

Recollection of two species of Crane`s Bill (*Geraniaceae*) after more than 100 years from India

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Abstract: Recent field explorations in the Jammu & Kashmir state of India, one of the biodiversity-rich and ecologically significant mountainous regions within the Himalayan biodiversity hotspot, have led to the recollection of *Geranium molle* L. and *G. rectum* Trautv., after more than a century since their last collection. The recollection of these rare species of *Geranium* is discussed in the context of botanical exploration in the region. Detailed descriptions are provided along with illustrations, field photographs, microscopic images, notes on taxonomy, distribution and comparison with allied species.

Key words: *Geranium*, Indus River, Kashmir Himalaya, Thomas Thomson

Introduction

The genus *Geranium* L., commonly known as Crane`s bill, consists of 307 species occurring mainly in the temperate and tropical alpine regions worldwide (Aedo, 2017, 2023). After Wallich`s enumeration (1828), the first systematic documentation of Indian *Geranium* is available in the *Flora of British India* (Edgeworth & Hooker, 1874), which reported 18 species, 17 of which occur within the present-day political boundaries of India. Over the past four decades, numerous new taxa have been identified in India (Yeo, 1984; Wagh & Hurrah, 2020; Hurrah & Wagh, 2020, 2021; Hurrah *et al.*, 2022 a, b) and about 32 species of *Geranium* are currently known to occur in

India (Lindley, 1840; Edgeworth & Hooker, 1875; Knuth, 1923; Malhotra, 1997; Wagh *et al.*, 2015), with their distribution primarily concentrated in the Himalayan region, although a few species are also found in tropical hills (Hurrah *et al.*, 2023).

During a recent plant exploration in Jammu & Kashmir, the first author collected many specimens of different *Geranium* species. The subsequent critical study and comparison, based on living and herbarium material (CAL, DD, LWG), a perusal of the relevant literature (Linneaus, 1753; Trautvetter, 1860; Edgworth & Hooker, 1874; Knuth, 1912; Nasir, 1983; Xu & Aedo, 2008), and verification with digital images of authentic specimens deposited in various herbaria (E, G, K, L, LE, LINN, MA, NY), confirmed the identity of the material as *Geranium molle* L. and *G. rectum* Trautv. In India, both the species are reported from the states of Himachal Pradesh, Jammu & Kashmir & Uttarakhand. However, published literature and herbarium data suggests that although these species were mentioned in the recent regional studies (Atkinson, 1882; Duthie, 1906; Blatter, 1928; Sharma & Kachroo, 1981; Chowdhery & Wadhwa, 1984; Malhotra, 1997; Pusalkar & Srivastava, 2018), the records are based on century old collections.

A review of all data available in the public domain and specimens from various herbaria revealed that the last collection of *G. molle* from Jammu &

Kashmir and Uttarakhand dates back to before 1874 (K), while *G. rectum* was last collected from Ganderbal, Sind Valley, in 1891 (CAL). This minimal representation from India may be attributed to the rarity of these species, as both inhabit specific ecological niches. The limited availability of suitable habitats likely results in low occupancy or restricted distribution.

The present collection of these taxa from the Kashmir Himalaya represents the first authentic record after a gap of more than 100 years. As these species have never been fully described or illustrated from India, a detailed description is provided below, along with field photographs, microscopic images, illustrations, habitat information, and notes on their taxonomy, distribution, and comparison with allied species.

Material & Methods

Materials of *Geranium molle* and *G. rectum* were collected during floristic explorations in the Baramulla and Ganderbal districts of Jammu & Kashmir state in August 2023. All collections were processed following the standard herbarium preparation method (Jain & Rao, 1977), mounted on sheets for future reference, and deposited at the LWG herbarium. Specimens were critically studied under a stereomicroscope (Leica S8APO) equipped with a Leica Microsystems 120 HD camera. The identifications were confirmed by referring to the protologue and relevant literature (Linnaeus, 1753; Trautvetter, 1860; Edgworth & Hooker, 1874; Knuth, 1912; Nasir, 1983; Xu & Aedo, 2008). The type collections were examined through high-resolution digital images accessed online from K and LE herbaria (acronyms according to Thiers, 2024). The coordinates of the plant species locations were recorded using a global positioning system (GPS) device (Garmin Montana 680).

Taxonomic treatment

***Geranium molle* L.**, Sp. Pl. 2: 682. 1753. *Lectotype* (designated by Carolin, 1965: 332–333): *Geranium omnium villosissimum* in Vaillant, Bot. Paris.,

79, tab. 15, fig. 3-3a. 1727. *Epitype* (designated by Aedo 2023): SPAIN, **Madrid**, San Martín de Valdeiglesias, puente de San Juan, 4°23'W, 40°21'N, 01.04.1995, C. Aedo 3428 (MA [MA-552956 digital image!]).

Figs. 1–3

Annual herbs. Rootstocks 3–5 mm diam.; roots simple, thin, not rhizomatous. Stems up to 40 cm long, weak, trailing, ascending or erect, with pilose hairs, eglandular, 0.2–1.2 mm long, sometime upper part with very short glandular hairs. Stipules ovate–lanceolate, c. 2.0–5.0 × 1.0–3.5 mm, free, sometimes connate either at base or throughout the length, adaxially glabrous, abaxially pubescent, 0.15–1.2 mm long eglandular hairs along the margins. Petioles up to 10 cm long with short stiff hairs, c. 1 mm long, pilose, hairs eglandular, sometimes with short glandular hairs. Basal leaves few in a persistent rosette, cauline leaves alternate except a few lower leaves opposite; lamina globular–reniform, 1.25–2.5 × 1.6–3.0 cm, palmatipartite, ratio of main sinus length/middle segment length; segments 5–9, middle segment 1.5–4 mm wide at base, obtusate–obtriangular, margins incised, ratio of second sinus length/middle segment length 0.19–0.26; lobes 3–5(–6) in distal half, linear, longer than broad or as long as broad, acute or obtuse at apex occasionally round; hairs eglandular, sericeous on both surfaces, appressed prominently along the veins on abaxial surface. Cymes monochasial; cymules solitary with two flowers; peduncle 0.5–3.0 cm long, with short hairs, eglandular 0.1–0.4 mm long, pilose hairs c. 1.7 mm long; bracteoles ovate, 0.6–0.7 × 0.3–0.6 mm, adaxially glabrous, abaxially with c. 0.1–0.4 mm long, eglandular hairs; pedicels 0.5–2.5 cm long, with indumentum similar to peduncles. Flowers 2 per cymule, actinomorphic. Sepal 5, ovate-elliptic, 1.8–4.3 × 1.1–1.9 mm, mucronate, mucro c. 0.3 mm, margins ciliate, adaxially glabrous, abaxially with short hairs, eglandular 0.1–0.5 mm long, pilose hairs 1.2–1.9 mm long and very short glandular hairs. Petals obcordate, 1.7–3.0 × 1.3–1.5 mm, pink, deeply emarginate, notch 0.3–0.9 mm deep, sometimes clawed 0.2–0.5 mm

long, glabrous, basal margin with 0.2–0.45 mm long cilia above the claw. Stamens 10 in 2 whorls; filaments lanceolate, gradually tapering into narrow apex, glabrous, margins rarely with cilia; anthers blue, 0.3–0.5 × 0.3–0.6 mm. Nectaries glabrous. Fruits 8.5–10 mm; mericarps *c.* 1.7–2 × 1–2 mm, obliquely wrinkled (rugose), glabrous; rostrum 4.5–5.2 mm long, puberulent, glandular & eglandular hairy; narrow apex 0.7–0.9 mm; stigmatic remains up to 1.0 mm.

Flowering & Fruiting: Flowering from July to August and fruiting from August to September.

Habitat & ecology: *Geranium molle* prefers to grow in lower altitude of Northwest temperate Himalaya along stream banks, under tree canopies, road sides or gentle slopes mostly between 1200–1600 m a.s.l.

Distribution: This species ranges from Europe and northern Africa to Western Himalayas, and it is introduced in Southwestern Canada, U.S.A., southern South America, South Africa, Hawaii, Taiwan, Australia and New Zealand.

Specimen examined: ARGENTINA, **Buenos Aires**, Sierra de la Ventana, Cerro Ventana, 28.12.1978, *Proyecto Ventania* 349 (NY digital image!). AZERBAIJAN, **Absheron**, Baku, distr. Saljany, Sttepa Mil inter Karadanly et tumulum Boz-Tapa, 15.04.1928, *Prilipko s.n.* (LE digital image!). LEBANON, **Bzoumar, near Jounie**, 3000 ft., 16.04.1959, *Polunin, Vladimir* (E [E0033097 digital image!]). LIBYA, **Jabal al Akhdar**, Jebel Akhdar, near Slonta, 1939, *Sandwith* 2285 (K [K004315349 digital image!]). GERMANY, **Hannoveræ**, *Ehrhart, Friedrich* LINN-HS1147-29-3 (LINN digital image!). INDIA, **Jammu & Kashmir**, Baramullah,

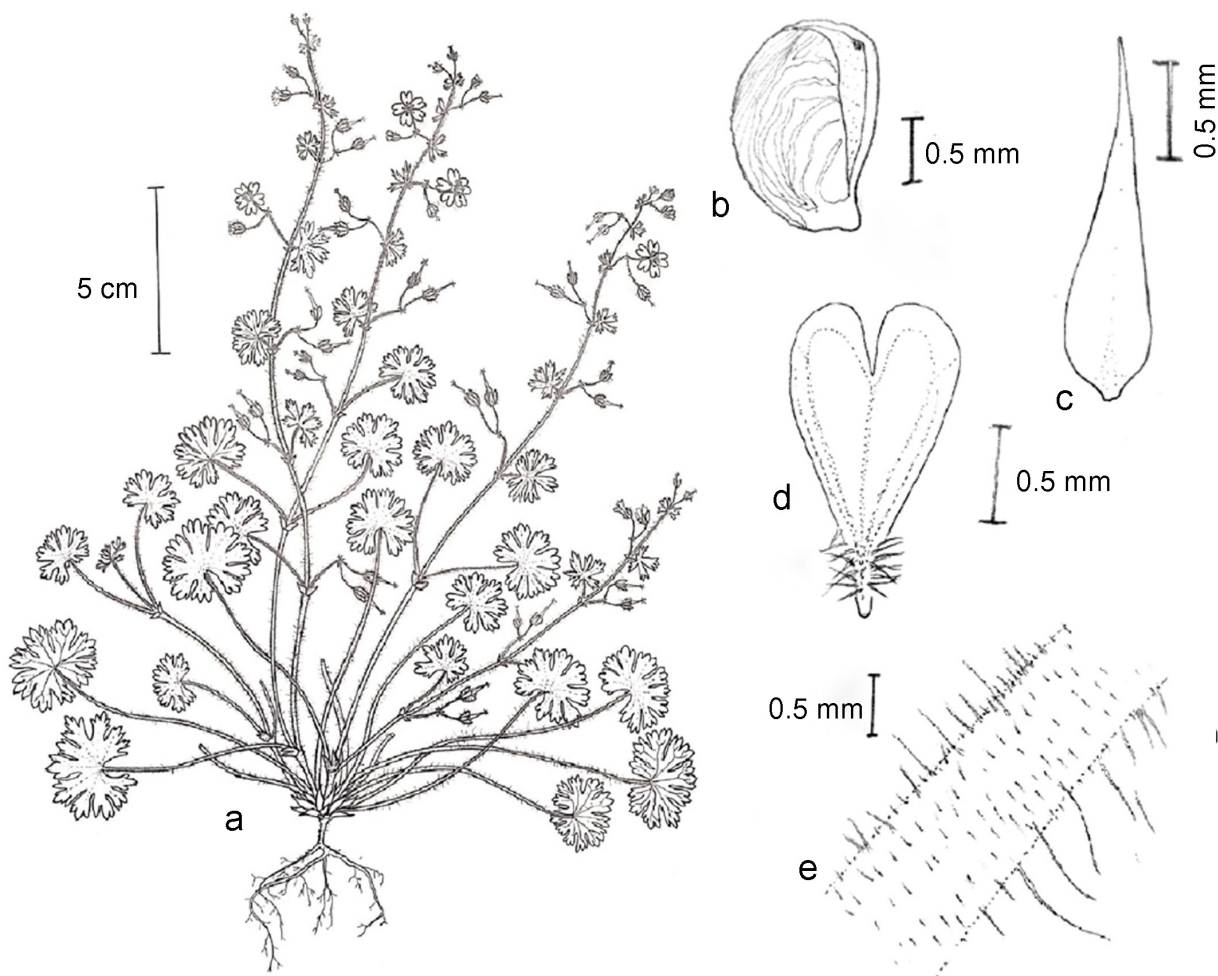


Fig. 1. *Geranium molle* L.: a. Habit; b. Mericarp; c. Staminal filament; d. Petal; e. Stem indumentum illustrations (drawn by M. Ahmad).

Azad gunj, along the bank of River Jhelum, 34.2089N, 74.3482E, 1601 m, 18.07.2023, I.A. Hurrah 343575, 343576 (LWG). JORDAN, **Jerash**, 530 m, 03.05.1911, Meyers, Fred S. & Dinsmore, J.E. s.n. (E [E00330982 digital image!]). PORTUGAL, **Madeira**, ribeira da Fonte do Louro, 32°47'N, 16°55'W, 31.08.2003, Aedo 9703 (MA [MA-704761 digital image!]); **Minho**, pr. Monçao, 42°4'N, 8°28'W, 20.04.2008, Aedo 15581 (MA [MA-768555 digital image!]). SAUDI ARABIA, **Jabal Ibrahim**, off the Taif Abha road, 7000 ft. 19.04.1982, Collette

Iris Sheila s.n.(E [E00331349 digital image!]). SPAIN, **Madrid**, San Martín de Valdeiglesias, puente de San Juan, 40°21'N, 4°23'W, 01.04.1995, C. Aedo 3428 (MA [MA-552956 digital image!]).

Notes: *Geranium molle* belongs to sect. *Batrachoida* W.D.J. Koch under subg. *Robertium* (Picard) Rouy. It is characterised with alternate cauline leaves, rugose and glabrous mericarps and emarginate petals, distinguishing it from its close akin *G. pusillum* L. and *G. pyrenaicum* Burm.f. Globally, it



Fig. 2. *Geranium molle* L.: **a, b & c.** Habit; **d.** Roots; **e.** Inflorescence; **f.** Flower; **g.** Fruits. (photos by I.A. Hurrah).

is distributed in Africa, Australia, China, Europe, India, Kazakhstan, Kyrgyzstan, Macaronesia, New Zealand, North America, Russia, South America, Tajikistan, Turkmenistan, Uzbekistan and is also reported from Japan, sub-Antarctic and the north-central Pacific Islands (Knuth, 1912; Aedo *et al.*, 1998).

In India it occurs in the western Himalayas, extending up to Himachal Pradesh (Aedo *et al.*, 1998). Edgeworth & Hooker (1874) were the first to report this species in India, based on collections by *T. Thomson* (Kishtwar, Kashmir) & *E. Madden* (Kumaon). Subsequently, the species has been routinely cited in various floristic works related to

Indian Himalaya region (Atkinson, 1882; Blatter, 1928; Stewart, 1972; Chowdhery & Wadhwa, 1984; Sharma & Kachroo, 1981; Malhotra, 1997; Duthie, 1906; Pusalkar & Srivastava, 2018). However, none of these works cited independent collections, relying instead on Hooker's (1874) documentation or the collections of Hooker's collaborators, *T. Thomson* and *E. Madden*.

Stewart (1972) mentioned *G. molle*, but his records were based on Falconer's 1860s collection. Notably, this species has minimal representation in Indian and international herbaria, with the primary specimen being housed at the Kew Herbarium (K). This herbarium sheet contains three specimens:

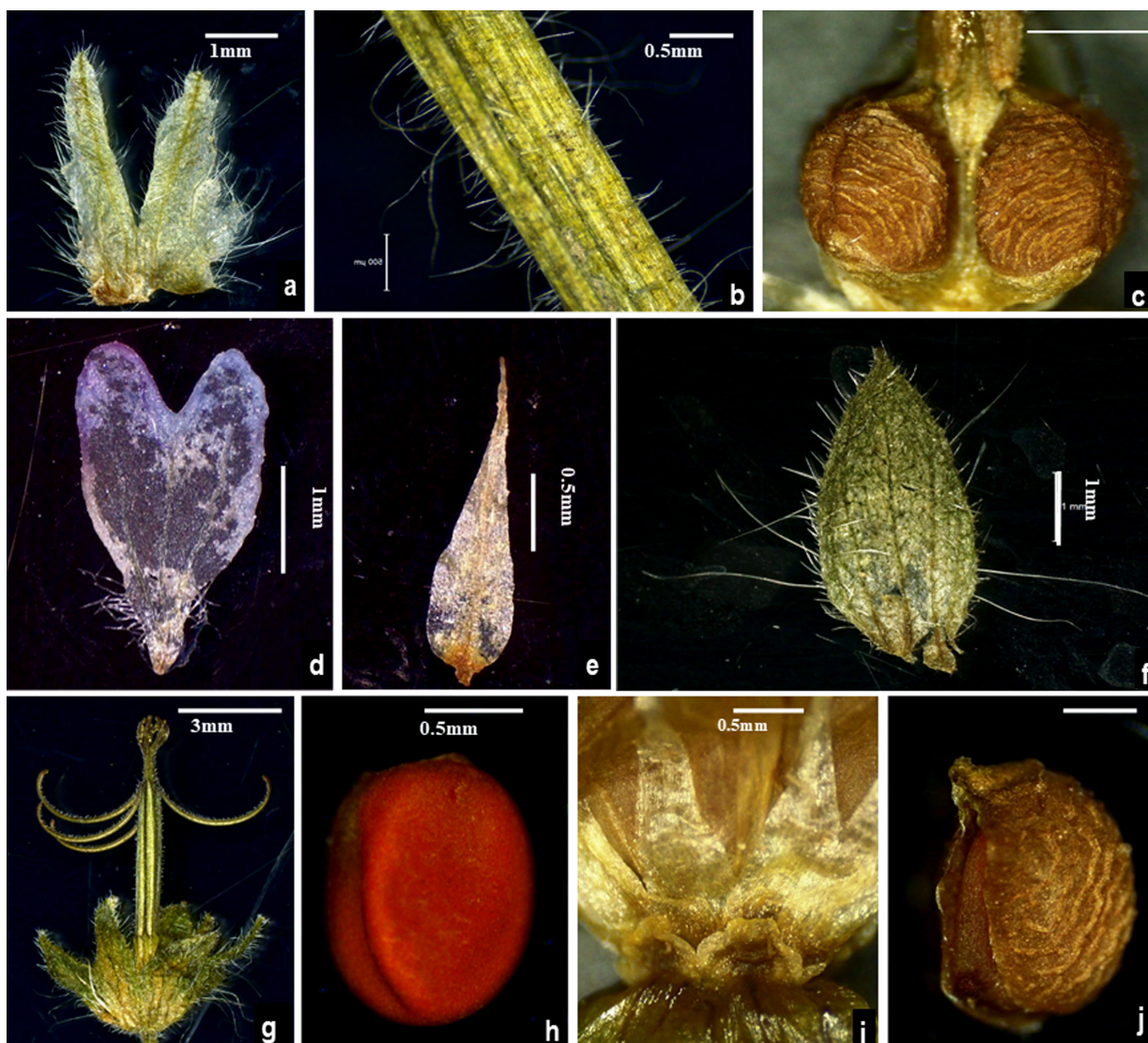


Fig. 3. *Geranium molle* L.: **a.** Stipules; **b.** Pilose eglandular hair on stem; **c.** Mericarps attached to the columella; **d.** Petal; **e.** Staminal filament; **f.** Sepal; **g.** Fruit; **h.** Seed; **i.** Nectaries; **j.** Mericarp with seed (from *I.A. Hurrah* 343575, 343576; photos by M. Ahmad & I.A. Hurrah).

one collected by C.B. Clarke and two presumably by E. Madden. Aedo (2023) misattributed Clarke's collection to *G. molle*, which is actually *G. ocellatum* (characterized by fruits 13–17 mm long, a twisted rostrum, and glabrous mericarps with more than eight shallow ridges).

Madden's collections include one specimen marked with a single "x," identified as *G. rotundifolium* (fruit length 15–18 mm, a narrowed apex ~3 mm long, smooth and hairy mericarps, and reticulate seed sculpturing), and another marked with a double "xx," which appears to be *G. molle* (fruit ≤10 mm long with a 1–2 mm long narrowed apex, rugose and glabrous mericarps). However, the date of collection for Madden's *G. molle* specimen is not recorded. The herbarium sheet bears J.D. Hooker's handwritten notes, aligning with information in the *Flora of British India*, indicating that the material was collected before 1874.

It is inferred that the last verified collection of *G. molle* dates back to the 19th century, from T. Thomson and E. Madden's collections, nearly 149 years ago. The present collection was made from Azad Gunj, Baramulla, Kashmir, along the banks of the River Jhelum. The species primarily inhabits low-altitude areas (1200–1600 m a.s.l.), thriving along stream banks, under tree canopies, roadsides, or gentle slopes.

Geranium rectum Trautv., Bull. Soc. Imp. Naturalistes Moscou. 33(1): 459. 1860. *Lectotype* (designated by Novoselova 1996: 87): KAZAKHSTAN, **Alatau**, Baskan, 46°14'N, 78°56'E, 29 June 1840, A. Schrenk s.n. (LE [LE01304214 digital image!], isolecto K [K-729476 digital image!]).

Figs. 4–6

Perennial, herbs. Root stocks elongated, 8–10 mm diam.; roots vertical, woody, rough, thickened not rhizomatous. Stems 30–60 cm long, sparsely pubescent with 0.1–0.5 mm long, retrorse, shiny, eglandular hair and sparingly 0.4–1 mm glandular hairs. Stipules lanceolate-subulate, 5–12 × 1.4–3.1 mm, papery, distinct, acuminate at apex, margins with c. 0.2 mm long cilia, abaxial surface with

short, antrorse, eglandular hairs and sparsely c. 1.5 mm long, glandular hairs, adaxial surface glabrous. Petioles up to 10 cm long, with 0.2–0.5 mm long, retrorse, eglandular hairs, sparingly glandular hairs. Basal leaves deciduous, cauline leaves opposite; lamina pentagonal, 3.0–6.2 × 3.8–7.5 cm, palmatipartite, ratio of main sinus length/middle segment length 0.50–0.65; segments 3–5, middle segment 5–9 mm wide at the base, trullate-rhombic, margins deeply incised, ratio of second sinus length / middle segment length; lobes 7–18 in distal half, as long as broad, acute; hairs sericeous, eglandular 0.2–0.5 mm long on adaxial surface, prominently along with veins on abaxial surface. Cymes dichasial with monochasial branches; cymules solitary with two flowers; peduncle 4.2–7.8 cm with 0.1–0.3 mm uncinata, retrorse, eglandular and 9–11 mm long glandular hairy; bracteoles lanceolate, 2.6–4.3 mm long, ciliate along margins, cilia 0.1–0.2 mm long, adaxial surface sparsely hairy, abaxial surface sometime glandular hairy, hairs 0.9–1.2 mm long; pedicels 2–5 cm long, retrorse, uncinata eglandular hairy, hairs 0.21–0.38 mm long. Flowers 2 per cymule, actinomorphic. Sepals elliptic-lanceolate or oblong, 6–9 × 2.3–3.4 mm long, mucronate, mucro 1.2–1.7 mm long bear eglandular, glandular hairs and a mesh of hairs on inner side at the base, margins ciliate, adaxial surface glabrous, abaxial surface pubescent with 0.13–0.40 mm long eglandular hairs and 1.3–2.1 mm long dense glandular hairs. Petals wedge-shaped, 11–17 × 6.5–10.2 mm, light-dark pink, 5-veined, round or shallow wide notched or sometime flat apex, tapering towards base, both surface glabrous except base with ciliate margins and sparsely eglandular hairy at adaxial base. Stamens 10 in two whorls; filaments lanceolate-nearly linear, 5–7.1 × 0.6–0.9 mm, slightly dilated base, gradually tapering towards apex, adaxially glabrous, abaxial surface glabrous-sparsely hairy, 0.1–0.4 mm long cilia along the margins upto one-half length in inner whorl and upto dilated part in outer whorl; anthers pale indigo, 1.3–1.5

mm. Nectaries glabrous. Fruit 25–30 mm long; mericarps 3.8–4.0 mm long, surface smooth with 0.2–0.5 mm long eglandular hairs and a few *c.* 1.5 mm long glandular hairs at apex; rostrum 16–8 mm long with 0.16–0.30 mm long eglandular hairs and few *c.* 1.5 mm long glandular hairs at lower portion; awn hairy at inner surfaces; apex narrow, 3.3–3.6 mm long; stigmatic remains *c.* 3.5 mm long.

Flowering & Fruiting: Flowering from July to August and fruiting from August to September.

Habitat & ecology: This species thrives in treeline ecotones along north-facing slopes of mountains, growing in loamy soil under the canopies of *Abies pindrow* (Royle ex D.Don) Royle, *Betula utilis* D.Don, *Cedrus deodara* (Roxb. ex D.Don) G.Don, and *Pinus wallichiana* A.B. Jackson. It is found at elevations of 2900–3000 m a.s.l.

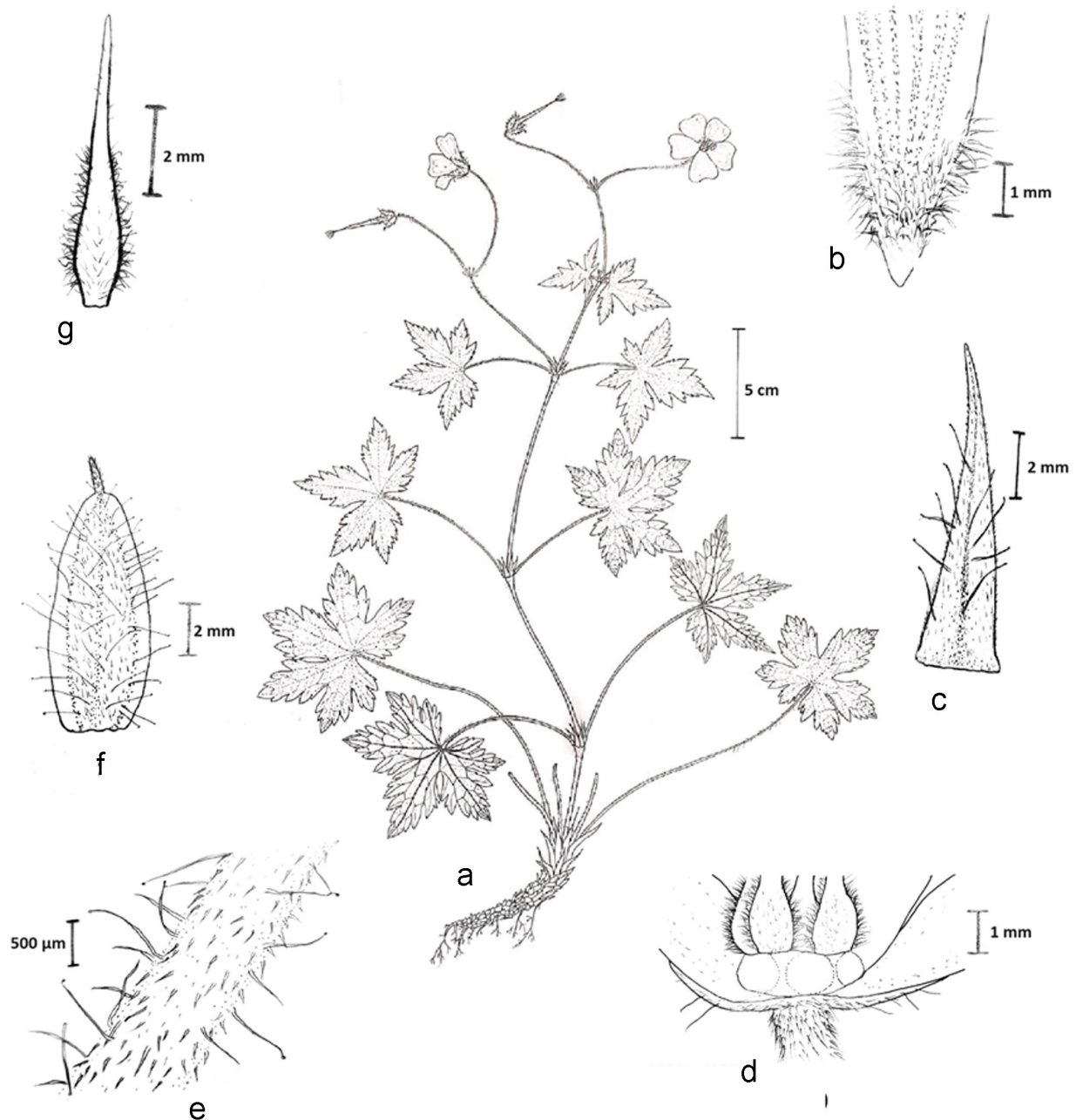


Fig. 4. *Geranium rectum* Trautv.: a. Habit; b. Petal adaxial base; c. Stipule; d. Nectaries; e. Stem indumentum; f. Sepal; g. Staminal filament illustrations (drawn by M. Ahmad).

Distribution: This species ranges from India to Kazakhstan through Northwestern China, Pakistan, Uzbekistan and Kyrgyzstan.

Specimen examined: KAZAKHSTAN, **Songarei**, 1867, *A.G. von Schrenk s.n.* (G, K [K000729476 digital image!]). INDIA, Himalaya Borealis Occidentalis, *s.d.*, *T. Thomson s.n.* (K [K004316409, K004316403 digital image!]); **Jammu & Kashmir**, Ganderbal, Baltal, Amarnath base camp, 34.253N, 75.414E, 2929 m, 25.07.2023, *I.A. Hurrah* 343584, 343585,

343586 (LWG); **Sind Valley**, Sonmarg, near Tajwas nallah, 18.08.1893, *J.F. Duthie* 13630 (DD, CAL); **Siran Valley**, Hazara, 03.07.1896, *Inayat* 19266 (DD); near Gurez, 07.09.1892, *J.F. Duthie s.n.* (DD); Kargah Valley, 30.08.1893, *J.F. Duthie* 13895 (DD, CAL); Sind Valley near Baltal, 18.08.1892, *J.F. Duthie* 11602 (CAL, DD); Kargah Valley, Tilail, 30.08.1893, *J.F. Duthie* 13895 (CAL); 09.1874, *C.B. Clarke* 24251 (CAL); Sonmarg, 10.08.1913, *Capt. F.E. Koebel* 83 (CAL); Sind valley, Ganderbal, 25.07.1891, *G.A. Gammie s.n.* (CAL).

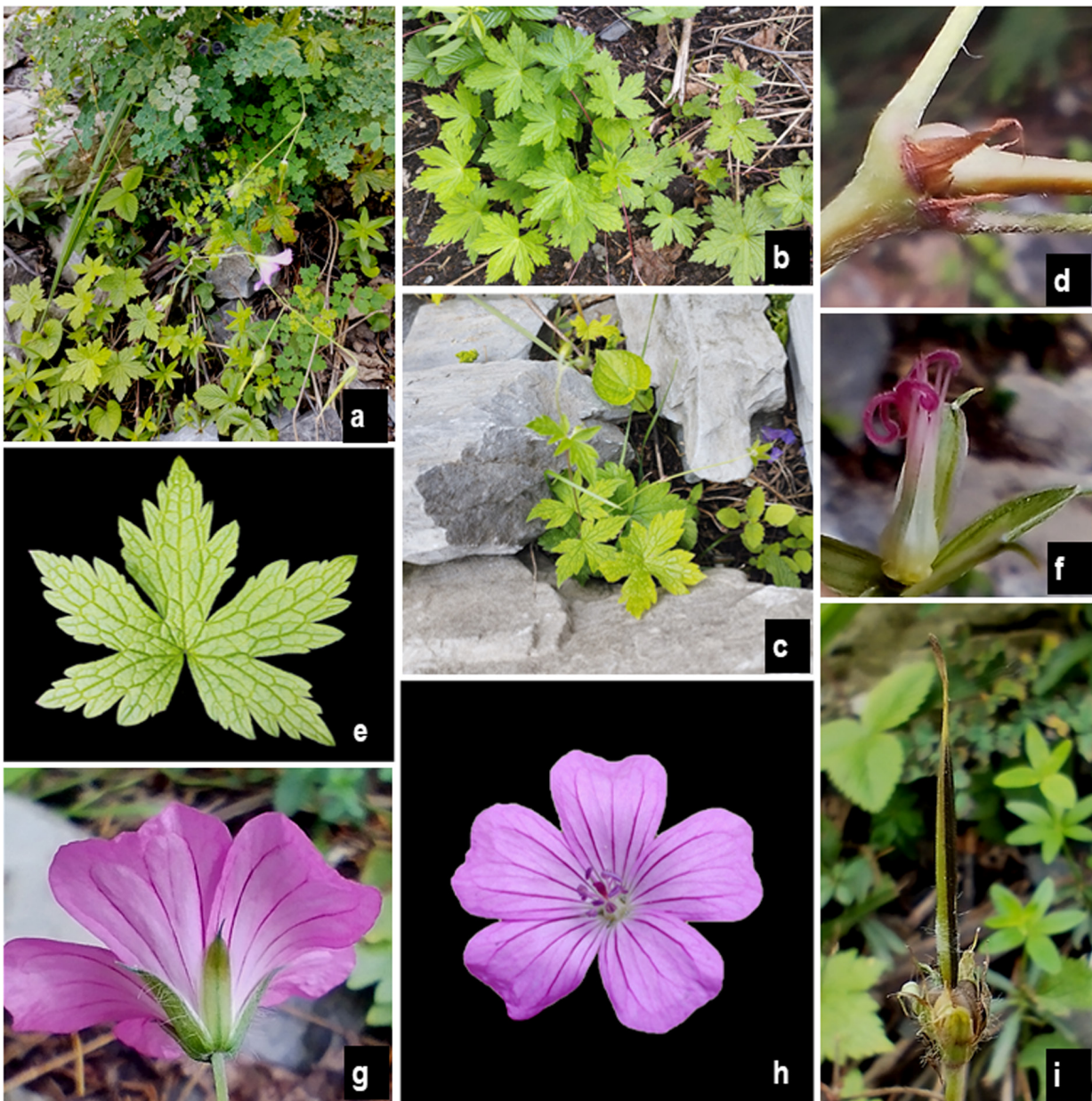


Fig. 5. *Geranium rectum* Trautv.: **a.** Habitat; **b & c.** Habit; **d.** Stipules; **e.** Leaf; **f.** Androecium & glabrous nectaries; **g.** Ventral side of flower; **h.** Dorsal side of flower; **i.** Fruit (photos by I.A. Hurrah).

Notes: *Geranium rectum* is native to Northwest China (Dzungaria~Soongaria), Kazakistan, Uzbekistan, Kyrgyzstan, Pakistan and India (Trautvetter, 1860; Edgworth & Hooker, 1874; Nasir, 1983; Xu & Aedo, 2008). It differentiates from its allied taxa *G. nodosum* L. and *G. versicolor* L. by its leaves with 5–7 rhombic-trullate segments, petals with a hairy adaxial base and a flat or shallowly notched apex, and short staminal filaments short that are glabrous to sparsely pilose at the abaxial base.

In the Himalayas, *G. rectum* is often confused with *G. rubifolium* Lindl. & *G. wallichianum* D. Don ex Sweet. However, it differs by its sparsely leafy habitat with eglandular, scanty and appressed hairs; leaves with 5–7 segments; staminal filaments that are lanceolate to nearly linear; glabrous nectaries, and glandular hairs that are scanty but long with a narrow apical cell.

In India this species is poorly represented in both literature and herbaria. The earliest report is that of Edgworth & Hooker (1874), based on



Fig. 6. *Geranium rectum* Trautv.: **a.** Stipules; **b.** Stipules with few glandular hairs; **c.** Petiole hairs; **d.** Bracteoles; **e.** Glandular & eglandular hairs on pedicel; **f.** Petal adaxial base hair; **g.** Bud hair; **h.** Flowering bud; **i.** Sepal; **j.** Staminal filament (s.f.); **k.** Abaxial base of s.f.; **l.** Glabrous nectaries; **m.** Mericarp (from I.A. Hurrah 343584, 343585; photos by M. Ahmad & I.A. Hurrah).

collections by Falconar (declared doubtful by the authors themselves) and *T. Thomson* from Baltal Kashmir. Subsequent mentions, such as those by Blatter (1928), Stewart (1972), Chowdhery and Wadhwa (1984), and Malhotra (1997), rely heavily on the *Flora of British India* records, and the cited specimens are not accessible in the referenced herbaria.

Several taxonomists have questioned the presence of *G. rectum* in the Indian Himalayas. Falconer's specimen (Falconer 324, P-05124324) was misidentified as *G. rectum* and is actually *G. rubifolium*. Additionally, T. Thomson's specimen may have been inaccessible to them. However, after communicating with the Royal Botanic Gardens, Kew, we obtained T. Thomson's specimens from the Western Himalayas, as cited by Edgeworth & Hooker (1874). Furthermore, the specimens collected by the authors from hill slopes along the Indus River at Baltal, the precise locality mentioned in the FBI, confirm the presence of *G. rectum*.

Regional herbarium consultations reveal its extended occurrence in Gurez, Kargah, and Ganderbal areas of Jammu & Kashmir (see Specimens Examined section). The last traced collection of *G. rectum* was made by Capt. E.F. Koebel from Sonamarg, Kashmir, in 1910. Additionally, specimens collected by Rich., cited by Stewart, though not located, were likely collected on or before 1918 (Stewart, 1972). Consequently, our collection from Baltal represents the first confirmed recollection of *G. rectum* from the Indian Himalayas after more than 100 years.

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