

NEW TAXA OF *GALIUM* L. (RUBIACEAE) FROM THE INDIAN SUBCONTINENT

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A B S T R A C T

Two sections of *Galium* L. Sect. *Asperigalium* and sect. *Hirtiflorum* are described. Three new species and one new variety from the Indian subcontinent are described and illustrated. Of these *G. duthiei* and *G. duthiei* var. *glabriusculum* are from India (Uttaranchal) and adjoining W. Nepal. *G. kaganense* and *G. shanense* are from Pakistan and Myanmar respectively. Affinities of the sections are discussed.

INTRODUCTION

Taxonomic studies on the genus *Galium* L. from the Indian subcontinent necessitates the publication of few novelties. These are *G. duthiei* and *G. duthiei* var. *glabriusculum* from India (Uttaranchal) and W. Nepal, *G. kaganense* from Pakistan and *G. shanense* from Myanmar. This study is primarily based upon the specimens extant in CAL Herb. and some materials received on loan from the foreign herbaria of E, BM and from one Indian herbarium DD. Heterostyly has been frequently observed in different species of *Galium* L. In short-styled flower the style remains included within the tube or sometimes remains just near the mouth, whereas in long styled one it is far exerted from the tube. Styler length bears a relation with the length of filament variable in different species of *Galium*. Of the three new species described here *G. duthiei* and *G. shanense* have short styles with subequal (i.e. slightly short, long or equal) filaments and long styles with short filaments and in *G. kaganense* the short styles are with long filaments and long styles with subequal filaments.

GALIUM L.

Asperigalium R. Bhattach. sect. nova.

Sect. *Trachygalium* K. Schum. (1891) sensu Ehrend. (2005) in Fl. Iran. 176: 185-194 p.p. excl. "*Asperifolium* group".

Plantae perennes scandentes ad diffusae interdum stoloniferae. Caules quadrangulares retrorsum pubescentes ad scabridi et aculeati interdum patenter pilosi ad hispido-tomentosi vel glabri. Folia in verticillis (4-) 5-6-na, uninervia, apice hyalino-cuspidata ad marginem costaue infra retrorsum scabridi ad aculeati, interdum patenter hispido-tomentosi, raro glabrescentes cum pilis scabridis minutis perpaucis retrorsis, nunquam antrorsum scabridi vel pubescentes. Inflorescentia laxa,

plerumque perramosa panicula cymosa bracteata pauci- ad multiflora interdum redacta in cyma 1-3-flora; bractee foliaceae, omnino praesentes, pedicellis divaricatis aequilongae vel breviores. Flores hermaphroditi. Corolla rotata, viridi-alba ad purpurascens, lobi acuminato-apiculatis. Mericarpia subglobosa glabra verrucosa interdum cum pilis sparsis ad densis setosis non uncinatis.

Typus sectionis : *Galium asperifolium* Wall. in Roxb.

Besides the type, 13 other species are present in the Indian subcontinent. Of these 5 are new to science. 10 species are endemic of which 7 are in Uttaranchal and H.P., 1 in S. India and 2 in Pakistan.

Distrib. : India (Kashmir, Punjab, Himachal Pradesh, Uttaranchal, Sikkim, West Bengal, Meghalaya, Manipur, Arunachal Pradesh, Assam, Orissa, Tamil Nadu and Karnataka); Nepal; Bhutan; Myanmar; Pakistan; Tibet and China.

(Plant perennial, scrambling to diffuse often stoloniferous. Stems 4-angled, retrorsely sometimes patently pilose to hispid tomentose, scabrid to aculeate, rarely glabrous. Leaves (4-) 5-6 in a whorl, 1-nerved, apex hyaline-cuspidate, margin and lower midrib retrorsely scabrid to aculeolate often patently hispid tomentose, rarely glabrous with at least few and minute scabrid hairs or aculeolations, never antorsely scabrid or pubescent. Inflorescences lax, few to many flowered, usually densely branched bracteate cymose panicle, sometimes reduced to one flowered cymes; bracts foliaceous, present throughout the inflorescences, equalling or shorter than pedicels. Corolla rotate, greenish white to purplish; lobes apiculate. Mericarps glabrous, verrucose, sometimes beset with sparse to dense, non uncinete setose hairs.)

Notes: Sect. *Asperigalium* is widespread in the Indian subcontinent from the mountainous region of N.W. to N.E. Himalayas including the southern hilly states of India, Pakistan, Nepal, Bhutan, Sri Lanka, Myanmar and China. The section comprises of 14 species and the main center of distribution is in the Kumaon and Garhwal Himalaya of Uttaranchal and Himachal Pradesh comprising of 8 species of which 7 are endemic. These are *G. acutum*, *G. megacyttarion*, *G. vicaryii*, *G. himachalense*, *G. confertum*, *G. poluninii* and *G. duthiei* occurring in Uttaranchal, H.P. and adjoining W. Nepal and *G. pseudoasperifolium* is wide from N. W. to N.E. Himalaya. In South India (Tamil Nadu and Karnataka) *G. pilosissimum* is endemic and 2 other endemic species, *G. subfalcatum* and *G. tetraphyllum* are reported from Pakistan (Nazimuddin and Qaiser, 1987). Ehrendorfer (2005) in his new circumscription of Sect. *Trachygaleum* K. Schumann included *G. asperifolium* and its three allies from Pakistan. This circumscription agrees with Sect. *Asperigalium* in some characters like stem angles retrorsely scabrid to aculeolate, leaves 1-nerved with hyaline-cuspidate leaf apices, corolla lobes acuminate apiculate and $\pm$ glabrous mericarps. But Sect. *Asperigalium* differs from Sect. *Trachygaleum* K. Schumann in having leaf margin and lower midrib of leaves always retrorsely scabrid to aculeate, rarely glabrous but at least with very few and minute scabridities on the leaf midrib (never antorsely scabrid or aculeate); leaves including stipular (4-) 5-6 in a whorl (never to 12 / whorl); corolla universally rotate (not infundibular or campanulate); inflorescences conspicuously bracteate to the end and mericarps glabrous, $\pm$ verrucose and rarely with non uncinete setose hairs.

Ehrendorfer himself (2005) considered Sect. *Trachygaleum* emended by him as heterogeneous and provisionally separated three species groups of which "*Asperifolium*" group is one. He characterized

the group by having "strongly bracteate inflorescence, rotate corolla and $\pm$ verrucose mericarps sometimes with curved appressed hairs".

Considering the well-correlated characters present throughout the range of species occurring in the Indian subcontinent and from the stand point of distinct phytogeographical limit (never proceeding westward beyond Pakistan), it seems better to separate the informal "*Asperifolium* group" of Ehrendorfer and to raise it in a sectional rank to maintain homogeneity in the classification.

Hirtiflorum R. Bhattach. sect. nova.

Syn. Sect. *Platygalium* W. Koch (1835) sensu Ehrend. (2005). in Fl. Iran. 176: 175-181 p.p.

Herba perennis, scandens ad suberecta ascendensque, caespitosa et suffruticosa. Caules quadrangulares secus anguli patenter hirsuti interdum dense appresso-velutini ad subvelutini ad puberuli, raro laeves. Folia cum stipulis foliaceis 4-na, anguste oblona, oblongo-lanceolata ad ovali-elliptica, apice obtusa ad subacuta, non mucronata, subtrinervia cum nervis lateralibus minus prominentibus, non convergentibus et $\pm$ evanescentibus ad medium secus marginem folii, cellulis epidermidis paginae superioris foliorum multo-majoribus (sub lente $\times$ 20 facile visis), subtus cum glandibus conspicuis stictis infra apices. Inflorescentia pluriflora panícula corymbosa, rami ultimi 3-5(-7)-flori, ebracteati. Flores hermaphroditi. Corolla campanulata ad subrotata, pallide viridula-alba, lobi subacuti ad leviter apiculati. Mericarpi subglobosa ad fere reniformia, uncinata setosa.

Typus sectionis : *Galium hirtiflorum* Requier ex DC.

Besides the type, two other species, *G. falconeri* Bhattacharjee (sent for publication) and *G. subtrinervum* Ehrend. & Schonb.-Tems. are present in the Indian subcontinent, the former in India (Uttaranchal and Himachal Pradesh) and the latter in Pakistan, both being endemic.

Distrib. : India : Uttaranchal, Himachal Pradesh and Sikkim; Nepal; Bhutan and Pakistan.

(Scrambling to suberect and ascending perennial, caespitose and suffrutescent at base. Stems 4-angled, angles spreading hirsute, sometimes densely adpressed velutinous to puberulent. Leaves including stipules foliaceous, 4 in a whorl, narrowly oblong, oblong-lanceolate to oblong-elliptic; apex obtuse to subacute, not hyaline-cuspidate, subtrinerved with lateral nerves less prominent, non converging and $\pm$ disappearing midway along leaf margins. Lower surface of leaves with conspicuous and dotted glands below the apex. Inflorescences few to several flowered corymbose panicle, ultimate branches 3-5(-7) flowered, bracteate to ebracteate. Flowers bisexual. Corolla campanulate to subrotate, pale greenish white; lobes obtuse to subacute, to faintly apiculate. Mericarps subglobose to faintly reniform, uncinata setose).

Notes : This new section from Indian subcontinent is fairly homogeneous having three allopatric species: *G. hirtiflorum* Req. ex DC. from Sikkim, Nepal and Bhutan in the N.E. Himalaya proceeding westward to Kumaon and Garhwal region of Uttaranchal, *G. falconeri* Bhattacharjee (sent for publication) from Uttaranchal and H.P. and *G. subtrinervum* Ehrend. & Schonb.-Tem. from Pakistan being the western limit. *G. hirtiflorum* is $\pm$ wide in distribution and the two latter species are endemic to India (Uttaranchal and H.P.) and Pakistan respectively. It has affinity with Sect. *Platygalium* W.

Koch in having 4 subequal leaves in a whorl, tricostate venation of leaves, ovoid corymbiform inflorescences and uncinat setose fruits but differs consistently throughout the range of these species in some well correlated characters shown in *Table 1*.

Ehrendorfer in his circumscription of Sect. *Platygalium* (2005) included *G. subtrinervum* from Pakistan within the section including the two other species occurring in India, Nepal and Bhutan.

Table 1. Differences between Sect. *Hirtiflorum* and Sect. *Platygalium* s.s.

Sl. No.	Sect. <i>Hirtiflorum</i>	Sect. <i>Platygalium</i>
1.	Stems multicauline and suffruticose	Stems rhizomatous to stoloniferous (not suffruticose)
2.	Leaves narrowly oblong to oblong-elliptical	Leaves rotund, broadly ovate, to obovate rarely broadly lanceolate.
3.	Leaf apices obtuse to subacute and non-mucronulatesometimes subacute	Leaf apices usually mucronulate,
4.	Leaf venation tricostate, not convergent	Leaf venation tricostate convergent
5.	Two lateral nerves of tricostate venation faint to obscure, disappearing midway along the leaf margins	Two lateral nerves of tricostate venation distinct and converging at apex
6.	Lower surface of leaves with conspicuous glands below the apex	Lower surface of leaves not glandular below the apex
7.	Corolla campanulate to subcampanulate	Corolla rotate

These well correlated characters throughout the range of species in Sect *Hirtiflorum* justify its separation from Sect. *Platygalium* s.l., to avoid heterogeneity in classification.

***Galium duthiei* R. Bhattach. sp. nov.**

(Fig. 1)

G. campylotricho Nazim. & Ehrend. affine, sed differt indumento denso ad sparso in folio et cauli, inflorescentia cymosa, plerumque (1-) 3-5(-7) floribus, pedunculata, corollae lobis setulosis, setulis in ovario et mericarpio 2-3-plo majoribus. Differt a *G. asperifolium* Wall. inflorescentia pauciflora et mericarpio ovarioque cum pilis densis parum curvatis, non uncinatis setosis.

Typus : India : Uttaranchal : Tehri-Garhwal, Ganga valley, 2400-2700 m, Oct. 1882, *Duthie, J. F.* 1677 (holo. CAL).

Allied to *G. campylotrichum* Nazim. & Ehrend. but differs in having dense to sparse stem and leaf indumentum, usually (1-)3-5(-7) flowered pedunculate inflorescence, setulose corolla lobes, setae on mericarp and ovary $\times$ 2-3 longer. Differs from *G. asperifolium* in having few flowered inflorescence and ovary and mericarp with dense, faintly curved non uncinat setose hairs.

Prostrate to ascending tuft forming delicate stoloniferous perennial. Stems (3-) 6-44 cm long, 0.5-0.8 mm broad, profusely branched from base upwards, weak, 4-angled, faintly grooved, densely

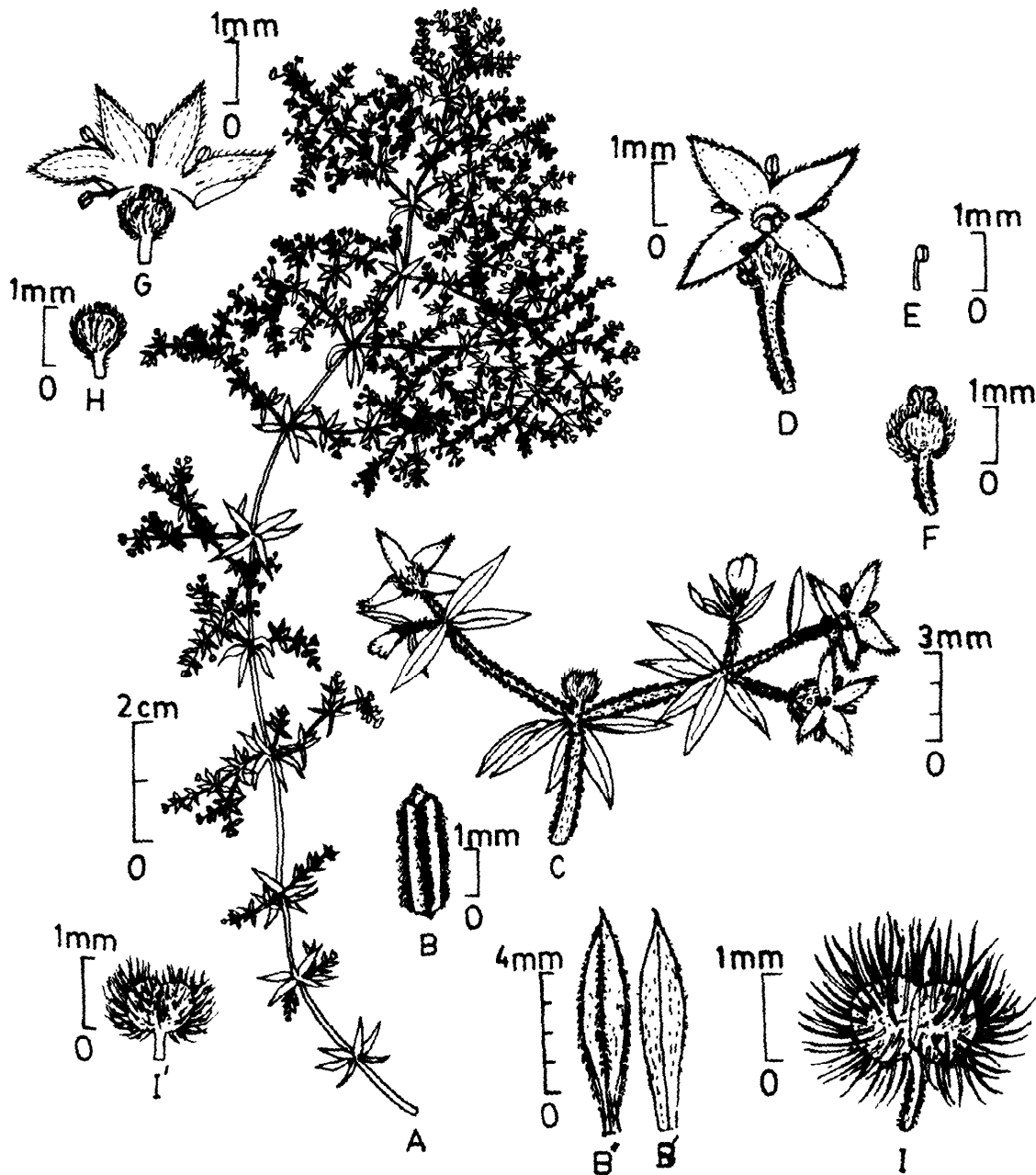


Fig. 1: *Galium duthiei* R. Bhattach. :

A portion of the shoot; B stem; B' & B''- leaf upper and lower surface; C portion of the shoot with inflorescence; D flower with long style; E stamen; F & H- ovary with long and short styles; G flower (cut opened) with short style; I' & I''- mature ovary and fruit. (A Dutta, R.M. 183; B-F & I-I' Duthie, J.F. 1677; G-H Duthie, J.F. 3007).

subvillose to appressed pilose-tomentose with $\pm$ arcuately curved hairs, sometimes sparsely retrorse to somewhat spreading, rarely glabrous with at least very few scabridities; hairs 0.05-0.4 mm; nodes pubescent rarely glabrous; internodes on main stems 6-75 mm, on side branches 0.8-25 mm. Leaves in whorls of (5-) 6, herbaceous, 1-nerved, subsessile, usually narrowly rarely broadly oblanceolate, oblong-lanceolate, elliptical to oblong-elliptical, $3-12 \times 0.6-3.5$ mm on main stems, *ca* $5-5.5 \times$ as long as broad and $1.5-10 \times 0.5-2.5$ mm on side branches, *ca* $3-3.3 \times$ as long as broad; apex acute, gradually passing into hyaline mucro of *ca* 25-0.5 mm on leaves of main stems and 0.08-0.2 mm side branches; base attenuate; upper surface glabrous, sometimes with few hairs along margins, epidermal cells distinct and large under a $\times 20$ lens; lower surface glabrous with few scattered raphides; lower midrib of main stem leaves faintly distinct, of the side branches obsolete; margin and lower midrib densely to sparsely subsetulose, rarely glabrous with very few and minute retrorse scabridities of *ca* 0.05-0.2 mm. Inflorescences axillary and terminal, solitary or 2-5(-8) flowered bracteate cymes; peduncles (0.8) 2.5-6 (-7) mm, sometimes obsolete (when the flower solitary); bracts $2.5-7 \times 0.6-1$ mm, foliaceous, 1-5 in number, *ca* $2-3 \times$ the pedicels. Pedicels 0.5-5 mm elongating to 6.5 mm in fruits. Corolla 1.8-3.4 mm across, rotate, white; lobes 4 rarely 5 in number, $0.9-1.7 \times 0.45-0.7$ mm, oblong, oblong-lanceolate to ovate-oblong, densely to sparsely setulose on outer surface, fewer at margins, *ca* 0.1-0.2 mm, apiculate, apiculus 0.15-0.4 mm; tube 0.2-0.3 mm. Filaments 0.2-0.65 mm; anthers 0.15-0.25 mm, ovoid to oblongoid. Ovary $0.4-0.65 \times 0.5-0.68$ mm, subglobose, densely setose, *ca* 0.2-0.4 (-0.45) mm, white, upwardly curved; styles heterostylous, short styles 0.05 mm with arms 0.15-0.2 mm, rarer in occurrence, long styles 0.2-0.5 mm with arms 0.1-0.35 mm, brownish black; stigma to 0.1 mm, globose, black. Mericarps $0.85-1.2 \times 0.55-0.7$ mm, ovoid, greyish brown, densely to moderately setose; setae 0.25-0.55 mm, greyish white to brownish, stiff, patent to upwardly directed $\pm$ straight to faintly curved and non-uncinate.

Key to varieties

- 1a. Stems and leaves densely to moderately pubescent, hairs 0.2-0.4 mm;
corolla lobes $\pm$ densely setulose ... 1. var. *duthiei*
- 1b. Stems and leaves glabrous, occasionally with very few and minute scabridities of
ca 0.05-0.1 mm; corolla lobes very sparsely hairy with few stubby hairs ... 2. var. *glabriusculum*

1. var. *duthiei*

Fl. : Jun. Sept. (Oct.); *Fr.* : Aug. Oct. (Endemic to Kumaon of Uttaranchal and adjoining W. Nepal).

Distribution and ecology : India : Uttaranchal and W. Nepal. Rocky river valleys and river banks, alt. 2600-4350 (- 5000) m.

Specimens examined : (Specimens are CAL except stated otherwise). INDIA : Uttaranchal : Kumaon, Nipchang valley in Darma, 4000-4350 m, 31.8.1884, *Duthie, J.F.* 3007 (CAL & DD); Mulapa Gadh, Darma, 3340-3670 m, 5.8.1886, *Duthie, J.F.* 5655; Kali valley, Byans, 2670-3000 m, 17.7.1886, *Duthie, J.F.* 5649 (BM, CAL); Kuti valley, *Dutta, R.N.* 183, 231, 251 & s.n.; Way to Gongotri, 2670 m, 30.6.1953, *Mitra, S.N.* 9536; Gongotri area, 3246 m, 19.9.1967, *Naithani, B.D.* 37348; Tehri-Garhwal, Nila

valley, 4670-5000 m, 17.8.1883, *Duthie, J.F.* 1115a (CAL & DD). W. NEPAL : Maharigaon, 5 miles N. E., 4850 m, 22.7.1952, Polunin, *O.*, *Sykes & Williams, L.H.J.* 275 (CAL).

Amongst his collections from the river valley regions of Kumaon, Tehri-Garhwal and W.Nepal (adjoining Kumaon), J. F. Duthie considered specimen no. 3007 as a new species in sched. Various other collections made by him and subsequently by others justify their new specific status. Instead of selecting *Duthie* 3007 (specimen only in flowering), *Duthie* 1677 from Tehri-Garhwal has been selected as the type bearing both flowers and fruits.

2. var. *glabriusculum* R. Bhattach. var. nov.

(Fig. 2)

G. campylotricho Nazim. & Ehrend. affine, sed differt indumento in cauli per sparso minute scaberulo (ca 1-2 per ramo), pilis paucis in parte distali marginis folii et costa infra raro cum pilis paucis, lobis corollae leviter pilosis et setosis ovarii / mericarpio 2-3-plo longioribus.

Typus : India : Uttaranchal : Kumaon, Kali valley, rocks above Garbyans, 3300-3600 m, 15.9.1884, *Duthie, J. F.* 3000 (holo. E, iso. DD).

Affinity with *G. campylotrichum* Nazim. & Ehrend. but differs in having very sparse and minutely scabrid (about 1-2 per branch) stem indumentum, distal part of the leaf margin with few hairs and lower midrib of the leaves occasionally with few scabridities. Besides the corolla lobes are faintly pubescent and ovary / mericarp setae $\times$ 2-3 longer.

Fl. : July- August (Sept.) & *Fr.* : Aug.- Sept. (Oct.). (Endemic to Kumaon of Uttaranchal and adjoining W. Nepal).

Distribution and ecology : India (Uttaranchal) and W. Nepal. Rocky river valleys or along river banks and on exposed rocks; 3300-4000 m.

Specimens examined : INDIA : Uttaranchal : Kumaon, Dhauli valley below Rima, 3670-4000 m, 3.9.1884, *Duthie, J. F.* 2999 (DD). W. NEPAL. Opposite Budhi village, 3340-3670 m, 18.7.1886. *Duthie, J. F.* 5654 (CAL).

***Galium shanense* R. Bhattach. sp. nov.**

(Fig. 3)

A *G. karakulensi* Pobed. differt floribus bracteatis omnino in inflorescentia (non ebracteatis in ramis ultimis), paucibus floribus fructibus sessilibus ad subsessilibus (pedicellis 0.1-0.3 mm) mixtis cum floribus fructibus normalibus (pedicellis 3.5-4 mm) in isdem inflorescentiis, (non omnibus floribus fructibus pedicellibus ca 6-10 mm), foliis anguste oblongis ad oblongo-lanceolatis ca 20-45 $\times$ 3.5-7 mm (non late oblanceolatis ad oblongo-ellipticis ca 8-30 $\times$ 7-14 mm), subsessilibus fructibus cum pedicellibus valde incrassatis interdum torsivis ca 1.5 mm crassis et foliorum numeris semper 4 in uno verticillo (nunquam ad 5-6).

Typus : Myanmar, Southern Shan State, Fort Stedman, 26.2.1917, *Carter, H. G.* EB337 (holo. CAL).

Allied to *G. karakulense* Pobed. but differs in having bracteate flowers throughout the inflorescence (not ebracteate in ultimate branches), few sessile to subsessile flowers and fruits with

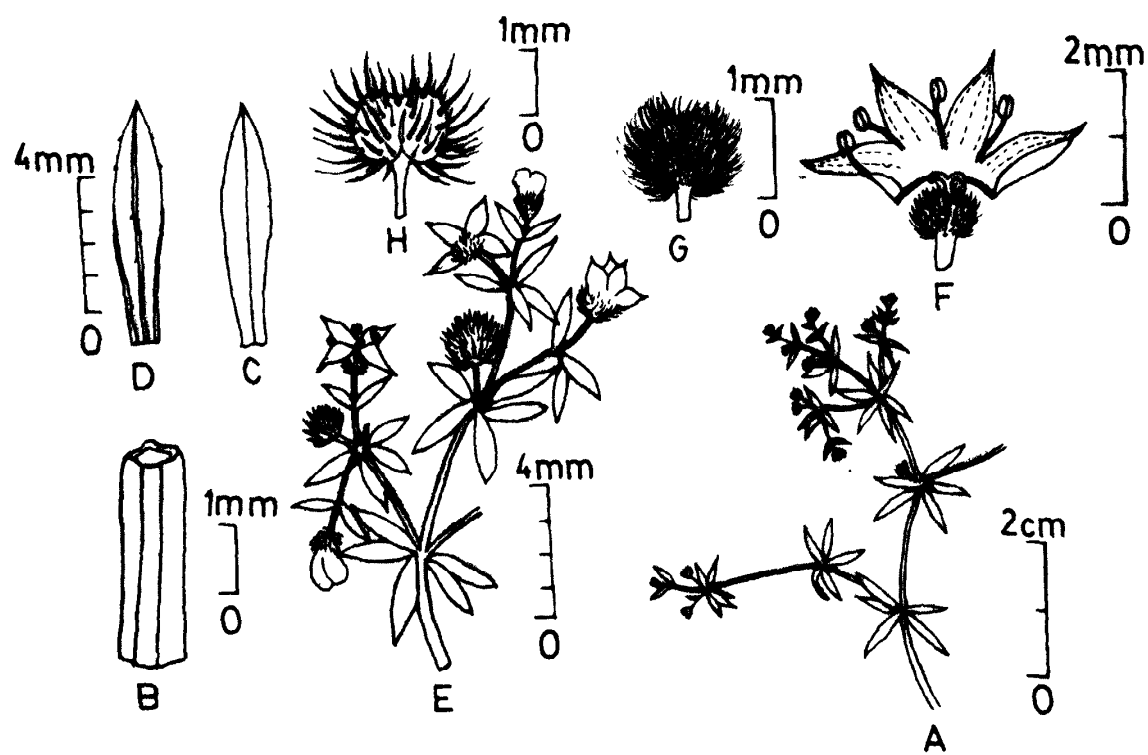


Fig. 2: *Galium duthiei* var. *glabriusculum* R. Bhattach. :

A portion of the shoot; B stem; C & D leaf upper and lower surface; E portion of the shoot with inflorescence; F flower (cut opened) showing short style; G & H mature ovary and fruit. (A- F & G Duthie, J.F. 5654; H Duthie, J.F. 3000).

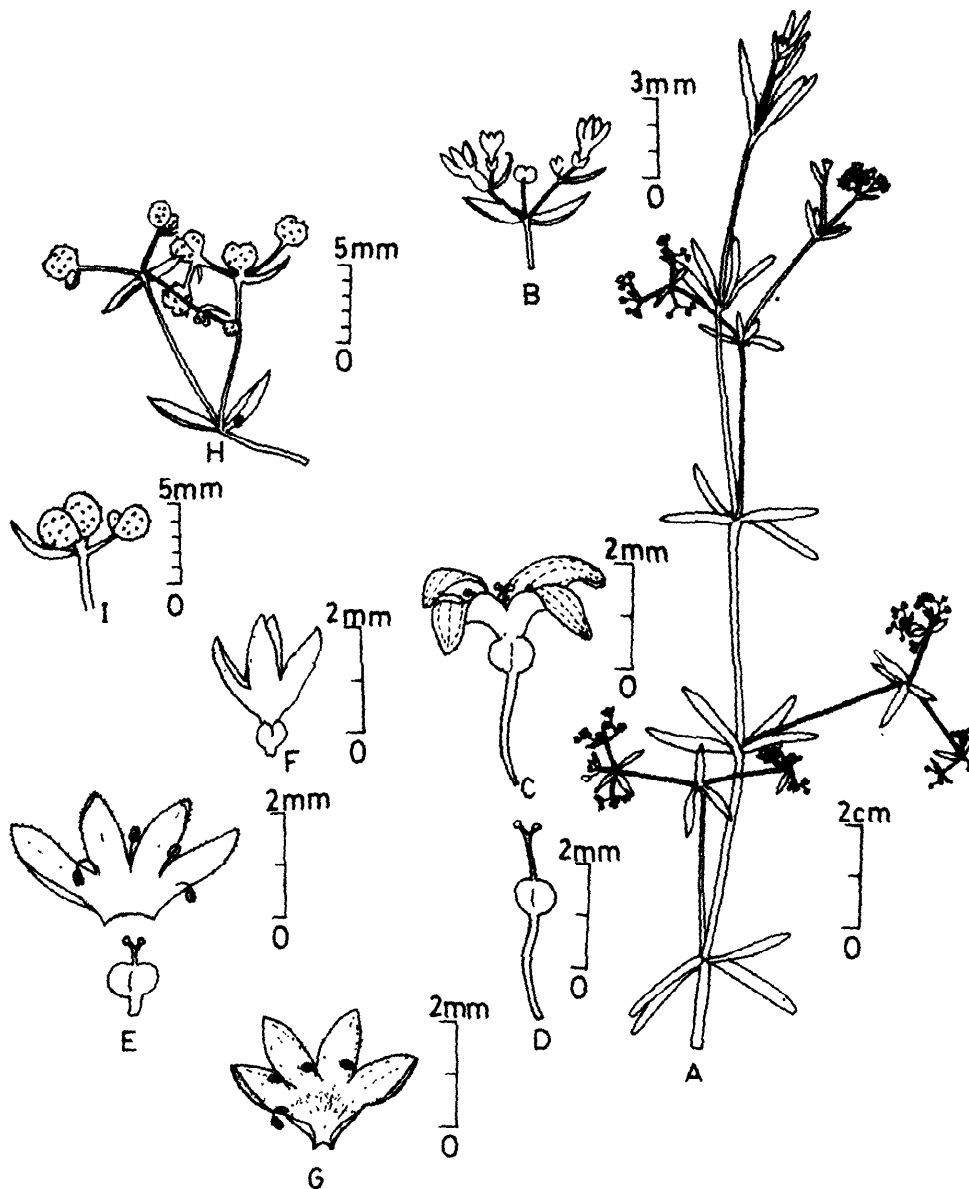


Fig. 3: *Galium shanense* R. Bhattach. :

A- portion of the shoot; B- inflorescence with sessile and pedicellate flowers; C & F- flowers; D- ovary with long style; E- flower opened showing short style; G- flower opened showing androecium; H & I- fruiting inflorescence showing sessile, subsessile and pedicellate fruits. [A, C-D & G Carter, H.G. EB337; E - Abdul Khalil s.n. (from Tangyi); B, H & F. from Abdul Khalil s.n. (from Fort Stedman)].

pedicels 0.1-0.3 mm, mixed with normal pedicellate ones with pedicels 3.5-4 mm in the same inflorescences (not all flowers and fruits pedicellate and pedicels *ca* 6-10 mm), subsessile fruits with strongly thickened sometimes twisted stalks *ca* 1.5 mm thick, leaves narrowly oblong to oblong-lanceolate *ca* 20-45 × 3.5-7 mm. (not broadly oblanceolate to oblong-elliptic *ca* 8-30 × 5-10(-14) mm and number of leaves always 4 in a whorl (never to 5-6).

Stoloniferous, ascending perennial, blackish on drying. Stems 100- 120 cm, ± stout, *ca* 1.5-2.2 mm broad, 4-angled, angles obtuse, whitish, glabrescent to minutely and sparsely spinulose to retrorsely scaberrulous, *ca* 0.02-1.5 mm; nodes pubescent; internodes 25-80 mm. Leaves 4 in a whorl, 20-45 × 3.5-7 mm, narrowly oblong to oblong-lanceolate, tough in texture; 1-nerved, nerve distinctly raised below; apex bluntly obtuse to subacute; base sessile, faintly narrowed to ± truncate; surfaces glabrous, upper surface glossy, usually with conspicuously large epidermal dots (easily seen under a × 20 lens); margin ± distinctly revolute; lower midrib and margin sparsely to densely retrorse scabrid to aculeolate, sometimes sparsely scaberrulous to spinulose *ca* 0.05-1.5 mm. Inflorescences axillary and terminal, several flowered lax cymose panicle distributed ± towards apices of the main stems; ultimate branches 5-7 (-8) flowered bracteate; peduncles (7-) 8-18 (-25) mm, faintly to densely scaberrulous to spinulose, branches horizontally divaricate, very tough at maturity; bracts 0.3- 4.5 × 0.1- 0.3 mm, oblong, oblanceolate, oblong-elliptic to linear-lanceolate sometimes filiform, 1-2 in number. Flowers 2-2.9 mm, bisexual, pedicellate with at least 1-3 sessile to subsessile flowers in each ultimate branch; sessile to subsessile flowers with pedicels 0.1-0.4 mm, distinctly thickened to 1.5 mm, sometimes twisted and non elongating in fruits, pedicellate flowers 1-3 mm elongating to 4 mm in fruits, not conspicuously thickened and twisted like subsessile fruits, stiff and horizontally divaricate at maturity. Corolla 2.5-4 mm across, white, shallowly infundibular; tube 0.55-1 mm long, *ca* 0.7-0.9 mm wide above and abruptly narrowing to 0.2-0.3 mm at base; lobes 1.4-1.7 × 0.7-0.9 mm, oblong to oblong-elliptic to broadly ovate-lanceolate, bluntly subacute to faintly apiculate, minutely puberulent on outer surface, otherwise glabrous. Filaments 0.35-0.55 mm, about 1/3rd × lobes; anthers to 0.25 mm, oblong-elliptic. Ovary 0.4-0.65 × 0.5-0.9 mm, globose to subglobose, smooth, blackish; styles heterostylous, short styles 0.25-0.3 mm with arms 0.1-0.15 mm and long styles 0.7-0.75 mm with arms 0.15-0.2 mm, blackish brown; stigma to 0.15 mm, globose, black. Mericarps 1.2-2.4 × 0.85-2.1 mm, globose to hemispherical, sometimes single by abortion, black, less matured ones spinulose, later coarsely warty to rugose, sometimes subtended by persistent bracts.

Fl. : Feb.- June. *Fr.* : Jun.- Sept. (Endemic).

Distribution and ecology : Myanmar (Shan State). Marshy and wet places; 2000-4000 m.

Specimens examined : MYANMAR : Southern Shan State, Taungyi, 1894, *Abdul Khalil s.n.* (CAL); Monay, 1896, *Abdul Khalil s.n.* (CAL); Fort Stedman, 1893, *Abdul Khalil s.n.* (CAL); 2.7.1893, *King, G. s.n.* (CAL); Inle Lake near Fort Stedman, 26.2.1917, *Annandale* 337 (CAL).

This taxon of rather isolated occurrence in the Shan State of Myanmar belongs to Sect. *Aparinoides* (Jordan) Gren.(1851). Of the 3 species of Sect. *Aparinoides* in the Indian subcontinent, *G. karakulense* Pobed. (the closest relative of *G. shanense*) occurs in the N.W. Himalayas in Kashmir and Pakistan extending further West and is related to the European *G. palustre* L. (fide Pobed., 1958). The two other species, *G. innocuum* Miq. and *G. shanense* are Eastern showing a wide disjunction in

distribution with *G. karakulense*. *G. innocuum* Miq., described from Java and Sumatra and extending to the N.E.Himalayan states of the Indian subcontinent is related to *G. trifidum* L., a species with a very wide range of distribution (Cuf. 1940). *G. shanense* on the other hand, occupying an isolated position in the S. Shan State of Myanmar shows affinity with *G. karakulense*. Puff (1974) considers *G. karakulense* Pobed., *G. trifidum* L. and the related species like *G. innocuum* Miq. and others belonging to the "*G. trifidum* group" of Sect. *Aparinoides* has a circumpolar N. Hemispheric distribution extending in the (sub) tropical mountains of C. America and S.E.Asia / New Guinea (vide Ehrend., 2005).

***Galium kaganense* R. Bhattach. sp. nov.**

(Fig. 4)

G. ceratophylloides Hook. f. (1881) affine, a quo differt inflorescentia 8-12 flora trifaria corymbiforme (non cyma simplicis 2-3-flora), caulibus multo longioribus crassibusque, 30-40 cm (non 10-16 cm), foliis longioribus ca 30-35(-40) mm (non 10-17 mm) plerumque internodii brevioribus (internodia 42-45 mm), pedunculis longioribus ca 15-25 mm (non 3-4 mm), pedicellis longioribus ca 7-8 mm (non 3-4 mm).

Typus : Pakistan: Hazara: Kagan, N. of Rawalpindi and W. of Srinagar, 9400 ft., 19.9.1896, *Inayat* 19645 (holo. CAL).

This species has affinity with *G. ceratophylloides* Hook.f. but differs in having 8-12-flowered triparous corymbiform inflorescence (not 2-3-flowered simple cyme), longer and stouter stems ca 30-40 cm (not 10-16 cm), longer leaves ca 30-35(-40) mm (not 10-17 mm) usually shorter than internodes (internodes ca 42-45 mm), longer peduncles ca 15-25 mm (not 3-4 mm), and longer pedicels ca 7-8 mm (not 3-4 mm).

Perennial, erect to ascending. Stems (10-) 25-45 cm, $\pm$ stout, ca 0.1-1.2 mm broad, 4-angled, angles obtuse, faintly grooved, usually sparsely branched near base or just above remaining unbranched upwards, almost glabrous, rarely very sparsely and minutely puberulent; hairs ca 0.05 mm on middle internodes when present, glabrous towards apices; nodes glabrous; internodes 40-45 mm on main stems, 8-12 mm on side branches. Leaves (5-) 6 in a whorl, 30-40 $\times$ 0.5-3 mm and 15-25 $\times$ 0.5-2.5 mm on side branches, l/b ratio 15-18:1, herbaceous, 1-nerved, linear-lanceolate, slightly shorter to equalling, sometimes longer than internodes; apex acute, gradually tapering into long aristate hyaline tips ca 0.5-2 mm; base attenuate, sessile, $\pm$ truncate; upper and lower surfaces glabrous; epidermal cells on upper surface scarcely distinguishable under $\times$ 20 lens; midrib $\pm$ -distinct; margin revolute to flat, midrib and margin antrorsely scaberulous, marginal hairs more towards upper side less or glabrous on lower side. Inflorescences ca 8-35 mm, axillary, (3-) 8-12 flowered, divaricately branched, triparous, corymbose cymes, ultimate branches 2-3 flowered, bracteate to ebracteate; peduncle 7-20 (-22) mm, glabrous to minutely puberulent; bracts 0.15-7 $\times$ 0.1-0.9 mm, foliaceous, subulate to linear-lanceolate, 1-3 in number. Pedicels 2-8 mm, minutely puberulent, divaricate and slightly deflexed at anthesis. Flowers 2-2.4 mm, bisexual. Corolla 2.2-3.5 mm across, widely campanulate, brownish on dry specimens; lobes 1.7-2.2 $\times$ 0.5-0.8 mm (incl.apiculæ), narrowly oblong-lanceolate to ovate-lanceolate, puberulent on outer surface and margin, glabrous on inner surface, conspicuously apiculate; apiculus 0.8-1 mm, inflexed, densely pubescent, lobe and apiculus ratio 3:2; tube 0.4-0.5 mm. Filaments 0.4-0.55 mm, ca 1/4 $\times$ lobes; anthers 0.2-0.25 mm, oblong-ovoid. Ovary 0.3-0.65 $\times$ 0.5-0.7 mm, subglobose, blackish-brown, glabrous; styles heterostylous, short styles 0.05-0.15 mm with arms 0.15-0.2 mm and

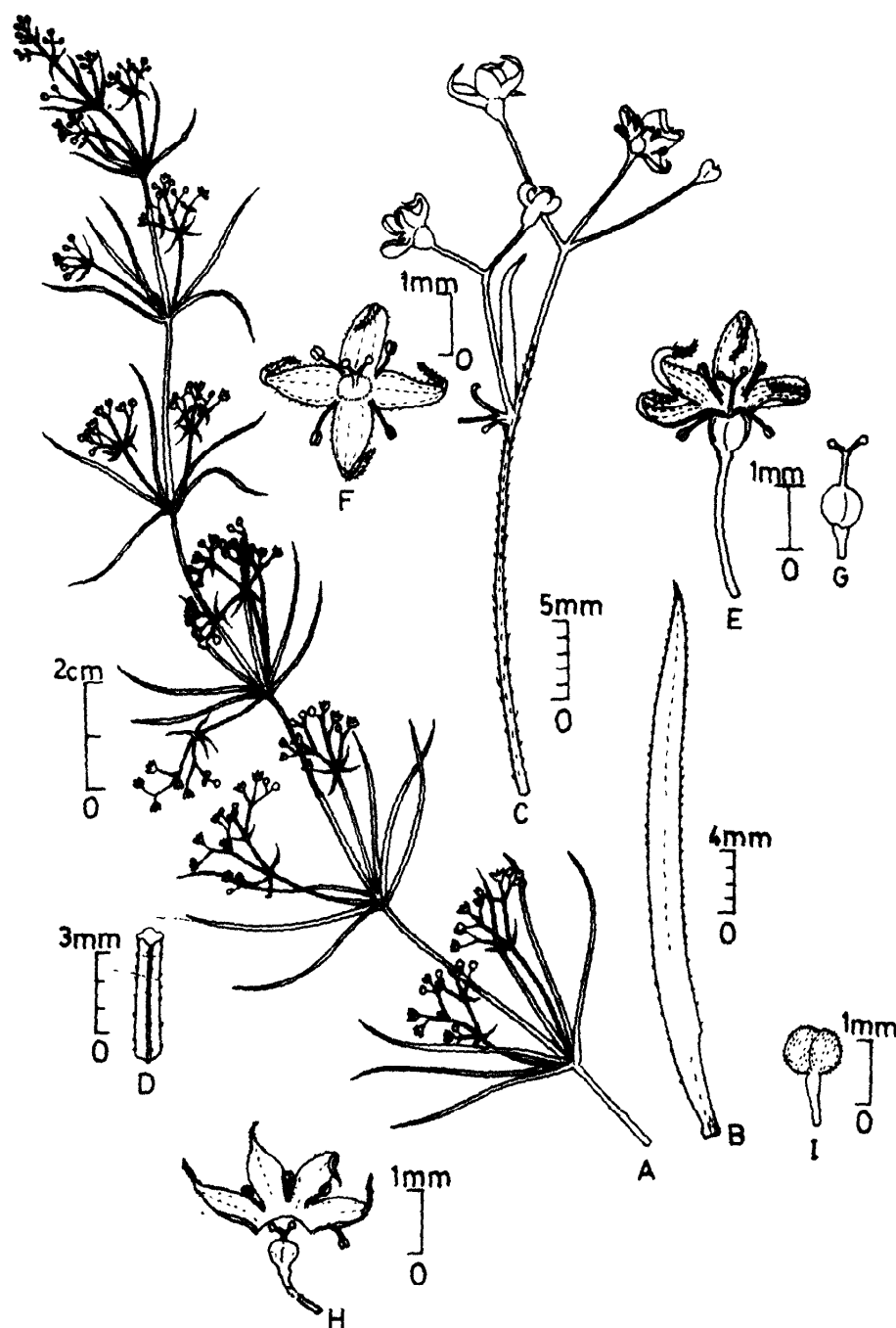


Fig. 4. : *Galium kaganense* R. Bhattach. :

A- portion of the shoot; B- leaf; C- portion of inflorescence; D- stem; E & H- flowers opened showing long and short styles; F- flower (top view); G- ovary with long style; I- fruit. (A- F, G & I *Inayat* 19645; H *Inayat s.n.*).

long styles 0.25-0.3 mm with arms 0.15-0.2 mm, blackish brown; stigma 0.1-0.12 mm, globose, black. Mericarps 0.65-0.75 × 0.35-0.4 mm, blackish-brown, hemispheroid, faintly reniform, glabrous to faintly spinulose.

Fl. : Sept. *Fr.* : Sept.- Oct. (Endemic).

Distribution and Ecology : Pakistan : Hazara (Kagan valley). In moist places; ca 3130 m.

Other specimen examined : PAKISTAN : Hazara, Chapri, Kagan, 26.9.1899, *Inayat s.n.* Acc. No. 216745 of CNH (CAL).

This new species is closely related to *G. ceratophylloides* Hook. f., (1881) from Kashmir (Poonch) in several correlated characters e.g. leaves linear-lanceolate with long hyaline-aristate tips, internodes ± equalling, wide campanulate to rotate corolla and lobes with long acuminate-apiculate ca × 1/2 as long. Recently Nazimuddin and Qaiser (1989) in Fl. Pakistan described *G. ceratophylloides* from Pakistan (no specimens available for comparison) and considered it as annual. *G. ceratophylloides* is a little known species known only from the type (about 22 gatherings in the single sheet). Hooker f. described the species as perennial with a query mark. Close observation of the type gatherings shows remnants of root-stock leaving no doubt about its perennial habit. Description of *G. kaganense* is based on two sheets; in one there is no sign of roots but in the other, *Inayat sn.* from Chapri, Kagan valley, distinct rhizomatous rootstock is found. On analyzing the sectional as well as the species characters from Flora Iranica (Ehrend. & Schonb.-Tem., 2005), the sectional position of *G. kaganense* and its closest ally *G. ceratophylloides* is considered to belong to the "*G. rivale group*" Sect. *Trachygalium* of Near East, extending eastward to Pakistan.

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सार संक्षेप

भारतीय उपमहाद्वीप से तीन नई जातियां व एक नई किश्म चित्र सहित वर्णित है । इनमें से जी. डथई व जी. डथई किश्म ग्लैबरियसकुलुम भारत के उत्तरांचल व पश्चिम नेपाल के निकटवर्ती क्षेत्रों में पाई जाती है । जी. केगनेनसी व जी. सेनेनसी क्रमशः पाकिस्तान व मायनमार में पाई जाती है। श्रेणियों के संबंधों पर चर्चा की गई है।