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THE GENUS SANGUISORBA (ROSACEAE) IN INDIA

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SUMMARY

Sanguisorba L. emend. Nordborg is represented in India by five taxa: *S. officinalis* L. subsp. *longifolia* (Bertol.) Purohit & Panigrahi, stat. nov., *S. diandra* (Hook. f.) Wallich ex Nordborg var. *diandra*, *S. diandra* var. *villosa* Purohit & Panigrahi, var. nov., *S. filiformis* (Hook. f.) Hand.-Mazz. and *S. minor* Scop. subsp. *minor*, of which *S. minor* is a new record for India. A key to the Indian taxa is provided, nomenclature and typification discussed; cytological, palynological, ecological data and notes on economic uses, wherever available, are furnished, range of distribution indicated and specimens examined, cited.

INTRODUCTION

*Sanguisorba** L. (1753, 1754) was based on two species: *S. officinalis* L. and *S. canadensis* L., the former typified by plants from Europe and the latter from Canada (North America). Simultaneously, *Poterium*** L. was founded on three species, viz., *P. sanguisorba* L., *P. hybridum* L. and *P. spinosum* L., described on plants from Europe and Southwest Asia. Linnaeus, who assigned *Sanguisorba* L. to his class 'Tetrandria-Monogynia' and *Poterium* L. to 'Monoecia-Polyandria', distinguished them as follows:

Bisexual flowers with four stamens and one style ..... **Sanguisorba** L.
Monoecious plants with male flowers having many stamens; female flowers with two styles ..... **Poterium** L.

Although Scopoli (1772) observed '*Sanguisorba auriculata* (Scopoli) coniungit *Poterium* cum *Sanguisorba officinali*, omnibus etiam habitus idem vires medicae communes, fructificatio et florescentia similis', not only he had not cited *Poterium* as a synonym of *Sanguisorba* L. but had transferred only one of the three species of *Poterium* (1753) to *Sanguisorba* without any comment on the generic status of the remaining two species. Therefore, Nordborg's (1966) and Robertson's (1974) opinion

* From the Latin, *sanguis*, blood and *sorbere*, to absorb, referring to the styptic (checking bleeding) properties of the type species.

** From the Greek, *poterion*, drinking cup, referring to the shape of the floral tube as used by Dioscorides and Pliny.

that Scopoli (1772) was the first to consider *Sanguisorba* and *Poterium* as congeneric is not correct.

However, consequent to the lectotypification of *Poterium* L. by *P. sanguisorba* L. (= *S. minor* Scop.) by Rydberg (1908) (as type) and by Hutchinson (1964) (as lectotype), *Sanguisorba* L. emend. Nordborg is accepted today as the correct name for the combined taxon.

Bertoloni (1835), Cesati (1841), Focke (1888), Ascherson & Graebner (1902), Bailey (1949), Nordborg (1966, 1967b), Robertson (1974) and Yu & Li (1979) have generally treated *Poterium* L. p.p. *majore* as a congeneric synonym of *Sanguisorba* L., excluding *Poterium spinosum* L. as the type species of another genus, *Sarcopoterium* Spach (1846).

However, Gaertner (1801) erred in adopting the illegitimate name *Pimpinella* (Tourn.) Adans. (1763) (= *Poterium* L. 1753, non *Pimpinella* L. 1753) for the combined taxon represented by *Sanguisorba* L. s.l.

While Gray (1867), J.D. Hooker (1878), Fiori (1923-25) and Stewart (1972) adopted *Poterium* L. as the correct name for the two genera when combined, De Candolle (1825), Spach (1846), Rydberg (1908), Juzepczuk (1941), Hutchinson (1964) and, of late, Airy Shaw (1973) support Linnaeus' (1753, 1754) treatment and diagnose the two genera as follows:

Flowers bisexual, usually brightly coloured, rarely greenish; stamens 4; pistil 1, stigma papillate; entomophilous . . . . . **Sanguisorba** L.

Flowers unisexual, monoecious or polygamous, greenish; stamens numerous, pistils 2, stigma penicillate; anemophilous . . . . . **Poterium** L.

Despite such differences in their diagnostic characters, Nordborg (1966, 1967b), Robertson (1974) and Yu & Li (1979) reduced *Poterium* L. p.p. (excl. *P. spinosum* L.) as a subgenus of *Sanguisorba* L., because the species group included in *Sanguisorba* L. s.s. vis-à-vis *Poterium* L. p.p. [including *P. sanguisorba* L. (= *Sanguisorba minor* Scop.), the type species of *Poterium* L.] share between them:

1. 3-colporate pollen grains although sect. *Sanguisorba* has 6-colporate pollen;
2. dry, ± distinctly 4-angled, fusiform receptacle with smooth faces, reticulately or longitudinally ridged or irregularly sculptured;
3. some of the entomogamous characters (e.g., coloured sepals, shorter filaments, a prominent nectarium, and compact stigma) and anemogamous features (e.g., greenish sepals, longer filaments, lack of nectarium and presence of penicillate stigma).

   S. diandra (Hook.f.) Wallich ex Nordborg of subg. *Sanguisorba*, for example, exhibits amalgamation of both the characteristics, viz. coloured sepals and shorter filaments vis-à-vis penicillate stigma and lack of nectarium.

Furthermore, it is difficult to judge only from morphological data whether the stigmata are pollinated by insects (a feature of *Sanguisorba*) or by wind (as in *Poterium*) and therefore, the pollination mechanism cannot be utilized as a practical taxonomic character. Differences between compact (as in *S. officinalis* L.), tufted (as

in *S. dodecandra* Mor. of sect. *Pterachaenium* Cesati of subg. *Sanguisorba*) and penicillate stigma (as in *S. minor* Scop.) represent differences in degree of branching and are not fundamental in nature.

That the number of stamens is always 4 in *Sanguisorba* and ∞ in *Poterium*, is also not correct. The number of stamens varies from 4–12 in sect. *Sanguisorba*, 2–12 (with 4 and 8 as dominant numbers) in sect. *Pterachaenium* of subg. *Sanguisorba* and even in *Poterium* the number of stamens varies from 1 or a few in the apical ♀ flowers to 20–30 and maximally 50, in the same inflorescence.

For a similar reason, the number of pistils as a generic character, cannot be used because it may vary from 1 (rarely 2) in *Sanguisorba* L. s.s. to 2 (rarely 1–3) in *Poterium* L.

Again, cytology provides no guidance for the generic delimitation: the species group represented by *Sanguisorba officinalis* L. and by *Poterium sanguisorba* L. (= *Sanguisorba minor* Scop.) share similar homoploid sets, 2n = 28, 56 and in both groups the chromosomes are small, maximally 1 μm in length and are very similar in all other aspects (Nordborg, 1966).

While we agree with Nordborg (l.c.) that it is extremely difficult to define the generic concept and accept Nordborg's (l.c.) merger of *Poterium* L. p.p. *majore*, as a congeneric synonym of *Sanguisorba* L. (vide Art. 57.1 ICBN, Stafleu et al., 1978), we note that:

1. Nordborg's recognition of four subgenera within *Sanguisorba* L. s.l. is based on the sexuality of flowers/inflorescences/plants (a character which she finds unreliable for generic delimitation).
2. Generic/subgeneric concept often represents a subjective or intuitive approach of the 'experienced' taxonomists and is aimed at conveniently pigeon-holing specimens in a herbarium or for assigning a group of species a place in a theoretical hierarchical system of classification, with or without any objective criteria.

However, we wish to include the four Indian taxa under *Sanguisorba* L. emend. Nordborg s.l. and assign them to two of the four subgenera, viz., subg. *Sanguisorba* and subg. *Poterium* (L.) A. Br. & Bouché.

MATERIALS

The present study is based on all available herbarium specimens deposited in various herbaria in India, viz., Botanical Survey of India, Eastern Circle, Shillong (ASSAM); B.S.I., Northern Circle, Dehra Dun (BSD); B.S.I., Industrial Section, Indian Museum, Calcutta (BSIS); Central National Herbarium, Howrah (CAL); Forest Research Institute, Dehra Dun (DD) and Lloyd Botanic Garden, Darjeeling (DJ, abbreviated here). The identification of the specimens have been critically evaluated with the help of photographs of the type specimens obtained from the herbarium of the Royal Botanic Gardens, Kew (K) and the microfiches procured from LINN and deposited in CAL. References to such photographs and microfiches are abbreviated as 'photo CAL!' or 'microfiche CAL!'.

KEY TO THE ALLIED INDIAN GENERA OF THE TRIBE SANGUISORBEAE (SUBFAMILY ROSOIDEAE)

1a. Floral tubes with hooked bristles in upper part; petals present; leaves imparipinnate with large leaflets interspersed with smaller ones . . . . . **Agrimonia**
b. Floral tubes without bristles, petals absent; leaves simple or imparipinnate with ± equal leaflets 2
2a. Leaves simple, palmately lobed or palmatifid; stamens 4(–5); flowers perfect in few-flowered sessile cymules . . . . . **Alchemilla**
b. Leaves imparipinnate; stamens 2–30(–50); flowers often imperfect, crowded in dense heads or spikes at the tips of long peduncles . . . . . **Sanguisorba**

SANGUISORBA

Sanguisorba L., Sp. Pl. (1753) 116; Gen. Pl. ed. 5 (1754) 53; Scop., Fl. Carniol. ed. 2, 1 (1772) 109; DC., Prod. 2 (1825) 593; Focke in E. & P., Nat. Pfl. Fam. 3, 3 (1888) 44; Rydberg, N. Amer. Fl. 22 (1908) 386; Juzepczuk, Komarov's Fl. URSS 10 (1941) 421 (English ed. 1971: 315); emend. Nordborg, Op. Bot. 11 (2) (1966) 43 & Rechinger's Fl. Iran 66 (1969) 152; Proctor & Nordborg in Tutin et al., Fl. Europ. 2 (1968) 33; Robertson, J. Arn. Arbor. 55 (1974) 396; Yu & Li, Acta Phytotax. Sin. 17 (1) (1979) 7. – Lectotype: *S. officinalis* L. (selected as type species by Rydberg, 1908; formally as lectotype by Robertson, 1974).

Poterium L., Sp. Pl. (1753) 994; Gen. Pl. ed. 5 (1754) 430, p.p. (excl. *P. spinosum* L.); Hook. f., Fl. Br. India 2 (1878) 362. – Lectotype: *P. sanguisorba* L. (= *Sanguisorba minor* Scop.) (selected as type species by Rydberg, 1908; formally as lectotype by Hutchinson, 1964).

Herbs rhizomatous perennial or annual with taproots (or shrubs). *Aerial stems* erect, ± branched, trichomes unicellular-acuminate, multicellular-acuminate, and/or glandular. *Leaves* basal and cauline, imparipinnately compound, long petiolate, leaflets sessile or shortly petiolulate, toothed or deeply dissected; stipules of basal leaves entirely adnate forming membranaceous wings, those of cauline leaves basally adnate to petioles, apices free and leaflet-like. *Inflorescences* compact to dense spikes or in heads, long pedunculate. *Flowers* small, subsessile, perfect or imperfect, plants then polygamo-monoecious (♂ ♀, ♂ ♀ ☿, ♂ or ♀). Bract 1, bracteoles 2 (sometimes reduced), membranous. *Floral tubes* urceolate, ± 4-angled, variously textured. *Disc* (= nectar ring) nearly closing the mouth of floral tube or absent. *Sepals* 4, white, green or reddish, imbricate, at length deciduous. Petals absent. *Stamens* 2–c. 50; filaments white, green or red, filiform or flattened, anthers didymous, dorsifixed. *Carpels* 1–3, enclosed by but free from floral tube; styles terminal, exserted beyond the throat of floral tube; stigmas branched; compact, tufted or penicillate; ovule 1. *Fruit accessory* of 1–2(–3) achenes enclosed in the dry, hardened, 4-angled or 4-winged floral tube.

Seed character. Ovules solitary, suspended, unitegmic with connate integuments or with outer integuments suppressed along the anteraphe. Seed-coat not lignified, endosperm 1 cell thick (Corner, 1976).

Distribution. 20–28 species distributed in Asia, Europe, northern Africa, North America, Canary Islands, and Madeira; absent from Greenland; 5 taxa in India distri-

buted in the Himalayan tracts of Uttar Pradesh, Darjeeling-Sikkim sector and Meghalaya, between 1525 and 4422 m.

Chromosome numbers. x = 7; 2n = 14, 28, 42(?), 54, 56 (Löve & Löve, 1961; Nordborg, 1966, 1967b). The tetraploids with 2n = 28, have larger geographical distribution than the octoploids. The report of 2n = 42 (Löve & Löve, 1956) is doubtful and no aneuploid number has so far been found.

Notes. 1. Floral tube: In the flowers of *Sanguisorba* the tubular structure below the sepals are variously referred to as 'fruit-cup', 'calyx-tube' (Hooker, 1878; Bailey, 1949), 'hypanthium' (Rydberg, 1908; Juzepczuk, 1941; Backer & Bakhuizen van den Brink, 1963; Proctor & Nordborg, 1968), 'receptacle' (Nordborg, 1966, 1967b), or 'floral tube' (Robertson, 1974). The last one is adopted here in describing the Indian taxa.

2. Faces: When the floral tubes ('receptacles') are ± 4-angled, the angles are usually provided with lists or wings; the four parts into which the surface thus divided are called 'faces'.

3. Lists: The 'lists' are the linear ridges at the angles of floral tube, broad-based, rounded or squared above, height not exceeding ¼th of the maximal breadth of the surface. The term 'list' is used to distinguish the type of vertical ridges delimiting the faces from the rather irregular ones often present on the faces.

4. Wings: The 'wings' are lateral strongly compressed ridges, ± sharp above, height usually exceeding ¼th of the maximal breadth of the surface. They are linear or slightly sinuate with entire or notched margins.

KEY TO THE INDIAN SPECIES

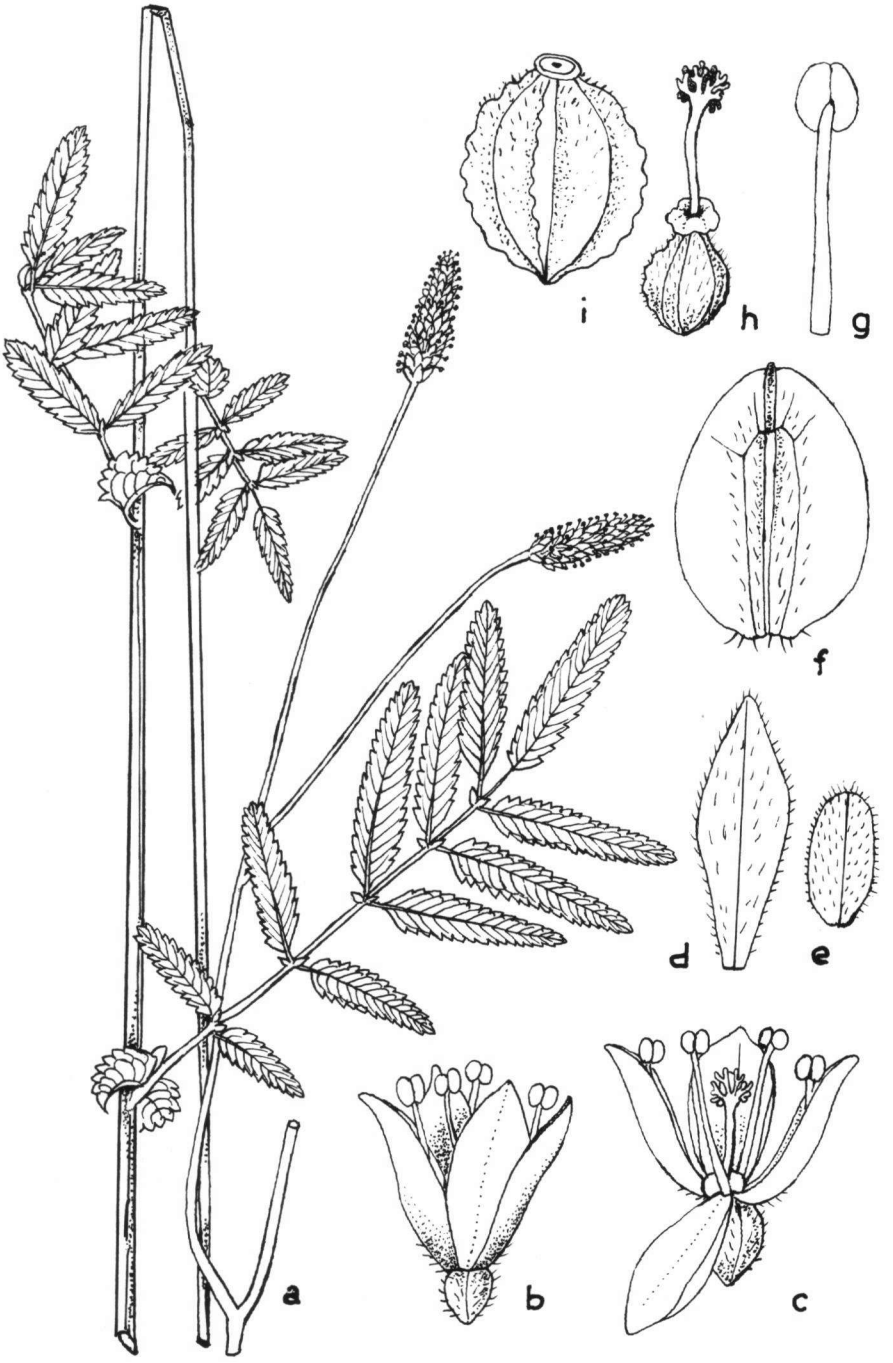
1a. Leaflets with 10–30 teeth on each side, spike with bisexual flowers only, sepals often brightly coloured; stamens 1–5, filaments coloured; pistil 1 2

b. Leaflets with 1–10 teeth on each side; spike with ♂ ♀ or ♂ ♀ ☿ flowers; sepals green or greenish white, stamens in ♂ flowers 3–25, filaments pale white; pistils 1 or 2 3

2a. Leaves 15–57 cm long, leaflet blades 1.5–8 × 0.5–3 cm, linear-oblong with ± parallel sides, petiolules rigid; spike cylindric, 1.5–5 cm long, with 120–150 flowers, floral tubes pubescent, stamens 4 (or 5), stigma compact, fruit (mature floral tube) 4-angled with ± marked wings, with faces smooth; pollen 6-colporate **1. S. officinalis** subsp. **longifolia**

b. Leaves 5–32 cm long, leaflet blades 1–3 × 0.8–2.5 cm, ovate-oblong-orbicular, cordate, petiolules slender; heads globose, 6–10 mm in diameter with 15–30 flowers per head, floral tube glabrous to villose, stamens 2 (1–4), stigma penicillate, fruits (mature floral tubes) with ± fusiform body with broad wings, with faces sparsely or longitudinally ridged, pollen 3-colporate . . . . . **2. S. diandra**

3a. Leaflets elliptic-obovate with 3–7 teeth on each side; inflorescences short spikes and in globose heads with ♂, ♀ and ☿ flowers, sepals green or greenish with white margins; stamens 18–25; pistils 2; fruits (mature floral tubes) with faces wrinkled-transverse/reticulate striations; achenes 2, 2–3 times larger than those of **S. filiformis** . . . . . **4. S. minor** subsp. **minor**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b. Leaflets orbicular to obovate with 2–4 teeth on each side; inflorescences globose head with only ♂ and ♀ flowers, never ☿; sepals white or whitish green, stamens 3–8; pistil 1; fruits (mature floral tubes) with smooth or rough faces; achene 1 **3. S. filiformis**

Subgenus Sanguisorba

Leaflets crenate-serrate with 10–30 teeth on each side. Flowers perfect. Sepals and stamens often brightly coloured. Stamens (2–)4–12, equalling or exceeding sepals; pollen 6-colporate or 3-colporate. Floral tubes in fruit ± 4-angled, winged, with smooth faces, or fusiform, longitudinally ridged or rough.

Type: *S. officinalis* L.

Section Sanguisorba

Stamens usually 4, pollen 6-colporate. Carpel 1, stigma compact or tufted. Floral tubes in fruit ± 4-angled, winged with smooth faces.

1. Sanguisorba officinalis L. subsp. **longifolia** (Bertol.) Purohit & Panigrahi, *stat. nov.* – **Fig. 1.**

S. longifolia Bertol., Misc. Bot. 22 (1861) 234, t. 1, and *Mem. Acad. Sc. Bologn. 12 (1861) 234; Nordborg, Op. Bot. 11 (2) (1966) 51 (pro syn. probable sub *S. officinalis* L.). – *Poterium longifolium* (Bertol.) Hook.f., Fl. Br. India 2 (1878) 363. – *S. officinalis* L. var. *longifolia* (Bertol.) Yu & Li, Acta Phytotax. Sin. 17 (1) (1979) 9. – Lectotype (present authors): *Hook.f. & Th. s.n.* [372] (K, selected by Nordborg in sched.), India, Meghalaya, Khasi Hills, 1525–1830 m.

Herbs perennial. *Rhizome* creeping, 5–8 × 0.5–1.2 cm, unbranched. *Stems* 60–120 cm long, hollow, cylindrical, striated, glabrous. *Leaves* radical (15–57 × 4.5–11 cm) in rosette and cauline (5–28 × 3–10 cm) alternate, petioles 1–40 cm long, stiff, glabrous; leaflets 9–13, opposite (or scarcely alternate), leaflet blades 1.5–8 × 0.5–3 cm, linear-oblong with ± parallel sides, base subcordate, oblique, apex obtuse-rounded, glabrous or pubescent only beneath, rigid and ± coriaceous, teeth 10–25 (–30) on each side, acute or obtuse mucronulate, petiolules 2–20 mm long, often with accessory leaflets at the base. *Stipules* of radical leaves subulate, those of cauline leaves foliaceous, fan-shaped, 1–1.3 × 1.2–1.6 cm, glabrous or pubescent, toothed.

* Not consulted in original. Nordborg (1967: 51) cites p. 4 in 'literature cited', and p. 363 in the text and Hooker (1878) cited Misc. Dec. 22: 14, t. 1.

Fig. 2. *Sanguisorba diandra* (Hook.f.) Wallich ex Nordborg var. *villosa* Purohit & Panigrahi. a. Habit, × 2/3; b. flower showing relative positions of sepals, bracts and bracteoles, × 8; c. bract with ciliate margins, × 10; d. bracteole with ciliate margins, × 10; e. sepal, × 20; f. stamen, × 15; g. carpel with penicillate stigma, × 9; h. fruit, × 7 (*G. King's collector s.n.*, CAL, Acc. no. 151190).

Inflorescences cylindrical spike, 1.5–5 × 0.5–1 cm, with 120–150 flowers per spike, axis villous, peduncles branched, 5–30 cm long, glabrous, erect. *Bract* 2–3 × 0.5–1 mm, ovate-elliptic-oblong, concave, with a midvein, bracteoles oblong, 1–1.5 × c. 1 mm, both bract and bracteoles hairy on margin and upper surface. *Flowers* bisexual, subsessile, 4–5 mm in diameter. *Floral tube* 1–2 × 1–1.5 mm, ellipsoid, compressed, 4-angled, pubescent. *Nectarium* annular, prominent. *Sepals* 3–3.5 × 1.5–2.5 mm, broadly elliptic-oblong, in opposite pairs, of which one is broader than the other, concave, 3-veined, thick and thickened towards tip which is notched with a mucro in the notch, with a few hairs on outer surface, pinkish purple to deep red. *Stamens* 4 or 5, filaments red, 2–3.5 mm long, stiff, glabrous, equalling or slightly exceeding sepals. *Carpel* 1, style 1, 1–1.5 mm long, stigma reniform, and ± compact. *Fruits* (mature floral tubes) ellipsoid to ± globose, 4-angled, 4-winged, 2–2.5(–3) × 1.5–2 mm, ± pubescent, faces smooth, achene 1.

Field notes. Herbs up to 120 cm tall, flowers pink.

Distribution. India (Meghalaya), Burma, and China.

INDIA. Meghalaya: Shillong, 1677 m, 24-8-1886, Clarke 44631A (CAL); ibid., 16-10-1930, P.C. Kanjilal 8711 (ASSAM); Elephant Falls, 23-7-1956, Sacki s.n. (ASSAM); Taitkar forest, 19-11-1962, Kar 29471 (ASSAM); near Shillong peak, 22-9-1959, Deka 19125 (ASSAM, CAL); Shillong peak, 2-9-1943, Bor 17822 (DD); Khasi Hills, sine loc., July 1876, Gustavmann 436 (ASSAM, DD); Sheirung, 1677 m, 25-11-1890, Collett s.n. (CAL); Mawphlang, 1830 m, 22-10-1914, U.N. Kanjilal 4666 (ASSAM); Mairung, 1372 m, 30-10-1871, Clarke 16110 (CAL); Markasa to Mairung, 4.8 km from Kynski, 23-6-1958, Panigrahi 16613 (ASSAM); Smit forest, 21-11-1931, Deka 9718 (ASSAM).

Ecology. Grows on limestone and moist clayey soil, often mixed with gravels, in meadows and shrubby formations, open grassy slopes, ravines and outcrops, forest edges, edges of bogs and banks of streams and in the embankments of rice-fields. Flowering June–September; fruiting October–November.

Pollen grains. 6-colporate, with colpi situated at the same distance from each other, equatorial ora present; prolate (Nordborg, 1966).

Vernacular name. Bat tari (Khasi, Meghalaya).

Uses. Flowers and rhizomes of *S. officinalis* have blood clotting properties; it has also been used against diarrhoea, dysentery, and tuberculosis (Nordborg, 1966).

Notes. 1. J.D. Hooker (1878) mentioned the number of stamens to be 4 and stigma capitate. Our dissection of about 30 flowers in CAL show also 5 stamens in c. 30% of the flowers and the stigma compactly branched.

2. We agree with Nordborg (1966) that the inflorescences, pollen grains and floral tubes ('receptacles') of *S. longifolia* Bertol. resemble those of *S. officinalis* L. but the leaves (basal leaves 15–57 cm long) of the former are hard, conspicuously coriaceous, so much so that plants from the India-Burma-China sector are at once set apart from the European biotypes. Nordborg treated *S. officinalis* L. as a species group comprising as many as 24 taxonomic entities, validly published or named taxa (as nom. nuda or nom. dub. or nom. illegit.) and extended the range of distribution of *S. officinalis* from Europe to Southeast and South Asia. Whether or not each such taxonomic unit considered conspecific with *S. officinalis* L. may represent an 'allo-

patric ecotype' (Valentine, 1978), *S. longifolia* Bertol. may be interpreted as a distinct 'geographical race' restricted to the Meghalaya-Burma-South China sector. We, therefore, raise *S. officinalis* L. var. *longifolia* (Bertol.) Yu & Li to the status of a subspecies (= geographical race). A variety which represents an 'ecological race' (Valentine, 1978) is best exemplified by *S. diandra* var. *villosa* (see page 61) representing an ecological cline from Sikkim (3050–4270 m) to Tibet (3355–3660 m), all within the same broad geographical area.

Section Pterachaenium

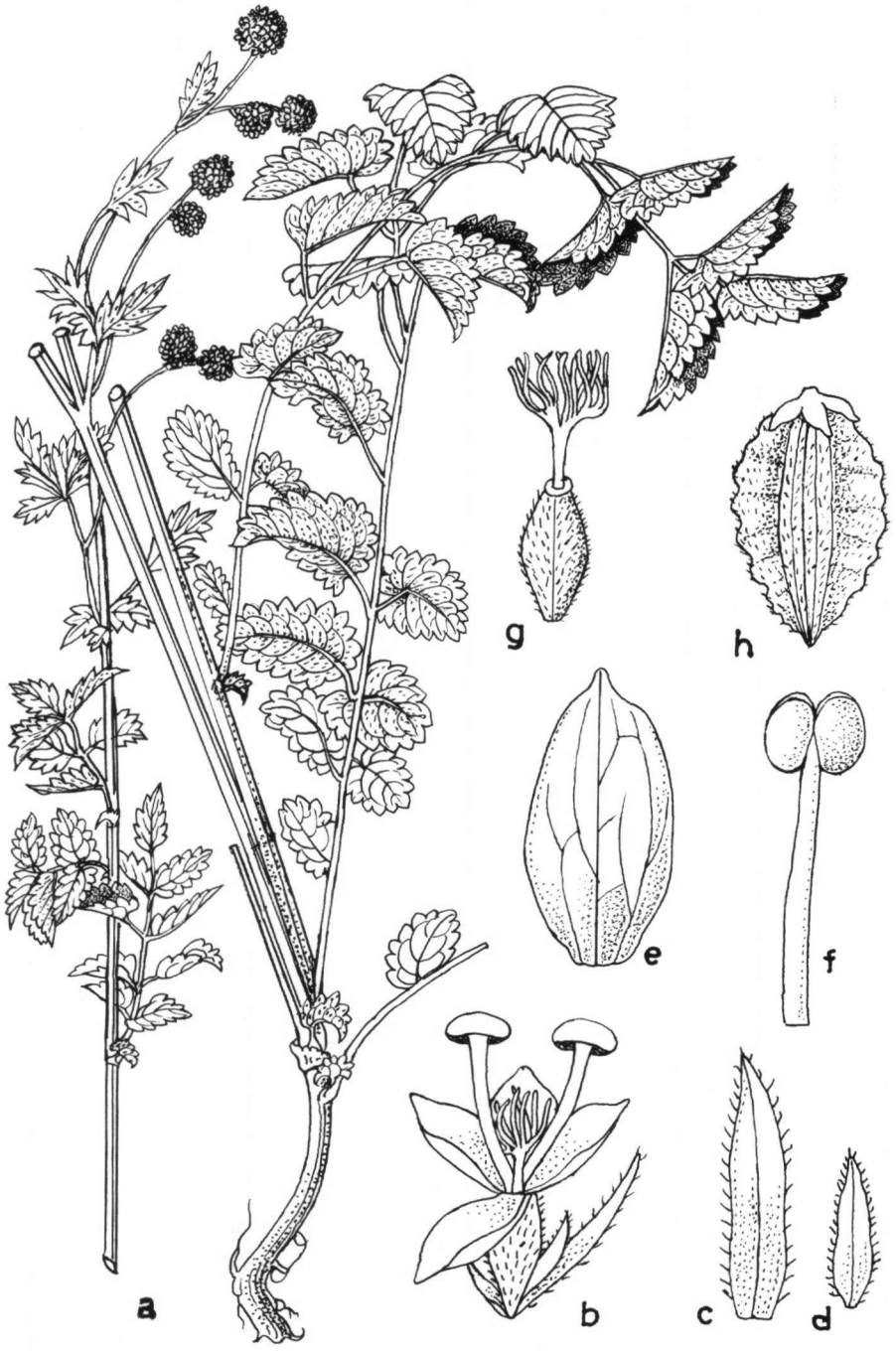
Sect. *Pterachaenium* Cesati; Nordborg, Op. Bot. 11 (2) (1966) 59. – Type: *S. dodecandra* Moretti.

Stamens (2–)4–12, pollen 3-colporate. Carpels 1 (or 2), stigma tufted or penicillate. Floral tube in fruit fusiform, longitudinally ridged or rough, broad-winged.

2. Sanguisorba diandra (Hook. f.) Wallich ex Nordborg

S. diandra (Hook. f.) Wallich ex Nordborg, Op. Bot. 11 (2) (1966) 60. – *Poterium diandrum* Hook. f., Fl. Br. India 2 (1878) 362; Hara in Hara & Ohashi, Fl. East. Himal. 2 (1971) 54. – *S. diandra* Wallich & Benth., Num. list no 710 (1829), nom. nud. – *S. decandra* Hook. f. in Benth. & Hook. f., Gen. Pl. 1 (1867) 624 (sphalm. for *S. diandra* Wallich, nom. nud.), nom. nud. – Lectotype (present authors): *Wallich 710* (K, selected by Nordborg in sched.; photo CAL!, isolectotype CAL!), Tibet, Gossain Than (sphalm. Gufram Thun; Nordborg, l.c.).

Herbs perennial. *Rhizome* 4–7.5 × 0.3–0.8 cm. *Stems* 18–90 cm, striated, glabrous or sparsely pubescent. *Leaves* without rosette, all cauline, alternate, 5–32 × 3–6 cm, petiole 0.5–4 cm long; leaflets 9–13, opposite or alternate, blade 1–3 × 0.8–2.5 cm, ovate-oblong-orbicular, cordate at base, obtuse-rounded at apex, glabrous above, pubescent beneath, teeth 6–15 on each side, acute or obtuse-mucronulate, apical tooth narrower, petiolules 2–25 mm long. *Stipules* of lower cauline leaves adnate to petiole and forming membranaceous wings at apices, those of upper cauline leaves basally adnate but free and leafy at apices, ½ lunate, 6–8 × 8–10 mm, deeply toothed, hairy. *Inflorescences* globose heads, 6–10 mm in diameter with 15–30 flowers, on axillary and terminal peduncles of 0.5–2.5 cm (0.8–13.5 cm in fruiting condition). *Bracts* 3–5 × c. 1 mm, ovate-acuminate or linear-oblong, fimbriate; bracteoles 2–3 mm long, ovate-lanceolate-acuminate, fimbriate. *Flowers* bisexual, subsessile, 4–5 mm long, 2.5–3 mm in diameter. *Floral tubes* 2–2.5 × c. 1 mm, ellipsoid, glabrous or villous. *Nectarium* almost absent. *Sepals* c. 2 × 1 mm, obovate-oblong, mucronulate, concave, 3-veined, red or reddish green to green, persistent, glabrous. *Stamens* 1–4 (generally 2), filaments 2–2.5 mm long, stiff, red, equalling or exceeding sepals, glabrous. *Carpel* 1, style 1, c. 1 mm long, stigma penicillate. Fruit-head 1–2 cm in diameter; *fruits* (mature floral tubes) 5–8 × 2.5–4.5 mm with wings, narrow and fusiform, oblong with wings, glabrous or villous, 4-angled, 4-winged, wings broad, flattened, undulate in parallel pairs, narrowing at the ends, faces sparsely longitudinally ridged, achene 1.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KEY TO THE VARIETIES

1a. Flowers dark-purple; bracts ovate-acute to acuminate; floral tubes glabrous or minutely pubescent at margin; fruits completely glabrous . . . . . **a. var. diandra**

b. Flowers green or reddish green, bracts linear-oblong, floral tubes villous; fruits villous . . . . . **b. var. villosa**

a. var. diandra

Field notes. Flowers red or dark-purple.

Distribution. Himalayas (from Garhwal through Darjeeling and Nepal to Sikkim).

INDIA. Uttar Pradesh: Kumaon, Palang Gadh, Bijans, 3355–3660 m, 21-7-1886, Duthie 5519 (CAL); Garhwal, Valley of flowers, 3800 m, 19-8-1963, Bhattacharyya 29575 (BSD); Kedarnath, 19-10-1938, Kirat Ram 8934 (DD). – West Bengal: Darjeeling Dist., E of Phallut, c. 3050 m, 21-10-1904, Burkill 25331 (BSIS); Sandakphu west, 3633 m, 16-9-1962, Safui 1729 (CAL); Singalelah, 3355 m, 7-10-1870, Clarke 13441C (CAL). – Sikkim: Tankra Int., 3965 m, 2-8-1892, Gammie 380 (CAL); Tsomgo, 3660 m, 9-8-1945, Bor's collector 990 (DD); Phullelong, 3660 m, 26-10-1875, Clarke 25670A (CAL); Phedap, Oct. 1908, Ribu 292 (CAL); Mingerdora pasture, Sept. 1901, Prain's collector 170 (CAL); sine loc., 3050-3965 m, J.D. Hooker 911 (CAL); Patang la, 17-7-1877, King 4390 (CAL); Choubhanjan, 3355 m, 1-9-1919, Cave s.n. (DJ*); Gnathong, 3965 m, 20-9-1916, Cave s.n. (DJ).

Ecology. The plants grow in high altitudes between 3050–3965 m. Flowering June–July; fruiting July–October.

Pollen grains. 3-colporate, with broad and long colpi, operculate, sexine not markedly thickened; prolate (Nordborg, 1966).

Chemical constituents. Nordborg (1966) reported the presence of yellow fluorescing flavonoles both in *S. dodecandra* Moretti and *S. diandra* (Hook. f.) Wallich ex Nordborg, a chemical evidence in agreement with close similarities in their morphology.

Note. Nordborg (1966) observed 4 stamens in *S. diandra* and stated that even if there were 2 stamens as mentioned by Hooker (1878), that was not the only number. Our dissections of c. 30 flower buds and some mature flowers show 1–4 stamens per flower, 2 being the most common. Further, Hooker (l.c.) indicated that *S. diandra* possessed orbicular sepals and glabrous floral tube ('calyx tube'), but our specimens show obovate-oblong sepals with mucronate tip and floral tubes glabrous to rarely minutely pubescent at margin.

* DJ is abbreviated here for the herbarium of the Lloyd Botanic Garden, Darjeeling.

Fig. 2. *Sanguisorba diandra* (Hook. f.) Wallich ex Nordborg var. *villosa* Purohit & Panigrahi. a. Habit, × 2/3; b. flower showing relative positions of sepals, bracts and bracteoles, × 8; c. bract with ciliate margins, × 10; d. bracteole with ciliate margins, × 10; e. sepal, × 20; f. stamen, × 15; g. carpel with penicillate stigma, × 9; h. fruit, × 7 (*G. King's collector s.n.*, CAL, Acc. no. 151190).

b. var. villosa Purohit & Panigrahi, *var. nov.* – Fig. 2.

Var. villosa differt a varietate typica floribus rubello-viridibus viridibusve, bracteis lineari-oblongis, tubis floralibus villosis, fructibusque villosis. – Typus: *King's Coll. s.n.* (holo, CAL-Acc. no. 151190; iso, CAL-Acc. no. nil & 151189), India, Sikkim, Cho-le-la, July 1879.

Field notes. Flowers green, reddish green.
Distribution. India (Sikkim) and China (Tibet).

INDIA. Sikkim: E of Chungthang, Boring sho, fl., 16-7-1938, Basil Gould 1125 (DD).
TIBET. Chumbi: Toongthung, above Galing, fr., 30-7-1877, Dungboo 4642 (CAL); ibid., fr., 30-7-1877, G. King 4642 (CAL); Gautza, 3355–3660 m, fr., Aug. 1912, B.T. Gould 118 (CAL); 10 miles S of Chumbi, Pa lo, fl., 5-7-1878, Dungboo s.n. (CAL).

Ecology. Plants grow more or less in the same range of altitudes as var. *diandra*. Flowering and fruiting July–August.

Subgenus Poterium

Sanguisorba subg. *Poterium* (L., p.p.) A.Br. & Bouché, Ind. Sem. Hort. Bot. Berol. Appendix (1867); Nordborg, Op. Bot. 11 (2) (1966) 64. – *Poterium* L., Sp. Pl. (1753) 994; Gen. Pl. ed. 5 (1754) 430, p.p. (excl. *P. spinosum* L.); Hook.f., Fl. Br. India 2 (1878) 362. – Type: *P. sanguisorba* L. (= *Sanguisorba minor* Scop.).

Leaflets crenate-serrate with 1–10 teeth on each side. Flowers perfect and imperfect, the plants variously monoecious, sepals green usually with white margins. Stamens in ♀ flowers 1–c. 50, longer than sepals. Pollen 3-colporate. Carpels (1) 2 (3). Floral tubes in fruit 4-angled or fusiform with lists or wings, faces ± sculptured.

Section Poterium

Lateral branches usually reaching same height as the main stem. Leaflets ± of the same size. Floral tubes in fruit ± 4-angled, with lists or wings, faces reticulate or variously sculptured.

3. Sanguisorba filiformis (Hook. f.) Hand.-Mazz.

S. filiformis (Hook. f.) Hand.-Mazz., Symb. Sinic. 7 (1933) 524*; Nordborg, Op. Bot. no 16 (1967) 94; Yu & Li, Acta Phytotax. Sin. 17 (1) (1979) 12. – *Poterium filiforme* Hook. f., Fl. Br. India 2 (1878) 362. – Lectotype: *J.D. Hooker s.n.* (W, selected by Nordborg, 1967; isolectotype K, photo CAL!), India, Sikkim Himalayas, Lachen valleys, 3507 m, in marshy ground, 15-7-1849.

Herbs perennial, gracile, 5–23 cm high. *Rhizome* 4–8 × 0.3–0.8 cm, branched or unbranched. *Stems* 1.5–6 cm long, ascending, thin, glabrous, tufted (sparsely or not

* Nordborg (1967: 94) cites *S. filiformis* Hand.-Mazz., Symb. Sin. 7: 254. 1933.

branched). *Leaves* radicals in rosette, cauline 0–3, alternate, 3–11 × 0.8–1.2 cm, petioles 1.5–7 cm long, leaflets 5–11, 5–9 × 5–8 mm, obovate to ± orbicular-obcordate, entire, cuneate-truncate at base, glabrous, teeth 2–4 on each side, obtuse, apical tooth shorter and narrower, sessile or with petiolules 1–3 mm long. *Stipules* of radical leaves brown, those of cauline leaves for the most part leafy, c. 3 mm long, glabrous, entire. *Inflorescences* globose heads, 5–8 mm in diameter, with 10–30 flowers, peduncles subradical, unbranched, 5–15 cm long, filiform, glabrous, often with a minute reduced leaf and bud about the middle. *Bracts* less than 1 × 0.5 mm, obovate-oblong-suborbicular, glabrous or minutely pubescent at apex; bracteoles absent. *Flowers* ♂ and ♀ with the ♀ centrally located and ♂ peripheral; ♂ flowers 4.5–5 mm long, 4–4.5 mm in diameter, floral tubes ellipsoid, 1.5–2 mm long. Nectarium absent. *Sepals* 2–2.5 × 1–1.5 mm, elliptic-obovate, white or whitish green, glabrous. *Stamens* 3–8 (generally 5–7), borne on the narrow apical part of receptacle, filaments 3–4 mm long, white, filiform, glabrous, exceeding sepals. ♀ *Flowers* 2.5–3 mm long, 2–2.5 mm in diameter, floral tube 1.25–1.5 mm long. *Sepals* c. 1 × 0.5 mm. *Carpel* 1, style 1, 1.5–2 mm long, stigma compact. *Fruits* (mature floral tubes) 2–2.5 mm long, ± rhomboid to globosely ellipsoid, 4-angled, wingless (with lists), glabrous, faces ± smooth to rough, achene 1.

Distribution. India (Sikkim), Bhutan and China (S. Tibet). Nordborg (1967b), who defines relic endemics as those taxa with an isolated geographic distribution restricted to rocky environment and bare cliffs, treats *S. filiformis* in the Himalayas as a relic endemic.

INDIA. Sikkim: Nathong, 13-7-1877, King 4373 (CAL); Lamtong to Samdong, Sept. 1903, Prain s.n. (CAL); Thangu, Sept. 1903, Prain s.n. (CAL); Eastern Himalayas, Chhamba, 17-6-1906, White s.n. (CAL); Llonok, 4422 m, 31-7-1909, Smith & Cave 2088 (CAL); Dikchu Valley, 3660 m, 23-7-1910, Smith 3228 (CAL); sine loc., 3355–3660 m, J.D. Hooker s.n. (MH); sine loc., R.S. Rao 895 (CAL). In addition from Sikkim a photograph of a syntype labelled *Poterium filiforme* J.D. Hooker, J.D. Hooker s.n. (K), 3355–3660 m, has been studied.

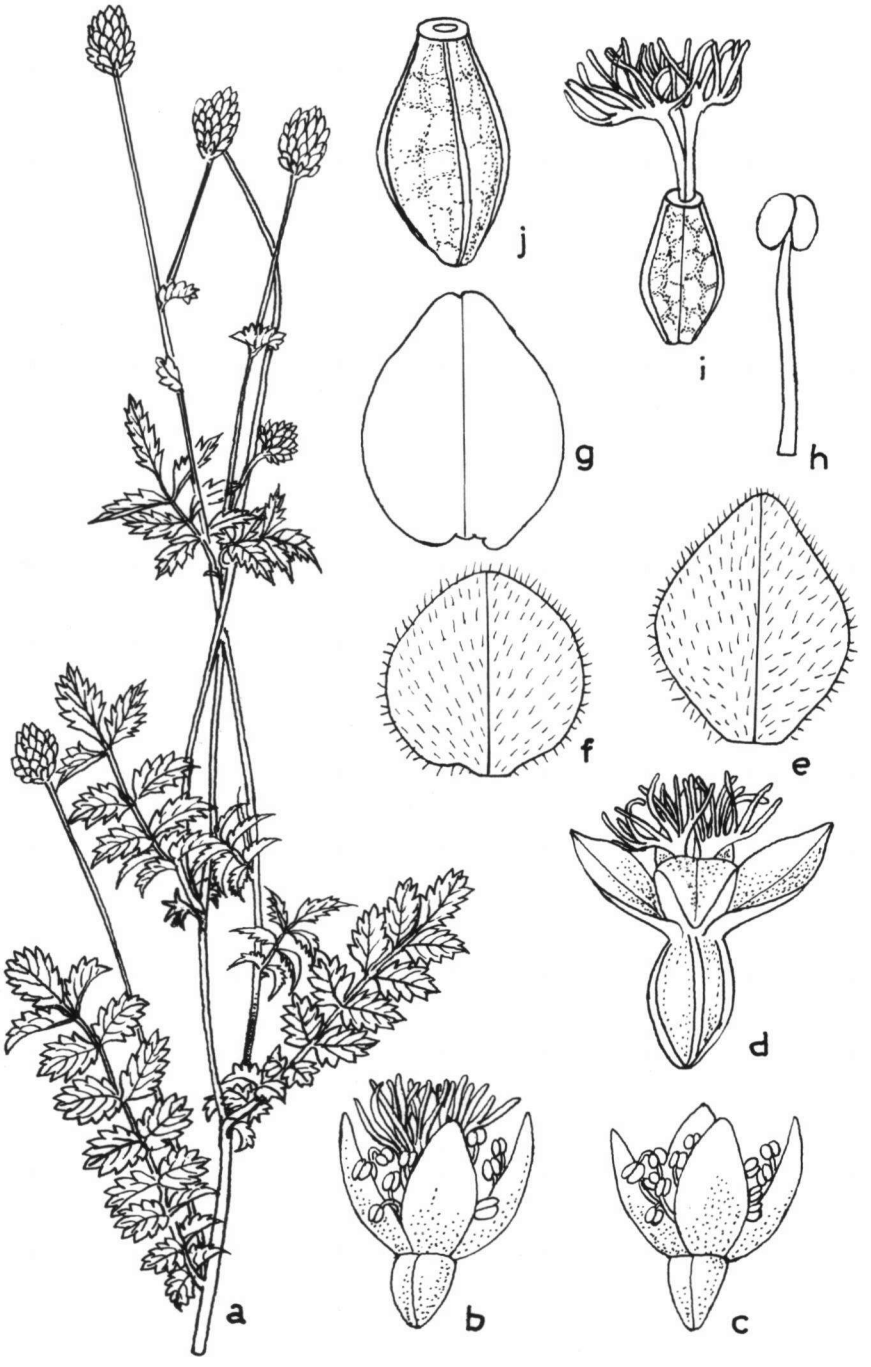
Ecology. Occurs in moist to wet meadows; marshy plains, at high altitudes up to 4422 m. Flowering and fruiting June–September.

Pollen grains. 3-colporate, brevicolpate and operculate with small pores; subprolate (i.e., the ratio polar axis : the equatorial diameter) 1.14–1.33 (8 : 7–8 : 6), exine about 2 μm thick, sexine normally 1–1.5 μm and tectate, tectum surface commonly smooth, psilate or striate (Nordborg, 1967b).

Note. According to Nordborg (1966, 1967b) the number of stamens per flower varies from 2–7 (generally 5–6) and stigma penicillate in *S. filiformis*. Our study of c. 30 flower buds show 3–8 (generally 5–7) stamens and invariably 'compact' type of stigma (stigma compactly branched) described as capitate by J.D. Hooker (1878).

4. Sanguisorba minor Scop. subsp. **minor – Fig. 3.**

S. minor Scop., Fl. Carniol. ed. 2, 1 (1772) 110; non Bertol. (1835); Nordborg, Op. Bot. no 16 (1967) 98. – Type (neotype): *Nordborg 8040* (LD; selected by Nordborg, l.c.), Spain, Jaen, Sierra de Cazorla, 1300 m, 20 May 1964.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Poterium sanguisorba L., Sp. Pl. (1753) 994 [non sensu Hook.f., Fl. Br. India 2 (1878) 363, = *P. polygamum* Waldst. & Kit. 1805, = *S. minor* Scop. subsp. *muricata* (Spach) Briq.]. – Type: *Loefling s.n.* (LINN; Savage Cat. no 673; microfiche CAL!), Spain. – The specimen is in vegetative state and cannot with certainty be referred to the subspecies *minor, muricata* or *magnolii*, all of which grow in Spain, and subsp. *minor* the rarest there.

Herbs. Rhizome not seen. *Stems* angled-striated, glabrous, branches 8–16 cm long (to 120 cm, cf. Nordborg). Radical leaves not seen. *Cauline leaves* alternate, 6–9 × 2–2.3 cm, leaflets 11–19, 5–14 × 4–9 mm, obovate-oblong, sessile or with a petiolule of 1–3 mm long, base cuneate-rounded, apex blunt, glabrous above, sparsely hairy on the midvein beneath, 3–7 teeth on each side, apical tooth short. *Stipules* ½ lunate, deeply toothed, 5–7 × 5–6 mm, sparsely hairy at base. *Inflorescences* globose-ovoid head, 6–15 mm long, axis hairy. *Bracts* 2.5 × 2 mm, rhomboid-ovate, bracteoles 2–2.5 × 1.5–2 mm, ovate-obovate-orbicular, hairy on outer surface and margin. *Flowers* ♂ ♀ ♀ from below upward (Nordborg, 1967: 30, recorded only ♀ and ♀ flowers), 3 mm long, 3–4.5 mm in diameter, whitish green, subsessile, actinomorphic. *Floral tubes* ellipsoid, 2–2.5 × 1–1.5 mm, glabrous. *Nectarium* nearly lacking. *Sepals* 2.5–3.5 × 2–3 mm, ovate-elliptic, concave on the inner surface, green or green with white margins, glabrous. *Stamens* 18–25 [according to Nordborg, c. 30(–50)] filaments filiform, declined, 2–2.5 mm long. *Carpels* 2, styles 2, 1–1.5 mm long, stigma penicillate. *Fruits* (mature floral tubes) 2–3.5 × 1.5–2 mm, 4-angled, ellipsoid, wingless, but with lists, glabrous, faces faintly reticulately ridged; achenes 2.

The Indian biotypes belong to the *virescens* form series.

Seed character. Integument 6 cells thick (4 + 2), but on the anteraphe side 2 cells thick as the inner integument, the outer integument on this side being suppressed as a slight bulge round the chalaza (Corner, 1976; as *Poterium sangusorba* L.).

Distribution. Most parts of Europe from southern Scandinavia to northern Africa and the Canary Islands, Southwest and Central Asia (Iraq, Iran, Afghanistan), rare in the U.S.A. (introduced), India (Uttar Pradesh). *A new record for India.*

INDIA. Uttar Pradesh: northwestern Himalayas, Mussoorie range, 1869, G. King s.n. (CAL).

Ecology. Nordborg (1967b) provides a detailed account on the habitat of the species. The specimens from Mussoorie, without any notes on the habitat of the species, were collected from subtropical to temperate altitudes (1830 m and above) with a moist cool climate. Flowering and fruiting May–July.

Chromosome numbers. 2n = 28, subsp. *minor* (Erdtman & Nordborg, 1961; Nordborg, 1967b); 2n = 28, 54, 56, subsp. *muricata* (Spach) Briq.

Pollen grains. 3-colporate, colpi often pontoperculate, i.e., provided with sexinous operculum, the apical part of which merges with the surrounding exine, subprolate, i.e., the ratio polar axis : equatorial diameter is 1.44–1.33 (8 : 7–8 : 6); cir-

Fig. 3. *Sanguisorba minor* Scop. subsp. *minor*. a. Habit, × 2/3; b. bisexual flower, × 11; c. male flower, × 10; d. female flower, × 8; e. bract, × 11; f. bracteole, × 11; g. sepal, × 14; h. stamens, × 14; i. carpel with penicillate stigma, × 8; j. fruit, × 13 (*G. King s.n.*, CAL, Acc. no. 151215).

cular in polar view, exine 2 μm thick, sexine thin, c. 1 μm and tectate, bacula of tectum reticulately arranged; tectum surface psilate or smooth, never verrucate, opercula c. 8 μm long and 2 μm broad at the equator (Nordborg, 1967b).

Embryology. Nordborg (1967a) found that only reduced embryosacs are functional in spontaneous tetraploid and octoploid plants of *S. minor* and that there is a strong tendency towards apospory. Both amphimixis and apomixis were found in artificial tetraploid and hexaploid hybrids.

Uses. It is noteworthy that of the five taxa of *Sanguisorba* occurring in India, only *S. minor* and *S. officinalis* are known for their important therapeutic uses. The leaves of *S. minor* are used as a vegetable for soup and salad. When crushed, the plant has a smell of cucumber. It is also used against headache, melancholy, plague, and stomach, intestinal and uterine ailments. In Hungary *S. minor* is called Csabaire, Csaba's balsam. This name derives from a folk tale, telling that Attilla's son Csaba woke to life the dead Hun soldiers with this plant, and so became the winner of the battle. This species was the characteristic component in 'Pimpinella spirits' (Nordborg, 1966).

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IDENTIFICATION LIST

The numbers following the semicolons refer to the taxa in the preceding enumeration. Unnumbered collections and/or collections without collector's names have not been included. The unnumbered specimen of taxa no. 4 is included only in the text.

Bhattacharyya 29575: 2a – Bor 17822: 1 – Bor's collector 990: 2a – Burkill 25331: 2a – Clarke 13441C: 2a, 16110: 1, 25670A: 2a, 44631A: 1 – Deka 9718: 1, 19125: 1 – Dungboo 4642: 2b – Duthie 5519: 2a – Gammie 380: 2a – Gould 118: 2b, 1125: 2b – Gustavmann 436: 1 – J.D. Hooker 911: 2a – P.C. Kanjilal 8711: 1 – U.N. Kanjilal 4666: 1 – Kar 29471: 1 – G. King 4373: 3, 4390: 2a, 4642: 2b – Panigrahi 16613: 1 – Prain's collector 170: 2a – Ram 8934: 2a – R.S. Rao 895: 3 – Ribu 292: 2a – Safui 1729: 2a – Smith 3228: 3 – Smith & Cave 2088: 3.

INDEX OF SPECIFIC AND INFRASPECIFIC NAMES

Numbers refer to the number of the accepted species. New names are in bold type. Synonyms have '=' before the number of the species to which they belong.