inflorescences, appearing terminal; capitula 4–9-flowered, c.1.5cm diameter at flowering. *Lowest bract* shorter than inflorescence, blade bristle-like, sheathing base narrowly membranous. *Outer tepals* 3.5–5 × 0.8–1.4mm, narrowly lanceolate, acute, keeled, cream; inner tepals 4–5.3 × 0.9–1mm, similar in shape, cream. *Filaments* exceeding tepals; anthers exserted, 1.4–2.5mm, pale yellow, narrowly oblong. *Ovary* 5–6.5 (incl. style) × 1–1.5mm, straw-coloured, very narrowly ovoid, gradually tapered into beak-like style. *Stigma lobes* 0.5–1mm ± spreading. Capsule c.6 × 1.8mm, very narrowly ovoid, straw-coloured, shining.

Type: Sikkim, Prek Chhu Bridge below Bakhim, 2300m, 27 vii 1992, *ESIK* 771 (holo. E, iso. K).

Other specimens seen:

BHUTAN. Dotena, 2730m, 20 vii 1991, *Noltie* 13 (E). Above Gortsam, Bumthang, 3510m, 10 viii 1991, *Noltie* 137 (E).

NEPAL. NW of Saltie, along trail to Pangsing Bhanjyang, 2760m, 25 viii 1974, *De Haas* 2547 (BM).

Apparently endemic to the E Himalaya (E Nepal to C Bhutan), where it grows in the evergreen oak–blue pine forest zone on extremely wet cliffs with running water, fruiting during the monsoon.

J. clarkei grows in similar forest but on mossy boulders lacking running water (apparently in stony pastures in Yunnan) and fruiting later (at the end of the monsoon or beginning of the dry season).

(D) *Juncus amplifolius* and allies

An interesting group not known to Buchenau, with brown flowers and flat, coriaceous leaves. *J. minimus* Buchenau placed in section 51 should be included here. Camus (1910) was correct in suggesting that *J. amplifolius* came between Buchenau's subgenera *Alpini* and *Graminifoli*, demonstrating the need for a better infrageneric classification.

J. amplifolius A. Camus in Notulae Systematicae 1(10): 281 (1910).
This species was described from Yunnan but herbarium studies show that its distribution extends as far west as E Nepal.

Specimens seen:

E NEPAL. Chhovang Khola W of Num, Arun Valley, 12,500ft, 21 vi 1956, *Stainton* 727 (BM, E). Khongma La, 18km N of Num, 3965m, 10 vii 1974, *Emery* CH 48 (K).

SIKKIM. Mon Lapcha to Phedang, 3800m, 26 vii 1992, *ESIK* 750 (E).

BHUTAN. Tongsa District: Yuto La, 10,700ft, 3 vi 1966, *Bowes Lyon* 3304 (BM).

BURMA. Tama Bum, N Triangle, 10,000ft, 20 vi 1953, *Kingdon Ward* 21017 (BM). Naung Chaung Valley, 11,000ft, 20 vi 1914, *Kingdon Ward* 1703 (E). Hpimaw Pass, 11,000ft, 7 vi 1929, *Parkinson* 10056 (K).

CHINA — YUNNAN. Dali, Cangshan *CLD* 1316 (E), 1339 (E); *Forrest* 4909 (E); *Kingdon Ward* 865 (E), 625 (E); *Sino-British Exped. Cangshan* 619 (E), 826 (E), 879 (E); *Sino-American Bot. Exped.* 854 (E).

TIBET. Trulung, Po Tsangpo, Pome, 8000ft, 28 v 1947, *Ludlow, Sherriff & Elliot* 13050 (E). Lisum, Nunkhu Phu Chu, nr Tongkyuk, Pome, 11,000ft, 26 v 1947, *Ludlow, Sherriff & Elliot* 13769 (E). Doshong La, Kongbo, 13,000ft, 17 viii 1947, *Ludlow, Sherriff & Elliot* 14384 (E).

J. nepalicus Miyam. & H. Ohba in J. Jap. Bot. 68: 28 (1993). Holotype: Nepal, around Cha Ding Kharka, Sankhuwa Sabha District, 3970m, 9 viii 1990, *Minaki et al.* 90 (TI!).

This species is closely related to *J. amplifolius*, having a similar contracted, woody, rhizomatous rootstock and broad coriaceous leaves, but differs in having inflorescences with 1–2 (vs 2–3) heads, smaller, more acute tepals (the inner 3.3–4 vs (4–)5.1–6mm); smaller anthers (c.1.3 vs 2–2.5mm), shorter stigma lobes (2–2.5 vs 3–5mm) and smaller, shorter-beaked capsules. It turns out to have been found earlier by Hooker in Sikkim.

Other specimens seen:

SIKKIM. Lachen, 10,000ft, 6 vi 1849, *Hooker* s.n. (K); Lachen, 12,000ft [another field label on same sheet reads Kankola, 15,000ft, but probably does not refer to this species], *Hooker* s.n. (K — sheet bearing mixture of *J. nepalicus*, *J. himalensis*, *J. sikkimensis* and *J. duthiei*).

Juncus spumosus Noltie, **sp. nov.**
In characteribus vegetativis *J. amplifolio* A. Camus similis, sed inflorescentia decomposita, inflorescentiis partialibus ('capitulis') pluribus (6–21, non 2–3) minoribus, tepalis brevioribus (interioribus 3–3.5mm, non (4–)5.1–6mm), pallidioribus (albescentibus roseo-tinctis, non atro-

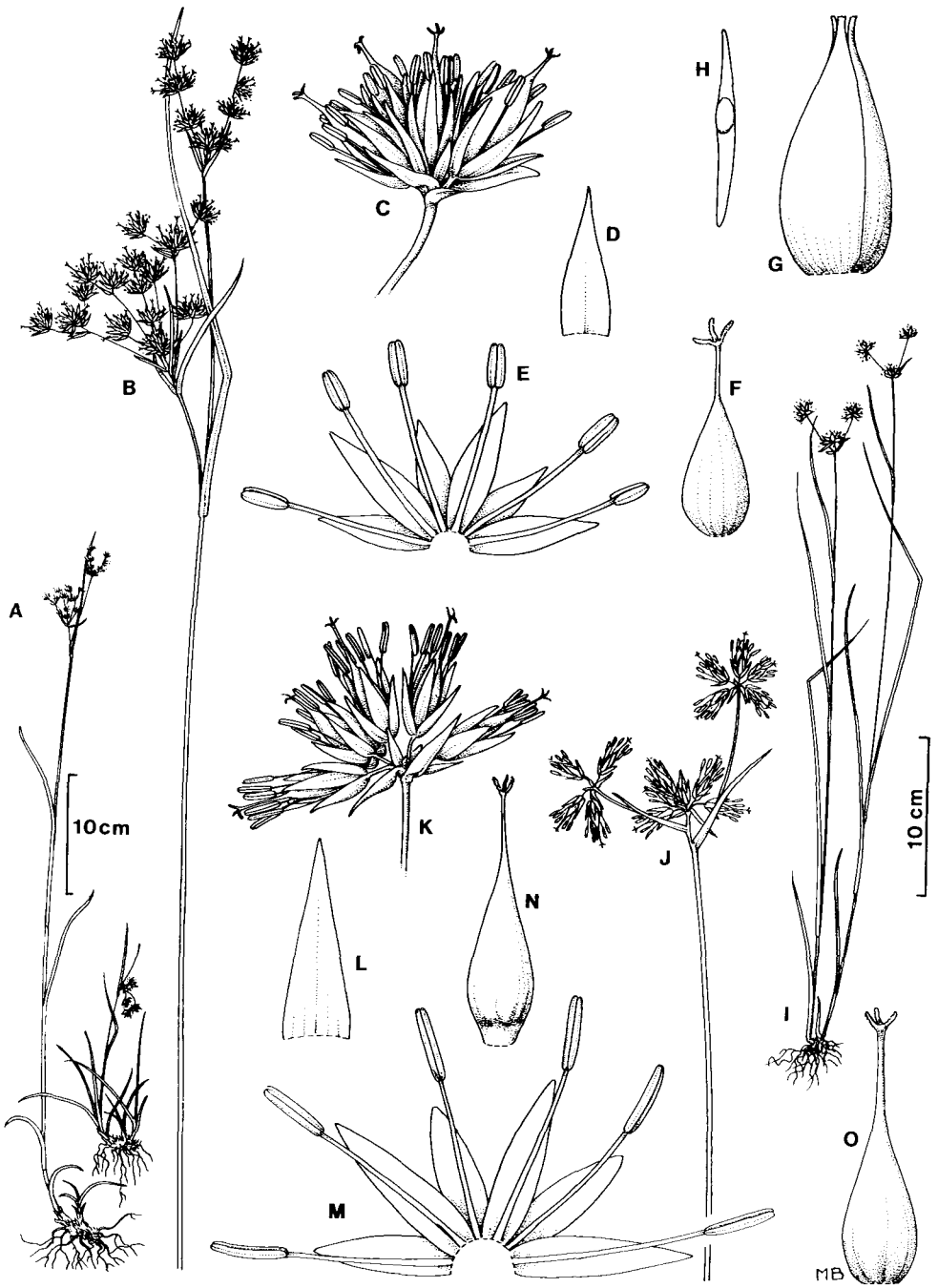

FIG. 2. *Juncus spumosus* Noltie (*Noltie* 122). A, habit; B, inflorescence (× ⅔); C, partial inflorescence (× 4); D, bract (× 6); E, flower (× 6); F, ovary (× 6); G, fruit (× 6); H, immature seed (× 12). *J. hydrophilus* Noltie (*ESIK* 771). I, habit; J, inflorescence (× 1); K, partial inflorescence (× 3); L, bract (× 6); M, flower (× 6); N, ovary (× 6); O, fruit (× 9).

fuscis) et praecipue antheris exsertis minoribus (0.7–1mm, non 2–2.5mm) et lobis stigmaticis multo minoribus (0.6–0.8mm, non 3–5mm) differt. **Fig. 2A–H.**

Rhizome system very condensed, woody, bearing fibrous remains of old shoots. *Flower stems* 11–56cm; reduced scale leaves present at base. *Stem leaves* 2–4, evenly spaced, 3–8 × 0.2–0.4cm, leaf sheaths 2–7cm, reddish, lacking auricles. *Leaves of non-flowering shoots* to 9cm, widest just above base and tapering gradually to blunt apex, margins narrowly hyaline, minutely papillose, upper surface smooth, lower ridged. *Inflorescence* usually of 2 superposed anthelae with 6–21 capitate partial inflorescences; capitula 2–6-flowered, to 7mm diameter at flowering. *Lowest bract* leaf-like, about equalling inflorescence; bracts of capitula shorter than capitula, reddish, ovate. *Outer tepals* 2.4–2.8 × c.0.7mm, narrowly lanceolate, acute, keeled, whitish-membranous, flushed pinkish brown near centre and apex, midrib tinged greenish; inner tepals 3–3.5 × c.1mm, similar in shape, whitish. *Filaments* 3–3.4mm, exceeding tepals, anthers exserted, 0.7–1mm, pale yellow, oblong. *Ovary* c.3.7 × 2mm, brown, narrowly ovoid, tapered into beak-like style c.1.2mm. *Stigma lobes* 0.6–0.8mm ± spreading. Capsule 5.5 × 2.5mm, narrowly ovoid, dark reddish-brown, shining, beak 0.5mm; immature seeds 0.4mm, tails c.0.9mm — total length c.2.2mm.

Type: Bhutan, Tongsa District, W side of Yuto La, 3350m, 8 viii 1991, *Noltie* 122 (holo. E, iso. K).

This extremely attractive and distinctive species was seen in great quantity on landslips in *Abies densa* forest on both sides of the Yuto La in Central Bhutan. The epithet refers to the frothy appearance of the pale inflorescence. Vegetatively it is indistinguishable from *J. amplifolius*, but the inflorescence and flowers are very different.

SUBGENUS GRAMINIFOLI

J. ochraceus Buchenau in Abhand. Naturwiss. Vereine Bremen 3: 292 (1872).

Syn.: *J. tratangensis* Satake in Hara, Fl. E. Himal. 2: 164 (1971). Holotype: Bhutan [Tongsa District], Tongsa to Uto La Road, 2000–2500m, 17 iv 1967, *Kanai & Yamazaki* 5952 (TI!).

Placed in this subgenus, though with some doubt ('an rectius ad *J. alpinos* transferendus?') in Buchenau's section 58, is the extremely curious *J. ochraceus* Buchenau. This was first described from Sikkim and Assam, but later discovered in Yunnan (Tsangchan, *Delavay* 2603, P!) as reported by Camus (1910). It has recently been refound in Yunnan (*CLD* 90, E), though it is not recorded in Wu (1984).

J. ochraceus is characterized by having a large proportion of the partial inflorescences transformed into sterile, spirally arranged aggregates of golden-coloured 'bracts'. Most of these bracts are empty but some subtend curious reduced shoots (?sterile flowers). The aggregates of bracts resemble superficially a Cyperaceous spikelet (e.g. *Fimbristylis* spp.) and merit further anatomical and developmental investigation. In most specimens some fertile, typically Juncaceous flowers occur, especially towards the base of the inflorescence; the relative proportion of sterile to non-sterile flowers, however, varies and is presumably subject to environmental modification. Buchenau (1885) suggests, by analogy with *Luzula flavescens*, that infection with a smut might be a reason for the transformation. Specimens with a higher proportion of fertile

flowers were described from Bhutan as *J. tratangensis* but observations in E Nepal show that they merely form an extreme type and are not worth taxonomic recognition.

MISCELLANEOUS NOTES

In the course of this work the types of several recently described Sino-Himalayan species have been studied and the following new synonymy can be made.

J. unifolius A.M. Lu and Z.Y. Zhang in Acta Phytotax. Sin. 8: 125 (1979). Holotype: Tibet, Za-Yul, 4250m, 13 viii 1973, *Chang & Cheng* 1525 (PE!) = **J. minimus** Buchenau (the type consists of a mixture of a *Luzula*, possibly *L. oligantha* Sam., in addition to the *Juncus*).

J. phaeocarpus A.M. Lu & Z.Y. Zhang in Acta Phytotax. Sin. 8: 126 (1979). Holotype: Tibet, Ne La Mu, Chang Mu, 3550m, 11 v 1966, *Chang & Ling* 3285 (PE!) = **J. grisebachii** Buchenau.

J. longibracteatus A.M. Lu & Z.Y. Zhang in Acta Phytotax. Sin. 8: 126 (1979). Holotype: Tibet, Gyi-Lung, 4152m, *Qing-Zang Exped. Veg. Group* Q131-1 (PE!) = **J. kingii** Rendle.

J. luteocarpus Satake in J. Jap. Bot. 43: 384 (1968). Holotype: Bhutan, Chendebi to Rukubi, 2300–2600m, 21 iv 1967, *Kanai et al.* 8478 (TI!) = **J. concinnus** D. Don.

J. albescens Satake in Fl. E. Himalaya, Second Report, ed. H. Hara, p. 161 (1971) non (Lange) Fernald. Holotype: Bhutan, Laya to Laum Thang, 3650–3900m, 18 v 1967, *Kanai et al.* 11847 TI!) = **J. concinnus** D. Don.

J. yoskisukei Goel in J. Econ. Tax. Bot. 7: 208 (1985) (*nom. nov.* for *J. albescens* Satake) = **J. concinnus** D. Don.

J. bracteatus Buchenau in Bot. Jahrbuch. 6: 220 (1885). Type: Sikkim, 12,000ft, Hooker [Juncus 9] (holo. presumed destroyed at B; isotype BM!) = **J. benghalensis** Kunth.

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