



भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

FASCICLES OF FLORA OF INDIA

FASCICLE 23

Alliaceae
Liliaceae
Trilliaceae
Uvulariaceae

Edited by
N.P. Singh
M. Sanjappa

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OF
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N.P. Singh
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with assistance of
G.V.S. Murthy
P. Singh



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(Photos : Courtesy Northern Circle, BSI, Dehra Dun)



ALLIACEAE

J. Agardh., *Theoria Syst. Pl.* 32. 1858 (*nom. cons.*)

Syamali Dasgupta*

Herbs, perennial, bulbous or rhizomatous, often strongly smelling. Leaves radical or cauline, filiform, cylindrical, semi cylindrical, linear, lanceolate to ovate, fistular or non fistular, sheathing at base. Inflorescence terminal, cymose umbel or cylindrical spike, enclosed by 1 or more valved spathe when young. Flowers bisexual, hypogynous, pedicellate. Tepals 6, in 2 whorls, free or connate at base, 1-7-nerved. Stamens 6, in 2 whorls, free or connate, epitepalous; anthers dehiscing longitudinally inwards. Ovary tricarpellary syncarpous, trilocular; 2 or more ovules per locule; stigma simple or trilobed. Fruit a loculicidal capsule. Seeds compressed or globose, winged or not.

About 30 genera and 850 species, (Mabberley, *The Plant Book*, 1997) cosmopolitan excluding Australia; 2 genera and 35 species in India.

KEY TO THE GENERA

- | | |
|---|------------------|
| 1a. Inflorescence cymose umbel; flowers polyphyllous | 1. Allium |
| 1b. Inflorescence cylindrical spike; flowers gamophyllous | 2. Milula |

1. ALLIUM

L., *Sp. Pl.* 294. 1753 & *Gen. Pl.* ed. 5. 143. 1754; Baker in *J. Bot.* 12: 290. 1874; Regel in *Acta Horti Petrop.* 3, 2: 10. 1875; Hook.f., *Fl. Brit. India* 6: 337. 1892; Stearn in *Herbertia* 12: 73. 1947; Nasir in *Nasir & Ali, Fl. W. Pakistan* 83: 1. 1975.

Herbs, perennial, bulbous; bulbs solitary or aggregate on rhizome, strongly smelling, ovoid or cylindrical, rarely with bulbels. Stem solid or hollow. Leaves radical or cauline, sheathing at base, filiform, linear, fistular or not, lanceolate to oblanceolate. Inflorescence terminal, umbel, few-many-flowered, rarely with bulbils; spathes 1-or several valved, persistent or caducous. Flowers bisexual, regular, polyphyllous. Tepals 6, in 2 whorls, free or connate at base, variously coloured. Stamens 6 in 2 whorls free or connate at base, inserted at base of tepals; filaments entire or toothed or cuspidate; anthers elliptic to oblong, dorsifixed. Ovary subglobose or ovoid; style linear or filiform arising from base; stigma subglobose or 3-lobed. Capsule loculicidal. Seeds 3 or 6 or more; testa black, non lustrous.

About 700 species distributed in N. hemisphere; 34 species in India.

*Central National Herbarium, Botanical Survey of India, Howrah

KEY TO THE SPECIES

- 1a. Bulbs cylindrical often inconspicuous 2
- 1b. Bulbs ovoid or oblong or globose 20
- 2a. Mature umbels bigger (6-9cm diam.). Pedicels 2-5.5 cm long 3
- 2b. Mature umbels smaller (2-5 cm diam.). Pedicels up to 2 cm long rarely 2.5 cm in fascicle 5
- 3a. Flowers cup-shaped. Tepals truncate. Ovary with apical swelling. Filaments equal to tepals **21. A. macranthum**
- 3b. Flowers campanulate. Tepals not truncate. Ovary without apical swelling. Filaments shorter than tepals 4
- 4a. Bulbs reticulate fibrous. Leaves basal **14. A. gilgiticum**
- 4b. Bulbs not reticulate fibrous. Leaves 5-16 cm above the base **31. A. wallichii**
- 5a. Bulbs fibrous 6
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- 6a. Filaments similar, not cuspidate 7
- 6b. Filaments dissimilar, 3 cuspidate 15
- 7a. Filaments connate at base 8
- 7b. Filaments free 12
- 8a. Bulbs bigger (more than 4 cm long), not profuse rooting 9
- 8b. Bulbs smaller (less than 4 cm long), profuse rooting below **29. A. tuberosum**
- 9a. Flowers tubular, purple **3. A. barczewskii**
- 9b. Flowers campanulate 10
- 10a. Filaments more than $\frac{1}{2}$ the tepals 11
- 10b. Filaments less than $\frac{1}{2}$ the tepals **17. A. humile**
- 11a. Bulbs reticulate fibrous, umbels many flowered **2. A. auriculatum**
- 11b. Bulbs not reticulate fibrous. Fascicle few flowered **22. A. mairei**
- 12a. Bulbs parallel fibrous 13
- 12b. Bulbs reticulate fibrous 14
- 13a. Flowers lilac purple or blue. Tepals oblong. No fusiform roots **26. A. sikkimense**
- 13b. Flowers white or greenish white. Tepals lanceolate irregularly coiled on maturity. Many fusiform roots **11. A. fasciculatum**
- 14a. Leaves basal, 2 mm broad. Filaments included **23. A. oreoprasum**
- 14b. Leaves not basal, 1-4 cm broad. Filaments exerted **30. A. victoralis**
- 15a. Filaments exerted, connate at base. Bulbs reticulate fibrous **27. A. stoliczki**

- 15b. Filaments included, connate 2/3 portion at base. Bulbs parallel fibrous... 16
- 16a. Tepals dark purple or olive green, broadly oblong (7-8 × 4 mm)
1. A. atosanguineum
- 16b. Tepals yellow, elliptic lanceolate (8-13×2-3 mm) **12. A. fedschenkoanum**
- 17a. Filaments included, connate at base. Leaves not basal
25. A. schoenoprasum
- 17b. Filaments not included, nearly free. Leaves basal 18
- 18a. Umbels ca. 1.5 cm diam. Flowers few. Filaments exceeding tepals
13. A. filifolium
- 18b. Umbels 2.5-4.5 cm diam. Flowers many. Filaments as long as tepals 19
- 19a. Pedicel longer than flowers (10-20 mm). Flowers white **16. A. hookeri**
- 19b. Pedicel as long as flowers (5-6 mm). Flowers yellow **8. A. chrysanthum**
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- 20b. Umbels without bulbels 21
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- 21b. Bulbs fibrous 32
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- 22b. Matured umbels big (5-8 cm diam.) 29
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- 24a. Flowers campanulate 25
- 24b. Flowers tubular 26
- 25a. Flowers pink. Filaments free **7. A. chitralicum**
- 25b. Flowers white. Filaments connate **10. A. farcatum**
- 26a. Tepals unequal. Filaments less than 1/2 the tepals, 2/3 connate at base
15. A. griffithianum
- 26b. Tepals equal. Filaments more than 1/2 the tepals, connate at base only
18. A. jacquemontii
- 27a. Bulbs smaller (1.5-2 × 1cm). Filaments included **1. A. caesioides**
- 27b. Bulbs bigger. Filaments exceeding tepals 28
- 28a. Bulbs outer coat reddish brown. Flowers reddish **24. A. roylei**
- 28b. Bulbs outer coat not reddish brown. Flowers purple **6. A. chinense**
- 29a. Filaments dissimilar 30
- 29b. Filaments similar **19. A. loratum**
- 30a. Matured bulbs bigger (5-8 × 2.5-7 cm), outer scales light brown. Leaves narrow (0.5-1 cm broad) **32. A. cepa**
- 30b. Matured bulbs small (2.5-4 × 1-4 cm), outer scales not light brown. Leaves broad (1-4 cm broad) 31

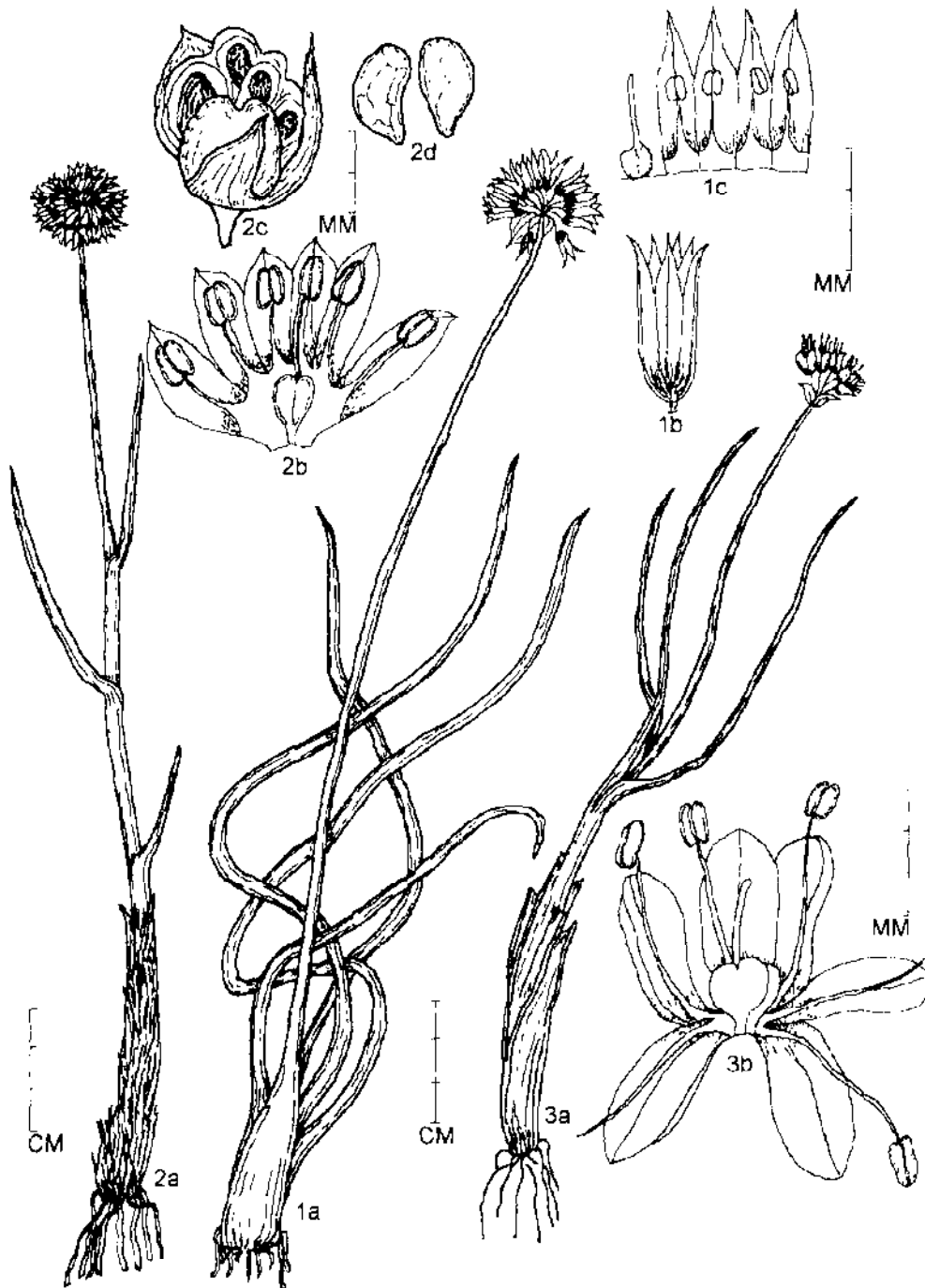


Fig. 1. *Allium atosanguineum* Shrenk 1a. Habit. 1b. Flower. 1c. Dissected Flower. *A. auriculatum* Kunth 2a. Habit. 2b. Dissected Flower. 2c. Capsule. 2d. Seeds. *A. filifolium* Regel 3a. Habit. 3b. Dissected Flower.

- 31a. Filaments nearing tepals, 3 alternate indistinctly dentate below. Bulbs without bulbels inside. Internode absent **20. A. macleanii**
- 31b. 3 alternate filaments with 2 threadlike lateral cusps (3-4 mm long), exceeding tepals. Bulbs with bulbels inside. Internodes distinct **33. A. porrum**
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- 33b. Leaf base not sheathing. Pedicel smaller than flowers (3-5 mm long) **28. A. stracheyi**

1. **Allium atosanguineum** Schrenk in Bull. Acad. Sci. St. Petersbourg 10, 23: 355. July 1842 & Enum. Pl. Nov. 2: 9. 1842; Regel in Acta Horti Petrop. 3, 2: 83. 1875; Hook.f., Fl. Brit. India 6: 338. 1892; Stearn in Bull. Brit. Mus. Nat. Hist. 2(6): 184. 1960; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 12. 1975. Type: Turkestan, Songaria, in monto Dschabyk, 10.7.1841, *Schrenk s.n.* (LE). **Fig.1.1a – 1c**

Herbs 12 - 30 cm high with strong smell; bulbs gregarious, cylindrical, 4 - 6 x 1 cm, coats brownish-black, fibrous. Leaves 2 or 3, arising from about the middle, linear, c. 5 mm broad, fistular, basal one c. 2.5 cm long, top one 10 - 16 cm long, broadly sheathed at base, internode 2 - 4 cm long. Umbels hemispherical, c. 2 cm in diam., many-flowered; spathe 2-fid, ovate, c. 1.5 x 1.5 cm. Flowers campanulate; pedicels c. 8 mm long. Tepals dark purple or olive green with brown veins, broadly oblong, 7 - 8 x 4 mm, obtuse, midvein present, connate up to 1.5 mm at base. Stamens and pistil half the perianth. Filaments c. 3 mm long, connate at base to form a ring, c. 1 mm free above, inner 3 minutely toothed and outer 3 indistinctly bi-cuspidate; anthers broadly oblong. Ovary pyriform, c. 2.5 x 2 mm; style c. 1 mm long.

Fl. & Fr.: June - July.

Habitat: Swamp alpine pasture slopes from 3690 m to 4200 m.

Distrib.: INDIA: Jammu & Kashmir (Kashmir); PAKISTAN, C. ASIA, CHINA.

Specimens examined: Jammu & Kashmir: Gilgit, Nittar Valley, 21.8.1892, *Duthie* 12389 (BM, CAL); Kashmir, Alampi la, *Duthie* 12178

(CAL, E, BM, K); Astore to Rongo, *Winterbottom* 789 (CAL); Astore, *Duthie* 171 (K).

2. **Allium auriculatum** Kunth, Enum. Pl. 4: 418. 1843; Baker in J. Bot. 12: 295. 1874; Regel in Acta Horti Petrop. 3, 2: 169. 1875; Hook. f., Fl. Brit. India 6: 342. 1892. Type: India Orientalis, Kunawar, *Jacquemont* 1528 (P, photo!). **Fig.1.2a – 2d**

Herbs 12 – 35 cm high; bulbs cylindrical, 5 – 8 x 1 – 1.5 cm, coats fibrous, reticulate; root c. 1 mm in diam. Leaves 3 or 4, arising from basal half of stem, linear, 12 - 20 x 0.3 - 0.5 cm, flat, obtuse; internodes 1 – 5 cm long. Umbels hemispherical 1.5 – 2.5 cm in diam., many-flowered; spathe lanceolate, bifid, 1 – 2 x 0.5 cm. Flowers campanulate; pedicels 2 – 8 mm long. Tepals red or purple, broadly lanceolate, 4.5 – 10 x 1.5 – 3 mm, acute, with midvein, scarious, pouched at base. Filaments subulate, 3.5 – 7 mm x 1 mm, connate up to 1 mm at base, adherent to the perianth; anthers ovoid or oblong, 1 – 1.7 mm long. Ovary obovoid, 1.5 - 2 x 1 – 1.7 mm, triquetrous, stipitate, ovules 6; style 2 – 3.5 mm long. Capsules obovoid, 5 x 4 - 5 mm, light-yellow; pericarp papery. Seeds 6, oblong, concavo-convex, 2.5 – 4 x 1 – 2 mm, black, non lustrous.

Fl. & Fr.: July – September.

Habitat: Abundant on rocky slopes at 3350 – 5480 m.

Distrib.: INDIA: Himachal Pradesh, Jammu & Kashmir (Kashmir); NEPAL.

Note: New record for Nepal.

Specimens examined: Himachal Pradesh: September 1964, *Cleghorn* (E); Lahul, Kunlung, 21.7.1941, *N.L. Bor* 16498 (E); South of Taklingla, *D. Stoliczka s.n.* (CAL); Neighbourhood of Chikkim station, *D. Stoliczka s.n.* (CAL); Pangi, 1879, *A.W. Heyde s.n.* (CAL); Jammu & Kashmir: Ladakh, 5.8.1976, *B.M. Wadhwa* 59612 (BSD); Rupshu, 12.7.1931, *Walter Koelz* 2279 (L); Ladakh, Zanskar, 22.7.1973, *U.C. Bhattacharyya* 52146 (BSD).

Nepal: Sengla, 25.8.1973, *Greywilson & Phillips* 722 (BM).

3. **Allium barsezewskii** Lipsky in Acta Horti Petrop. 18: 114. 1900; Vved. in Kom., Fl. URSS 4: 121. 1935; Wendelbo in Rech. f., Fl. Iranica 76: 12. 1971; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 7. 1975. Type: C.

Asia, Karategin, Barszczewskii glacier, 3800 m, 3.8.1896, *W.H. Lipsky s.n.* (LE). **Fig.2.1a – 1d**

Plants 16 - 23 cm high, slender; bulbs cylindrical, 4 - 7 x 1.5 - 2 cm, gregarious, attached to rhizome profusely rooting at base; roots c. 1 mm in diam., outer tunics reticulately fibrous. Stem 1 - 1.5 mm in diam., glabrous; internodes 1 - 3 cm long. Leaves 2 or 3, arising from basal part of the stem, 5 - 25 x 0.1 cm, upper longer, semiterete, slender, not fistular. Umbels hemispherical, 2.5 - 3.5 cm in diam., 15 - 20 flowered; spathe ovate, bifid, 10 - 15 x 7 - 10 mm, membranous, persistent. Flowers tubular or narrowly campanulate; pedicels 6 - 10 mm long, glabrous, ebracteate. Tepals purple pink, lanceolate, 6 - 7 x 1.5 - 2 mm, inner 3 slightly longer, connate and pouched at base, acuminate, midvein prominent. Filaments linear or subulate, c. 5 mm long, 1.5 mm at base, connate and adnate to the perianth to form a ring; anthers ovoid-oblong, 1 - 1.5 mm long. Ovary ovoid, 1.5 - 2.5 x 1 - 1.5 mm, apex tricrenulate; style c. 3 mm long, included; stigma prominent, globose. Capsules obovoid-globose, c. 4 x 4 mm, with persistent tepals, light brownish-yellow. Seeds 3, one in each locule, obovoid, c. 3.5 x 1.7 mm, compressed, black, non lustrous.

Fl. & Fr.: May - August.

Habitat: 1980 - 3000 m on very dry ground among *Artemisia*.

Distrib.: INDIA: Jammu & Kashmir (Kashmir); PAKISTAN, C. ASIA. New record for India.

Specimens examined: Jammu & Kashmir: Astor, 22.7.1892, *Duthie* 12202 (CAL).

Note: *Bowes-Lyon* 767 was identified as *A. tenuicaule* Regel in Fl. W. Pakistan (1975) with 6 - 10 mm long pedicels and filaments nearly as long as or slightly shorter than tepals, this specimen belongs to *A. barszczewskii*.

4. **Allium caesioides** Wendelbo in Bot. Notis. 122: 29. 1969 & in Rech. f. Fl. Iranica 76: 24. 1971. Nasir in Nasir and Ali, Fl. W. Pakistan 83: 16. 1975. Type: Afghanistan, Badakhashan, *Giles* 210 (holo, K). *A. kachrooi* G. Singh in Geobios 4: 166. 1977. Type: Manasbal, Kashmir 6. 6. 1974 (Kashmir Univ. Herbarium, DD) **Fig.3.1a – 1d**

Herbs 15 - 30 cm high, small; bulbs ovoid, 1.5 - 2 x 1 cm, scaly, outer coats white, membranous. Leaves 1 or 2, arising 3 - 5 cm above the

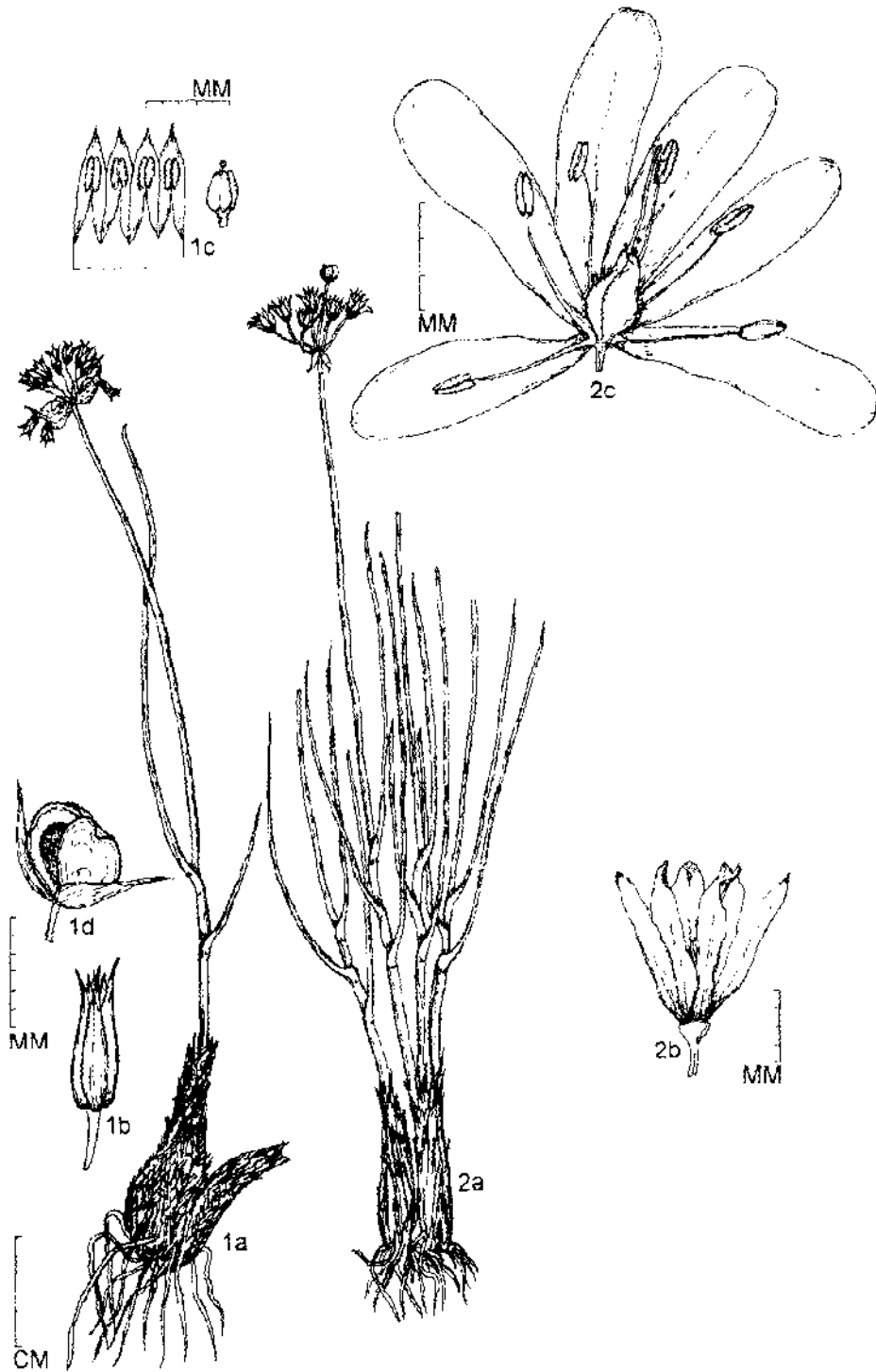


Fig. 2. *Allium barsczewskii* Lipsky 1a. Habit. 1b. Flower. 1c. Stamens and Pistil. 1d. Capsule. *A. mairei* H. Lev. 2a. Habit. 2b. Flower. 2c. Dissected flower.



Fig. 3. *Allium caesioides* Wendelbo 1a. Habit. 1b. Dissected flower. 1c. Capsule. 1d. Seeds.
A. chitralicum Wang & Tang 2a. Habit. 2b. Dissected flower.
A. farcatum Wendelbo 3a. Habit. 3b. Dissected flower.

bulb, filiform, 10 - 16 x 2 mm, fistular. Umbels hemispherical, 2.5 - 3.5 cm in diam., 18 - 30 flowered; spathe bifid, 7 - 8 x 3 mm. Flowers broadly campanulate; pedicel 1 - 1.5 cm long, angular; bracteate. Tepals purple, ovate-lanceolate, 5 - 6.5 x 1 - 1.5 mm, membranous, midvein prominent, connate up to c. 1 mm at base. Stamens and pistil included. Filaments 3.5 - 4.5 mm long, connate up to 1 mm at base, outer 3 subulate, 1 mm broad at base, inner 3 with toothed bases, 1.5 mm broad; anthers ovate-oblong, c. 0.7 x 0.5 mm, mucronate. Ovary ovoid, 2 x 1.5 - 2 mm, trilobed; ovules 2 in each locule; style 1 - 1.5 mm long. Capsules globose-oblong, 4 x 3 mm. Seeds ellipsoid, brownish-black, c. 2 x 1 mm.

Fl. & Fr.: June.

Habitat: Rocky slopes from 2700 to 4000 m. altitude.

Distrib.: INDIA: Jammu & Kashmir and Himachal Pradesh; PAKISTAN, AFGHANISTAN.

Specimens examined: Himachal Pradesh: Lahul, 9500 - 13000 ft., June, 1868, *D. Stoliczka* (CAL); June 1864, *Dr. Brandis* (CAL); 19.6.1976, *J.D.A. Stainton* 7606 (BM); Jammu & Kashmir: Kashmir, Chenab Valley, 14.6.1881, *Ellis* 1259 (CAL); Gilgit, 1885, *Giles s.n.* (CAL).

Note: The species is very near to *A. caesium* Schrenk. In India, this species was collected from 4 localities in 19th century and only one locality in 20th century indicating its rarity.

5. **Allium carolinianum** DC. in Redoute, Liliac. 2: t. 101. 1804; Stearn in *Herbertia* 12: 76. 1947 & in *Bull. Brit. Mus. Nat. Hist.* 2: 173. 1960; Wendelbo in *Rech. f., Fl. Iranica* 6: 14. 1971; Nasir in *Nasir & Ali Fl. W. Pakistan* 83: 9. 1975. Type: Cultivated in Jardin, Paris, (P, fig. seen). *A. blandum* Wall., *Pl. Asiat. Rar.* 3: 38, t. 260. 1832; Baker in *J. Bot.* 12: 295. 1874; Regel in *Acta Horti Petrop.* 3, 2: 129. 1875; Hook. f., *Fl. Brit. India* 6: 339. 1892. Type: China, Tartaria 1818, *Don W.S. Webb. s.n. n.v.* *A. obtusifolium* Klotz. in *Klotz. & Garcke, Bot. Ergebn. Reise Prinz. Waldemar*: 51, t. 95. 1862. Type: Himalaya, *Hoffmeister* (P). *A. thomsonii* Baker in *J. Bot.* 12: 294. 1874; Regel in *Acta Horti Petrop.* 3, 2: 141. 1875; Hook. f., *Fl. Brit. India* 6: 340. 1892. Type: W. Tibet, 10-14000 ft. *T. Thomson* 19 (K, photo! CAL!); *Lace* 279 (E). *A. aitchisonii* Boiss., *Fl. Orient.* 5: 248, 1882. Type: Afghanistan, Kurram Valley, *Aitchison* 734 (K, BM, CAL!). *A. platyspathum* Schrenk var. *falcatum* Regel in *Acta Horti Petrop.* 3, 2: 135.

1875; Hook. f., Fl. Brit. India 6: 340. 1892. Type: China, Kansu, *Przewalski s.n.* (LE); Tibet occ. *Regel s.n.* (CAL!). **Fig 4.1a – 1c**

Herbs 14 - 52 cm high, pungent; bulbs brown, gregarious, oblong or narrowly ovoid, 4 - 7 x 1.5 - 3.5 cm, produced into a long neck; scales fibrous, papery. Stem leafy below the middle, internodes prominent, glabrous, terete, ribbed. Leaves 4 - 6, flat, thick, lower portion sheathing completely encircling the stem, abruptly linear to lanceolate above, 12 - 25 x 0.5 - 1.5 cm, falcate, obtuse at apex, shorter than scape, glabrous. Umbel globose or hemispherical, 2 - 4 cm in diam., many-flowered; spathe ovate, 1 x 1 cm. Flowers campanulate; pedicels 6 - 10 mm long. Tepals purple to pink, broadly oblong or elliptic, 5 - 8 x 1.5 - 4 mm, unequal, outer little shorter, inner longer, concavo-convex, coherent below, pouched at base, midvein prominent. Filaments subulate, 9 - 12 mm long, exserted, at base coherent and adherent to perianth, tube 1 - 1.5 mm long; anthers oblong, 1 - 1.5 x 0.7 mm, dorsifixed in the middle. Ovary globose or ellipsoid, 2 - 3 x 1.5 - 3 mm, trilobed; style 5.5 - 11 mm long, trisulcate, exserted; stigma obscure. Capsule obovoid-globose, c. 4 x 4 mm, light brown with persistent perianth and style. Seeds deep brownish-black, ovoid, c. 3 x 2 mm, triquetrous, granulate.

Fl. & Fr.: July - August.

Habitat: Gregarious on dry, shady rocks or on alpine steppes between 2700 and 4200 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh and Uttaranchal; NEPAL, CHINA, BHUTAN, AFGHANISTAN, C. ASIA.

Note: Name "*carolinianum*" was given by De Candolle with the impression that it had been introduced from Carolina, by L.A.G. Bosc. S. Watson pointed out (Proc. Amer. Acad. Arts. & Sci. 14: 234. 1879) that the species is not known in America. Schrenk (1841) did not mention occurrence of *A. platyspathum* in India. Regel (1875) proposed new variety *A. platyspathum* var. *falcatum* Regel for specimens collected by Przewalski from Kansu and by himself from "Tibet prov. occidentalis" (CAL). The description of this variety completely matches with that of *A. carolinianum* and therefore treated here as synonym.

Specimens examined: Himachal Pradesh: Takling nala, 29.7.1972, U.C. Bhattacharyya 49117 (CAL); Spiti, 25.7.1972, U.C. Bhattacharyya

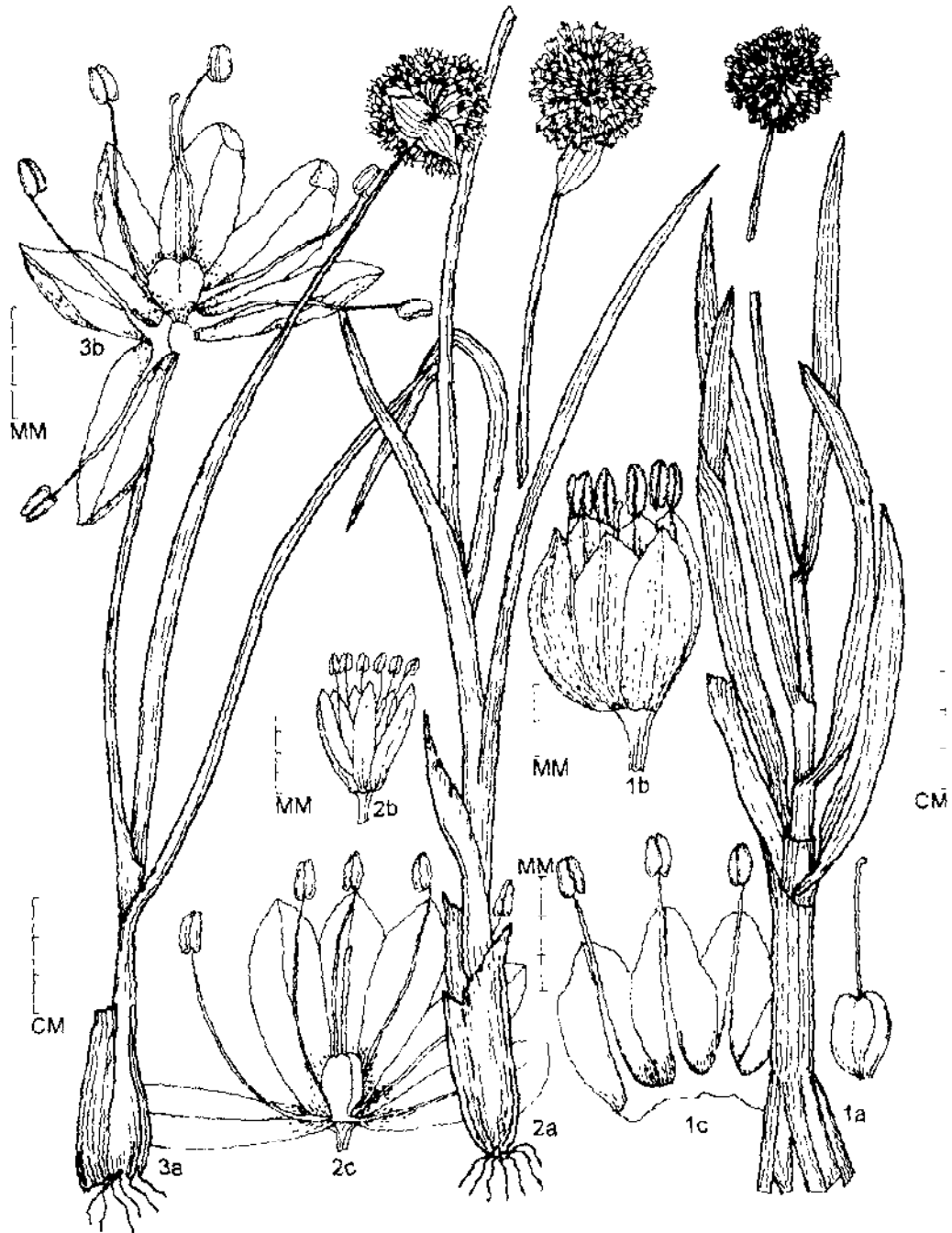


Fig. 4. *Allium carolinianum* DC. 1a. Habit. 1b. Flower. 1c. Stamens and Pistil.
A. chrysanthum Regel 2a. Habit. 2b. Flower. 2c. Dissected flower.
A. consanguineum Kunth 3a. Habit. 3b. Dissected flower.

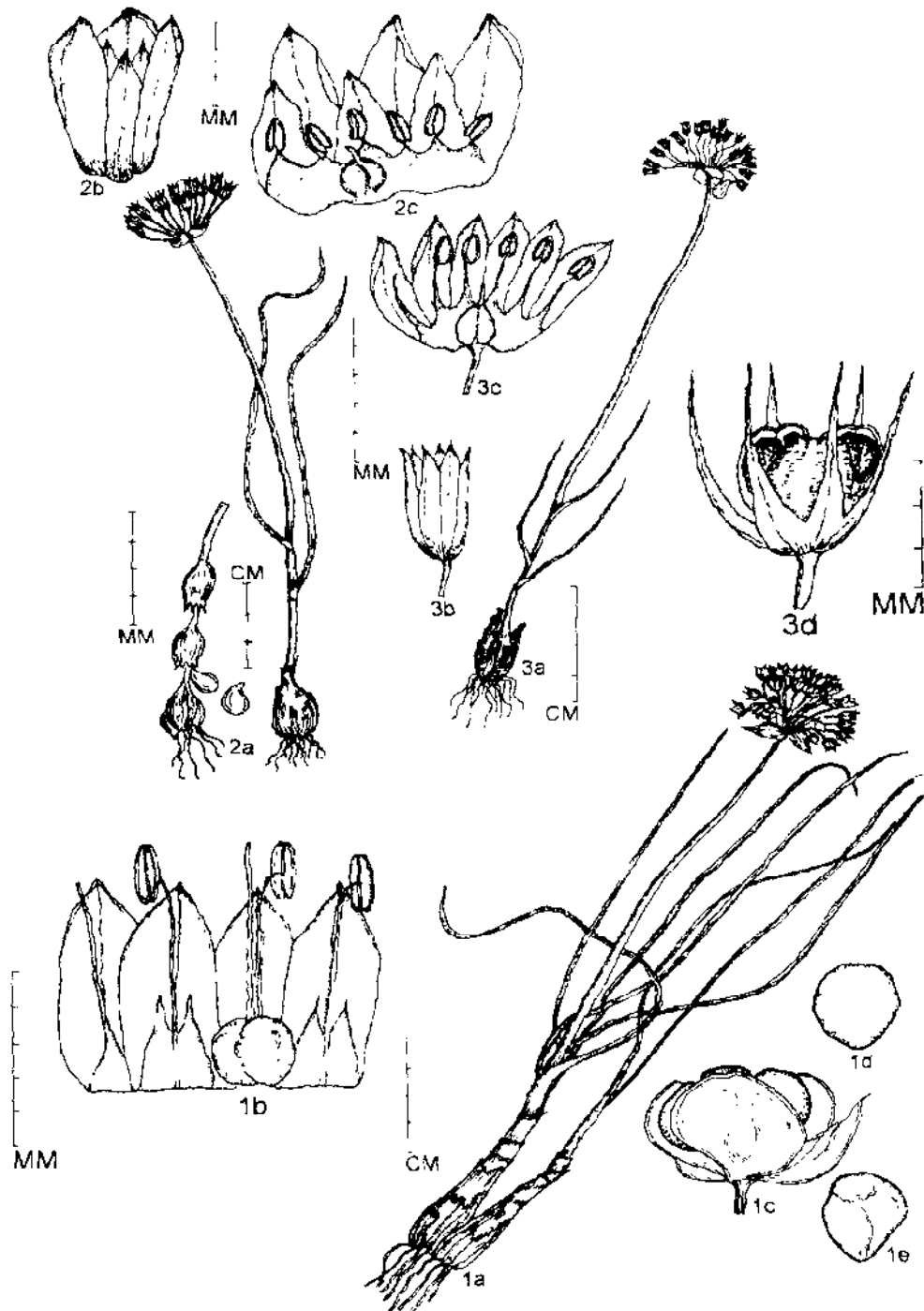


Fig.5. *Allium chinense* G. Don. 1a.Habit. 1b. Dissected flower. 1c. Capsule. 1d. & 1e. Seeds. *A. griffithianum* Boiss. 2a. Habit and underground bulbels. 2b. Flower. 2c. Dissected flower. *A. jacquemontii* Kunth 3a. Habit. 3b. Flower. 3c. Dissected Flower. 3d. Capsule.

48831 (CAL); 3.8.1972, *U.C. Bhattacharyya* 49277 (CAL); Lahul, June 1884, *Dr. Bandis s.n.* (CAL); Chamba, 16.8.1899, *J.H. Lace* 2041 (CAL); Lahul, 11.9.1961, *N.C. Nair* 16868 (BSD); Jammu & Kashmir: Gilgit, 1886, *Giles* 182 (CAL); Murzid valley, 27.7.1893, *Duthie* 13280 (CAL); Gilgit, Naltar Lakes, 21.7.54, *R.R. Stewart* 26322 (BM); Mapanan, 24.7.1876, *C.B. Clarke* 29577C (CAL); Panchtarani, 27.7.1966, *N.C. Nair* 37055 (BSD); Ladak, *Vicary* (CAL); Dras, 31.7.1891, *Gammie* (CAL); Valley of Kishenganga 27.6.1847, *Winterbottom* 600 (CAL); Uttaranchal: Kumaun, 17.6.1958, *T.A. Rao* 6974 (BSD).

6. *Allium chinense* G. Don Monogr. *Allium* : 83. 1827 & in Mem. Werner Nat. Hist. Soc. 6: 83. 1832; Baker in J. Bot. 12: 291. 1874; Stearn in Bull. Brit. Mus. Nat. Hist. 2: 174. 1960. Type: Cochinchina, *Lourino s.n.* (BM). *Caloscordum exsertum* Lindl. in Bot. Reg. 33: t. 5, 1847, pro descr.. Type: Chusan, *Fortune* 102 (K). *A. exsertum* (Lindl.) Baker in J. Bot. 12: 294. 1874, non *A. exsertum* G. Don (1827). *A. bakeri* Regel in Acta Horti Petrop. 3, 2: 141. 1875; Hook. f. Fl. Brit. India 6: 341. 1892.

Fig. 5. 1a – 1e

Herbs, 16 – 50 cm high; bulbs gregarious, elongated-ovoid, 3.5 – 8 x 1 – 1.5 cm, coats not fibrous. Stem taller than leaves, slender, terete. Leaves 2 – 8, basal, narrowly terete, linear, 10 – 25 x 0.1 – 0.4 cm, sometimes coiled, glabrous. Umbels hemispherical, 7 - 40-flowered, lax; spathe ovate or deltoid, 8 x 5 mm. Flowers broadly campanulate; pedicels 1 – 1.5 cm long. Tepals purple, broadly oblong, 5 – 7 x 2 – 4.5 mm, convex, hooded, tubercled, coherent up to 1 mm at base, obtuse or acute, midvein prominent. Filaments 3 – 8 mm long, coherent up to 1 mm at base, alternate filaments bidentate at base, gradually tapering above, adherent to the perianth at base, exserted; anthers oblong, 1.5 - 2 x 0.7 mm, dorsifixed in the middle or little below. Ovary globose, 2 - 2.5 x 2 - 2.5 mm, trilobed, sessile, surface uneven; style 5 – 9 mm long, filiform, often very short, broader above.

Fl.: July – September.

Habitat: 1220 – 1830 m altitude.

Distrib.: INDIA: Meghalaya and Uttaranchal; BANGLADESH, CHINA, JAPAN.

Uses: Culinary onion of importance.

Specimens examined: Meghalaya: Khasia, Lartankota, 30.9.1886, *C.B. Clarke* 44859 A & B (BM, CAL); Khasia, *Hooker f. & Thomson s.n.*

(CAL). Uttaranchal : N.W. Himalaya, Mussoorie, 1897, *P.W. Mackinon* 156; 20.7.1898, *P.W. Mackinon* (CAL).

7. **Allium chitralicum** Wang & Tang in Bull. Fan. Mem. Inst. Biol. Bot. Peking 7: 298. 1937; Wendelbo in Rech. f., Fl. Iranica 76: 85. 1971; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 29. 1975. Type: Chitral, *Harriss* 16691a (K, CAL!). **Fig.3.2a & b**

Herbs 13 - 50 cm high; bulbs ovoid, 1 - 2 x 1 - 1.5 cm, scaly, outer scales brownish, inner white. Leaves 1 - 6, arising little above the base of the scape, linear, 15 - 20 x 0.3 - 1.2 cm, glabrous. Umbels globose or hemispherical, 2.5 - 3 cm in diam., 25 - 30-flowered, congested; spathe 2 - 3-fid, ovate, c. 1 x 0.5 mm, pale rose coloured, scarious. Flowers broadly campanulate or stellate; pedicels 1 - 2 cm long. Tepals pink, lanceolate, 4 - 6 x 1 mm, obtuse, free, membranous. Filaments linear, c. 4 mm long, as long as tepals, adnate to base of tepals, broad at base, abruptly linear above; anthers broadly oblong, c. 1.2 x 1 mm. Ovary obovoid, c. 1 - 1.5 mm, stipitate, verrucose; style 2 - 3 mm long, linear. Capsules obovoid, c. 4 x 4 mm, deep brown, nonlustrous. Seeds oblong, c. 2 x 1.5 mm, light brown, compressed.

Fl. & Fr.: April - June.

Habitat: High altitude plant, between 2200 and 3300 m altitude.

Distrib.: INDIA: Himachal Pradesh and Jammu & Kashmir (Kashmir); AFGHANISTAN, PAKISTAN.

Specimens examined: Himachal Pradesh: Kinnaur dist., 6.6.1962, *N.C. Nair* 22489 (BSD). A new report for India.

Note: According to Wendelbo (1971) this species is endemic to Afghanistan and Pakistan. The capsule and seeds are described for the first time here based on *Stainton* 2673 (BM).

8. **Allium chrysanthum** Regel in Acta Horti Petrop. 3: 91. 1875 & 10: 313. 1887; Stearn in Bull. Brit. Mus. Nat. Hist. 2: 175. 1960. Type: China occidentalis, Kansu, 1872, *Przewalski* 256 (LE, K, photo!, CAL!). **Fig.4.2a - 2c**

Herbs 20 - 50 cm high; bulbs 4 - 10 x 1 - 1.5 cm, insignificant, with leaf bases, brownish. Leaves 2 or 3, more or less basal, arising from a single point, linear, 20 - 40 x 0.3 - 0.5 cm, fistular. Umbels subglobose,

2.5 - 3.5 cm in diam. with numerous, congested flowers; spathe ovate, c. 2 x 2 cm. Flowers narrowly campanulate; pedicels c. 5 mm long, glabrous. Tepals yellow, elliptic-lanceolate, 4 - 6 mm long, midvein prominent. Filaments linear, 4 - 9 mm long, adnate at base; anthers oblong, c. 1 x 0.5 mm. Ovary oblong, c. 1.5 x 0.8 mm, black; style c. 2.5 mm long, slender.

Fl.: July - October.

Habitat: Alpine meadows between 3800 m and 4876 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir) and Himachal Pradesh; CHINA.

Specimens examined: Himachal Pradesh: Pangi, 1879, *Hegde s.n.* (CAL); Jammu & Kashmir: Kashmir, Pajroti, July 1848, *Strachey & Winterbottom* 6 (CAL); Tajong, 20.4.1848, *Strachey & Winterbottom* 9 (CAL).

Note: Stearn (1960) reported the species from S.E. Tibet on the basis of *Kingdon Ward* 12278 in addition to China, *Prezowski* 256. Occurrence in India was not known earlier.

9. **Allium consanguineum** Kunth, Enum. Pl. 4: 431. 1843; Baker in J. Bot. 12: 293. 1874; Regel in Acta Horti Petrop. 3, 2: 131. 1875; Hook. f. Fl. Brit. India 6: 340. 1892; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 9. 1975. Type: Ind. Or. Kashmir, Sind Valley, *Jacquemont* 982 (K, P, photo!).

Fig.4.3a & b

Herbs up to 70 cm high; bulbs elongated ovoid, 2 - 7 x 0.8 - 2 cm, outer coats fibrous. Internode distinct on maturity. Leaves 2 - 4, arising 2 - 7 cm above the base, linear to lanceolate, falcate, 8 - 40 x 0.4 - 0.5 cm, obtuse at apex, completely sheathing at base, glabrous. Umbels hemispherical, 1.5 - 4 cm in diam., 12 - 40-flowered, often congested; spathe bivalved, elongated ovate, 13 - 17 x 6 - 12 mm. Flowers campanulate; pedicels 7 - 15 mm long, equal or longer than flowers. Tepals creamy to golden yellow, ovate-oblong, 4 - 6 x 3 mm, acute to obtuse, margin in rolled, pouched at base; midvein prominent. Filaments 5 - 7 x 0.7 mm, adherent and adnate to tepals at base; anthers oblong, c. 1 x 0.7 mm. Ovary subglobose to obovoid, 1.5 - 2.5 x 1 - 1.5 mm, trilobed, sulcate at base; styles c. 6 mm long, exerted. Capsules light brownish yellow, globose, c. 4 x 4 mm. Seeds black, angular - oblong, c. 3 x 1 mm.

Fl. & Fr.: July - September.

Habitat: Near moraine, in open fields or in crevices of rocks at an altitude of 2440 - 3050 m.

Distrib.: INDIA: Jammu & Kashmir (Kashmir) and Himachal Pradesh; PAKISTAN.

Specimens examined: Himachal Pradesh: Songla, 25.9.1964, *N.C. Nair* 34265 (BSD); Chamb, Sauch Valley, 17.8.1899, *Harsukh* (CAL); Jammu & Kashmir: Gilgit, 1885, *G.M. Giles* (CAL); Minimarg, August 1905, *A. Meebold* 4009 (CAL); Sonemarg, 17.8.1893, *J.F. Duthie* 13611 (CAL); July 1956, *T.A. Rao* 806 (CAL); *T. Thomson* 17 (CAL); Sonemarg to Baltal, Sept. 1880, *A.P. Young s.n.* (BM); Pahalgaon, 23.8.1956, *Polunin* 56/448 (BM); Ladakh, 25.7.1988, *H.J. Chowdhury & B.P. Uniyal* 85719 (BSD).

10. ***Allium farcatum*** Wendelbo in *Nytt Mag. Bot.* 14: 101. 1967 & in *Rech. f., Fl. Iranica* 76: 18. 1971; Nasir in Nasir & Ali, *Fl. W. Pakistan* 83: 16. 1975. Type: Pakistan, Kohat to Hangu, *Rechinger* 30991 (W).

Fig.3.3a & b

Plants 40 - 130 cm high; bulbs reddish brown, ovoid-oblong, 3.5 x 2 - 2.5 cm, coats scaly. Leaves 3 or 4, arising at 5 - 6 cm above the bulb, fistular, 20 - 30 x 0.2 - 0.5 cm, much shorter than the stem. Umbels hemispherical, 2 - 3 cm in diam., densely flowered; spathe bivalved, ovate, c. 8 x 5 mm. Flowers campanulate; pedicels 8 - 15 mm long. Tepals white, elliptic, oblanceolate, c. 4 x 1 mm, obtuse. Filaments linear, c. 3.5 x 1 mm, connate up to 1 mm at base, cup-like; anthers yellow, oblong, c. 1.2 x 0.7 mm. Ovary obovoid, c. 1.5 x 2 mm, deeply trilobed; style linear, c. 2 mm long. Capsules light yellow, obcordate, 4 - 5 mm broad, 3-seeded, wrinkled. Seeds brown, wrinkled.

Fl.: April. *Fr.:* June.

Habitat: In crevices of steep rocky boulders at an altitude of 2000 - 3000 m.

Distrib.: INDIA: Himachal Pradesh; PAKISTAN, AFGHANISTAN.

Specimens examined: Himachal Pradesh: Kalpa, 3.6.1972, *K.P. Janardhanan* 47673 (BSD).

Note: First record for India.

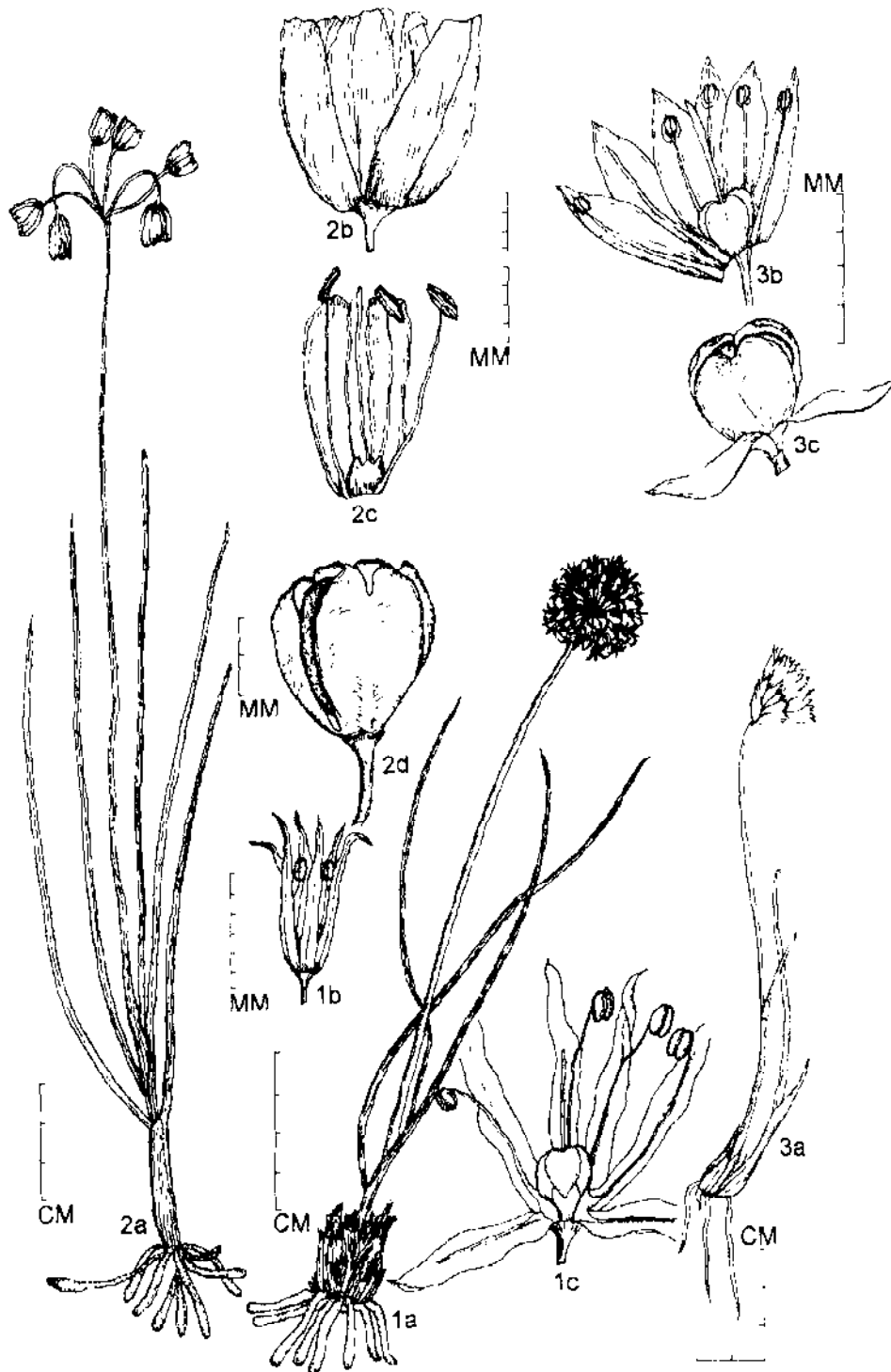


Fig. 6. *Allium fasciculatum* Rendle. 1a. Habit. 1b. Flower. 1c. Dissected flower.
A. macranthum Baker. 2a. Habit. 2b. Flower. 2c. Dissected flower. 2d. Capsule.
A. sikkimense Baker 3a. Habit. 3b. Dissected flower. 3c. Capsule.

11. **Allium fasciculatum** Rendle in J. Bot. 44: 42. 1906. Steam in *Herbertia* 12: 83. 1947 & Bull. Brit. Mus. Nat. Hist. 2: 183. 1960. Type: Tibet, Phari, July, 1879, *Dungboo s.n.* (BM, lecto., CAL!). *A. gageanum* W.W. Sm. in Rec. Bot. Surv. India 4: 247. 1911. Type: Sikkim, Lhonak 4500 m, 5.8.1909, *Smith & Cave 2130* (K, CAL!); Nathula, 5500 m. Sept. - Oct. 1909. *Ribu & Rhomoo 2771* (CAL!). **Fig.6.1a - 1c**

Herbs 10 - 35 cm high; bulbs ovoid, 1 - 3 x 0.5 - 2 cm, or insignificant, surrounded with coarse parallel fibres; roots 6 - 8, fleshy, fusiform or cylindrical, 2 - 3 x 0.5 cm. Stem fistular, glabrous, often shorter than leaves. Leaves 2 - 5, basal or arising from a common point; c. 4 cm above the base, linear, 10 - 25 x 0.2 - 0.4 cm, margin scabridulous. Umbels globose to subglobose, 2 - 3 cm in diam., compact, numerous-flowered; spathe broadly ovate, c. 2 cm long, acute. Flowers campanulate; pedicels 5 - 10 mm long. Tepals white or greenish-white, lanceolate or linear-lanceolate, 5 - 7 x 1 - 1.5 mm, acute, irregularly coiled at maturity. Filaments linear, 2.5 - 5 mm long, subequal; anthers yellowish-green, oblong, c. 0.7 x 0.5 mm. Ovary obovoid, 1 - 1.5 x 0.7 - 1.2 mm, base narrowed to form a stipe, conspicuously 3 furrowed; style 1 - 2.5 mm long. Capsules obovoid, 3 - 4 x 3 - 4 mm, trilobed, light brownish yellow, pericarp papery, locules 2-seeded. Seeds ovoid or obovoid, c. 2.5 x 1.5 - 1.7 mm, concavo-convex, convex side reticulate.

Fl. & Fr.: July - September.

Habitat: Open rocky slopes or sandy river beds between 2700 - 4800 m altitude.

Distrib.: INDIA: Nagaland and Sikkim; NEPAL, BHUTAN, CHINA (TIBET).

Specimens examined: Sikkim: Dongdong, 10.7.1906, *J.C. White s.n.* (CAL); Kambajang, Sept. 1903, *Prain s.n.* (CAL); Lhonak, 5.8.1909, *Smith & Cave 2130* (CAL); *Smith & Cave 2132* (CAL); 15.8.1882, *King's collector* (CAL); Nathula, Sept. - Oct. 1809, *Ribu & Rhomo 2771* (CAL). Nagaland: Kohima, July 1886, *D. Prain* (CAL).

Note: Swollen fleshy roots also serve as storage organs. The reduction in size of the bulbs probably due to their occurrence in moist areas in E. Himalayas.

12. **Allium fedschenkoanum** Regel in Acta Horti Petrop. 3, 2: 82. 1875; Hook. f., Fl. Brit. India 6: 338. 1892; Wendelbo in Rech. f., Fl. Iranica

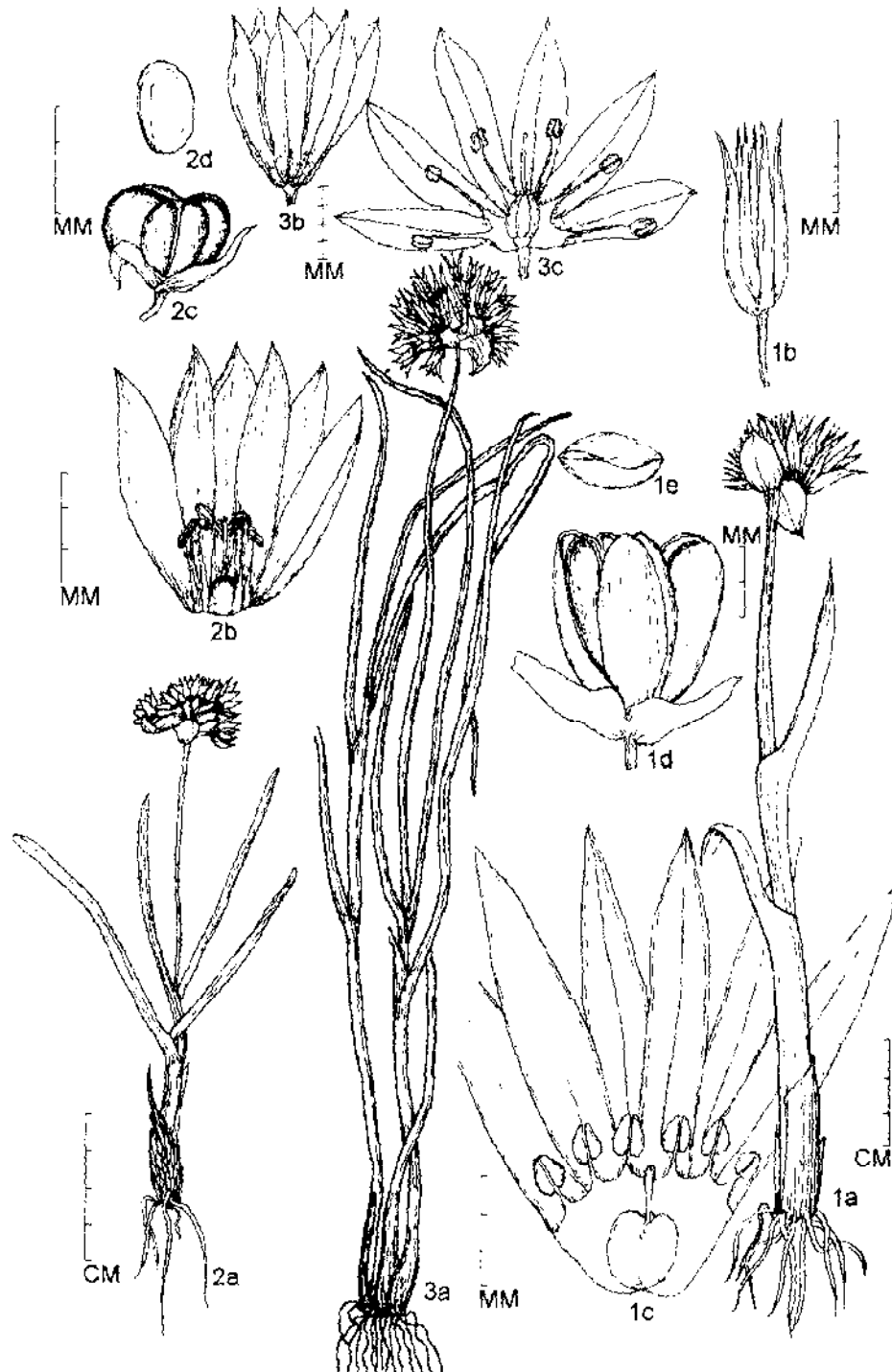


Fig. 7. *Allium fedschenkoanum* Regel. 1a. Habit. 1b. Flower. 1c. Dissected flower. 1d. Capsule. 1e. Seed. *A. humile* Kunth 2a. Habit. 2b. Dissected flower. 2c. Capsule. 2d. Seed. *A. schoenoprasum* L. 3a. Habit. 3b. Flower. 3c. Dissected flower.

76: 16. 1971; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 11. 1975. Type: Turkestan, Sarawschausk Valley, *Fedtschenko* (K, LE). *A. semenovii* Regel in Acta Horti Petrop. 3, 2: 85. 1875; Hook. f., Fl. Brit. India 6: 338. 1892. Type: Tien Shan, Mt. Alatau, 6-10000 ft *Semenow* (LE). Himalaya Occ. 7 - 12000 ft, Kashmir, *Falconer s.n.* (K); Kistwar, *Thomson* (K, L, CAL!); Interbaltal et Dras, *Henderson s.n.* (CAL!); Garhwal, *Strachey & Winterbottom* (K). **Fig.7.1a - 1e**

Robust herbs 18 - 40 cm high; bulbs gregarious, cylindrical, 3 - 6 x 1 - 1.5 cm or insignificant, outer coats membranous, fibrous when matured. Leaves 2 - 5, arising in the middle of stem, broadly linear, 5 - 10 mm broad, fistular, lowest 3 - 8 cm long and topmost 8 - 25 cm long; broadly sheathed at base. Umbels globose 3 - 3.5 cm in diam., 20 - 30-flowered; spathe bifid, ovate, 1.5 - 1.8 x 1 - 1.5 cm, acute, pink when dry. Flowers campanulate; pedicels unequal, 3 - 10 mm long. Tepals yellow, elliptic-lanceolate, 10 - 13 x 2 - 3 mm, often unequal, inner smaller, acute, connate upto 2 mm at base, midvein prominent. Stamens & pistil nearly half the length of the tepals. Filaments 3 - 4 mm long, connate at base to form a ring, 1 mm free above, alternate 3 obtusely toothed on either side; anthers oblong, 1 x 0.5 mm. Ovary globose or pyriform, 2 - 3.5 x 2 - 2.5 mm, 3-lobed; style 1 - 2 mm long; stigma 3-lobed. Capsules brownish-yellow with persistent perianth, obovoid, 5 - 6 x 4 - 5 mm, 12-seeded, 4 in each locule. Seeds black, elliptic, 2 - 2.5 x 1 - 1.2 x 0.2 - 0.3 mm, planoconvex, granulate.

Fl. & Fr.: June - September.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh and Uttaranchal ; PAKISTAN, AFGHANISTAN, C. ASIA, CHINA.

Specimens examined: Himachal Pradesh: Pangi, August 1911, *Inamud Din* 103 (CAL); Chamba, Pangi, 4.9.1897, *J.H. Lace* 1659 (CAL); 14.7.1964, *N.C. Nair* 32454 (BSD); Simla hill states, Rupin Pass, Dhaoladhar Range, 7.7.1939, *G. Sherriff* 7409 (BM); Him. Bor. Occ, Kistwar, *T. Thomson* 13 (CAL, L). Jammu & Kashmir: Bhotkoha, July 1905, *A. Meebold s.n.* 4100 (CAL); Baltistan, Barila, 11.7.92, *J.F. Duthie s.n.* (CAL, K); K. Burzil, 28.7.1876, *C.B. Clarke* 29719 (CAL); Gilgit, *Dr. Giles* 183 (CAL); Kangila, July 1905, *Meebold* 4097 (CAL); Chenab Valley, Phondru, 15.6.1881, *R.M. Ellid* 1224 (CAL); 13.7.1841, *Winterbottom* 789 (CAL); 21 June 1847, *Winterbottom* 509 (CAL); Dras, 31.7.1891, *Gammie* (CAL); Astor, 21.7.1892, *Duthie* 12178 (CAL, BM).

Notes: The original descriptions of *A. semenovii* Regel, *A. fedschenkoanum* Regel and *A. atrosanguineum* Schrenk are based on the specimens collected from W. China, S. Russia & Himalayas show minor differences like filaments 1/4 of tepals in *A. semenovii*, flowers yellowish in *A. fedschenkoanum* and pinkish in *A. atrosanguineum*. The types of *A. fedschenkoanum* and *A. atrosanguineum* have not been seen. On examination of the syntypes of *A. semenovii* Regel (Kistwar, *T. Thomson 13* and inter Baltal & Dras, *Henderson CAL*) show 2 or 3 leaves, c. 1 cm broad, arising from lower half of the plant with broad sheath, flowers c. 12 mm long, filaments c. 5 mm long of which c. 4 mm connate at base and 3 alternate obscurely cuspidate on either side. So, in *A. semenovii* filaments are 1/2 - 1/3 of the tepals, not 1/4 as described by Regel in protologue, thus showing similarity with *A. fedschenkoanum* and *A. atrosanguineum*.

All the specimens examined from India and adjoining regions have obscure bulbs, membranous outer coats becoming fibrous with age; leaves 2 - 5, 5 - 10 mm broad, lowest shorter and topmost longer with broad sheathing base, arising all over the scape forming long prominent internode; filaments nearly half the tepals and nearly three-fourth of its length connate at base. In some specimens flowers are c. 12 mm with inner tepals smaller than outer, yellow, and in others flowers are c. 8 mm, deep brown or purple; thus the present study supports Nasir (1975) in merging *A. semenovii* with *A. fedschenkoanum* on the basis of larger, yellow flowers and keeping *A. atrosanguineum* as a distinct species.

13. **Allium filifolium** Regel in Acta Horti Petrop. 10: 352, t. 6, f. 3. 1887; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 11. 1975. Type: Mt. Alexandricorum in Talas and Bisch-Tasch river, 5000 ft, *Fetisow* (LE, CAL!).

Fig.1.3a & b

Herbs 10 -20 cm high; bulbs cylindrical, 5 - 11 x 1.5 cm, gregarious, tunics coriaceous, laciniate apex. Leaves 2 - 4, basal, linear, filiform, 15 x 0.2 cm, smaller or longer than scape, margin and base finely scabridous. Umbels 1.5 cm broad, fascicled, 5 - 12-flowered; spathe ovate, 12 - 15 x 8 - 10 mm. Flowers campanulate; pedicels 4 - 6 mm long, glabrous. Tepals pale yellow or greenish white, oblong lanceolate, 4 - 5 x 2 mm, midvein prominent. Filaments filiform, 5 mm or longer, exerted after anthesis, connate at the base only; anthers oblong, 1.5 x 0.7 mm. Ovary oblong, 2 x 1.7 mm, trilobed; style 2-7 mm long, filiform, elongating with age. Capsules subglobose.

Fl. & Fr.: July - August.

Habitat: Rock crevices at an altitude of 3700 m.

Distrib.: INDIA: Jammu & Kashmir (Kashmir); PAKISTAN, AFGHANISTAN.

Specimens examined: Jammu & Kashmir: Gilgit, *Duthie* 12424 (CAL); Baltistan, 13.7.1892, *Duthie* 12026 (CAL); Nagarstate, Karakorum, Minapin glacier, 1861, *Lloyd & Megaw* 3 (BM).

Note: This is a new record for India. It extends from Russia through Hindukush and Karakorum mountains to Pakistan, Afghanistan and India. In protologue the flowers are reported as pink soon turning to white. The scabridous nature of leaf margin and base is not reported earlier. This may be due to drier ecological condition.

14. **Allium gilgiticum** Wang & Tang in Bull. Fan. Mem. Inst. Biol. Peiping, Bot. Ser. 7: 294. 1937; Nasir in Nasir & Ali, Fl. W. Pakistan. 83: 29. 1975. Type: Gilgit, 10000 ft., 26.6.80. *Tanner* 166 (K, Photo!).

Herbs 50–60 cm high; bulbs rhizomatous, cylindrical, 2.5 x 1 cm, outer coats reticulate, fibrous. Leaves 5–6, basal, linear, 30–35 x 1–2 cm, obtuse, glabrous. Umbel hemispherical, 5–9 cm in diam., laxly 20–30-flowered; spathe broadly ovate, shorter than pedicel. Flowers campanulate; pedicels 2–5.5 cm long, unequal, glabrous, ebracteate. Tepals purple, lanceolate, 1–1.2 cm long, acute. Filaments shorter than tepals, linear. Ovary globose, c. 2 mm in diam., style longer than ovary; stigma 3, recurved.

Fl.: June.

Habitat: At about 3050 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir).

Notes: Known from type collection only. Endemic and endangered in Kashmir.

15. **Allium griffithianum** Boiss., Diagn. Pl. Orient. nov. ser. 2, 4: 117. 1859; Baker in J. Bot. 12: 290. 1874; Wendelbo in Rech.f., Fl. Iranica 76: 37, t.14, f.5. 1971; Nasir in Nasir & Ali, Fl. W. Pakistan. 83: 20, f. 7 A-C. 1975. Type: Afghanistan, *Griffith* 452 (G holo, K iso. photo!). *A. rubellum* M. Bieb. var. *grandiflora* Boiss., Fl. Orient. 5: 253. 1882; Hook. f., Fl. Brit. India 6: 339. 1892.

Fig.5.2a – 2c



Fig. 8. *Allium hookeri* Thwaites 1a. Lower portion of plant. 1b. Scape with umbel. 1c. Flower. *A. tuberosum* Rott. ex Spreng. 2a. Lower portion of plant. 2b. Scape with umbel. 2c. Dissected flower. *A. wallichii* Kunth 3a. Lower portion of plant. 3b. Scape with umbel. 3c. Capsule. 3d. Seed.

Herbs 20–30 cm high, slender; bulbs ovoid, 1–2 x 1–2 cm, outer coats coriaceous, fibrous, often series of bulbs arranged one above the other with more than one bulbels; bulbels elliptic, 10–12 x 4–5 mm, with outer coats papery and inner ones fleshy, bulbels get separated from the bulbs leaving the papery scales and grow as independent plants; roots few, c. 2 mm dia. Leaves 2 or 3, arising from 2.5–5 cm above the bulb, linear, 15–17 cm x 2 mm, semiterete, grooved. Umbels 2–3 cm in diam., fascicled or hemispherical, 10–30-flowered; spathe bifid, c. 8 mm long. Flowers tubular or narrowly campanulate; pedicels 4–15 mm long, unequal, erect, angular. Tepals whitish or mauve pink, unequal, broadly lanceolate to elliptic, obtuse, appear acute on drying, entire, midvein present, margin inrolled; outer 5–7 x 2–2.5 mm, inner 3–4.5 x 1.5 mm, connate at base, pouched below. Filaments included, 2–3 mm long, about 2/3 of base connate and adnate to tepals, 1 mm above, free; often inner filaments broader; anthers ovate-oblong, 1–1.5 x 0.5 mm. Ovary globose or ovoid-oblong, 1–2.5 x 1–1.5 mm, often with 3 glands at base; style linear, 1–5 mm long. Capsule not seen.

Fl.: March–May.

Habitat: On gravelly soil between 1500 and 2100 m altitude.

Distrib.: INDIA: Punjab and Jammu & Kashmir (Kashmir); PAKISTAN, AFGHANISTAN, C. ASIA.

Specimens examined: Jammu & Kashmir (Kashmir): *T. Thomson* (CAL, L); Avantipur, 1.5.1940, *Ludlow & Sherriff* 7595 (BM). Punjab: 1860, *C.B. Clarke* 60 (CAL).

16. **Allium hookeri** Thwaites, Enum. Pl. Zeyl.: 339. 1864; Baker in J. Bot. 12: 292. 1874; Hook. f., Fl. Brit. India 6: 341. 1892; Trimen, Handb. Fl. Ceylon 4: 291. 1898; Marquand in J. Linn. Soc. London 48: 226. 1929; Airy Shaw in Notes Roy. Bot. Gard. Edinburgh 16: 138. 1939; Stearn in Bull. Brit. Mus. Nat. 2(6): 183. 1960. Type: Sri Lanka, Petrotlayalla, 7000 ft, *Thwaites c.p.* 3659 (K, photo!). **Fig.8.1a – 1c**

Local name: *Dung Dung /Dudusag (Nep.)*.

Herbs up to 90 cm high; bulbs indistinct, 10–20 x 1 cm, cylindrical, profusely rooting at base. Leaves 4 or 5, arising from the base, linear, 20–70 x 0.3–1.4 cm, prominent veins. Umbels 3.5–4.5 cm diam., hemispherical.

laxly 12 - 40-flowered; spathe ovate, 3 x 0.8 cm. Flowers campanulate stellate on maturity exposing the ovary; pedicels 1 - 2 cm long, angular, flat at base, ebracteate. Tepals white, lanceolate, 5 - 8 x 1 - 2 mm, connate at base, midvein inconspicuous, spreading after anthesis. Filaments 5 - 8 mm long, elongating on maturity, linear, slightly broader and adherent to the tepals at base; anthers oblong, 1.5 - 2 mm x 0.7 - 1 mm. Ovary broadly oblong or obovoid, 1.5 - 3 x 1.5 - 2 mm, stipitate; styles linear, 1-3 mm long, elongating on maturity; stigma inconspicuous. Capsules globose to subglobose, c. 5 x 5 mm (immature), brown.

Fl. & Fr.: July - October.

Habitat: In open or in marshy areas between 1200 and 4100 m altitude.

Distrib.: INDIA: West Bengal, Meghalaya, Arunachal Pradesh and Sikkim; BHUTAN, SRI LANKA, CHINA-TIBET.

Uses: Cultivated as vegetable in China and Eastern India.

Specimens examined: Meghalaya: Khasia, *J.D. Hooker* 7 (CAL); Shillong, Woodland compound, cultivated, 16.7.1964, *H. Deka* 37004 (CAL); 22.8.1964, *H. Deka* 37022 (CAL); Khasia, 1844 *Griffith* s.n. cultivated (K); Shillong, Woodland garden, 13.8.1963, *D.B. Deb* 35805 (CAL); West Bengal: Darjeeling, 30.5.1909, *R.K. Das* 32302 (CAL).

Note: Regel (1875) reduced *A. hookeri* as a synonym of *A. wallichii*.

17. **Allium humile** Kunth, Enum. Pl. 4: 443. 1843; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 12, f. 2G. 1975. Type: Ind. Orient. Pir Punjal, *Jacquemont* 533 (P, K, photo!). *A. govanianum* Wall. ex Baker in J. Bot. 12: 293. 1874; Hook.f. Fl. Brit. India 6: 344. 1892. Type: Kumaon, *Garan & Royle, Edgeworth* s.n.(CAL). **Fig.7.2a - 2d**

Plants with garlic smell, 8 - 30 cm high, slender; bulbs cylindrical, 3 - 6 x 0.5 - 1.5 cm, outer coat reticulate fibrous. Leaves 4 - 6 at the base of the stem, linear, flat, 3 - 26 x 0.3 - 0.5 cm, obtuse, glabrous. Umbels hemispherical, 2 - 3 cm diam., laxly 9 - 20-flowered; spathe bifid, ovate or lanceolate, c. 15 x 7 - 12 mm. Flowers broadly campanulate; pedicels 4 - 15 mm long. Tepals white or yellowish, elliptic or lanceolate, 5 - 9 x 1.5 - 3 mm, acute, often margins inrolled, finely nerved. Filaments subulate, 1.5 - 3.5 x 0.5 - 1 mm, unequal, connate up to 1 mm at base forming a cup and adnate to tepals; anthers oblong, 1 mm long. Ovary subglobose, 1 - 1.5 x

0.7–2 mm, lobes inconspicuous; style filiform, 1–1.2 mm long. Capsules subglobose or broadly obovoid, 3 x 3–5 mm; pericarp deep brown, surface uneven, locules 1-seeded. Seeds oblong, c. 3 x 2 mm, brownish black.

Fl. & Fr.: May–July.

Habitat: Between 2740–4000 m altitude on open hillsides or shady grassy slopes, gregarious. Vegetatively multiplies by extending horizontally in centrifugal pattern.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh and Uttaranchal ; PAKISTAN.

Uses: Leaves used in flavouring curry.

Specimens examined: Himachal Pradesh: Between Larot & Chanchal pass, 23.7.1965, *N.C. Nair* 36112 (BSD); Chamba, 14.6.1897, *J.H. Lace* 1581 (CAL); Chamba, 3.7.1899, *Harsukh* (CAL); Lahul, 6/1865, *D. Stoliczka* (CAL); Bashaur, 26.6.1891, *Lace* 950 (CAL); Jammu & Kashmir: Bhotka La, July 1905, *Meebold* 4095 (CAL); July 1956, *T.A. Rao* 470 (CAL); Saibal Base, 13.7.13, *Capt. F.E. Kobel* 51 (CAL); Liddar Valley, 21.7.1873, *J.F. Duthie* 13145 (CAL); Above Gulmarg, 2.6.1892, *J.F. Duthie* 11337 (CAL); Pirlayal, 6.7.1876, *C.B. Clarke* 28831 (CAL); Uttaranchal : Jaunsar, June, 1898, *Gamble* 27079 (CAL); Jaunsar, 11.6.96, *C.C. Roger* (CAL); Kankhal Sthan, 20.5.1979, *A.K. Goel* 66605 (BSD); Tehri Garhwal, 26.5.1894, *Duthie* 14535 (CAL); 25.6.83, *Duthie* 4304 (CAL); Horki Dun, Tehri Garhwal, June 1893, *Gamble* 24375 (CAL).

18. ***Allium jacquemontii*** Kunth, Enum. Pl. 4: 399. 1843; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 20. f. 7 H-J. 1975. Type: India Orientalis, Mirpur in montibus Rajaori, *Jacquemont* 138 (P iso, K photo!); *A. rubellum* Baker in J. Bot. 12: 290. 1874, non M.Bieb.1808; Hook. f., Fl. Brit. India 6: 339. 1892. *A. miserabile* Wendelbo in Nytt Mag. Bot. 14: 104. 1967 & in Rech. f., Fl. Iranica 76: 40. 1971; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 22. 1975. Type: Pakistan, Kohat to Thal, *Lamond* 1549 (E). **Fig.5.3a – 3d**

Plants 4–55 cm high, slender; bulbs gregarious, ovoid, 1–4 x 1–1.5 cm, tunics coriaceous, brownish. Stem angular, particularly at the apex, much longer than leaves, glabrous to scabriduous; internode 1–12 cm long. Leaves 2 or 3, arising from 2–9 cm above the bulb, linear, fistular, 2–20 cm x 1–2 mm. Umbels 2–4 cm in diam., 8–70-flowered; spathe bifid, ovate, 8–10 x 5–10 mm. Flowers tubular, constricted at the apex;

pedicels 5–10 mm long, up to 12 mm in fruits, erect, glabrous. Tepals purplish-blue or pale purple with dark purple midvein, lanceolate, 4–5 x 1 mm, acuminate, membranous, adherent up to 1 mm at base. Filaments included, 3–3.5 mm long, outer little shorter, adnate and adherent to the perianth at base up to 1 mm; anthers pea-shaped, 0.7 x 0.5 mm, dark violet. Ovary ovoid-oblong to globose, 0.7–1.5 mm; style 0.5–2.5 mm long; stigma inconspicuous. Capsules obovoid, light brownish-yellow, c. 3 x 3 mm, with persistent perianth and filaments, 3-seeded; pericarp thin. Seeds black, elliptic, 2.2 x 1.2 mm, plano-convex.

Fl.: April - August. *Fr.*: August.

Habitat: At foot of high mountains in exposed rocky places between 1200 and 3350 m altitude.

Distrib.: INDIA: Jammu & Kashmir, Himachal Pradesh and Uttaranchal ; PAKISTAN, AFGHANISTAN, C. ASIA.

Uses: Medicinal value, used as sudorific (Chopra et al. 1956).

Notes: *A. miserabile* Wendelbo, distinguished as a separate species from *A. jacquemontii* on the basis of pubescent leaf base and obtuse tepals, is not tenable as both pubescent to glabrous leaf sheath and acute to obtuse tepals were observed in the same gathering.

Specimens examined: Himachal Pradesh: Trilokinath, 21.8.1971, *U.C. Bhattacharyya* 45936 (BSD); Lahul, 30.6.1958; *M.A. Rau* 6010 (BSD); Jammu & Kashmir: Ladak, July 1905, *A. Meebold* 4098 (CAL); Jammu, *T. Thomson* (CAL); Karakorum, 24.7.1939, *R. Scott Russell* 1311 (BM); Balti, 26.7.1847, *Winterbottom* 727 (CAL); Gilgit, 1885, *Giles* 233 (CAL); Chenab, October 1864, *Brandis* 3355 (CAL); Purti, 20.7.1881, *R. Ellis* 1580 (CAL). Uttaranchal : Tehri, 1.4.1981, *A.K. Goel* 72868 (BSD); 10.4.1981, *A.K. Goel* 72968 (BSD).

19. **Allium loratum** Baker in J. Bot. 12: 290. 1874; Hook.f., Fl. Brit. India 6: 345. 1892. Type: W. Tibet, alpine region, 10–14000 ft., *T. Thomson s.n.* (K).

Plants 10–30 cm high; bulbs ovoid, 2–2.5 x 1.5–2 cm, outer coat membranous. Leaves 2–5, basal, lanceolate or narrowly lanceolate, 15–20 x 1.5–8 cm, often longer than scape, narrowed at base. Umbels hemispherical or globose, 4–5 cm diam., many flowered. Spathe bifid,

shorter than umbel. Flowers broadly campanulate or stellate; pedicels 1 – 2.5 cm long. Tepals white or pink, lanceolate, 3 - 4 x 1 mm, midrib prominent, adherent with each other at base. Filaments 4 – 5 x 0.5 mm, adnate to the tepals up to 1 mm at base; anthers oblong, 1.5 - 0.7 mm. Ovary obovoid or globose, c. 1.5 x 1.5 – 2 mm, triquetrous; style 2 – 5 mm long.

Fl.: May to August.

Habitat: 3000 m - 4000 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh and Uttaranchal ; AFGHANISTAN.

Specimens examined: India, Himal. Bor. Occ., Kistwar, *T. Thomson* 23 (L, CAL); Chenab valley, January 1881, *R. Ellis* (CAL); *Baden Powell* 308 (CAL). Uttaranchal : Tehri Garhwal, Bhairanghathi, 2800 m, 19.5.1973, *M.A. Rau* 51659 (BSD).

20. ***Allium macleanii*** Baker in Bot. Mag. 109, t. 6707. 1883; Wendelbo in Rech. f. Fl. Iranica 76: 88. 1971; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 29. 1975. Type: Cultivated in Kabul, *Maclean* (K). *A. atropurpureum* sensu Hook.f., Fl. Brit. India 6: 344. 1892. **Fig.9.1a – 1g**

Local name: “*Baadsah salap*” (trade name in India).

Plants 25 – 90 cm high; bulbs ovoid, 2.5 – 3 x 1 – 3 cm, outer tunics membranous, greyish-black; roots c. 2 mm in diam. Stem 0.5 - 1.2 cm diam., terete, glabrous, sometimes gland-dotted. Leaves 1 – 4, broadly linear to oblanceolate, 26 - 50 x 1.5 - 4.5 cm, acute. Umbels hemispherical or globose, 5 - 7 cm in diam., many flowered; spathe bifid, ovate, 1 - 2.5 cm long, long acute. Flowers campanulate to stellate; pedicels 1 – 5 cm long, 3 – 5 cm in fruit. Tepals rose purple, lanceolate or broadly lanceolate, 5 – 6 x 1.5 – 2 mm, concave, coherent at base, midvein prominent, inner 3 broader. Filaments pale mauve purple, 3 – 6 mm long, 1 – 2 mm broad at base, coherent and adherent to the perianth at base up to 1 mm, inner 3 broader, indistinctly awned, sometimes outer 3 longer, all tapering above; anthers oblong or ovate-oblong, 1 – 1.5 x 0.5 - 0.7 mm, dorsifixed. Ovary obovoid or globose, 1 – 1.5 x 1 – 2 mm, deeply trilobed, stipitate; style 2 – 6 mm long, linear. Capsule pyriform, 3 - 4 x 3 – 5 mm, locules 1-seeded; pericarp thin, scarious. Seeds ovoid-oblong, 2 – 3 x 2 x 2 mm, deep black, notched on one side, wrinkled.

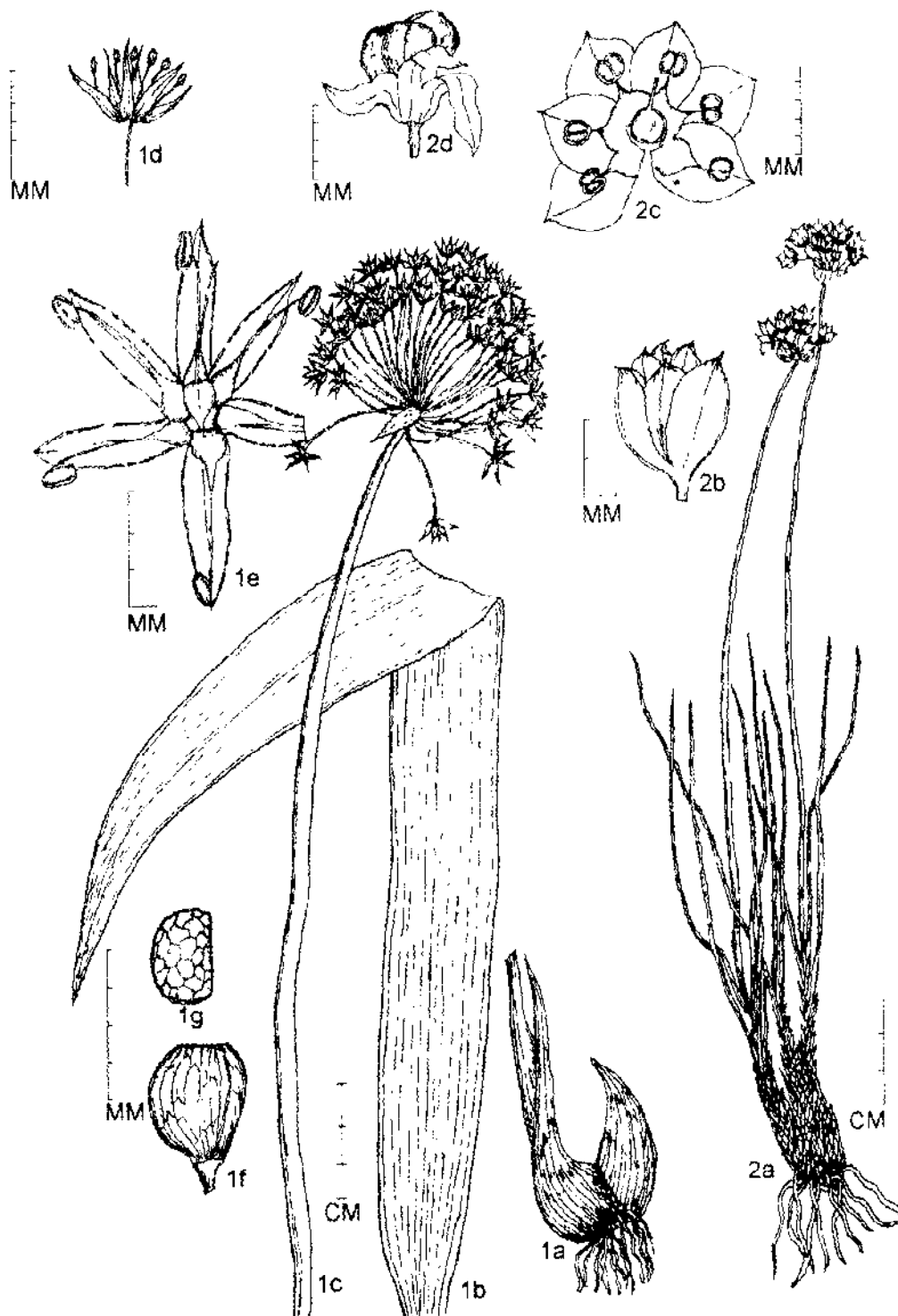


Fig. 9. *Allium macleanii* Baker 1a. Bulb. 1b. Leaf. 1c. Portion of scape with umbel. 1d. Flower. 1e. Dissected flower. 1f. Capsule. 1g. Seed. *A. oreoprasum* Schrenk 2a. Habit. 2b. Flower. 2c. Dissected flower. 2d. Capsule.

Fl. & Fr.: May - August.

Habitat: Among grasses or stony slopes between 1500 and 4500 m altitudes.

Distrib.: INDIA: Jammu & Kashmir (Kashmir) and Himachal Pradesh; PAKISTAN, IRAN, AFGHANISTAN, NEPAL.

Uses: Bulbs and leaves are edible. Contains neutral saponins.

Specimens examined: Himachal Pradesh: Chenab Valley, Kilar, 9.6.1979, *J.D.A. Stainton* 8108 (E, BM); Chamba, Pangi, 6.9.1899, *Harsukh* (CAL); Chamba, August 1880, *R. Ellis* 74 (CAL); Ind. Or., Kishtwar, *T. Thomson* 18 (CAL); Kashmir, May 1894, *Aitchinson* 20 (CAL).

21. **Allium macranthum** Baker in *J. Bot.* 12: 293. 1874 & in *Curtis' Bot. Mag.* 110, t.6789. 1884; *Hook. f., Fl. Brit. India* 6: 345. 1892; *Rendle in J. Bot.* 44: 44. 1906; *W.W. Sm. & Cave in Rec. Bot. Surv. India* 4: 248. 1911; *Stearn in Herbertia* 12: 82. 1947 & *Bull. Brit. Mus. Nat. Hist. London* 2(16): 186. 1960. Type: Sikkim, Lachen, *J.D. Hooker* 9 (K photo!).

Fig.6.2a – 2d

Herbs 22–28 cm high; bulbs narrowly cylindrical, 2.5–5 x 0.5 cm, inconspicuous, with many stout roots; roots 2–5 mm broad, often fusiform. Leaves 5–7, basal, linear, 20–22 x 0.2–0.5 cm, flat, acute. Umbels subglobose, 4–12-flowered, loose; spathe 2-3-valved, caducous. Flowers cup-shaped; pedicels 1.5–3.5 cm long, blackish-brown. Tepals purple or red, broadly oblong, 9–11 x 5–6 mm, obtuse to truncate, entire, midvein prominent. Filaments linear, 10 x 2 mm, connate up to 1 mm at base; anthers narrowly oblong, 1.5–0.7 mm. Ovary angularly oblong, 1.5–2.5 x 1–2.5 mm, with 6 apical swellings or crests; style linear, 9.5 mm long, often exserted; stigma slightly broader than style. Capsules obovoid, c. 4 x 5 mm, light yellowish-brown. Seeds black, non-lustrous.

Fl. & Fr.: July–September.

Habitat: On damp rocky soils and grassy hill slopes, between 3900 m to 4270 m.

Distrib.: INDIA: Sikkim; BHUTAN, CHINA-S.E. TIBET. Rare.

Specimens examined: Sikkim: Senthang, August 1886, *G. King s.n.*(CAL); Tangu 13.8.1909, *Smith & Cave* 2378 (CAL).

22. **Allium mairei** H. Lev. in Fedd. Rep. Nov. Sp. 7: 339. 1909; Airy Shaw in Notes Roy. Bot. Gard. Edinb. 16: 146. 1931; Stearn in Bull. Brit. Mus. Nat. Hist. 2: 177. 1960. Type: China, Yunnan, 1906, *E.E. Maire* 452 (P). *A. yunnanense* Diels in Notes Roy. Bot. Gard. Edinb. 5: 301. 1912; Marquand in J. Linn. Soc. London 48: 226. 1929. Type: Yunnan, 1906, *Forrest* 3038 (P). **Fig.2.2a – 2c**

Herbs gregarious, 10-40 cm high, slender; bulbs cylindrical, 3–8 x 0.5–1 cm, outer scales white becoming fibrous, roots less than 1 mm in diam. Stem angular, papillose. Leaves 3 or 4, basal, filiform, linear, 10–25 cm x 2 mm. Umbels 4–7-flowered in unevenly maturing fascicles; spathe ovate, 5–10 x 3–4 mm, acuminate. Flowers erect, broadly campanulate; pedicels 1–2.5 cm long, angular, papillose. Tepals white or purple with pink midvein, lanceolate or oblanceolate, 8–10 x 1.5–2.5 mm, obtuse, margin folded. Filaments linear, 4–6 x 0.5 mm, adherent to the tepals and connate up to 1 mm at base; anthers linear-oblong, 1–1.3 x 0.5 mm. Ovary ellipsoid, 2–3 x 1.5–2 mm; style 1.5–3 mm long. Capsules yellowish brown when young, obovoid-globose, c. 3.5 x 3.5 mm.

Fl.: August - October.

Habitat: In clumps on sunny turf often on cliffs, associated with species of *Roscoea*, *Iris*, *Saxifraga*, *Hypericum* etc. Abundant in places from 2430 to 3050 m altitudes.

Distrib.: INDIA: Arunachal Pradesh; CHINA, MYANMAR.

Specimens examined: Arunachal Pradesh: Dichu gorge, 6.8.1950, *F. Kingdon-Ward* 2110 (BM).

Note: New record for India and Myanmar.

23. **Allium oreoprasum** Schrenk in Bull. Sci. Acad. Imp. St. Petersb. 10: 354. 1842 & Enum. Pl. Nov. 2: 6. 1842; Regel in Acta Hort. Petrop. 3, 2: 180. 1875; Hook. f., Fl. Brit. India 6: 344. 1892; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 15. 1975, name only. Type: Turkestan, Kuhlas, 10.7.1841, *Karelin & Kirilow* 862 (LE). **Fig.9.2a – 2d**

Herbs 25–30 cm high; bulbs tufted, cylindrical, c. 3 x 1 cm, outer coats finely reticulate fibrous, yellowish, profusely rooting at base, roots 2 mm in diam. Leaves 5 or 6, basal, linear, 7–15 cm x 2 mm. Umbels hemispherical or fascicled, 2.5–3 cm diam., 6–12-flowered; spathe bifid,

ovate, 8–10 mm long. Flowers broadly campanulate; pedicels 8–12 mm long. Tepals white, oblong-ovate, 5–7 x 3–4 mm, recurved, acuminate, midrib prominent. Stamens and pistil included. Filaments 2.5–4 mm long, base 1.5–2 mm broad, connate and adnate to tepals at base; anthers globose-oblong, c. 1 x 1 mm. Ovary subglobose, 1.5–2.2 x 1.5–2.5 mm; style 1 mm or shorter. Capsules obovoid-globose, c. 5 x 6 mm, brownish yellow with persistent perianth.

Fl. & Fr.: July–September.

Habitat: Among boulders between 3000 and 5160 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir); PAKISTAN, CHINA (TIBET), C.I.S.

Specimens examined: Jammu & Kashmir: Ladak, 23.7.1929, Ludlow 551 (BM). Tibet occ. 12000–14000 ft. *T. Thomson* (L!)

Note: The description and figure of *A. oreoprasum* given by Nasir (1975) do not match with its protologue. Regel (1875) identified a collection from Zalung Karpo pass, Himalaya 10–17000 ft. *Stoliczka* (LE) as *A. oreoprasum* Schrenk though Hook. f. (1892) stated as “not seen any Indian specimens” In fact duplicate of the above collection available at CAL(!) matches with the description provided by Schrenk (1842) and Regel (1875).

24. **Allium roylei** Stearn in *Herbertia* 12: 75. 1947; Wendelbo in *Rech.f.*, *Fl. Iranica* 76: 15. 1971; Nasir in Nasir & Ali, *Fl. W. Pakistan* 83: 11, f. 2. D-F. 1975. Type: Western Himalaya, *Royle s.n.* (K, LE, CAL!) *Mussqorie*, *Edgeworth s.n.* (BM, E, K). *A. rubens* sensu Baker in *J. Bot.* 12: 293. 1874, non Schrad. ex Willd. 1809. *A. lilacinum* Royle ex Regel in *Acta Horti Petrop.* 3, 2: 89. 1875, non Klotzsch 1862; Hook. f., *Fl. Brit. India* 6: 339. 1892. Type: W. Himalaya *Royle s.n.* (K, LE, CAL) **Fig.10.1a – 1f**

Herbs 22–40 cm high. Bulbs ovoid, 3–8 x 1.5–2.5 cm, outer coat membranous, reddish brown. Stem 3–4 mm diam. Leaves 1–3, at the base of the stem, linear, 4–20 x 0.1–0.2 cm. Umbels hemispherical, 2.5–4 cm diam., 15–40-flowered. Spathe bifid, 12–15 x 10 mm. Flowers campanulate; pedicels 7–12 mm long; bracteate. Tepals reddish, ovate-lanceolate, 5.5–6 x 2.5–3 mm, acute, often plicate, midvein present. Stamens and pistil exerted. Filaments 6–8 mm long, connate and adherent with perianth up to 1.5 mm at base; 3 alternate filaments subulate, 1 mm broad at base, other 3 broader at base with 1 mm long teeth on either side; anthers oblong.

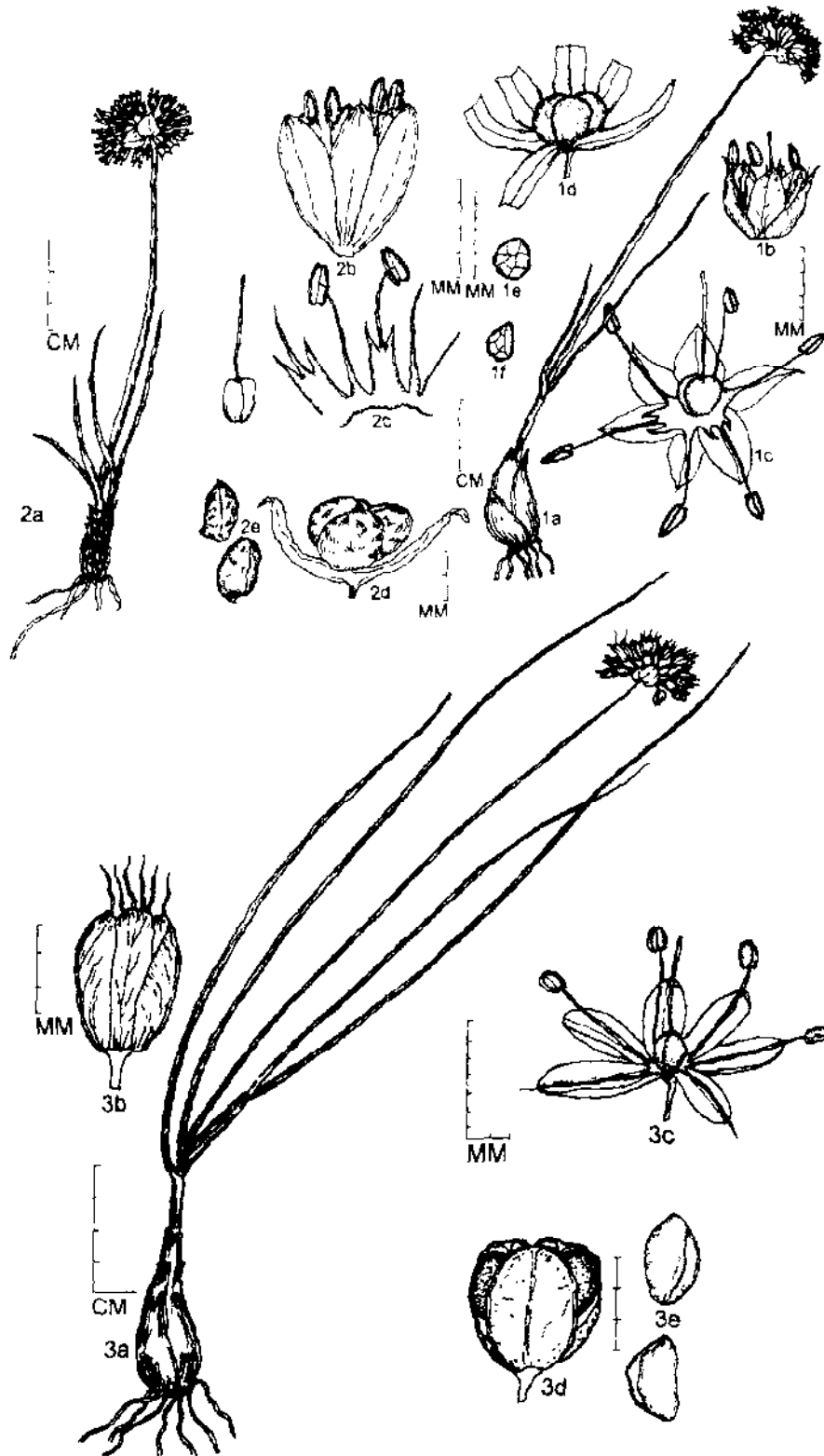


Fig.10. *Allium roylei* Stearn 1a.Habit. 1b. Flower. 1c. Dissected flower. 1d. Capsule. 1e & 1f. Seeds. *A. stoliczki* Regel 2a. Habit. 2b. Flower. 2c. Stamens and Pistil. 2d. Capsule. 2e. Seeds. *A. stracheyi* Baker 3a. Habit. 3b. Flower. 3c. Dissected flower. 3d. Capsule. 3e. Seeds.

1.5–2 x 0.7 mm. Ovary globose or ovoid, 2–2.5 x 2–2.5 mm, trilobed, style 5–9 mm long. Capsules obovoid, 4–5 x 4–6 mm, deeply trilobed, pericarp thin, papery, light yellowish brown. Seeds brownish black, orbicular, c. 2.7 x 2.5 x 2 mm, concavo-convex, wrinkled on convex surface.

Fl. & Fr.: July–September.

Habitat: On moist rocky slopes, between 2000–3200 m. altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir) and Uttaranchal ; PAKISTAN AND AFGHANISTAN.

Specimens examined: Jammu & Kashmir: Sanjhi-Chat-Bhairan temple, 11.9.1989, *B.P. Uniyal* 86703 (BSD); Uttaranchal : Garhwal, 18.9.1870, *G King s.n.* (CAL); Mussoorie, 18.8.1870, *G King s.n.* (CAL); Shali, 1.7.1886, *E.R. Johnson s.n.* (CAL).

25. *Allium schoenoprasum* L., Sp. Pl. 301. 1753; Baker in J. Bot. 12: 292. 1874; Regel in Acta Horti Petrop. 3, 2: 77. 1875; Hook. f., Fl. Brit. India 6: 338. 1892; Wendelbo in Rech.f., Fl. Iranica 76: 17. 1971; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 13. 1975. Type: Siberia, (LINN). **Fig.7.3a – 3c**

Local name: 'Chives' (English).

Herbs 20–35 cm high; bulbs cylindrical, gregarious, 1.5–2 x 0.5 cm, scales membranous; stem 5–6 mm in diam. Leaves 1–3, arising from 4–10 cm above the base, linear, 10–20 cm x 2–6 mm, fistular. Umbels subglobose, 3–4.5 cm diam., many-flowered; spathe bifid, ovate, 2–2.5 x 1–1.5 cm, acute. Flowers broadly campanulate; pedicels 7–12 mm long, glabrous. Tepals pink or mauve, lanceolate, 9–12 x 3 mm, acute. Filaments linear, 6–7 x 1 mm, connate up to 2 mm at base; anthers oblong, 1 x 0.5 mm. Ovary oblong, 2–3 x 2–2.5 mm, trilobed, base glandular; style linear, 3–3.5 mm, triquetrous.

Fl. & Fr.: June–August.

Habitat: On rocky ground between 3000–3900 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir) and Himachal Pradesh; ASIA, EUROPE, N. AMERICA. Cultivated as vegetable.

Specimens examined: Himachal Pradesh: Lahul, 2.7.1973, *U.C. Bhattacharyya* 51706 (BSD); Jammu & Kashmir: Kolohoi valley, 27.8.1956,

Polunin 578 (BM, E); Haramukh, 29.7.1940, *Ludlow & Sherriff* 7842 (BM); Seshnag, 17.7.1977, *J.D.A. Stainton* 7956 (E); Musjid valley, 25.7.1893, *J.F. Duthie* 13213 (K); Kashmir, September, 1894, *C.B. Clarke* 24253 (K).

26. ***Allium sikkimense*** Baker in J. Bot. 12: 292. 1874; Regel in Acta Horti Petrop. 3, 2: 146. 1875; Hook. f., Fl. Brit. India 6: 341. 1892; C.H. Wright in Curtis, Bot. Mag. 116, t. 8858. 1920; Stearn in Bull. Brit. Mus. Nat. Hist. Soc. 2: 178. 1960. Type: Sikkim, Tangu, 4200 m, *J.D. Hooker* 13 in part (K lecto photo!). *A. tibeticum* Rendle in J. Bot. 44: 41. 1906. Type: Tibet, Karo La, July 1904, *Walton s.n.* (BM lecto, CAL!). **Fig.6.3a – 3c**

Herbs 5–25 cm high, slender; bulbs gregarious, cylindrical, 2–4 x 0.3–0.5 cm, outer tunics with parallel fibres. Leaves 2 or 3, basal, linear, 4–18 cm x 1–2 mm, margins revolute to give a terete appearance, margin and veins muricated beneath. Umbels bent, hemispherical, 1.5–3 cm diam., 10–20-flowered; spathe deltoid, 10–12 x 6–9 mm, 1-valved. Flowers broadly campanulate; pedicels unequal, 2–6 mm long. Tepals lilac purple or light blue, obovate-oblong, 4–10 x 2–4 mm, boat-shaped, connate at base, pouched below, midvein present. Filaments blue, subulate, 3–8 mm long, free almost from the base, c. 1.5 x 1.5 mm at base; anthers yellow, subglobose, 1 mm long. Ovary globose, 1.5–3 mm in diam.; ovules 2 per locule; style 1.5–2 mm long; stigma obscure. Capsules obovoid-globose, c. 4 x 3.5 mm, light brown, with persistent perianth and filaments.

Fl. & Fr.: July–October.

Habitat: On open grassy hillsides and on sandy soils along rivers and streams between 3600 and 5200 m altitude.

Distrib.: INDIA: Sikkim; BHUTAN, C. NEPAL, TIBET-CHINA.

Specimens examined: Sikkim: *G.H. Cave* 134 (CAL); Lhonak, 4.8.1907, *Smith & Cave* 2105 (CAL); Naku chu, September/October 1909, *Lepcha collector* 2731 (CAL).

27. ***Allium stoliczki*** Regel in Acta Horti Petrop. 3, 2: 160. 1875; Stearn in Herbertia 12: 78. 1947; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 15. f. 4. D & F. 1975. Type: Ind. Or. Tibet, *Stoliczka s.n.* (LE, CAL!). *A. junceum* Jacq. ex Baker in J. Bot. 12: 295. 1874, non Smith 1809. Type: Tibet Occ. 12–16000 ft. *Thomson s.n.* (L!, K Photo!). *A. jacquemontii* Regel in Acta Horti Petrop. 3, 2: 162. 1875. Hook. f., Fl. Brit. India, 6: 342.

1892, non Kunth 1843. Type: India Orientalis, Ghoyoumel, Piti, *Jacquemont* 548 (P, Photo!). *A. przewalskianum* Regel in Acta Horti Petrop. 3, 2: 164. 1875; Stearn in Bull. Brit. Mus. Nat. Hist. 2: 173. 1960. Type: China, Kansu, 1872, *Przewalski s.n.* (CAL, K photo!). **Fig.10.2a – 2e**

Herbs 10–35 cm high; bulbs cylindrical, 1.5–6 x 0.4–1 cm, outer coat densely reticulate fibrous, often reddish. Stem terete, 1–3 mm in dia., leafy towards base, longer than leaves. Leaves 4 or 5, linear, 2–19 cm x 1–2 mm, acute. Umbel globose or hemispherical, 2–2.5 cm in diam., many-flowered; spathe bifid, ovate, c. 10 x 8 mm. Flowers campanulate; pedicels 3–4 mm long. Tepals violet or pink, ovate-lanceolate, 4–6 x 3 mm, unequal, entire, obtuse, midvein present; inner slightly bigger. Filaments 5.5–6 mm long, exserted, connate at base up to 1 mm forming a ring, outer 3 linear, c. 1 mm broad at base, inner 3 oblong, c. 3.5 x 1.5 mm at base, with 1.5–2.5 mm long needle and 2 awns on either side; anthers oblong or globose, 1–1.5 x 0.5–1 mm. Ovary obovoid, rarely ovoid, 1.5–2.5 x 1–2 mm, adherent to tepals and filaments at base; styles 4 mm long, upper triquetrous. Capsules obovoid, c. 3 x 4 mm, umbelicate, light brownish yellow, conspicuously trilobed with persistent tepals, splits from the top; locules 2-seeded; pericarp thin, surface uneven. Seeds deep brown, suborbiculate, surface uneven.

Fl. & Fr.: July–September.

Habitat: On Carbonaceous slates or gravel from 3300 to 5191 m. altitude.

Distrib.: INDIA: W. Himalayas, Jammu & Kashmir (Kashmir) and Himachal Pradesh; NEPAL, CHINA-TIBET.

Uses: Aitchison reported that it grows largely on high hills of Ladakh and used by the natives as condiment. It is sold in the market in the shape of balls. The whole plant is smashed into a semipulp and then made into a ball as big as the fist. The balls are strung through the middle and carried on a string (c.f. Royle, Ill. Bot. Himal. Mts.: 392–393. 1840).

Specimens examined: Himachal Pradesh: Spiti, Takcha, 25.7.1972, *U.C. Bhattacharyya* 48815 (BSD). Jammu & Kashmir: Ladak, 25.7.1941, *Ludlow & Sherriff* 8529 (BM); 8.9.41, *Ludlow & Sherriff* 8571 (BM); Ganglas, 1.8.1988, *H.J. Chowdhury & B.P. Uniyal* 86043 (BSD); 1880, *Aitchison* 376 (CAL).

Note: The three species of Regel *A. stoliczki*, *A. jacquemontii* (non Kunth) and *A. przewalskianum* appear to be conspecific as evident from their descriptions and types.

Regel described *A. stoliczki* on the basis of some incomplete specimens collected from Ind. Or. Prov. Tibet by Stoliczka. Hook. f. (1892) has not mentioned this species, though there were several collections of *Stoliczka* at CAL. Stearn (1960) also has not seen *Stoliczka* specimens. In CAL there are two specimens collected by *Stoliczka* from Ind. Or. Tibet: Karnag, Zalung Karpo Pass 14-17000 ft. 8/65 and Karnag 12-15000 ft., July 65. Both are complete specimens with bulbs, leaves, heads with flowers and both have been collected prior to Regel's publication. These specimens completely match with the description of *A. stoliczki* Regel.

28. **Allium stracheyi** Baker in J. Bot. 12: 293. 1874; Regel in Acta Horti Petrop. 3, 2: 134. 1875; Hook. f., Fl. Brit. India 6: 340. 1892; Stearn in Bull. Brit. Mus. Nat. Hist. 2: 174. 1960. Type: Kumaon, Ralam, 1848, *Strachey & Winterbottom* 5 (K photo!, CAL!). *A. longistaminum* Royle, Ill. Bot. Himal. Mts.: 392. 1840. excl. descr. Type: Kunawar, *Royle s.n.* (K). **Fig.10.3a – 3e**

Local name: "Jambu" (Kumaon).

Herbs 20 - 30 cm high, slender; bulbs oblong-ovoid, 3.5 - 5 x 1 - 1.7 cm, fibrous. Stem leafy at the base, terete, glabrous. Leaves 2 - 4, arising 2 - 8 cm above the bulb, linear, 11 - 30 cm x 1 - 2 mm. Umbels subglobose or hemispherical, 1.0 - 2.5 cm in diam., 8 - 10-flowered, loose; spathe bifid, ovate, c. 1 x .5 cm, acuminate. Flowers oblong-campanulate; pedicels 3 - 5 mm long. Tepals rosy purple or yellow, often white with pink veins, broadly-oblong or ovate-oblong, 4 - 5 x 2 - 2.5 mm, outer slightly shorter, convex, obtuse, midvein prominent, coherent and pouched at base. Filaments purple, linear, 7 - 8 x 0.5 mm, free, adherent to perianth at base up to 1 mm, exerted after anthesis; anthers yellow, oblong, 1 - 1.5 x 0.5 - 0.7 mm. Ovary oblong, 1.5 - 2.5 x 1.2 mm, deeply trilobed, lobes winged, covered with large necteral pits by hood like projection; style purple, linear, 3.5 - 8 mm long, trisulcate; stigma obscure. Capsules globose-oblong, c. 4 x 3 mm; pericarp thin, papery, yellow, glabrous, 2 seeds in each locule. Seeds elliptic, plano-convex, c. 3 x 1.7 mm, black, surface uneven.

Fl. & Fr.: July - October.

Habitat: On dry open slopes or among rocky boulders, near streams or as an undergrowth in Pinus-Cedrus forests, between 2000 -3800 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh and Uttaranchal ; NEPAL, PAKISTAN.

Uses: Extensively used as a spice & curry powder.

Note: Nasir (1975) merged *A. stracheyi* Baker with *A. consanguineum* Kunth. But it is distinct species for having shorter pedicels (3 – 5 mm long) and narrower leaves (1 – 2 mm broad).

Specimens examined: Himachal Pradesh: Chamba, Pangi, 13.8.1899, *J.H. Lace* 2030 (CAL); Kakcham hill slopes, 13..8.1973, *K.P. Janardhanan* 52660 (BSD); Trilockinath, 22.8.1971, *U.C. Bhattacharyya* 45935 (BSD). Jammu & Kashmir: Banihal ridge, 14.9.1958, *T.A. Rao* 7712 (BSD). Uttaranchal : Kumaon, 23.8.1848 and 5.10.1848, *Strachey & Winterbottom* 5 (CAL); Jaunsar, October 1890, *J.S. Gamble* 25086 (CAL) & September 1898, *Gamble* 27280 (CAL); Mussoori, April 1897, *P.M. Mackinon* 156 (CAL); August 1877, *Duthie* 623 (CAL); Tehri Garhwal, Ganges Valley, October, *Duthie* 2079 (CAL); Tehri Garhwal, Gangotri-Rudragair, 19.9.1967, *B.D. Naithani* 3735 (BSD); Chirbasa-Gangotri, 5.9.1983, *U.C. Bhattacharyya* 74978 (BSD).

29. **Allium tuberosum** Rottler ex Spreng., Syst. Veg. ed. 16, 2: 38. 1825; Stearn in *Herbertia* 11: 239, tt. 264 - 266. 1946 & in *Bull. Brit. Mus. Nat. Hist. London* 2: 179. 1960. Type: Cultivated in Tranquebar Botanical Garden, Malabar, *Rottler s.n.* (K, LIV). *A. sulvia* Buch.-Ham. ex D. Don, *Prodr. Fl. Nepal.*: 53. 1825; Type: Nepal, Suimbu, 11 July, 1802, Buch.-Ham.*s.n.* (LINN. 583. 38). *A. tuberosum* Roxb., *Fl. Ind.* 2: 141. 1832; Baker in *J. Bot.* 12: 291. 1874; Hook. f., *Fl. Brit. India* 6: 343. 1892. Type: Gardens in Bengal, *Roxb. s.n.* (LINN 583. 21). *A. roxburghii* Kunth, *Enum. Pl.* 4: 454. 1843. Type: Cult. in Cal. Garden, *Roxb. s.n.* (LINN 583. 21). *A. odorum* sensu Baker in *J. Bot.* 12: 291. 1874 & sensu Hook.f., *Fl. Brit. India* 6: 343. 1892. *A. clarkei* Hook.f., *Fl. Brit. India* 6: 344. 1892. Type: Kashmir, Skardo, *Clarke s.n.* (CAL!).

Fig.8.2a – 2c

Local name: Bunga, Gandana (Bengal); Dume (Himachal Pradesh); Naive Leek, Chinese Chives (Eng.).

Herbs 16 - 45 cm high, odorous; bulbs cylindrical, 2.5 - 3.5 x 1 - 2 cm, often with reticulated fibrous scales, profusely rooting at base. Stem 0.5 cm in diam., glabrous, ribbed. Leaves 3 - 6, arising from 3 - 4 cm above the bulb, linear, 15 - 17 x 0.4 - 0.6 cm, not fistular. Umbels hemispherical, 3 - 5 cm in diam., 10 - 40-flowered. Spathe bifid, ovate, c. 2 x 1 cm. Flowers campanulate, stellate on maturity; pedicel 1 - 2 cm long. Tepals white, pink veined, oblanceolate, 4 - 7 x 1.5 - 2 mm, acuminate. Filaments dark brown or white, 2.5 - 4 mm long, connate up to 1 mm at base, deltoid, adherent with perianth; anthers pink or brown, oblong, 1 - 2 x 0.5 - 1 mm. Ovary green, obovoid, 1.5 - 2 x 1.5 - 1.7 mm; style white, 1 - 2.5 mm long; stigma obscure. Capsules broadly obovoid, 3 - 4 x 5 - 6 mm, trilobed, pericarp light yellow, thin, glabrous. Seeds obovoid, c. 3 x 2 mm, blackish brown, coarsely reticulate.

Fl.: July - Sept. *Fr.*: July - Nov.

Habitat: On open rocky slopes, open meadows and on moist sandy soils between 1900 and 2600 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal, Punjab, Meghalaya and Tripura; NEPAL, BANGLADESH, MYANMAR, CHINA, JAPAN. Wild & cultivated.

Uses: It is reported that the whole plant is consumed as a vegetable and widely favoured as salad ingredient. It has medicinal properties and seed is used in Spermatorrhoea.

Specimens examined: Jammu & Kashmir: N.E. Kargil, *Dr. Stoliczka* (CAL); Kashmir, Scardo, 16.8.1876, *C.B. Clarke* 30505 (CAL); Ladak, Lower Suri Valley, 23.8.1940, *R.R. Stewart* 21031 (CAL). Manipur: Imphal market, 14.10.1925; *S.N. Bal* 459 (BSIS). Meghalaya: Khasi Hills, Kylang rock, 4.9.1913, *U.N. Kanjilal* 2531 (CAL); Hollong, Nov. 1871, *C.B. Clarke* 15402 (CAL); 7.11.1891, *C.B. Clarke* 15408 (BM); Cherrapunji, 2.6.1911, *R.K. Das* 34958 (BSIS). Punjab: Hoshiarpur dist., 26.8.1970, *O.P. Misra* 41521 (BSD). Tripura: Agartala, 23.3.1920, *P.M. Deb Barman* 1214 (CAL); August 1915, *P.M. Deb Barman* 791 (CAL); Uttaranchal: Garhwal, Valley of flowers, 19.8.1963, *U.C. Bhattacharyya* 29571 (BSD); Kumaon, Dafia Dhura, 1.8.1972, *C.M. Arora* 49535 (CAL).

30. *Allium victorialis* L., Sp. Pl. 295. 1763; Baker in J. Bot. 12: 291. 1874; W.W. Sm. & Cave in Rec.Bot. Surv. India 4: 247. 1911; Kitamura in

Kihara, Fauna & Fl. Nepal Himalayas 1: 91. 1955. Type: Europe (LINN). *A. victoralis* var. *angustifolium* Hook. f., Fl. Brit. India 6: 342. 1892. Type: Sikkim, Lachen, 16.7.1842, *J.D. Hooker s.n.* (K). *A. prattii* C.H. Wright ex Forbes & Hemsl. in J. Linn. Soc. London Bot. 36: 124. 1903; Stearn in Bull. Brit. Mus. Nat. Hist. 2: 171. 1960. Type: China, Sikiang, Tatsienlu, *A.E. Pratt* 576 (K photo!, CAL!). *A. prattii* var. *ellipticum* Wang & Tang in Bull. Fan. Mem. Inst. Biol. Bot. Ser. 7: 297. 1937. Type: Nepal, Gossainthan, *Wallich* Cat. No. 5069 (K- W). **Fig.12.1a – 1d**

Local name: Kok-pa (Bhutia).

Herbs 15–45 cm high. Bulbs gregarious, cylindrical, 0.5–10 x 0.5–2.5 cm, tunics reticulated fibrous, onion scented. Stem slender, longer than leaves, ribbed, glabrous. Leaves 2–4, arising 2–16 cm above the bulb, internode obscure, lanceolate to elliptic, 16–33 cm x 1–4 cm, narrowed at base into petiole, acute, midvein prominent, petiole purple. Umbels hemispherical or subglobose, 15–60-flowered, 2–5 cm in diam.; spathe ovate, 1–4 x 1–4 cm. Flowers campanulate; pedicels 1–2 cm long, angular, longer in fruit. Tepals white to red with various intermediate shades, oblong, 4–6 x 1–2 mm, obtuse or acute. Filaments purplish, linear, 5–6 mm long, exserted, adnate and adherent at base; anthers dark yellow or brown, oblong, 1–1.5 x 0.5–0.7 mm. Ovary pink or dark green, obovoid, c. 2–1.5 mm, deeply lobed above; style light green, 3–4 mm long; stigma obscure. Capsules obovoid, 3–5 x 3–5 mm, trilobed; 1 seed in each locule. Seeds globose-oblong, C. 2 x 1.5 mm, wrinkled.

Fl. & Fr.: May–November.

Habitat: On river banks or near glacier, open grassy land amongst bushes, between 2100 m to 4100 m. altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal and Sikkim; PAKISTAN, NEPAL, BHUTAN, MYANMAR, CHINA, JAPAN, EUROPE, N. AMERICA. Wild and cultivated.

Uses: Leaves used for seasoning curries; used as carminative in W. Garhwal.

Specimens examined: Himachal Pradesh: Chamba, 10.6.1896, *Lace* 1420 (ISIM, CAL); Raturang, 17.5.72, *Janardhanan* 46794 (BSD); Pangi, *Stoliczka* (CAL); Pangi, 10.8.1899, *Harsukh s.n.* (CAL). Jammu & Kashmir:

Muree hills, June 1909, G. Watt (CAL); Sonemarg, 10.8.1913, Cap. F.E. Koebel 96 (CAL). Sikkim: Tangu, 7.7.1903, E. Younghusband (CAL); 31.5.1961, R.S. Rao 1010 (CAL); Thango, 18.10.1901, Prain 168 (CAL); Jongri, August 1887, King's collector (CAL); Chola Pass, 5.8.1877, King's collector 4479 (CAL); Stay Chochoka, 12.7.1906, J.C. White s.n. (CAL); Changu, 4.8.1985, D.C.S. Raju & S. Singh 2846 (BSHC). Uttaranchal: Kumaon, 18.6.1958, T.A. Rao 7030 (BSD); Tehri, 3.6.1978, A.K. Goel 64050 (BSD).

Notes: Baker (1874) recognised *A. victoralis* L. as most widely distributed species, extending from Europe to Japan. But Hook. f. (1892) differentiated Sikkim, Nepal specimens as a variety *A. victoralis* L. var. *angustifolia* Hook. f., having 1.3 - 3.2 cm broad leaves, pale pink flowers against broader leaves and white flowers in *A. victoralis* var. *victoralis*.

Wright (1903) described a new species *A. prattii* on the basis of a specimen collected by E. Pratt from China, having same characters of reticulate bulb coat, linear leaves (1.2 cm broad) and deeply trilobed ovary. Stearn (1947, 1960) after examining E. Himalayan specimens remarked that *A. victoralis* L. var. *angustifolia* Hook. f. and *A. prattii* C.H. Wright ex Forbes & Hemsl. as conspecific. The later is distinct from *A. victoralis* in having 2 linear leaves (1.2 - 3.2 cm broad) and pink flowers against 4 broader leaves and white flowers.

After study of the materials collected from Western and Eastern Himalayas, it is observed that there are two extreme forms of plants, one form bearing 4 robust leaves and white flowers as in *A. victoralis* L., occurring in W. Himalayas to the Kumaon-Nepal border and the other form with smaller plants bearing 2 leaves and pink flowers as in *A. prattii* C.H. Wright in E. Himalayas. These two forms in two different geographical regions and ecological conditions differ greatly indicating taxonomical distinction. But the plants from Bhutan, Nepal, Uttaranchal show intermediate characters like 2 or 3 lanceolate leaves with pink flowers and 2 lanceolate leaves with white flowers. It shows that there is a gradual change from smaller plants with linear leaves to bigger plants with broader leaves. But the change is so gradual that no distinction is possible. Moreover, very broad leaved and purple flowered plants have been collected from Myanmar and narrow leaved from Kumaon, Uttaranchal. This shows that geographical and ecological isolation is not complete and no distinction is possible. Therefore they are merged together in this work.

31. *Allium wallichii* Kunth., Enum. Pl. 4: 443. 1843; Baker in J. Bot. 12: 291. 1874; Regel in Acta Horti Petrop. 3, 2: 142. 1875; Hook.f., Fl. Brit. India 6: 341. 1892; W.W. Sm. & Cave in Rec. Bot. Surv. Ind. 6: 247. 1911; Kitamura in Kihara, Fauna & Fl. Nepal Himal. 1: 91. 1955; Stearn in Bull. Brit. Mus. Nat. Hist. Lond. 2: 182. 1960. Type: Nepalia & Kumaon, Wall. Cat. no. 5070 (L!, CAL!, K - W photo!). **Fig.8.3a - 3d**

Local name: "Ujnad" (Khasi)

Herbs 40 - 65 cm high; bulbs cylindrical, insignificant, stem base covered by old fibrous leaf bases, profusely rooting at base, strongly smelling like leek. Stem 3 - 8 mm in diam, glabrous, triangularish. Leaves 4, or 5, arising 5 - 16 cm above the base from a single node, linear, 25 - 60 x 0.5 - 2 cm, acute, sheathing at base. Umbels hemispherical, 5 - 7 cm in diam., 5 - 40-flowered; spathe 1 or 2-fid, lanceolate, 2 - 3 x 0.7 - 1 cm, caducous. Flowers broadly campanulate or stellate after anthesis; pedicels 2 - 2.5 cm, elongates to 4 cm in fruits, glabrous, angular. Tepals deep purple or brilliant magenta, ovate-lanceolate, 6 - 10 x 2 - 3 mm, membranous, acute, midvein prominent. Filaments subulate, 4 - 8 x 1.5 mm at base, adherent to the perianth up to 1 mm at base; anthers oblong, 1.7 - 2 x 1 mm. Ovary c. 2 x 1.5 mm; style linear, 2.5 - 4.5 mm long. Capsules globose to obovoid, 4 - 6 x 5 - 8 mm, light brownish yellow, trilobed. Seeds oblong, 3.5 - 4 x 2 mm, brownish black.

Fl.: August - November. *Fr.*: October - November.

Habitat: Besides running water, hilly slopes or rocky areas in open conifer forests, between 2800 and 3625 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Uttaranchal, Sikkim, Assam and Meghalaya; BHUTAN, NEPAL, TIBET-CHINA. Wild and cultivated.

Uses: Cooked with fried fish or roasted meat for flavouring.

Specimens examined: Meghalaya: Shillong, May 1918, H.G. Carter 817 (CAL); Uttaranchal: Kumaon, Edgeworth s.n. (CAL); 11.10.1848, Strachey & Winterbottom 2 (CAL); 6.8.1972, C.M. Arora 49674 (CAL); Tehri-Garhwal, August, Duthie 503 (CAL); 30.8.1883, Duthie 505 (CAL).

Cultivated species:

32. *Allium cepa* L., Sp. Pl. 300. 1753; Baker in J. Bot. 12: 295. 1874; Hook. f., Fl. Brit. India 6: 337. 1892; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 15. 1975. **Fig.11.1a - 1d**

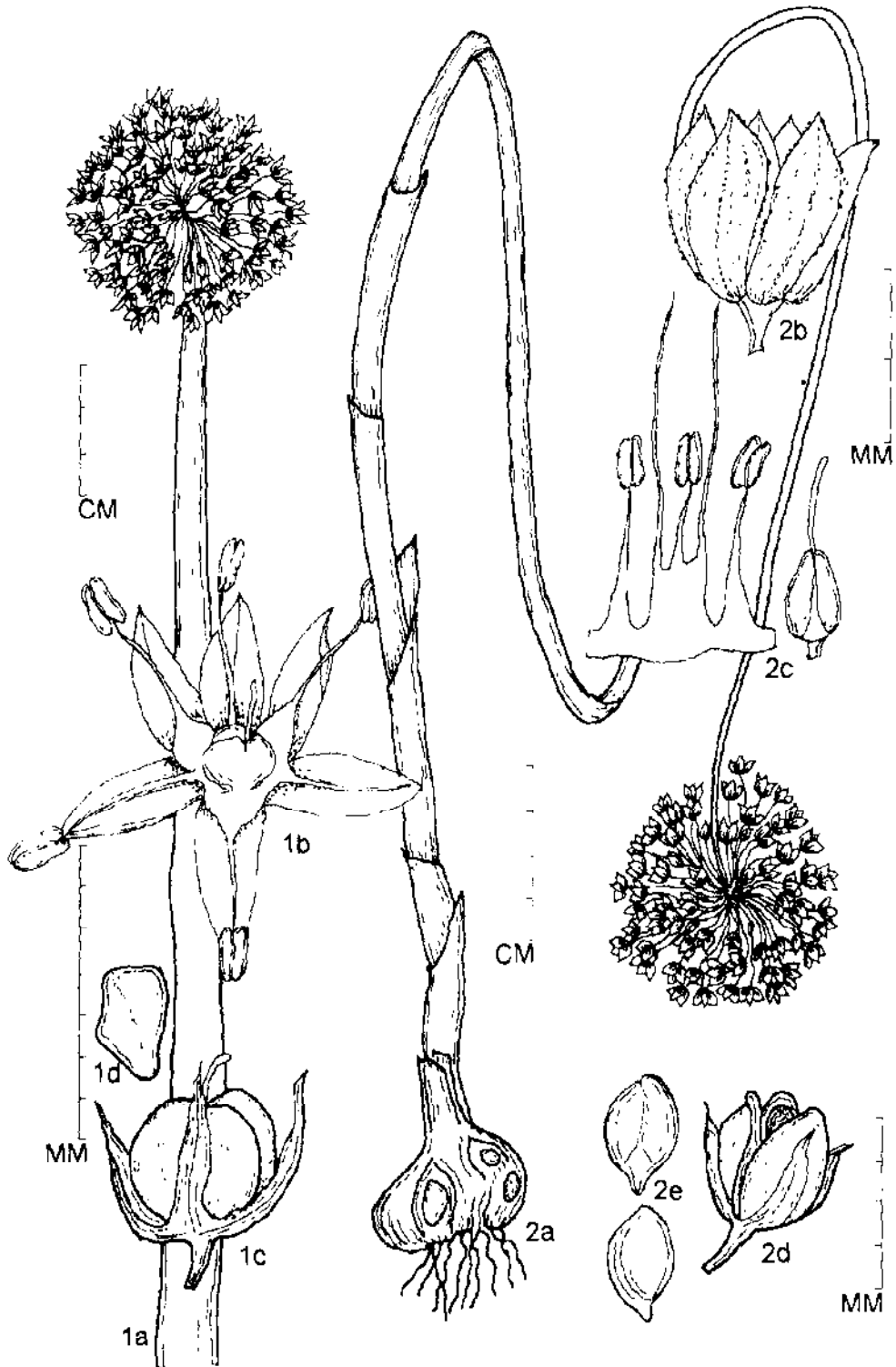


Fig. 11. *Allium cepa* L. 1a. Scape with umbel. 1b. Dissected flower. 1c. Capsule. 1d. Seed. *A. porrum* L. 2a. Habit. 2b. Flower. 2c. Stamens and Pistil. 2d. Capsule. 2e. Seeds.

Local names: Onion (Eng.); *Piyaz* (Hindi, Bengali); *Kanda* (Marathi); *Nirulli, Oollipai* (Telugu); *Irulli* (Kannada); *Vengayam* (Tamil); *Palandu* (Sanskrit).

Herbs 50 - 70 cm high; bulbs variously shaped, usually ovoid-globose, 4 - 8 x 2.5 - 7 cm, long necked, outer scales light brown, scarios, inner fleshy. Stem up to 1.5 cm in diam., fistular, terete, glabrous. Leaves few, linear, 20 - 40 x 0.5 - 1 cm, arising 10 cm above the bulb. Umbels globose, 4.5 - 6 cm diam., numerous flowered, compact; spathe 2-fid, ovate, 1.5 x 1 cm, scarios, persistent. Flowers white, campanulate; pedicels 2 - 3 cm long. Tepals lanceolate, 4 - 5 x 1.5 - 2 mm, acute, hooded, connate below, midvein prominent. Filaments linear, 3.5 - 4.5 mm long, connate below, base of inner 3 filaments ovate, 1.5 x 1.5 mm, indistinctly cuspidate on either side; base of outer 3 filaments ovate, c. 1 x 1 mm; anthers oblong, c. 1.5 x 0.5 mm. Ovary globose, 1 - 2 x 1 - 2 mm, deeply trilobed; style linear, 1.5 - 1.7 mm long; stigma inconspicuous. Capsules light brown, subglobose, c. 4 x 4 mm, trilobed, 3-seeded. Seeds black, rectangular-oblong, 3 x 2 mm, concavo-convex.

Fl. & Fr.: March - May.

Distrib.: Extensively cultivated throughout India and other countries.

Uses: Used all over the world as vegetable and spice.

33. **Allium porrum** L., Sp. Pl. 295. 1753; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 25. 1975. *A. ampeloprasum* L. var. *porrum* (L.) Regel in Acta Horti Petrop. 3, 2: 54. 1875. **Fig.11.2a - 2e**

Local names: Leek (Eng.); *Kirathi* (Arab); *Paru* (Bengali); *Vilati piyaz* (Hindi); *Seeme vengayam* (Tamil).

Herbs up to 1 m high; bulbs ovoid, 3 - 4 x 3 - 4 cm, scaly, with bulbels inside the outer papery scales; bulbels light brown, globose to ovoid, 4 - 10 x 3 - 7 mm. Leaves 6 - 12, spirally arising from distinct internodes, linear, 1 - 2 cm broad. Umbels globose, 5 - 8 cm in diam., numerous flowered; spathe long-beaked. Flowers campanulate; pedicels 2 - 3.5 cm long. Tepals white to light pink with green vein, lanceolate, 4 - 5 x 2 mm, acuminate, outer surface scabrid glandular. Stamens unequal, inner filaments longer than tepals with broader rectangular base (2.5 x 1.5 mm), tricuspidate, central cusp linear, 2.5 mm long, bearing anthers; lateral cusps 3 - 5 mm long, thread like; outer filaments subulate, 4.5 - 5 x 1 mm; anthers yellow.

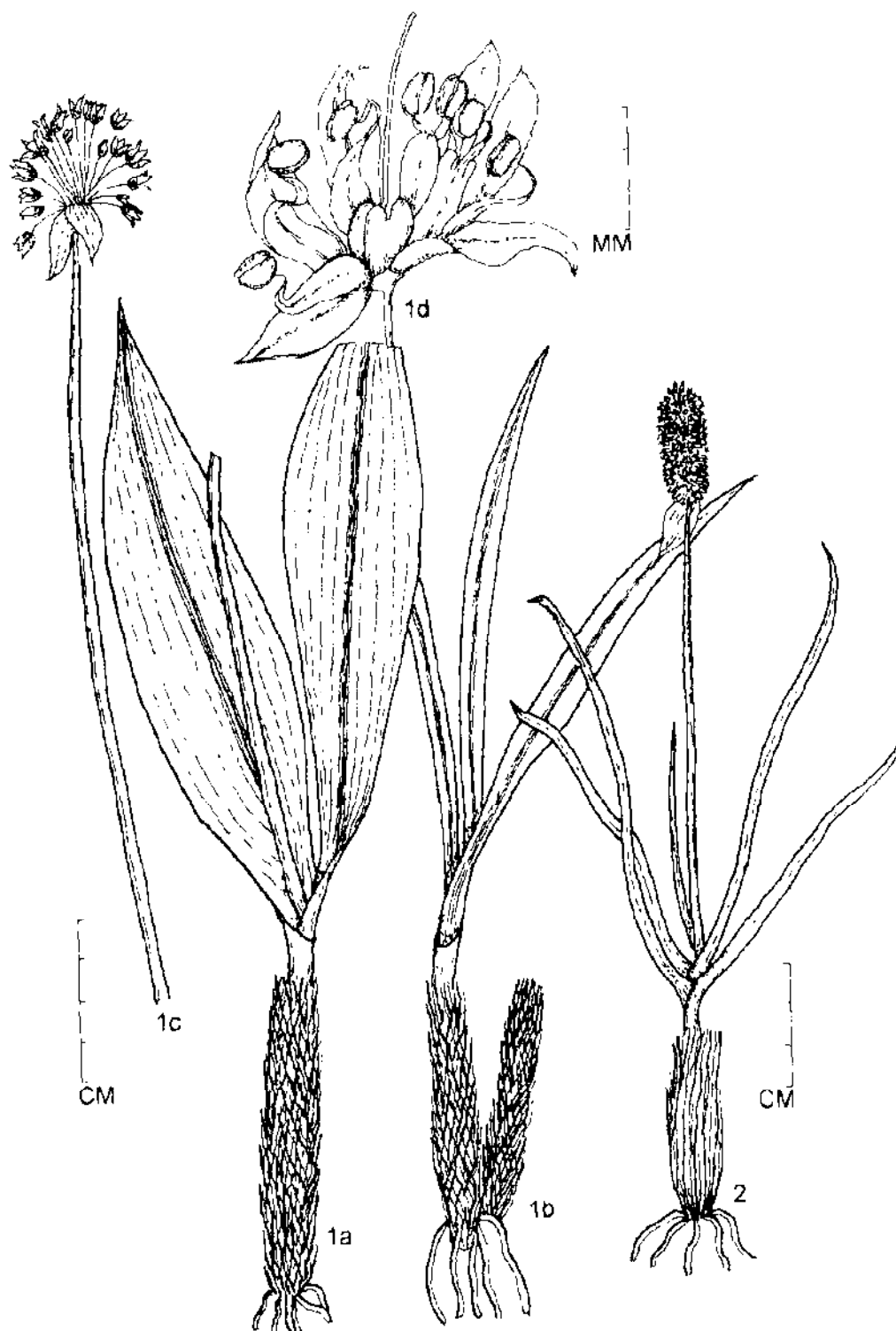


Fig. 12. *Allium victorialis* L. 1a.&1b.Habit.1c. Scape with umbel. 1d. Dissected flower. *Milula spicata* Prain 2. Habit.

oblong, 1.5 - 0.7 mm. Ovary ovoid, c. 2 x 1.5 mm, trilobed; style c. 2 mm long, included; stigma conspicuous. Capsules subglobose, c. 5 x 5 mm with persistent perianth. Seeds deep black, elliptic, 3.5 x 1.7 mm, triquetrous.

Fl. & Fr.: July.

Distrib.: Cultivated in India and other countries as vegetable.

Uses: Eaten raw or boiled as soup or stew.

34. **Allium sativum** L., Sp. Pl. 296. 1753; Hook.f., Fl. Brit. India 6: 337. 1892; Nasir in Nasir & Ali, Fl. W. Pakistan 83: 16. 1975.

Local names: *Garlic* (Eng.); *Lasun* (Hindi, Sanskrit).

Herbs up to 1 m high; bulbs ovoid, 3 - 4 x 2 - 4 cm, with many bulbels, bulbels elongated ovoid, 1 - 2 x 0.5 - 1 cm, outercoat papery. Stem 8 - 10 mm in diam., with prominent internodes, glabrous. Leaves 5 - 8, linear, 10 - 35 x 0.5 - 1 cm. Spathe 2-fid, ovate, c. 3 x 2.5 cm. Umbels with bulbils and rarely flowering. Flowers white; tepals lanceolate. Filaments shorter than tepals, inner filaments with 2 cusps on either side at base. Capsules few, ovoid, 8 x 6 mm; pericarp papery. Seeds 6 x 5 x 2 mm, semicompressed, black. Bulbils 1.2 - 3 x 1.2 - 2 cm, ovoid.

Distrib.: Extensively cultivated in India and other countries.

Notes: Used all over the world in medicine and as spice.

2. MILULA

Prain in Sci. Mem. Med. Off. Army India 9: 57, t. 1, 1895 & in Ann. Roy. Bot. Gard. Calcutta 5: 165, t.200. 1896; Stearn in Bull. Brit. Mus. Nat. Hist. 2: 187, t.9 - 12. 1960.

Bulbous, scapigerous herbs; bulbs solitary. Scape longer than leaves with terminal spike. Leaves radical, sheathing at base. Spathe solitary, membranous. Spike numerous flowered. Flowers gamophyllous. Stamens 6 in 2 whorls, free, connate at base; anthers oblong, dorsifixed. Ovary subglobose; style linear. Seeds not winged, testa black non-lustrous.

A monotypic genus of Himalayas in India, Nepal and Tibet.

Milula spicata Prain in Sci. Mem. Med. Off. Army India 9: 57, t. 1, 1895 & in Ann. R. Bot. Gard. Calcutta 5: 165, t. 200. 1896; Stearn in Bull. Brit. Mus. Nat. Hist. 2: 189. 1960; Chowdhery & Uniyal in Ind. J. For. 12:

323. 1989. Type: S.E. Tibet, Chumbi, August 1878, *Dungboo* 150 (K, CAL!). **Fig.12.2**

Herbs 15 - 25 cm high; bulbs with slight onion smell, ovoid-cylindrical, 4 - 7 cm long, outer tunics parallel fibrous; roots thick, many. Scape glabrous, 2 - 3 mm in diam. Leaves 5, basal, linear, 10 - 15 x 0.2 - 0.5 cm, glabrous. Spike oblong, 2 - 5 x 1 cm, numerous flowered; spathe purple, ovate, c. 3 x 2 cm, acuminate. Flowers reddish green, pinkish green or white, oblong-campanulate, c. 3 x 2 mm, gamophyllous with 6 lobes. Filaments white, 4 - 5 mm long, outer 3 with broader bidentate base; inner 3 linear; anthers purple, oblong, c. 1 x 0.5 mm. Ovary subglobose, 1.5 - 2 x 1.5 mm, trilobed; style 2 - 6 mm long. Capsule globose, diam. 3 mm. Seeds black, c. 2.5 x 1.5 mm, surface corrugated.

Fl.: June - August. *Fr.*: August - September.

Habitat: In open sandy drier places along the streams at about 3800 m altitude

Distrib.: INDIA: Jammu & Kashmir (Kashmir); NEPAL, CHINA-TIBET.

Uses: Eaten by the locals in Ladakh, it tastes like garlic (Chowdhery & Uniyal, 1989).

Specimens examined: Jammu & Kashmir: Ladakh 14.8.1988, *H.J. Chowdhery & B.P. Uniyal* 86185 (CAL).

LILIACEAE

Adans. Fam. Pl. 2 : 42. 1763 (*nom. cons.*)

Syamali Dasgupta*

Herbs with perennial bulbs; bulbs tunicated or imbricated. Stem erect, simple. Leaves radical or cauline or both, linear or lanceolate or cordate. Inflorescence racemose, corymbose or flower solitary. Flowers bisexual, hypogynous, pedicelled. Tepals free, 2 whorls of 3 each. Stamens 6 in 2 whorls; anthers oblong, dorsifixed or basifixed, latrorse; filaments free or connate at base. Pistil tricarpellary syncarpous. Ovary trilobed; ovules many in axile placentation; style simple; stigma trilobed or trifid. Capsules loculicidal, 6-lobed; lobes often winged. Seeds biseriate in each locule, triquetrous-rotund, often compressed and winged.

10 genera and 350 species (Mabberley, The Plant Book, 1997) all over N. hemisphere. 8 genera, 32 species, 2 varieties and 5 forma in India, of which 2 species are endemic.

KEY TO THE GENERA

- | | | |
|-----|--|------------------------|
| 1a. | Anthers dorsifixed | 2 |
| 1b. | Anthers basifixed | 6 |
| 2a. | Flowers infundibuliform or campanulate, rarely cupular; anthers attached at the middle; style much longer than ovary | 3 |
| 2b. | Flowers cupular or saucer-shaped; anthers attached below the middle; style as long as ovary or slightly longer or shorter | 5 |
| 3a. | Bulbs imbricate, without dry outer coat; flowers actinomorphic; stigma trilobed; seeds winged; nectaries conspicuous | 4 |
| 3b. | Bulbs tunicated, with dry outer coat; flowers slightly zygomorphic; stigma trifid; seeds not winged, nectaries obscure | 7. Notholirion |
| 4a. | Both radical and cauline leaves present; leaves cordate, long petioled, reticulately veined | 1. Cardiocrinum |
| 4b. | Only cauline leaves present; leaves linear or lanceolate, sessile, parallel veined | 4. Lilium |
| 5a. | Stigma trilobed; seeds obscurely winged, margin thickened; nectaries often on both sides of midrib of the tepals at base; often with processes | 6. Nomocharis |
| 5b. | Stigma trifid; seeds prominently winged, margin not thickened; nectaries oblong or rotund at the base of the tepals, glabrous | 2. Fritillaria |

*Central National Herbarium, Botanical Survey of India, Howrah

- 6a. Radical leaves absent; cauline leaves not modified into bracts; bracts absent; capsules beaked, without persistent perianth; bulb-scales often with hairs inside **8. Tulipa**
- 6b. Radical leaves present; cauline leaves few, modified into bracts above; capsules not beaked, with persistent perianth; bulb-scales without hairs inside 7
- 7a. Bulbs ovoid; scales fibrous; bulbils or bulbels absent; flowers in racemose or solitary; stamens and pistil shorter than tepals **5. Lloydia**
- 7b. Bulbs globose or ovoid; solitary fleshy radical leaf base inside, outer scales scarious or fibrous; bulbils and bulbels present; flowers in corymbose or scorpioid cyme or umbel; rarely solitary; stamens and pistil nearly as long as tepals **3. Gagea**

1. CARDIOCRINUM

Lindl., Veg. Kingd. 203. 1846; Hutchinson, Fam. Fl. Pl. 753. 1973. *Lilium* L. subgen. *cardiocrinum* (Endl.) Baker in J. Linn. Soc. 14: 227. 1874; Krause in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 15a: 331. 1930. Woodcock & Stearn, Lil. World 368. 1950.

Herbs tall, bulbous with both radical and cauline leaves; bulbs subglobose, with spirally arranged, loose, fleshy, imbricate scales; central axis producing flowering stem every year; stem fistular. Leaves spiral, cordate, uncostate, venation reticulate, lateral veins subopposite; petioles of basal leaves longer. Inflorescence terminal, racemose. Flowers infundibuliform; pedicels short; bracts foliaceous, caducous. Tepals 6 in 2 whorls, oblanceolate, base pouched, nectariferous. Nectaries at base of tepals, linear, glabrous. Stamens 6, nearly as long as tepals; filaments filiform; anthers linear-oblong, mid-dorsifixed, latrorse. Ovary sessile, linear-oblong; placentation axile; ovules biseriate; style much longer than ovary, filiform; stigma trilobed. Capsules broadly ellipsoid, trilobed, trilocular, loculicidal dehiscence, retuse at the tip; stipe short, stout, oblique on the pedicel; pericarp coriaceous, deeper coloured outside, light coloured and shining inside, dehiscing margin pectinate; central axis stout. Seeds numerous, biseriate, superposed, triangular, compressed, deep brown, broadly winged; wings membranous.

Distrib.: 3 species in Japan, China, Nepal, Bhutan and India; one in India.

Cardiocrinum giganteum (Wall.) Makino in Bot. Mag. Tokyo 27: 125. 1913; Hara, Fl. E. Himal. 1: 406. 1966 & 2: 165. 1971. *Lilium giganteum* Wall. Tent. Fl. Nepal.: 21. t. 12-13. 1824, excl. syn.; Baker in J. Linn. Soc. 14: 227. 1874; Hook. f., Fl. Brit. India 6: 349. 1892. Type: Nepal, 1821, Wallich Cat. 5075 (CAL! K-W, photo!). *Lilium cordifolium* D. Don, Prodr. Fl. Nepal. 52. 1825 non Thunb. 1794. Type: Nepal, 1821, Wallich Cat 5075 (CAL! K – photo!). *L. cordifolium* subsp. *giganteum* Baker in Gard. Chron. 479. 1871. **Fig. 13.1a – 1h**

Local name: Dumblai (Sunteg), Langitalli or Kaiangtalli (Khasia).

Plants 2 – 4 m high; bulbs in tufts, 2.5 – 6 x 2 – 6 cm; scales c. 3 cm broad; stems 2.5 – 5 cm in diam., hollow, glabrous. Leaves broadly cordate, 7 – 30 x 5 – 26 cm; petiole up to 30 cm long, 1 – 2 cm diam. Flowers 6 – 10, drooping, funnel-shaped, fragrant, 8 – 18 cm long, 5 – 9 cm in diam. at the apex; pedicels 0.5 – 1.2 cm long, 3 – 5 mm in diam.; bracts 6 – 8 x 2 cm. Tepals oblanceolate, 8 – 18 x 1.2 – 3 cm, white, with red or brown streaks inside the tube and greenish outside. Filaments filiform, 5 – 11 cm x 3 – 3.5 mm; anthers yellow, linear-oblong, 6 – 13 x 1.5 – 2.5 mm, umbonate at tip. Ovary linear-oblong, 25 – 30 x 3 – 4 mm; style filiform, 3.5 – 9 cm long, c. 1 mm in diam.; stigma trilobed, 2 – 4 mm broad. Capsules broadly ellipsoid, 4 – 7 x 2 – 6 cm. Seeds triangular, 5 – 6 x 2 – 4 mm; wing 1 – 1.2 mm broad, scarious.

Fl.: May – September. *Fr.:* August – October.

Distrib.: INDIA: Himachal Pradesh, Uttaranchal, Punjab, West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Nagaland, Manipur; NEPAL, BHUTAN, PAKISTAN, N. MYANMAR, S. TIBET CHINA.

Habitat: In shady humid places along the river or gorges, in bushes or scrub forests at an altitude of 2000 – 4000 m.

Uses: Plant (?) tincture in spirit is rubbed on the joints to cure pain. Bulbs are eaten by Mishmi tribals. Hollow stem is used to make musical instrument pipes.

Chr. no.: 2n = 24 (Sato in Bot. Mag. Tokyo 46: 68. 1932; Hall in Lily Year Book Lond. 1934: 35. 1934 and Sen in Folia Biol. Krakow 21: 83. 1973).

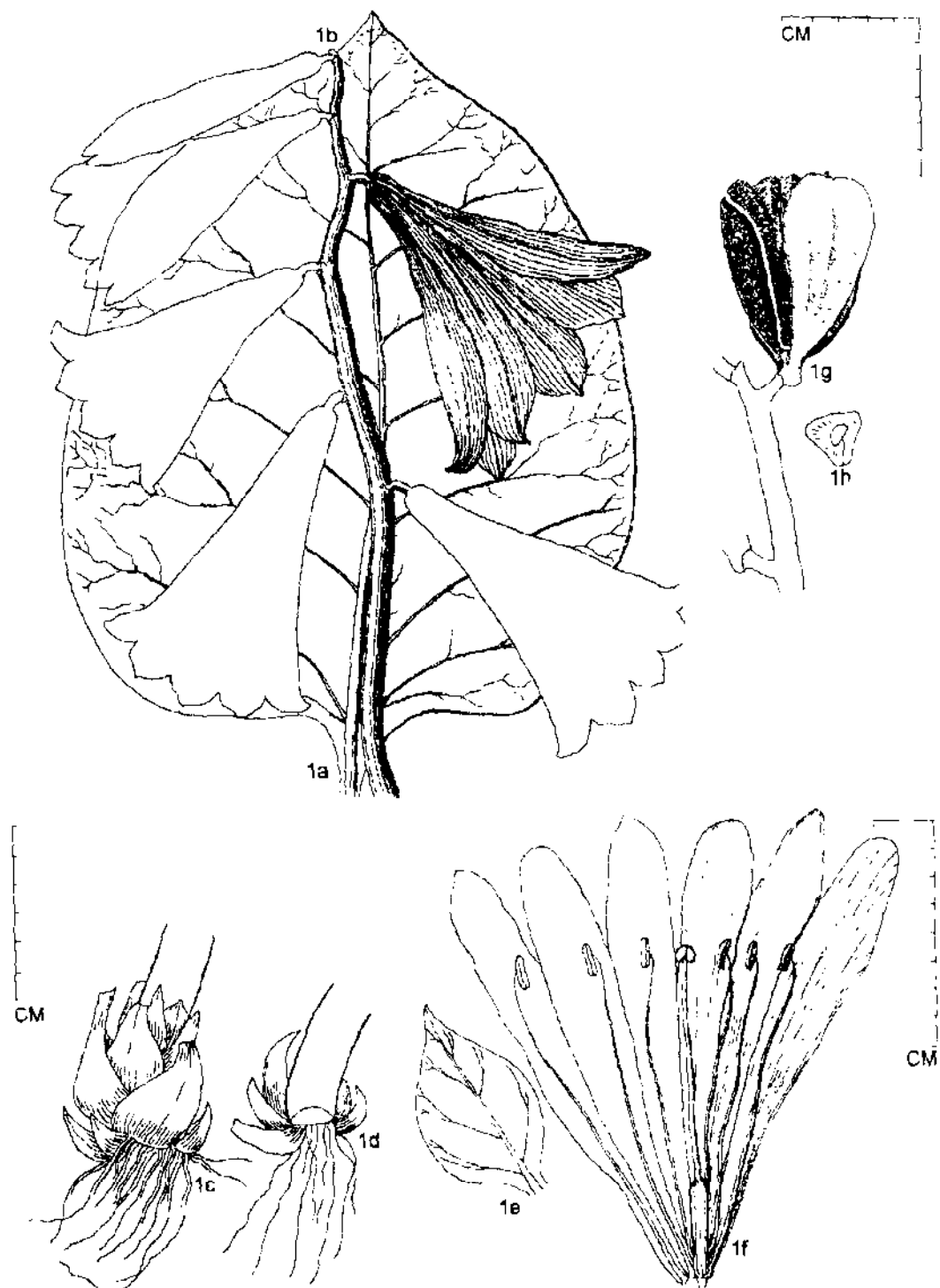


Fig.13. *Cardiocrinum giganteum* (Wall.) Makino 1a. Leaf. 1b. Inflorescence. 1c. Bulb. 1d. Bulb without scales. 1e. Bract. 1f. Flower split open. 1g. Capsule. 1h. Seed.

Specimens examined: Arunachal Pradesh: Bomdila, *Srinivasan* 56 (BSIS); Kameng, *Panigrahi* 15969 (CAL); *Panigrahi* 6965 (CAL); *Panigrahi* 6801 (CAL); Bomdila, *R.S. Rao* 7343 (CAL); Rupa to Bomdila, *R.S. Rao* 7302 (ASSAM); Zang to Tawang, *R.S. Rao* 7872 (CAL); Himachal Pradesh: Simla, *Gamble* 23505 (K); Kulu Valley, *Jain & Bharadwaj* -s.n. (DD); Manipur: Ching sow, *G. Watt* 6580 (CAL); Mao, *Watt* 6856 (CAL); Meghalaya: Khasia, *Watt* s.n. (BSIS); Khasia, *Burkill* 34239 & 34240 (CAL); Nagaland: Kohima, *Watt* s.n. (BSIS); Sikkim: Himalaya, *King's collector* s.n. (CAL); Talung, *Cave* 8 (CAL); Singlelah, *Gammie* s.n. (CAL); Sikkim, *Gamble* 10631 (K); Uttaranchal : Tehri Garhwal, *K.C. Sahni* 24886 (CAL); Near Chetti, *M.A. Rau* 15882 (BSD); Kumaon, Dwali, *T.A. Rao* 4314 (DD); Ticksane, *T.A. Rao* 6694 (BSD); Tehri Garhwal, Hanuman chetti, *B.V. Shetty* 35815 (BSD); Kumaon, near Lingrani R. Valley, *Pant & Naithani* 3977 (BSD); W. Bengal: Sandakpu, *King's collector* s.n. (CAL).

2. FRITILLARIA

L., Sp. Pl. 436. 1753 & Gen. Pl. ed. 5. 144. 1754; Baker in J. Linn. Soc. 14: 251. 1874; Hook. f., Fl. Brit. India 6: 352. 1892; Krause in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 15a: 33. 1930; S. Dasgupta & Deb in J. Ind. Bot. Soc. 65: 289. 1986.

Herbs erect; bulbs with heterogeneous or homogeneous tunicated scales; bulbels from the inner scales present. Leaves cauline, scattered or aggregated, sessile, lanceolate. Flowers 1 - 4 in racemes or umbels, cupular, pedicelled; bracts foliaceous. Tepals 6 in 2 whorls, oblanceolate or obovate or elliptic, gibbous at base. Nectaries rotund or oblong at base of tepals or slightly above. Stamens 6; filaments subulate; anthers linear or linear-oblong, dorsifixed at base. Ovary linear-oblong or obovoid-oblong; lobes doubly winged; style linear often broader above; stigma trifid, erect or reflexed; lobes longitudinally folded. Capsules oblong or obovoid, angular; lobes doubly winged, dehiscent from the top. Seeds many, triquetrous-rotund, compressed with broad membranous wing.

Distrib.: c. 85 species in N. temperate region; 4 in India.

KEY TO THE SPECIES

- 1a. Bulbs diam. 1.2 - 3 cm; scales inner nut-like, gradually thinner outwards becoming scarious outside; nectaries oblong, slightly above the base of tepals; anthers more than 1/2 of filaments; stigma erect; capsules obtusely angled

- 1b. Bulbs diam. 4–5 cm; scales thin, fleshy; nectaries round or oblong at the base of tepals; anthers 1/5 of filaments; stigma reflexed; capsules acutely angled 3
- 2a. Leaves lanceolate or linear-lanceolate, scattered; flowers slightly drooping or horizontal **1. *F. cirrhosa***
- 2b. Leaves elliptic-lanceolate, crowded in the middle; flowers erect **2. *F. delavayi***
- 3a. Leaves 8–10, subverticillate; flowers in umbels; bracts 5–12, lanceolate **3. *F. imperialis***
- 3b. Leaves in 3 close whorls of 3–4 each; flowers in racemes; bracts 2 per flower, broadly lanceolate **4. *F. raddeana***

1. ***Fritillaria cirrhosa*** D. Don, Prodr. Fl. Nepal. 51. 1825; Baker in J. Linn. Soc. 14: 257. 1874; Hook. f., Fl. Brit. India 6: 353. 1892; Kitamura in Kihara, Fauna & Fl. Nepal Himal. 92. 1955; Spring, Fl. Sikkim Himal. f. 88. 1963; Hara Fl. E. Himal. 1: 408. 1966 & 2: 166. 1971; S. Dasgupta & Deb in J. Ind. Bot. Soc. 65: 291. 1986. Type: Nepal, E. Gossainthan, August 1819, *E. Gardner s.n. Wall. Cat. 5079A* (BM! K-W photo!). *F. verticillata* Royle, Ill. Bot. Himal. Mts. 387. t. 92. f. 2. 1840, non Willd. 1799. Type; N.W. Himalaya, Royle s.n. (LIV) ex Wall. Cat. 5079C (CAL!). *F. roylei* Hook., Icon. Pl. 9: t. 860. 1852; Baker in J. Linn. Soc. 14: 257. 1874; Hook. f., Fl. Brit. India 6: 353. 1892. **Fig. 14.1a – 1h**

Local name: 'Pangoo' (Nepali).

Herbs 20–65 cm high. Bulbs subglobose, 1.5–3 x 1.5–2 cm; outer scales scarious, broadly ovate; innermost thick, nut-like. Stems erect, 0.5–1 cm diam., leafy towards tip. Leaves lanceolate or linear-lanceolate, 4–13 x 0.3–1.5 cm, lowest pair opposite, obtuse; upper ones in 2–3 whorls of 3–5 leaves each or a few alternate, uppermost falcate and often cirrhose. Flowers solitary or 2–3 in raceme, drooping or horizontal, overtopped by upper leaves; pedicels 1–4 cm long. Tepals light green with brown or purple chequering, oblanceolate, 3–5 x 0.7–2 cm. Nectaries oblong, naked. Filaments white, subulate, 11–17 x 1–2 mm; anthers pale yellow or light green, linear or linear-oblong, 6–19 x 1.5–2 mm. Ovary green, narrowly oblong, 5–16 x 1.5–2 mm; style whitish, 1–2 cm long; stigma erect. Capsules stipitate, broadly oblong, 2–3.5 x 1.5–2 cm, obtusely angled; wing c. 1 mm broad; dehiscing margin fimbriate. Seeds triangular-rotund, 3–7 x 2.5–5 mm; wing 1–2 mm broad.

Fl.: April July. *Fr.*: June October.

Habitat: Moist grassy slopes on open hillside, or in bottom of wide valley or on alpine meadow at 1500 – 4800 m altitude. Often among herbs, shrubs or trees like *Berberis*, *Juniperus*, *Rhododendron*, *Abies* etc.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal, Sikkim, West Bengal; PAKISTAN, AFGHANISTAN, NEPAL, BHUTAN, TIBET-CHINA, MYANMAR.

Chr. no.: $2n = 24$ (La Cour in *Heredity* 5(1): 37. 1951; A. Sharma & A.K. Sarkar in *Research Bulletin* 2: 38. 1967-68; S. Kurosawa in Hara, *Fl. E. Himalaya*: 355. 1971).

Note: W.J. Hooker (1852) treated *F. cirrhosa* D. Don as a synonym of *F. roylei* Hook. J.D. Hooker in *Fl. Brit. India* (1892) doubtfully treated the two as separate species stating that the former species “very nearly allied to *F. roylei*” Type of *F. roylei* N.W. India *Royle s.n.* extant at CAL shows cirrhose tendency.

Examination of a large number of specimens collected from Bhutan, Sikkim, Nepal, Uttaranchal, Himachal Pradesh and Kashmir shows that there is no difference in qualitative characters between the two species. Smaller plants with smaller bulbs, linear leaves, with cirrhose tips from E. Himalaya are gradually changed to bigger plants with bigger bulbs, broader leaves without cirrhie in W. Himalaya giving some indication of geographical and ecological distinction. But the change is so gradual that the distinction is quite impossible. The plants occurring in Uttaranchal and Nepal are intermediate between the two extremes. Sometimes comparatively bigger plants are found in Sikkim-Himalaya. In view of these observations, *F. roylei* is treated here as a synonym of this species.

Specimens examined: Himachal Pradesh: Chamba dist., *N.C. Nair* 32437 (BSD); Simla, *R.N. Parker* 3398 (K); Kashmir: Khilanmarg, 1936, *N.K. Robson s.n.* (BM); *Aslam Khan & Amin Shah* 86614 (LWG); *T.A. Rao* 9608 (BSD); Machhal Pass, Kishenganga valley, *Keshavananda* 1056 (DD); Liddarwat, Apharwat Lake, *T.A. Rao* 473 (BSD); Uttaranchal: Cheneil range, *Dutthie* 14548 (CAL); Harki Dun, *Gamble* (DD, CAL); West Bengal: Phalut, *K. Biswas* 8351 (CAL); Sandakphu, *Gammie* 23 (CAL); Sikkim: Aluthang to Chenthang, *S.N. Mitra* 9587 (CAL); Jongri, *R.S. Rao* 885 (CAL); *C.B. Clarke* 26189 (CAL); Lingto, *King's collector* 9242 (CAL).

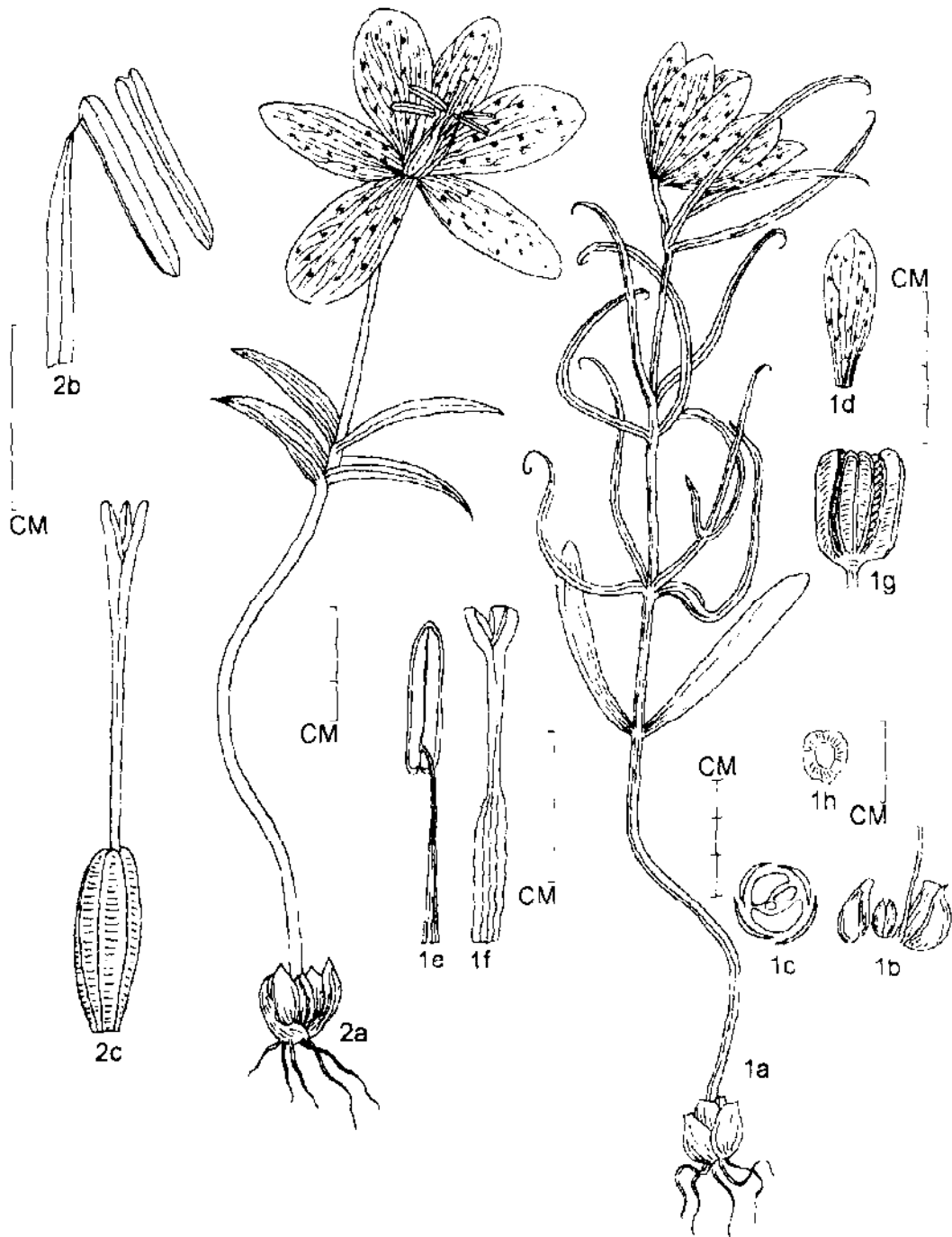


Fig. 14. *Fritillaria cirrhosa* D. Don 1a. Habit. 1b Bulbs opened. 1c. Bulbs T.S. 1d. Tepal. 1e. Stamen. 1f. Pistil. 1g. Capsule. 1h. Seed. *F. delavayi* Franch. 2a. Habit. 2b. Stamen. 2c. Pistil.

2. **Fritillaria delavayi** Franch. in J. Bot. Paris 12: 222. 1898; S. Dasgupta & Deb in J. Ind. Bot. Soc. 65: 296. 1986. Type: China, Yunnan, 3800 m, *Delavay* 27 (P). **Fig. 14.2a – 2c**

Herbs 25 – 35 cm high, bulbous herb with cauline leaves and solitary apical flower. Bulbs subglobose, 1.2 – 2 x 1.2 – 2 cm; inner scales few (4), thick, gradually becoming thinner outwards. Stem 4 mm diam.; lower part leafless. Leaves 4 – 5, crowded at middle of stem, elliptic-lanceolate, 4 – 8 x 0.4 – 1.5 cm, falcate. Flowers solitary, erect, cupular, on 7 – 10 cm long, stout pedicel. Tepals yellowish-green with red spots, elliptic, 4.5 – 5 x 1.7 – 2 cm, outer narrower. Nectaries oblong, 2 mm long, 1.5 cm above base of tepals. Filaments subulate, 9 – 15 x 1.5 – 2 mm, apiculate; anthers linear-oblong, 8 – 10 x 1.5 mm. Ovary obovoid-oblong, 8 – 12 x 3 – 4 mm; style 17 – 20 mm long; stigma erect. Capsules angularly obovoid, 1.2 – 1.4 cm long. Seeds triangular, 4 x 4 mm; wing as thick as seed.

Fl. & Fr.: July - August.

Distrib.: INDIA: Eastern Himalaya, Sikkim; CHINA.

Specimens examined: Sikkim: Lachung, *Dungboo* s.n. (CAL); Tang-kra-la, *King's collector* s.n. (CAL).

Note: *Fritillaria bhutanica* Turrill is a distinct species.

3. **Fritillaria imperialis** L., Sp. Pl. 303. 1753; Royle, Ill. Bot. Himal. Mts. 387. 1840; Baker in J. Linn. Soc. 14: 274. 1874; Hook. f., Fl. Brit. India 6: 353. 1892; S. Dasgupta & Deb in J. Ind. Bot. Soc. 65: 298. 1986. Type: Persia, Herb. Linn. (421.1 (LINN - microfiche!)). *F. coronaimperialis* Gaertn., Fruct. Sem. 1: 64. t. 17. f. 1. 1788. *Petilium imperiale* J. St.-Hil., Fam. Nat. 1: 120. 1805. **Fig. 15.1a – 1g**

Herbs 40 – 100 cm high, bulbous herb with subverticillate cauline leaves and apical umbels. Bulbs subglobose, 4 - 5 x 4 - 5 cm, propagated by offsets. Stem erect, 1 – 2.5 cm in diam. Leaves 8 – 10, subverticillate, lanceolate, 9 - 18 x 1.5 - 4.5 cm. Flowers 3 - 4 in umbels on 13 – 18 cm long peduncle, orange coloured; cupular or broadly campanulate; pedicels 2.5 – 5 cm, nodding in flower, elongating and erect in fruit; bracts 5 – 12, foliaceous, lanceolate. Tepals obovate or oblanceolate, 4 – 7 x 1.5 – 5 cm, gibbous at base. Nectaries white, round or oblong, 4 - 8 x 4 - 6 mm. Filaments filiform, 3 – 5 cm x 1 – 2 mm; anthers oblong, 7 – 9 x 2 – 2.5 mm. Ovary



Fig. 15. *Fritillaria imperialis* L. 1a. Habit. 1b. Bulb. 1c. Tepal. 1d. Stamen. 1e. Pistil. 1f. Capsule. 1g. Seed. *F. raddeana* Regel 2a. Leafy twig. 2b. Inflorescence.

oblong or linear-oblong, 6 - 11 x 1 - 4 mm; style 1.5 - 3 cm long; stigma reflexed. Capsules oblong, 3 - 5 x 2 - 4 cm, acutely angled, dehiscing margin pectinate; wing 3 - 5 mm broad. Seeds deep brown, 5 - 9 x 3 - 4 mm, thinly winged.

Fl.: April - June. *Fr.*: May - June.

Habitat: Common on rocks at 1740 - 3000 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir); PAKISTAN, AFGHANISTHAN, IRAN.

Chr. no.: $2n = 24$ (E. Strasburger in Arch. Mikrosk. Anat. 21: 476. 1882; Taylor in Amer. J. Bot. 13(3): 179. 1926; Darlington in Cytologia 2(1): 37. 1930 & Proc. Roy. Soc. Ser. B, 121: 264. 1936; A. Sharma & Sarkar in Research Bulletin 2: 38. 1967 - 1968; Kaul & Gohil in Phytion Horn. 15: 57. 1973; Mehra & Pandita in Taxon 27: 375. 1978).

Specimens examined: Kashmir: *T. Thomson s.n.* (CAL); Banihal mountain, *T.A. Rao* 9201 & 9208 (BSD); *P.M. Pinfold* 54 (BM); Chenab Valley, *R. Ellis* 1062 (CAL, K); Liddar valley, *Inayat* 25986 (CAL).

4. ***Fritillaria raddeana*** Regel in Acta Horti. Petrop. 10: 365. 1887; S. Dasgupta & Deb in J. Ind. Bot. Soc. 65: 299. 1986. Type: USSR, Khodzha-Kalabani, 11.3.1886, *Radde s.n.* (LE). **Fig. 15.2a & b**

Herbs up to 40 cm high; bulbs broadly oblong, 4 x 4 cm with fleshy scales. Stem c. 1 cm in diam.; leafless towards base. Leaves in 3 close whorls in the middle, each whorl with 3 - 4 leaves, elliptic, 13 - 18 x 4 cm. Flowers 3 - 5 in condensed racemes, cupular, nodding; peduncle 13 - 18 cm long; pedicels 2.5 - 3 cm long; bracts 2, foliaceous. Tepals oblong-lanceolate, 5 x 1.5 - 2 cm, acute. Nectaries round, c. 2 mm across, gibbous. Filaments linear, c. 3 cm long; stigma reflexed; anthers oblong, c. 7 x 2 mm. Ovary oblong, 11 x 4 mm; style linear, 3 cm long. Fruits not seen.

Fl.: June.

Habitat: 1500 m altitude.

Distrib.: INDIA: Jammu & Kashmir (Kashmir); USSR, IRAN.

Specimens examined: Jammu & Kashmir, Dras, *A.S. Harriss s.n.* (DD).

Note: Fritillaria pallidiflora Schrenk (1842) has been reported to be occurring in Kashmir, in Fl. U.S.S.R. (1935). One specimen from Kashmir, Kajnagrange, 10 – 11000 ft., 15.5.1892, *Duthie s.n.* (DD) examined, is very near to it but with some differences.

3. GAGEA

Salisb. in Kon. & Sims, Ann. Bot. 2: 555. 1806; Benth. in Benth. & Hook. f., Gen. Pl. 3: 819. 1883; Engl. in Engl. & Prantl, Nat. Pflanzenfam. 2, 5: 60. 1888; Hook. f., Fl. Brit. India 6: 355. 1892; Krause in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 15a: 318. 1930; Hutchinson, Fam. Fl. Pl. 754. 1973; S. Dasgupta & Deb in J. Bombay Nat. Hist. Soc. 83(1): 79. 1986.

Herbs small with both radical and cauline leaves and terminal inflorescence; bulbs ovoid, formed of single fleshy radical leaf base, surrounded by 1 or 2 layers of previous years scarious or fibrous radical leaf bases, with bulbels. Radical leaf as long as inflorescence. Stem arising later beside leaf base, terete, with terminal inflorescence. Cauline leaves 1 many, passing into bracts, often with bulbils at the axils or bulbiferous base. Flowers solitary or many in corymb or scorpioid cyme or racemes or umbel, campanulate, pedicelled; bracts linear, at base of pedicel or branching of peduncle. Tepals 6, in 2 whorls, yellow inside, persistent, lanceolate, divergent parallel veined. Filaments linear; anthers basifixed. Ovary oblong; style as long as or longer than ovary; stigma trilobed, truncate. Capsules broadly obovoid, trilobed, trilocular with persistent tepals, half the length of tepals, many-seeded. Seeds deep brown, triquetrous or semirobund, wingless.

Distrib.: 70 species in temperate Eurasia, 8 species and 1 variety in India.

KEY TO THE SPECIES

- | | | |
|-----|--|--------------------------------|
| 1a. | Flowers in lax panicle of corymbs or scorpioid cymes or racemes or solitary; bracts scattered in inflorescence | 3 |
| 1b. | Flowers in umbels; bracts confined to the base of inflorescence | 2 |
| 2a. | Inflorescence terminal, up to 6 cm long | 7. <i>G. reticulata</i> |
| 2b. | Inflorescence oblique, up to 2 cm long | 8. <i>G. setifolia</i> |
| 3a. | Cauline leaves and bracts distinguishable; stem leafless towards base | 5 |
| 3b. | Cauline leaves and bracts indistinguishable; stem leafy towards base | 4 |

- 4a. Cauline leaves with bulbiferous base; tepals acute **2. G. bulbifera**
 4b. Cauline leaves without bulbiferous base; tepals obtuse **5. G. olgae**
 5a. Inflorescences lax panicle of corymbs; cauline leaves if more than 1, alternate 6
 5b. Inflorescence scorpioid cymes; cauline leaves 2, subopposite 7
 6a. Ovary sessile; cauline leaf 1 **3. G. kunawarensis**
 6b. Ovary stipitate; cauline leaves 2 **6. G. persica**
 7a. Ovary and capsule depressed above; radical leaves 2 **1. G. anisanthos**
 7b. Ovary and capsule not depressed above; radical leaf 1 **4. G. lutea**

1. Gagea anisanthos C. Koch in *Linnaea* 22: 230. 1849; S. Dasgupta & Deb in *J. Bombay Nat. Hist. Soc.* 83: 91. 1986. Type: S. Russia, Lelwar, Koch s.n. (ER). **Fig. 14.1a – 1e**

Herbs 12 – 20 cm high; bulbs ovoid, 6 – 8 x 5 – 6 mm; bulbel 1 or 2, often germinating when still attached to the mother plant. Stem 2 mm dia., glabrous. Radical leaves 2, often exceeding the inflorescence, linear, 15 – 20 x 0.2 – 0.3 cm; cauline leaves 2, subopposite, towards the base of inflorescence, lanceolate, 4 – 8 x 0.3 – 0.6 cm, lower ones longer. Flowers 2 – 8 in condensed scorpioid cymes; bracts linear, 1.5 – 4 x 0.2 – 0.3 mm; pedicel 3 – 9 cm long, diverging, villous. Tepals yellow, elliptic-lanceolate, 1.5 – 2 cm long, subacute. Stamens shorter than pistil and half the length of the tepals; filaments linear, 5 – 9 mm long; anthers oblong, c. 2 x 0.7 – 1 mm. Ovary sessile, obovoid, triquetrous, 5 - 8 x 3 - 4 mm, depressed above; style 3 - 4 mm, stout. Capsules obovoid-triquetrous, 8.5 - 9.5 mm, depressed above. Seeds ovoid, 2 x 1.25 mm, neither compressed nor angular.

Fl.: April – May. *Fr.*: May.

Distrib.: INDIA: Western Himalayas, Jammu & Kashmir (Kashmir); W. ASIA, RUSSIA.

Specimens examined: Jammu & Kashmir: Kashmir, Raspassi Pass, J.E. Winterbottom 222 (CAL); Sonemarg, W.F. Saxton 1662 (CAL); Gulmarg, B.O. Coventry 1466 (K); Chandanbari, P.R. Dahadghao D368 (CAL).

2. Gagea bulbifera (Pall.) Salisb. in *Kon. & Sims, Ann. Bot.* 2: 557. 1806; S. Dasgupta & Deb in *J. Bombay Nat. Hist. Soc.* 83: 88. 1986. *Ornithogalum bulbiferum* Pall., *Reise* 2(2): 736. t. Q. f. 2. 1776. Type: U.S.S.R. Astrakhan, Pallas (LE, CAL!). **Fig. 16.2 a – 2e**

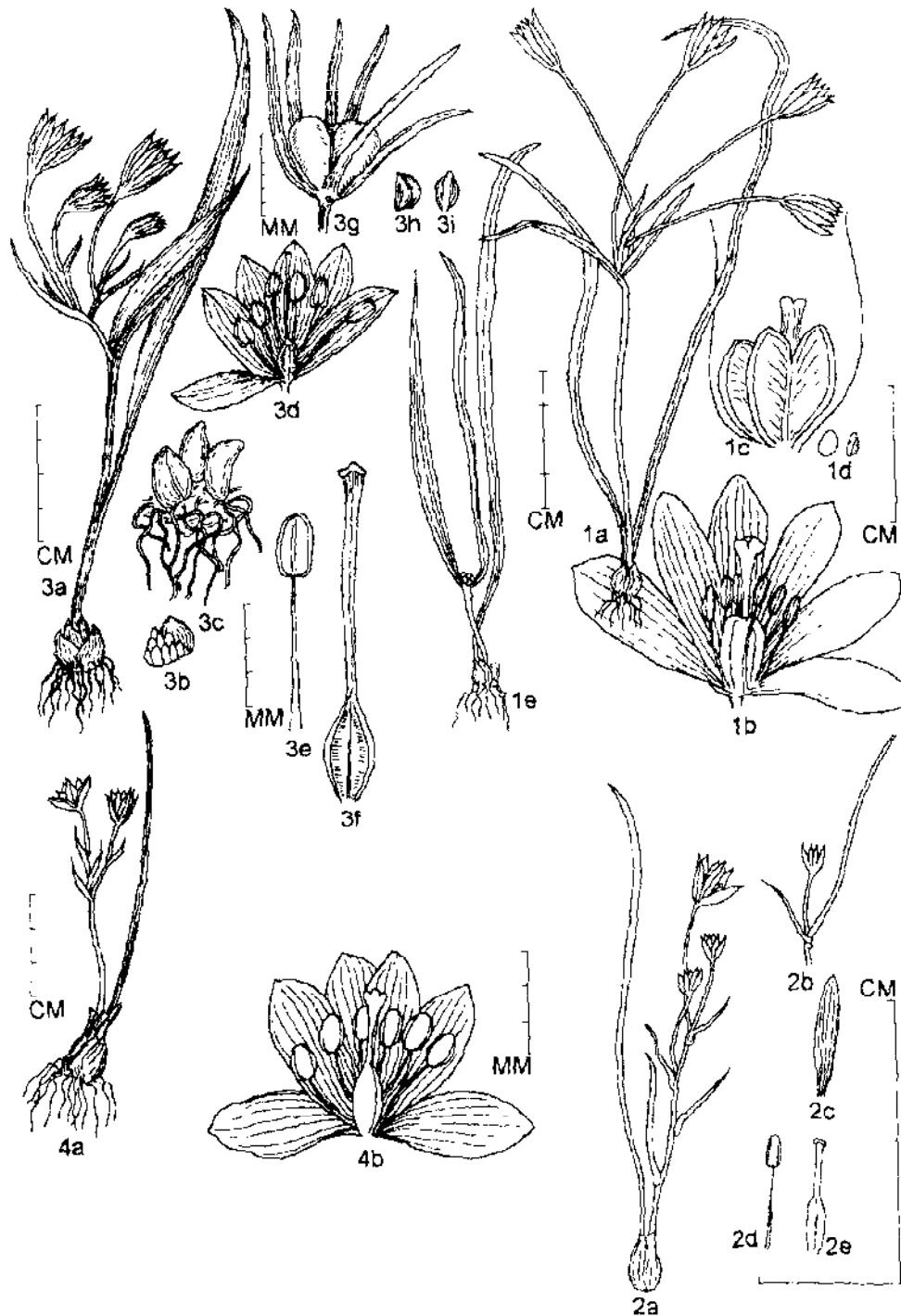


Fig. 16. *Gagea anisanthos* C. Koch 1a. Habit. 1b. Dissected flower. 1c. Capsule. 1d. Seed. 1e. Plant with axillary bulbils. *G. bulbifera* (Pall.) Salisb. 2a. Habit. 2b. Bulbiferous leaf base. 2c. Tepal. 2d. Stamen. 2e. Pistil. *G. lutea* (L.) Ker-Gawl 3a. Habit. 3b. Bulbels with radical leaf. 3c. Bulbels. 3d. Dissected flower. 3e. Stamen. 3f. Pistil. 3g. Capsule. 3h. Seed lateral view. 3i. Seed ventral view. *G. olgae* Regel 4a. Habit. 4b. Dissected flower.

Herbs 5 – 18 cm high; bulbs ovoid, 5 – 16 x 4 – 8 mm. Stem leafy. Radical leaf single, linear, 3 – 16 cm long; cauline leaves 3 – 4, alternate, linear, 1.5 – 6 cm long, gradually diminishing in size upwards, bulging bulbiferous at the base. Flowers 4 in a raceme; pedicels 2 – 4 mm long; bracts leafy. Tepals green, lanceolate, 8 – 13 mm long, acute, veins 7, with distinct midvein. Stamens and pistil much shorter than tepals; filaments linear, 5 – 7 mm long; anthers oblong, 1.25 – 2 mm long. Ovary sessile, oblong, 3 – 4 x 1 mm; style linear, 3.5 – 4.5 mm. Capsules ovoid, c. 6 mm long, triquetrous.

Fl.: March – May.

Distrib.: INDIA: W. Himalayas in Himachal Pradesh; AFGHANISTHAN, CHINA, C.I.S.

Habitat: On dry stony and gravelly slopes at an altitude of 1670 m.

Specimens examined: Himachal Pradesh: Simla, *E.R. Johnson* (CAL), *J.R. Drummond* 20926 (K).

3. ***Gagea kunawarensis*** (D. Don) Greuter in Israel J. Bot. 19: 155. 1970; S. Dasgupta & Deb in J. Bombay Nat. Hist. Soc. 83: 83. 1986. *Lloydia kunawarensis* D. Don in Royle, Ill. Bot. Himal. Mts.: 388. t. 93, f. 3. 1840. Type: Kunawar, Chango, *Royle s.n.* (LIV). *Bubillaria gageoides* Zucc., Pl. Hort. Bot. Moench. 3: 230. t. 2, f. 1. 1843. Type: Lebanon, 1838, Roth s.n. (Plate!). *G. persica* Boiss., Diagn. ser. 1, 7: 108. 1846, pro parte. Type: Iran-Esfahan, Aucher 5404 (BM!). *G. dshungarica* Regel in Acta Horti. Petrop. 6: 513. 1879; Kachroo & al., Fl. Ladak: 157. 1977, Type: China-Dzungarian, 13 – 6000 ft. A. Regel (LE). *G. gageoides* (Zucc.) Vved. Fl. Turkm. 1(2): 261. 1932. **Fig. 17.1a – 1d**

Herbs 6 – 10 cm high; bulbs ovoid, 0.6 – 1.5 cm long, 4 – 10 mm in diam.; bulbels present or not. Stems naked below the inflorescence. Radical leaf solitary, linear to lanceolate, 6 – 10 x 0.4 – 0.8 cm, as long as plant; cauline leaf one, below inflorescence, linear or lanceolate or broadly lanceolate, 2 – 5 x 0.4 – 0.7 cm. Flowers many in panicle of corymbs or with many axillary bulbils and few flowers one at the tip of each branch of peduncle; pedicels 5 – 10 mm long; bracts linear-lanceolate, 2 – 20 x 1 – 3 mm, often enclosing a cluster of bulbils in the axis in place of flowers. Tepals oblanceolate or elliptic, 5 – 6 mm long. Stamens and pistil as long as tepals; filaments linear, 3 – 5 mm long; anthers rotund or broadly oblong.

0.7 x 0.7 mm. Ovary sessile, obovoid, 1.5 x 1.2 mm; style 2.25 mm long; stigma truncate. Capsules obconical.

Fl.: April – August; *Frt.*: June – August.

Distrib.: INDIA: W. Himalayas, Jammu & Kashmir (Kashmir), Himachal Pradesh; PAKISTAN, AFGHANISTAN, IRAN.

Habitat: Dry slopes, open fields, gravelly foot hills, on edges of snowline at an altitude of 1700 – 3700 m. Bulbils develop in drier regions.

Specimens examined: Kashmir: Baramulla, *Watt s.n.* (BSIS); Liddar Valley, *Inayat 25765* (K); Kungwalan, *T.A. Rao 9296* (BSD); N.E. of Murgan Pass, *Fuller 15* (K); Tanmarg, *Timins 22* (BM); Pir Panjal, *Winterbottom 109* (CAL); *Thomson s.n.* (CAL, BM, L).

Chr. no.: $2n = 48, 60$ (Kaul & Gohil in *Phyton Horn.* 15: 57. 1973).

Note: *Lloydia kunawarensis* D. Don, *Gagea dshungarica* Regel and *G. gageoides* (Zucc.) Vved. are conspecific. Former two are without floral bulbils. Bulbils bearing *G. gageoides* and without bulbil *G. dshungarica* are found in the same gathering from N.W. Himalayas, T. Thomson *s.n.* (CAL, BM, L). It is observed that branching of the inflorescence is inhibited and flower production is reduced when axillary bulbils are produced. When axillary bulbils are developed in the inflorescence, the underground bulbs do not develop bulbels inside. Presence of bulbel inside the bulbs is directly correlated with the absence of axillary bulbils.

4. ***Gagea lutea*** (L.) Ker-Gawl. in *Curtis' Bot. Mag.* 30: t. 1200. 1809; Hook. f., *Fl. Brit. India* 6: 355. 1892; Collett, *Fl. Simlens.* 529. 1902; Bamber, *Pl. Punj.* 498. 1916; Blatter, *Beaut. Fl. Kashmir* 2: 170. 1928; S. Dasgupta & Deb in *J. Bombay Nat. Hist. Soc.* 83: 89. 1986. *Ornithogalum luteum* L., *Sp. Pl.* 306. 1753. Type: Sweden, Upsala, Herb. Linn. 428.4 (LINN microfiche!). *G. fascicularis* Salisb. in *Kon. & Sims, Ann. Bot.* 2: 555. 1806. Type: Greta Bridge, *Johnson s.n.*; Tubingen, *Fuchs s.n.*, *Woodstock, J. Banks s.n.* (K, BM!). *G. elegans* Wall. ex D. Don in *Royle, Ill. Bot. Himal. Mts.* 388. t. 95, f. 1. 1840. Type: Kumaon, Wall. Cat. 5065 (K–W Photo! BM!). *G. indica* Pascher in *Fedde Repert.* 2: 111. 1906 & in *Bull. Nat. Mosc.* 19: 364. 1906. Type: India Boreallis, Himalaya (LE). *G. lowariensis* Pascher in *Fedde Repert.* 2: 111. 1906 & in *Bull. Nat. Mosc.* 4: 364. 1906. Type: Chitral, Lowari Pass, *Harriss 16699 pro parte* (K Photo! CAL!).

Fig. 16.3a – 3i

Herbs 5 – 22 cm high; bulbs 1 – 3 x 0.5 – 2 cm; bulbels many. Stem with 2 cauline leaves. Radical leaf solitary, linear-lanceolate to broadly lanceolate, 6 – 35 x 0.2 – 2 cm, overtopping inflorescence; cauline leaves 2, subopposite, below the inflorescence, lanceolate to broadly lanceolate, 3 – 8 x 0.3 – 1 cm, lanate inside. Flowers up to 7, in condensed scorpioid cymes; pedicels 1.5 – 6 cm long, often lanate; bracts linear, 1.5 – 3 cm long. Tepals lanceolate, 9 – 14 mm long, bright yellow outside green and yellow margin. Filaments yellow, subulate, 3 – 8 mm long; anthers orange, narrowly oblong, 1 – 2.5 x 0.5 – 1 mm. Ovary green, sessile, obovoid or obovoid-oblong, 2 – 4 x 1.5 – 2 mm; style pale green, 4 – 7 mm long; stigma truncate. Obscurely papillose. Capsules broadly obovoid, 4 – 6 x 3 – 6 mm; locules 4-seeded. Seeds hemispherical or semirobund, 2 – 3 x 1 – 1.5 mm.

Fl. & Fr.: April - July.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal Sikkim; NEPAL.

Habitat: Open grassy hill side or humus rich plateau in alpine forests between 2744 and 4270 m altitude.

Chr. no.: 2n = 48 (Malik in Sci. & Cult. 27: 197. 1961); 78 (Tischler in Bot. Jharb. 67: 1. 1934; Westerguad in Physiol. 21: 195, 437. 1936; Mesicek & Hronka in Folia Geobot. Phyto. Czech. 9: 359. 1974; Vachova & Majovsky in Taxon 27: 375. 1978; Vachova in Taxon 29: 703. 1980); 36 (Leute in Taxon 23: 801. 1974); 96 and 132 (Kaul & Gohil in Phytom. Horn. 15: 57. 1973).

Specimens examined: Himachal Pradesh: Lahul, M.A. Rau 5865 (BSD); Chamba, N.C. Nair 32444 (BSD); Narkanda, M.A. Rau 11448 (BSD); Kashmir: Kungwalan, T.A. Rao 9308 (CAL, BSD); R.N Parker 367 (CAL); Uttaranchal : Tehri Garhwal, M.A. Rau 51651 (BSD); N.C. Nair 36787 (BSD); Kumaon, Strachey & Winterbottom 62 (CAL, BM); W. Himalayas, Mackinson s.n. (CAL); Sikkim: Thangu, K. Biswas 6993 (CAL).

Uses: Bulbs are eaten in times of scarcity.

Note: Originally the plants with the linear, hooded, radical leaves, ovate cauline leaves and few-flowered inflorescence were recognised as *G. indica* Pascher and those with broadly lanceolate (18 - 25 mm broad) radical leaves, broadly elliptic cauline leaves and many-flowered inflorescence were recognized as *G. lowariensis* Pascher. Those plants having elliptic

cauline leaves, many-flowered inflorescence and oblong or obovoid-oblong, acute tepals are kept as *G. lutea* (L.) Ker-Gawl., distinct from these 2 species. After a critical examination of specimens of all these species it is observed that leaves are hooded when young but spreading at maturity. Variations of these characters of leaves and inflorescence are seen in *Parker* 367, *Mackinnon s.n.*, *Strachey & Winterbottom* 62. Radical leaves of various breadth intermediate between *G. lutea* and *G. lowariensis* are evident in *T.A. Rao* 9308 and duplicate of the *Harriss* 16699 (holotype). In view of the intergrading characters the distinction of these species is not tenable and are conspecific.

5. ***Gagea olgae*** Regel in *Acta Horti. Petrop.* 3: 292. 1875; S. Dasgupta & Deb in *J. Bombay Nat. Hist. Soc.* 83: 87. 1986. Type: U.S.S.R. Uzbekistan, Samarkand, *O. Fedschenko* (LE); U.S.S.R.: Turkestan, *Korolkow & Krause* (LE). *G. jaeschkei* Pascher in *Lotos* 24: 128. 1904 & in *Bull. Nat. Mosc.* 4: 371. 1905, *syn. nov.* Type: Himachal Pradesh, Keylang, *Rev. Jaeschke s.n.* (LE). **Fig. 16.4**

Herbs 5 – 15 cm high; bulbs 1 - 2 x 0.5 – 1.5 cm with 3 cm collar like extension of outer sheath above. Radical leaves linear, 6 – 18 x 0.1 – 0.25 cm, exceeding inflorescence, glabrous; cauline leaves few, alternate, linear, gradually diminishing in size upwards and indistinguishable from bracts. Flowers 1 – 3 in raceme, campanulate; pedicel 0.3 – 2.5 cm long; bracts leafy. Tepals bright yellow often brownish outside, lanceolate or oblong, 8 – 18 mm long, obtuse. Filaments linear, c. 4 mm long; anthers linear-oblong, c. 2 mm long. Ovary sessile, oblong, c. 3 x 1.5 mm; style linear, c. 4 mm long. Capsules obovoid, 6 – 8 mm long.

Fl.: May – June.

Distrib.: INDIA: W. Himalaya in Himachal Pradesh; PAKISTAN, C.I.S.

Habitat: Stony hillsides between 3500 and 4200 m altitude.

Note: Except the type of *G. jaeschkei* Pascher from Himachal Pradesh, no specimens has been collected from India.

6. ***Gagea persica*** Boiss. *Diagn. Pl. Or.* Nov. 1(7): 108. 1846 (excluding *Aucher Eloy* 5404); Collett, *Fl. Simlens.* 599. 1902; Bamber, *Pl. Punj.* 499. 1916; S. Dasgupta & Deb in *J. Bombay Nat. Hist. Soc.* 83: 85. 1986. Type: Iran – Persepolis, *Kotschy* 237 (BM! CAL! G K). *G. stipitata*

Merckl. ex Bunge in Mem. Acad. St. Petersburg. 7: 512. 1851. Type: Crimenbakali, *Lehman* 1385 (S). *G. afghanica* Terracc. in Bull. Soc. Ort. Palermo 2: 4. 1904. Type: Turkmenistan-Krasnovodsk, *P. Sintensis* 6 (G); Turkestan, Ajak, *Korolkow* (LE); Afghanistan, Harirud Valley, *Atchinson* 1130 (K). *syn. nov.* **Fig. 17.2**

Herbs 14 – 23 cm high; bulbs 0.6 – 1 x 0.4 – 0.8 cm; bulbels present or not. Stem glabrous or pilose. Radical leaves as long as the flowering stem, linear; cauline leaves 2, lanceolate or linear-lanceolate, 1 – 5 x 0.2 – 0.4 cm, glabrous or pilose. Flowers 3 – 10, in lax panicle of corymbs; pedicel 1 – 3.5 cm long; bracts linear, up to 10 x 2 mm, often pilose. Sometimes bulbils replace flowers. Tepals greenish or pinkish outside, yellow or white inside, lanceolate, 5 – 8 x 1.5 – 3 mm. Stamens and pistil nearly as long as tepals; filaments linear, 3 – 5 mm long; anthers broadly oblong or rotund, 1 – 2 mm long. Ovary stipitate, obovoid or obovoid-oblong, 2 - 3 x 1.5 - 2 mm; style 2 - 5 mm long. Capsules obovoid, 5 - 6 mm long, many-seeded.

KEY TO THE VARIETIES

- | | |
|-----------------------------------|-------------------------------|
| 1a. Stem glabrous; radical leaf 1 | 6a. var. persica |
| 1b. Stem pilose; radical leaves 2 | 6b. var. kashmiriensis |

6a. var. persica

S. Dasgupta & Deb in J. Bombay Nat. Hist. Soc. 83: 87. 1986.

Bulbels many. Cauline leaves glabrous, lower longer. Flowers greenish or pinkish outside, yellow or white inside, 5 - 8 mm long. Capsules obovoid, stipitate.

Fl. & Fr.: April - July.

Distrib.: INDIA: W. Himalayas, Jammu & Kashmir (Kashmir), Himachal Pradesh; PAKISTAN, AFGHANISTAN, IRAN, C.I.S.

Habitat: Damp plain and on metamorphic rocks at altitudes from 1524 to 3960 m.

Chr. no.: 2n = 48 (Mehra & Sachdeva in Taxon 20: 609. 1971) and 2n = 72 (sub *G. stipitata* Merckl. ex Bunge by Kaul & Gohil in Phytion Horn. 15: 57. 1973).

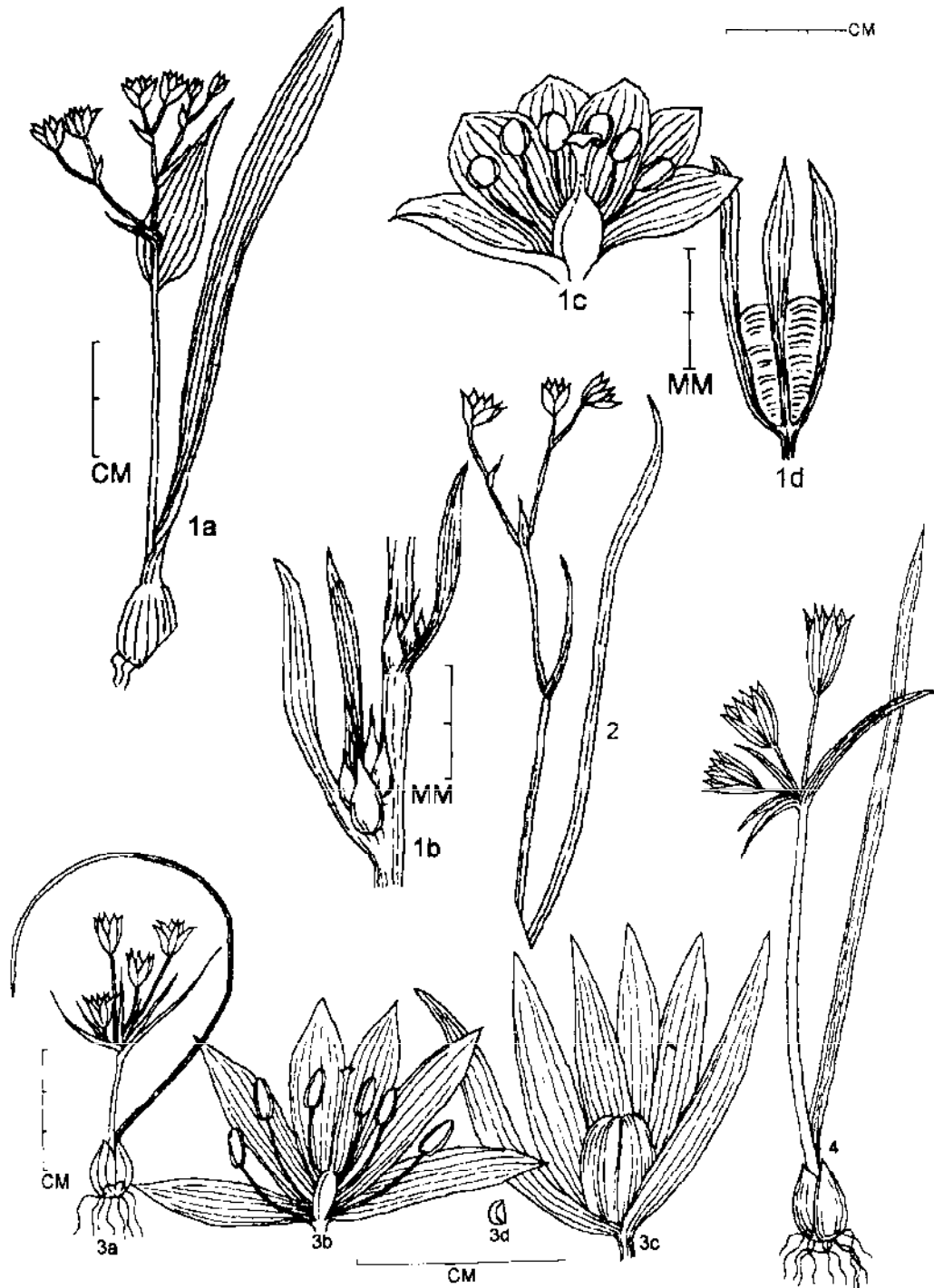


Fig. 17. *Gagea kunawarensis* (D. Don) Greuter 1a. Habit. 1b. Axillary bulbils. 1c. Dissected flowers. 1d. Capsule.
G. persica Boiss. 2. Habit. *G. reticulata* (Pall.) Schultes 3a. Habit. 3b. Dissected flower. 3c. Capsule. 3d. Seed.
Gsetifolia Baker 4. Habit.

Note: *Aucher Eloy* 5404 included in the description of *G. persica* is a different plant.

Description and plate of *G. stipitata* Merckl. ex Bunge in *Icon. Regel* (1876) agree perfectly with *Kotschy* 237. *G. afghanica* was proposed as a new species by Terracciano for plants with tepals purple outside, but this is not tenable as the protologue of *G. stipitata* mentions that tepals are pink outside. Therefore, *G. stipitata* and *G. afghanica* are reduced under *G. persica* Boiss.

6b. var. kashmiriensis (Turrill) S. Dasgupta & Deb in *J. Bombay Nat. Hist. Soc.* 83: 87. 1986. *G. kashmiriensis* Turrill in *Kew Bull.* 1928: 77. 1928. Type: Kashmir, Srinagar, 5700 ft., March 1926, *Canon Stokoe* 2 (holo K, photo!).

Bulbel 1. Cauline leaves pilose, lanceolate. Flowers yellow, 7–11 mm long. Capsule not seen.

Fl.: March–July.

Distrib.: INDIA: Western Himalaya, Jammu & Kashmir (Kashmir). Endemic.

Specimens examined: Kashmir: *B.O. Coventry* 1445 (K); *Rev. Jaeschke s.n.* (CAL).

Chr. no.: 24 (Kaul & Gohil in *Taxon* 20: 609. 1971).

7. *Gagea reticulata* (Pall.) Schult. f., *Syst. Veg.* 7: 542. 1829; Hook. f., *Fl. Brit. India* 6: 356. 1892; Collett, *Fl. Simlens.*: 529. 1902; S. Dasgupta & Deb in *J. Bombay Nat. Hist. Soc.* 83: 93. 1986; Bamber, *Pl. Punj.* 499. 1916. *Ornithogalum reticulatum* Pall., *Reise* 3: 727. t. D. f. 1776. Type: C.I.S. Astrakhan desert, *P.S. Pallas* (LE, BM, LINN). *O. circinatum* L. f., *Suppl.* 199. 1781. Type: Cl. S., Astrakhan desert, *P.S. Pallas* (LE, BM, LINN). *G. reticularis* (Pall.) Salisb. in *Kon. & Sims. in Ann. Bot.* 2: 557. 1806. *G. commutata* C. Koch in *Linnaea* 22: 227. 1849. Type: S. Russia, *C. Koch* (B). *G. triphylla* C. Koch in *Linnaea* 22: 229. 1849. Type: S. Russia, *C. Koch* (B). *G. sermentosa* C. Koch in *Linnaea* 22: 230. 1849. Type: S. Russia, *C. Koch* (B). *G. pseudoreticulata* Vved. in *Fl. Turkmenistan* 1(2): 268. 1932. Type: C.I.S., Turkmenistan, *Regel* (LE) *syn. nov.* **Fig. 17.3a – 3d**

Herbs 5–22 cm high; bulbs elongated ovoid, 4–12 x 2–6 mm; bulbels 1–2, often with leaves. Stem naked below inflorescence, pilose.

Radical leaves linear, 5–16 cm long; cauline leaves 4–6, verticillate at base of inflorescence, linear-lanceolate, up to 7 x 0.2 cm, erect, indistinct from bracts. Flowers up to 20 in umbels; pedicels 1.5–6 cm long, slender, pilose. Tepals lanceolate, 1–1.5 x 1.5–2 mm, acute, pubescent outside. Filaments unequal, linear, 4–6 mm long; anthers narrowly oblong, 1.5–2 x 0.5–0.7 mm. Ovary sessile, oblong or obovate-oblong, 2–3 x 1–1.5 mm; style 4–5 mm long. Capsules deep brown, obovoid or oblong, c. 6 x 3 mm, as long as tepals, trigonous. Seeds deep brown, triangular, c. 1 x 0.7 mm, compressed, thickly margined.

Fl.: February - April. *Fr.*: March - July.

Distrib.: INDIA: W. Himalaya, Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttar Pradesh; PAKISTAN, AFGHANISTAN, C.I.S.

Habitat: On soil formed of tertiary calcium carbonate rock debris or desert silt, in gorges or beside winter torrents with grasses at an altitude of 400–2895 m.

Specimens examined: Kashmir: Gilgit, *G.M. Giles* 113 (CAL). Himachal Pradesh: Chamba, *Lace* 1884 (BSIS); Kangra, *Drummond* 1747 (K). Uttar Pradesh: Dehra Dun, *Gamble* 22634 (K); Mackinson s.n. (CAL); *Kurz* s.n. (CAL).

Chr. no.: $2n = 24$ (Malik & Sehgal in *J. Sci. Industr. Res.* 18c: 155. 1959; Heyn & Dafni in *J. Bot. Israel* 20: 214. 1971 and Kaul & Gohil in *Phyton Horn.* 15: 57. 1973).

Note: *G. pseudoreticulata* Vved. was distinguished from *G. reticulata* (Pall.) Schultes by the absence of sheathing bulb scales below the stem. This character is variable due to ecological condition and does not have any taxonomic significance.

8. ***Gagea setifolia*** Baker in *J. Linn. Soc.* 18: 101. 1880; S. Dasgupta & Deb in *J. Bombay Nat. Hist. Soc.* 83: 94. 1986. Type: Afghanistan: Kurrum Valley, Alikhel, 17.4.1879, *Aitchinson* 104 (K photo!). **Fig. 17.4**

Herbs 8–16 cm high; Bulbs ovoid, 1.5–2 x 1–1.2 cm. Stem naked below inflorescence, minutely pilose. Radical leaf one, linear, 12–16 x 0.15 cm, pilose; cauline leaves many, verticillate below the inflorescence, linear-lanceolate, 1–5 x 0.1–0.4 cm, erect. Flowers 2–3, in umbels,

obliquely arranged, one side of the stem; pedicels 0.5–2 cm long, longest near the lowest cauline leaf; bracts similar to cauline leaves. Tepals yellow inside and green outside, lanceolate, 15–16 mm long, inner acute, outer plicate. Filaments subulate, 5–6 mm long; anthers narrowly-oblong, 2–3 x 0.7–1 mm. Ovary sessile, oblong, 4 x 1 mm, trilocular, 12–18 ovules in each locule; style 5–6 mm long, slender; stigma 0.5 mm broad, truncate. Fruit not seen.

Fl.: April–July.

Distrib.: INDIA: W. Himalayas, Jammu & Kashmir (Kashmir); PAKISTAN, AFGHANISTAN.

Habitat: Amongst snow-boulders at an altitude of 3960 m.

Specimens examined: Kashmir: Gilgit, *G.M. Giles s.n.* (CAL).

4. LILIUM

[Tournef. in Inst. Rei. Herb. 369. 1700] L., Sp. Pl. 302. 1753 & Gen. Pl. ed. 5. 143. 1754; Baker in J. Linn. Soc. Bot. 14: 225. 1874 excl. subgen. *Cardiocrinum*; Elwes, Monogr. *Lilium* 48. 1880; Benth. in Benth. & Hook. f., Gen. Pl. 3: 816. 1883; Engl. in Engl. & Prantl, Nat. Pflanzenfam. Teil. 2. Abt. 5. 60. 1888 excl. *Cardiocrinum* and *Notholirion*; Hook. f., Fl. Brit. India 6: 349. 1892 excl. *L. giganteum* Wall., *L. thomsonianum* Royle & *L. roseum* Wall.; E.H. Wilson, Lilies east Asia 17. 1925 excl. subgen. *Cardiocrinum*, *Notholirion* and *Lophophorum*; Krause in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 15a. 1930; Hutchinson, Fam. Fl. Pl. 754. 1973; S. Dasgupta & Deb in Candollea 39: 488. 1984.

Herbs, erect, bulbous with cauline leaves and terminal inflorescence. Bulbs subglobose with thick imbricate scales. Leaves spiral or opposite or verticillate, sessile, linear or lanceolate, parallel veined. Flowers solitary or lax in raceme, infundibuliform or cupular or campanulate, actinomorphic; bracts foliaceous. Tepals 6 in 2 whorls, free overlapping, erect or spreading or revolute, elliptic-lanceolate or oblanceolate, obtuse or acute. Nectaries linear, at base of tepals, glabrous or papillate. Stamens shorter than tepals; filaments linear or subulate; adnate to the tepals at base; anthers oblong or linear-oblong, mid-dorsifixed, latrorse. Pistil as long as stamens or longer. Ovary linear-oblong or obovoid, 6-lobed, trilocular, each lobe finely winged; ovules many, biseriate in each locule; style linear; stigma trilobed. Capsules

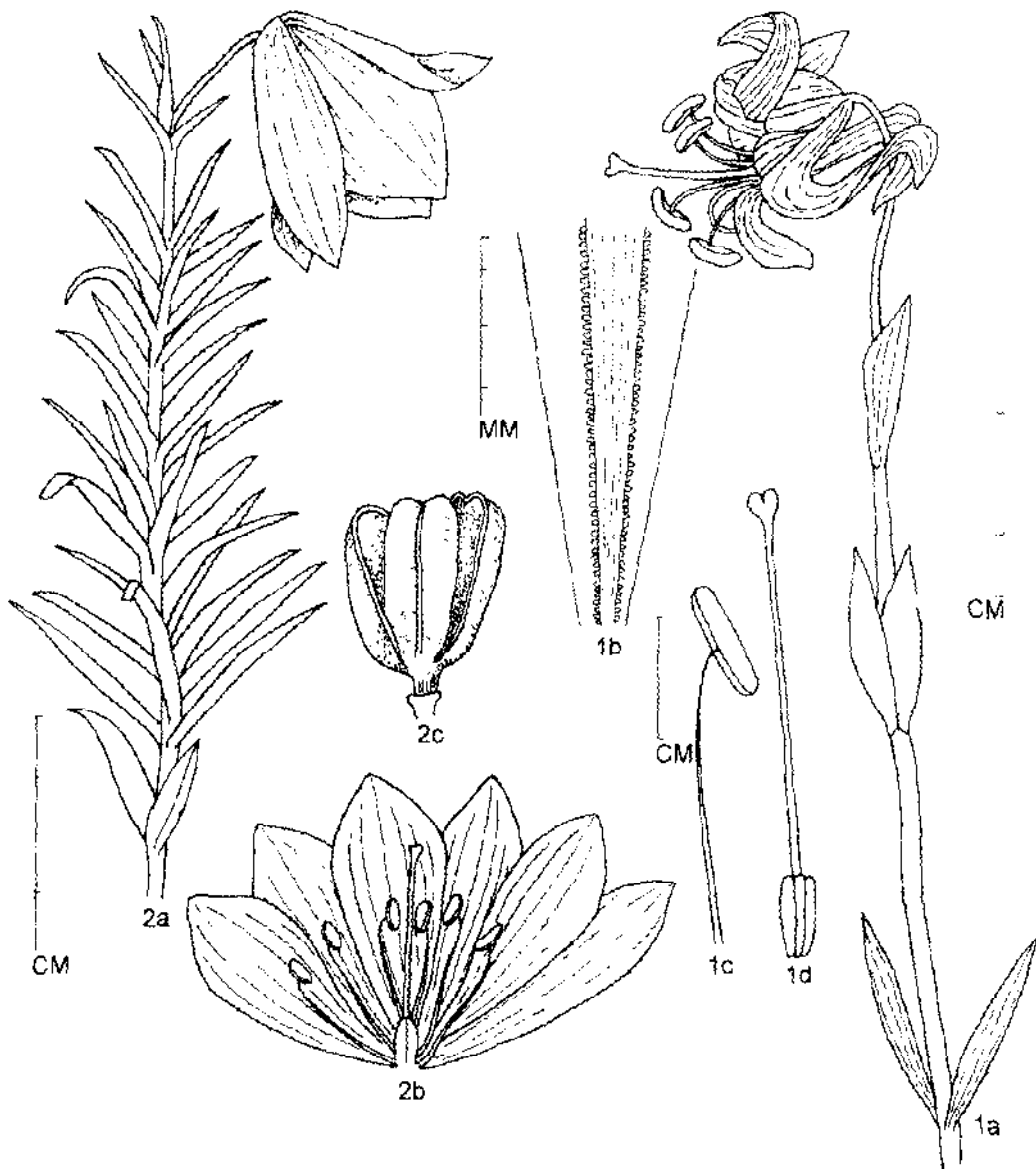


Fig. 18. *Lilium duchartrei* Franch. 1a. Flowering twig. 1b. Nectary. 1c. Stamen. 1d. Pistil.
L. macklineae Sealy 2a. Flowering twig. 2b. Dissected flower. 2c. Capsule.

broadly oblong or obovoid-oblong, 6-lobed, each lobe retuse above, finely winged, dehiscent margin longitudinally fibrillar. Seeds numerous, orbicular, compressed; wing membranous.

About 80 species in N. temperate regions; 6 species and one variety in India.

KEY TO THE SPECIES

- | | | |
|-----|--|----------------------------------|
| 1a. | Flowers 10 – 24 cm long, infundibuliform | 2 |
| 1b. | Flowers 4 – 10 cm long, open campanulate or cupular | 3 |
| 2a. | Flowers white; tube narrow, not coloured inside | 6. <i>L. wallichianum</i> |
| 2b. | Flowers yellow; tube broad, red or brown inside | 3. <i>L. nepalense</i> |
| 3a. | Tepals oblanceolate or lanceolate, revolute; nectaries linear | 4 |
| 3b. | Tepals oblong or elliptic, erect; nectaries broader below | 2. <i>L. macklineae</i> |
| 4a. | Nectaries glabrous | 5 |
| 4b. | Nectaries papillose | 1. <i>L. duchartrei</i> |
| 5a. | Flowers with brown spots near the margin; tepals distinctly revolute | 4. <i>L. polyphyllum</i> |
| 5b. | Flowers maroon coloured at base; tepals slightly revolute | 5. <i>L. primulinum</i> |

1. *Lilium duchartrei* Franch. in Nouv. Archiv. Mus. Paris ser. 2, 10: 96. 1887; S. Dasgupta & Deb in Candollea 39: 500. 1984. Type: China: Mupin, June 1869, *David s.n.* (P). *L. forrestii* W.W. Smith in Notes Roy. Bot. Gard. 8: 192. 1914. Type: China, *Forrest* 6244 (E). *L. farreri* Turrill in Gard. Chron. Ser. 3, 66: 76. 1919. Type: China, Kansu, 1914, *Farrer* 183 (K).

Fig. 18.1a – 1d

Herbs 20 – 35 cm high; bulbous with cauline leaves and big showy solitary or few apical flowers. Bulbs ovoid, 4 x 4 cm; scales ovate. Stem 2 – 4 mm in diam. often puberulous, underground portion bearing roots above bulbs. Leaves few spiral or opposite, linear-lanceolate, 2 – 6 x 0.3 – 0.8 cm, acute, margin often puberulous. Flowers 1-few, in raceme, strongly fragrant, horizontal, broadly campanulate. Pedicels 5 – 9 cm long. Tepals white with purple spots, oblanceolate, c. 5 x 1 cm, free to the base, revolute twice or thrice at apex. Nectaries c. 15 mm long, linear, margin papillose. Filaments exserted, linear, 2.5 - 4 cm long; anthers linear-oblong, 8 – 10 x 1 – 2 mm. Ovary oblong, 8 – 10 x 2.5 – 3 mm; style linear, c. 3 cm long; stigma 3 mm broad. Capsules obovoid, 2 – 3.5 x 3 – 3.5 cm.

Fl.: April - July. *Fr.*: May - July.

Distrib.: INDIA: Eastern Himalaya, Arunachal Pradesh; CHINA.

Habitat: In open pasture or undergrowth in pine forest or at outskirts of forests, in glades, thickets and at alpine meadows at an altitude of 1350 - 3450 m.

Specimens examined: Arunachal Pradesh, Dichugoruge, *F. Kingdon Ward* 19471 (BM), 19550 (BM) and 19578 (ASSAM).

Chr. No.: $2n = 24$ (R.N. Stewart in Amer. J. Bot. 34: 9. 1947).

2. ***Lilium macklineae*** Sealy in J. Roy. Hort. Soc. London 74: 349. t. 116 - 118. 1949; Deb in Bull. Bot. Surv. India 3(2): 120. 1961; S. Dasgupta & Deb in Candollea 39: 502. 1984. Type: N. Manipur, Sirhoi hills, January 1946, *Kingdon Ward* 16008 (fruit) (K, para!); *ibid.*, 5.5.1948, *Kingdon Ward* 17604 & 17605 (flowers) (BM, para!).

Fig. 18.2a - 2c

Bulbous herbs with cauline leaves and few big showy flowers at the apex. Bulbs broadly ovoid, c. 4.5 x 4 cm; scales pale yellow, outer 2 - 3 cm wide. Stem 22 - 40 cm high, greenish or reddish brown, hirsute. Leaves many in irregular spiral, topmost verticillate, upper linear, 2.5 - 7.5 x 0.4 - 0.7 cm, lower linear-elliptic, up to 15 x 1.2 cm, villous at base; midrib distinct on lower surface. Flowers 1-few, nodding, in raceme, cupular or broadly campanulate. Pedicel greenish or reddish brown, 2.5 - 6 cm long. Tepals white or purple outside and carmine at base, overlapping at base, erect or spreading at tip, oblong-lanceolate, 4.5 - 6 x 1.5 - 2.5 cm long. Nectaries 4 - 7 mm. Stamens included, half of tepals; filaments white, subulate, c. 2 cm long; anthers brick-red becoming brown, oblong, 6 - 7 x 2 mm. Pistil green; ovary linear-oblong, 7 - 8 x 2 - 3 mm; style c. 2 - 5 cm long, stigma 3 - 4 mm broad. Capsules pale yellow or light brown, broadly obovoid, 2.5 - 2.8 x 1.7 - 1.8 cm, abruptly constricted at base. Seeds dull greyish brown with a wide wing, deltoid-rotund, 8 - 10 x 6.5 - 9 mm, compressed.

Fl.: April - May. *Fr.*: Up to January.

Distrib.: INDIA: Manipur.

Endemic.

Specimens examined: Manipur, Sirhoi hills, *Kingdon Ward* 17255 & 17609 (BM).

Note: Allied to *Nomocharis* on one hand and *Lilium* on the other. Presence of long filaments, long style, mid-dorsifixed anthers, unlobed nectaries indicate it is more allied to the later.

3. ***Lilium nepalense*** D. Don in Mem. Werner. Nat. Hist. Soc. 3: 412. 1821 & Prodr. Fl. Nepal.: 52. 1825; Baker in J. Linn. Soc. 14: 231. 1874; Hook. f., Fl. Brit. India 6: 350. 1892; Bamber, Fl. Punjab 442. 1916; Kitamura in Kihara, Fauna & Fl. Nepal Himal. 1: 93. t. 5. 1955; Hara, Fl. E. Himal. 1: 408. 1966. S. Dasgupta & Deb in Candollea 39: 494. 1984. Type: E. Nepal, 1818, *Gardner s.n.* (BM, para!); 1819, *Gardner s.n.* (BM, para!).

Fig. 20.1a & b

Local name: *Bhangoo* (Nepal).

Herbs up to 1 m high; bulbs subglobose, 3.5 - 4 x 4 cm; scales ovate-lanceolate. Stem underground portion producing roots at intervals. Leaves irregular, spiral, fewer and smaller in the lower part, lanceolate or oblong-lanceolate, 2.5 - 9 x 1.2 - 3 cm, narrowed at base, deeply acute at apex; veins 5 - 7. Flowers 1 - 3, very fragrant, infundibuliform, narrowed below forming a broader tube; pedicels 1 - 8 cm long; bracts 3 - 7, verticillate. Tepals greenish-white, outside red or brown, inside except base and tip, elliptic or oblanceolate, 14 - 16 x c. 3.5 cm, spreading at the tip. Nectaries 1/3 of tepals, linear. Stamens more than half the length of tepals; filaments greenish-yellow, linear, 8.5 - 9 cm long; anthers brown, linear-oblong, c. 12 x 2 mm; pollen orange coloured. Ovary narrowly oblong, 2 - 3 cm x 2 - 3 mm; style green, 7 - 8 cm long; stigma 3 - 4 mm broad. Capsules oblong, 5 x 2 cm.

Fl.: June - July. *Frt.:* July - August.

Distrib.: INDIA: Himalayas in Uttar Pradesh; NEPAL, BHUTAN.

Habitat: Grows in grass land beside streams or rocky slopes of rivers in open or in partial shade of trees like *Betula*, *Abies* etc. at an altitude of 2700 - 3700 m.

Specimens examined: Uttaranchal, Kumaon, *Rupchand* 819 (L); Almora, *F.C. Thomas* 20853 (DD).

Chr. no.: 2n = 24 (S. Sen in Folia Biol. Krakow. 21: 83. 1973; S.B. Malla et al. in Taxon 23: 801. 1974).

4. ***Lilium polyphyllum*** D. Don in Royle, Ill. Bot. Himal. Mts. 388. 1840; Baker in J. Linn. Soc. 4: 246. 1874; Hook. f., Fl. Brit. India 6: 351.

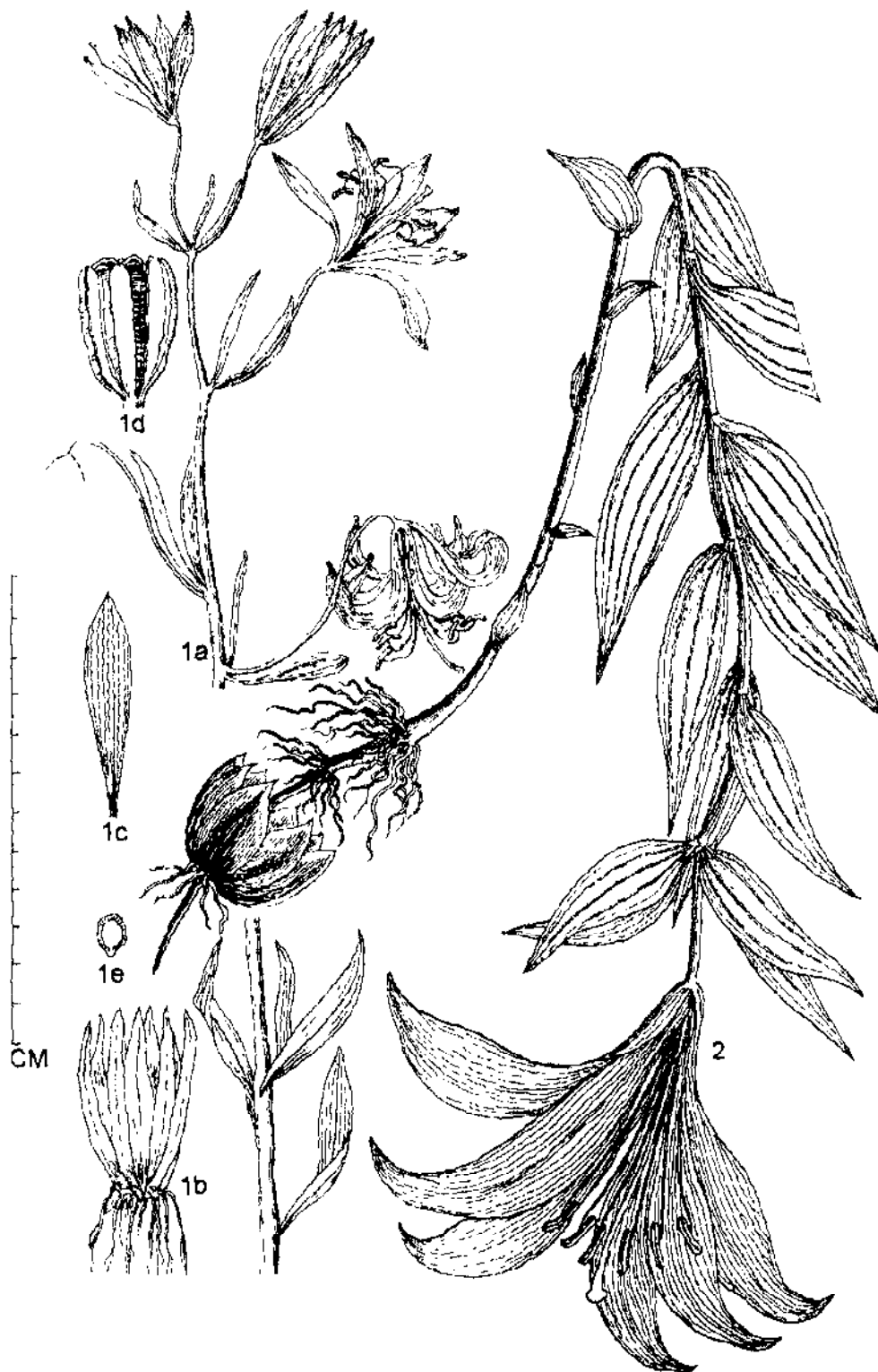


Fig. 19. *Lilium polyphyllum* D. Don 1a. Flowering twig. 1b. Bulb.
 1c. Tepal. 1d. Capsule. 1e. Seed.
L. primulinum Baker 2. Habit.

1892; Collett, Fl. Simlana. 527. 1902; Coventry, Wild Fl. Kashmir 1: 95. t. 47. 1923; Blatt., Beaut. Fl. Kashmir 2: 179, t. 60. f. 2. 1928; S. Dasgupta & Deb in Candollea 39: 497. 1984. Type: Kunawar, Taranda, *Royle s.n.* (LIV!). *L. polyphyllum* var. *uniflorum* Boiss. Fl. Orient. 5: 176. 1882.

Fig. 19.1a – 1e

Bulbous herbs, c. 2 m high with many cauline leaves and few big showy apical flowers. Bulbs ovoid, c. 5 x 3 - 4.5 cm; scales lanceolate, c. 1 cm broad. Leaves spiral, linear to lanceolate, 5 - 15 x 0.2 - 2.5 cm, long attenuated at base, acute at apex. Flowers 1-many in raceme, broadly campanulate; pedicels 2 - 12 cm long; bracts paired or verticillate. Tepals cream-yellow with purple or brown spots near margin, oblanceolate, 5 - 9 x 0.4 - 1.5 cm, loose, much revolute at apex, veins wavy; nectaries linear. Stamens and pistil slightly shorter than tepals, exserted; filaments linear, 3 - 5.5 cm long; anthers linear oblong, 7 - 13 mm long. Ovary linear or obovoid or oblong, 5 - 15 x 2 - 2.5 mm; style linear, 2.5 - 6 cm long; stigma 2 mm broad. Capsules obovoid-oblong, 2.5 - 6 x 1.5 - 4 cm, numerous seeded. Seeds deep brown, orbicular, 6 - 8 x 5 - 5.5 mm, thinly winged.

Fl.: June - August. *Fr.*: August - September.

Distrib.: INDIA: Western Himalayas in Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal and Punjab; AFGHANISTAN, PAKISTAN, NEPAL.

Habitat: Temperate to alpine regions at an altitude of 2000 m - 4500 m.

Chr. no.: $2n = 24$ (Mehra & Sachdev in Taxon 20: 609. 1971 and Mehra & Pandita in Taxon 27: 375. 1978).

Note: Fairly common in N.W. Himalayas but does not appear to grow east of Kumaon-Nepal boundary, except one collection in Nepal (Milka Danda) by Beer, Lancaster & Morris 1013 (BM). Gradually disappearing in Uttaranchal.

Specimens examined: Himachal Pradesh: Simla, Johnson 188 (CAL); Gamble 45729 (CAL); Chamba, Harsukh s.n. (CAL, DD); Kulu Valley, S & K. Jain R.C. Bhaaradwaj 113280 (DD); Kashmir: Pindabal, A. Meebold 4118 (CAL); Kunlwan, Clarke 29355, 29461 (CAL); Upper Chenab valley, R. Ellis 1479, 1609 (CAL); Uttaranchal : Garhwal, Osmaston 952 (CAL);

M.A. Rau 1570 & 10343 (BSD); *B.D. Naithani* 37508 (BSD); *Bashahr*, *N.C. Nair* 30623 (BSD); Kangarh, *Edgeworth* 101 (CAL).

5. ***Lilium primulinum*** Baker in Curtis, Bot. Mag. 118: t. 7227. 1892; Hook. f., Fl. Brit. India 6: 351. 1892; S. Dasgupta & Deb in Candollea 39: 497. 1984. Type: Upper Burma, Shan States, Boni, *W. Boxall s.n.* (K). *L. ochraceum* sensu E.H. Wilson, Lilies east Asia: 61. 1925. **Fig. 19.2**

Bulbous plants, 30 cm – 1.5 m high, with cauline leaves and few big showy apical flowers. Bulbs cream-coloured turning to purple on exposure, ovoid, 3 - 6 x 3.5 – 9 cm; scales lanceolate-ovate. Underground stem rooting at nodes; aerial part green, purple or shining brown. Leaves spiral, denser and larger in the middle of the aerial stem, lanceolate to elliptic, 2 – 9 x 0.8 – 2.2 cm, acute. Flowers 1-few, in raceme, fragrant, horizontal, broadly campanulate; bracts 2 – 3, leafy. Tepals glossy cream to different shades of maroon, 4 – 10 x 1.2 – 3 cm, loose, revolute at apex. Filaments linear, 3.5 – 7 cm long; anthers linear-oblong, 0.8 – 1 x 0.2 mm. Ovary oblong, 1.5 x 0.2 - 0.3 cm; style 6 – 8 cm long, curved, broader above; stigma 5 mm broad. Capsules obovoid.

Fl.: July – September.

Distrib.: INDIA: Arunachal Pradesh; BHUTAN, MYANMAR.

Habitat: In high loamy, well drained soil of dense forests on steep slopes or river bank at 2400 – 2700 m altitude.

Specimens examined: Arunachal Pradesh: Balipara, above Dirang Dzong, *Kingdon Ward* 13999 (BM).

6. ***Lilium wallichianum*** Schult. f., Syst. Veg. Pl. 7(2): 1689. 1830; Baker in J. Linn. Soc. 14: 227. 1874; Hook. f., Fl. Brit. India 6: 349. 1892; S. Dasgupta & Deb in Candollea 39: 491. 1984. Type: Nepal, 1826, *Wallich s.n.* (K – W, para, photo!); Kumaon, Srinagar, *Blinksworth s.n.* (K – W, para, photo!, CAL!). *Lilium japonicum* D. Don, Prodr. Fl. Nepal. 52. 1825; non Thunb. 1794. *L. longiflorum* Wall., Tent. Fl. Nepal. 40, t. 29. 1826, non Thunb. 1794.

Plants c. 2 m high; bulbs subglobose, 3 – 5 x 3 – 6 cm; scales oblong or ovate-lanceolate, 1.5 cm broad. Stem underground portion rooting at nodes. Leaves spiral, larger and denser in the middle of the stem, linear or

lanceolate, 5 - 20 x 0.3 - 2 cm, veins 5; adaxial surface deeper coloured. Flowers 1 or 2, creamy white, 15 - 23 cm long, infundibuliform, half the length below tube like, gradually expanding up to 16 cm wide mouth; pedicels short; bracts 1 or few leafy. Tepals spatulate, 2 - 5 cm broad, midvein prominent. Nectaries linear. Stamens and pistil slightly shorter than tepals. Filaments filiform, 10 - 17 cm long; anthers narrowly oblong, 1.5 - 3 x 0.2 - 0.25 cm. Ovary narrowly oblong, 3 - 5 x 0.2 - 0.4 cm; style filiform, 11 - 15 cm long; stigma 0.8 - 1 cm broad. Capsules oblong, c. 10 cm long.

KEY TO THE VARIETIES

- 1a. Margin of bulb scales scarios; leaves linear 14 - 20 x 0.3 - 0.8 cm
6a. var. wallichianum
- 1b. Margin of bulb scales not scarios; leaves lanceolate or linear-lanceolate,
 5 - 14 x 0.8 - 2 cm
6b. var. neilgherrense

6a. var. wallichianum

Fig. 20.2a & b

Leaves linear. Flowers fragrant, tube green. Tepals midvein yellowish-green on abaxial side and half the length on adaxial side. Nectaries green. Filaments green, 12 - 14 cm long; anthers yellow, 2.5 - 3 cm x 2.0 - 2.5 mm, pollen golden yellow. Ovary 4 - 5 x 0.2 - 0.4 cm; style green, 11 - 12 cm long. Capsules oblong, c. 10 cm long.

Fl. & Fr.: May - September.

Distrib.: INDIA: Himalayas in Uttaranchal and Sikkim; NEPAL, BHUTAN, MYANMAR.

Habitat: Sandy grassy hill side at 1350 - 2000 m altitude.

Uses: Bulbs are eaten as vegetable by the local people.

Chr. no.: 2n = 24 (Hall in Lily Year Book 1934: 35. 1934; Sen in Folia Biol. Krakow. 21: 83. 1973; Malla et al. in Taxon 30(1): 68. 1981).

Specimens examined: Uttaranchal: Dehra Dun, *M.B. Raizada* 172 (DD); Nainital, *S.K. Jain* 13087 (LWG); Banks of Surjoo, *Strachey & Winterbottom* 2 (CAL); Arunachal: *R.S. Rao* 1480 (CAL); Sikkim: *Singhik, Lestee* (CAL).

6b. var. neilgherrense (Wight) Hara in Ohashi, Fl. E. Himal. 3: 132. 1975; S. Dasgupta & Deb in Candollea 39: 492. 1984. *L. neilgherrense*



Fig. 20. *Lilium nepalense* D. Don 1a. Bulb with rooting stem. 1b. Flowering twig.
L. walliachianum var. *wallichianum* Schultes 2a. Bulb. 2b. Flowering twig.

Wight, Icon. Pl. Ind. Orient. 6: 20. t. 2031-2032. 1853; Baker in J. Linn. Soc. 14: 230. 1874; Hook. f., Fl. Brit. India 6: 350. 1892; Fyson, Fl. Nilgiri & Pulney Hill Tops 1: 416. 1915. Type: Nilgiri, *Wight s.n.* (CAL! K! L!). *L. tubiflorum* Wight, Icon. Pl. Ind. Orient. 6: 20. t. 2033-2034. 1853. Type: Nilgiri, *Wight s.n.* (CAL! L! K!). *L. wallichianum* Wight, Icon. Pl. Ind. Orient. 6: t. 2035, 1853, non Schultes f. 1830. *L. neilgherricum* Hort. Veitch Lem. Ill. Hort. 10: 353. 1865. *L. metzii* Steud. ex Duch. in J. Soc. Hort. Par. ser. 2, 4: 536. 1870. Type: Nilgiri, 1857, *Hohenacker* 954 (L! BM!). *L. longiflorum* Thunb. subsp. *neilgherrense* (Wight) Baker in Gard. Chron.: 479. 1871.

Leaves lanceolate or linear-lanceolate. Flowers creamy white. Filaments 10–17 cm long; anthers 1.5–3 x 0.2–0.25 cm. Ovary 3–4 x 0.2–0.4 cm; style c. 15 cm long.

Fl.: June–December.

Distrib.: INDIA: Karnataka, Tamil Nadu and Kerala; NEPAL.

Chr. no.: $2n = 24$ (Abraham in Ann. Bot. London 3: 545. 1939 and Sen in Folia Biol. Krakow. 21: 83. 1973).

Specimens examined: Kerala, Travancore, *Narayanaswami* 113 (CAL); Tamil Nadu, Nilgiri, *King s.n.* (CAL); *Fischer* 1311 & 2916 (CAL); *Cleghorn* (E); Nadvattam, *K. Subramanyam* 10541 (MH); Ramnad, *Vajravelu* 39336 (CAL); Madura, *Jacob* 17522 (CAL); W. Bengal, cultivated in IBG, Howrah (CAL).

5. LLOYDIA

Salisb. [in Trans. Hort. Soc. 1: 328. 1812] ex Reichb., Fl. Germ. Excurs.: 102. 1830; Benth. in Benth. & Hook. f., Gen. Pl. 3: 820. 1883; Baker in J. Linn. Soc. 14: 299. 1874; Engl. in Engl. & Prantl, Nat. Pflanzenfam. Teil 2. Abt. 5.: 63. 1888; Hook. f., Fl. Brit. India 6: 354. 1892; Krause in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 15a: 337. 1930; Hutchinson, Fam. Fl. Pl. 2: 609. 1959; S. Dasgupta & Deb in Ind. J. For. 9: 104. 1986.

Herbs small, slender, bulbous with both radical and cauline leaves and apical inflorescence; bulbs narrowly ovoid, imbricated, formed of old, fibrous, rarely needle-like radical leaf bases, surrounding the present radical leaf bases. Stem as long as radical leaves leafy above. Radical leaves linear

midvein. Filaments subulate, 4 - 6 x 0.5 mm, sparsely pilose at base; anthers oblong, 2 - 3 mm long. Ovary oblong, 3.5 - 4 x 2 mm; style 4 - 6 mm long; stigma trilobed. Capsules oblong, 12 - 15 x 4 mm. Seeds oblong, c. 3 x 1 mm, thicker on one side.

Fl.: May - August. *Fr.*: September.

Distrib.: INDIA: Himalayas in Arunachal Pradesh and Sikkim; NEPAL, BHUTAN, CHINA.

Habitat: Open grassy hill slopes or alpine meadows or sometimes on the banks of streams in *Rhododendron* forest at an altitude of 3695 - 4270 m.

Specimens examined: Assam (now in Arunachal Pradesh): Thachu, *F. Kingdon Ward* 19604 (BM); Sela, *F. Kingdon Ward* 11602 (BM); Sikkim: Tsomgo, *Bor & Ram* 19770 (DD); Changu to Kupup, *B.J. Gould* 2009 (BM).

2. *Lloydia himalensis* Royle, Ill. Bot. Himal. Mts.: 388. t. 93. f. 2. 1840; Hara, Fl. E. Himal. 1: 655. 1966; S. Dasgupta & Deb in Ind. J. For. 9: 108. 1986. Type: Kedarkanta, Choor, *Royle* (LIV). **Fig. 21.2a & b**

Herbs 10 - 17 cm high; bulbs elongated, ovoid, 2 - 3 x 0.5 - 1 cm, fibrous. Stem leafy, glabrous. Radical leaves 1 or few, linear, 15 - 19 x 0.1 cm; cauline leaves 3 - 5, linear, 1 - 3 x 0.1 - 0.2 cm, terminal, campanulate. Flowers solitary, white with green base inside, dark red base outside and red-brown striations above; pedicels 1 - 1.5 cm long. Tepals outer narrower, lanceolate, inner broader oblanceolate, 17 - 25 x 3 - 8 mm, obtuse. Nectaries inconspicuous. Filaments subulate, 4 - 6 x 1 mm, glabrous; anthers oblong, 2 - 3 x 1 mm. Ovary obovoid-oblong, c. 3 x 1.5 mm; style linear, c. 10 mm long, longer than stamens; stigma 3-fid, spreading.

Fl.: June - July.

Distrib.: INDIA: Himalayas, Jammu & Kashmir (Kashmir), Himachal Pradesh, Sikkim; BHUTAN, NEPAL.

Habitat: On cliffs or on rocks and gravelly soils, amongst moss scrub or grass at 3695 - 3810 m altitude.

Specimens examined: Himachal Pradesh: Simla, *C.R. Broune* 370 (DD). Sikkim: Tsomgo, *Bor & Kirat Ram* 19924 (DD); Jammu & Kashmir: Kashmir, Barnaj Nullah, *Ludlow & Sherriff* 9173 (BM).

Note: Though Noltie (1993) kept E. Himalayan plants of *Lloydia himalensis* sensu Dasgupta & Deb in *L. yunnanensis* Franch., he admitted that except trifid stigma no other character is convincing.

3. ***Lloydia longiscapa*** Hook., Icon. Pl. 9: t. 834. 1851; Hara, Fl. E. Himal. 1: 655. f. 63b. 1966 & in Ohashi, Fl. E. Himal. 3: 132. 1975; S. Dasgupta & Deb in Ind. J. For. 9: 109. 1986. Type: W. Himalaya, Changseel, 13000 ft., June 1844, *Capt. Munro* (K). **Fig. 21.3a & b**

Herbs 8 – 25 cm high; bulbs elongated ovoid, 3 - 6 x 0.7 – 1 cm; bulb scales fibrous. Stem longer than leaves, glabrous. Radical leaves 5 – 8, linear, 8 – 25 x 0.1 – 0.2 cm; cauline leaves 3 – 4, lanceolate, 1.5 – 3 cm long, hairy. Flowers 1 – 3 in raceme, nodding, broadly campanulate, fragrant; pedicels 0.5 - 1.5 cm long, stout. Tepals whitish, yellow blotched and pilose at base inside, brownish orange outside, elliptic or ovate-elliptic, outer narrower, 1.5 – 2.0 x 0.4 – 0.7 cm, plicate or acute at apex. Nectaries inconspicuous. Filaments white, often unequal, linear, 2 - 6 x 0.5 mm, pilose; anthers white, linear-oblong, 1 - 2 x 0.7 mm. Ovary oblong, 3 - 5 x 1.5 mm; style 3.5 – 5 mm long, stout; stigma trilobed.

Fl.: May - August.

Distrib.: INDIA: Himalayas in Uttarakhand, Himachal Pradesh and Sikkim; NEPAL, BHUTAN, CHINA, MYANMAR.

Habitat: On open grassy hill side amongst shrub or on alpine meadows along streams at 3048 – 4876 m altitude.

Specimens examined: Himachal Pradesh: Lahul, Kulu, *Drummond* 23180 (K); Mahasu dist., Larot Chanchal Pass, *N.C. Nair* 36119 (L, BSD). Sikkim: Semthang, *King's collector* (L); Uttarakhand: Garhwal, Patharkori, *Strachey & Winterbottom* 1 (BM); Tunganath, *Naithani* 44174 (BSD); Garhwal, *M.A. Rau* 38662 (BSD).

4. ***Lloydia serotina*** (L.) Reichb., Fl. German. Excurs. 1: 102. 1830; Baker in J. Linn. Soc. 14: 300. 1874; Hook. f., Fl. Brit. India 6: 354. 1892; Collett, Fl. Simlen.: 528. 1902; Bamber, Pl. Punj.: 443. 1916; Blat., Beaut. Fl. Kashmir 2: 177. 1928; Kachroo et al., Fl. Ladak: 152. 1977; S. Dasgupta & Deb in Ind. J. For. 9: 107. 1986. *Bulbocodium serotinum* L., Sp. Pl. 294. 1753. *Anthericum serotinum* L., Sp. Pl. ed. 2. 444. 1762. Type: Linn 432. 1 & 432.2 (LINN). *Rhabdocrinum serotinum* (L.) Reichb., Consp. Reg. Veg. 65. 1828. Type: Linn 432. 1 & 432.2 (LINN). *Ornithogalum striatum* Willd.,

Sp. Pl. 2: 112. 1799. *Lloydia alpina* Salisb. in Trans. Hort. Soc. 1: 328. 1812. Type: Halifax, *W. Alexander s.n. Lloydia serotina* (L.) Reichb., f. *parva* Marq. & Shaw in J. Linn. Soc. 48: 228. 1929. Type: S. Tibet, Rongchu Thumbatse, 4300 m. 18.6.1924, *F. Kingdom Ward* 5798 (BM!). *L. serotina* (L.) Reichb. var. *parva* (Marq. & Shaw) Hara, Fl. E. Himal. 2: 166. 1971 & in Ohashi, Fl. E. Himal. 3: 133. 1975. *L. delicatula* Noltie in Edinburgh J. Bot. 50(1): 55. 1993. Type: Bhutan, Me La, 14500 ft., 9.6.1999 *Ludlow, Sherrif & Hicks* 20347 (holo – BM!). **Fig. 21.4a – 4e**

Herbs 10 – 25 cm high, bulbs ovoid, 1.5 – 9 x 0.7 – 1.2 cm; scales fibrous, few daughter bulbs. Stem about as long as radical leaves. Radical leaves linear, 10 - 20 x 0.1 - 0.2 cm; cauline leaves linear, 3 - 30 x 1 - 3 mm. Flowers 1 – 4, campanulate; pedicels 0.2 – 3 cm long, glabrous. Tepals white with pink or brown or green streaks outside, oblanceolate, 5 – 20 x 2 – 8 mm, acute or obtuse; veins deeper coloured. Nectaries transverse. Filaments subulate, c. 2.5 mm long, glabrous; anthers oblong, 0.7 – 2 mm long. Ovary obovoid-oblong, 1.5 - 4 x 1 – 1.5 mm; style as long as or longer than ovary, stout; stigma trilobed. Capsules subglobose or oblong, 7 – 8 x 6 – 8 mm. Seeds triquetrous, c. 2 x 1 mm.

Fl.: May - August. *Fr.*: June - August.

Distrib.: INDIA: Himalayas: Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal, Sikkim, Arunachal Pradesh; BHUTAN, NEPAL, PAKISTAN, CHINA.

Note: Marquand's (1929) *Lloydia serotina* var. *parva* is the smaller variety of *L. serotina* and Noltie's (1993) *L. delicatula* with further segregation of more smaller plants from the fold of *L. serotina* var. *parva* shows no qualitative difference and variations are continuous with intermediate stages. So I prefer not to recognize any new species or variety.

Specimens examined: Arunachal Pradesh: Thachoi, *F. Kingdom Ward* 19607 (BM); Sikkim: King's collector s. (L); Himachal Pradesh: Lahul, *U.C. Bhattacharya* 52110 (BSD); *M.A. Rau* 6101 (BSD); Spiti, *U.C. Bhattacharya* 48974 (BSD); Mahagunesh Pass, *N.C. Nair* 36969 (BSD); Himachal Pradesh: Lahul, *U.C. Bhattacharya* 52110 (BSD); *M.A. Rau* 6101 (BSD); Spiti, *U.C. Bhattacharya* 48974 (BSD); Mahagunesh Pass, *N.C. Nair* 36969 (BSD); Kashmir: Ladak, *U.C. Bhattacharya* 52181 (BSD);

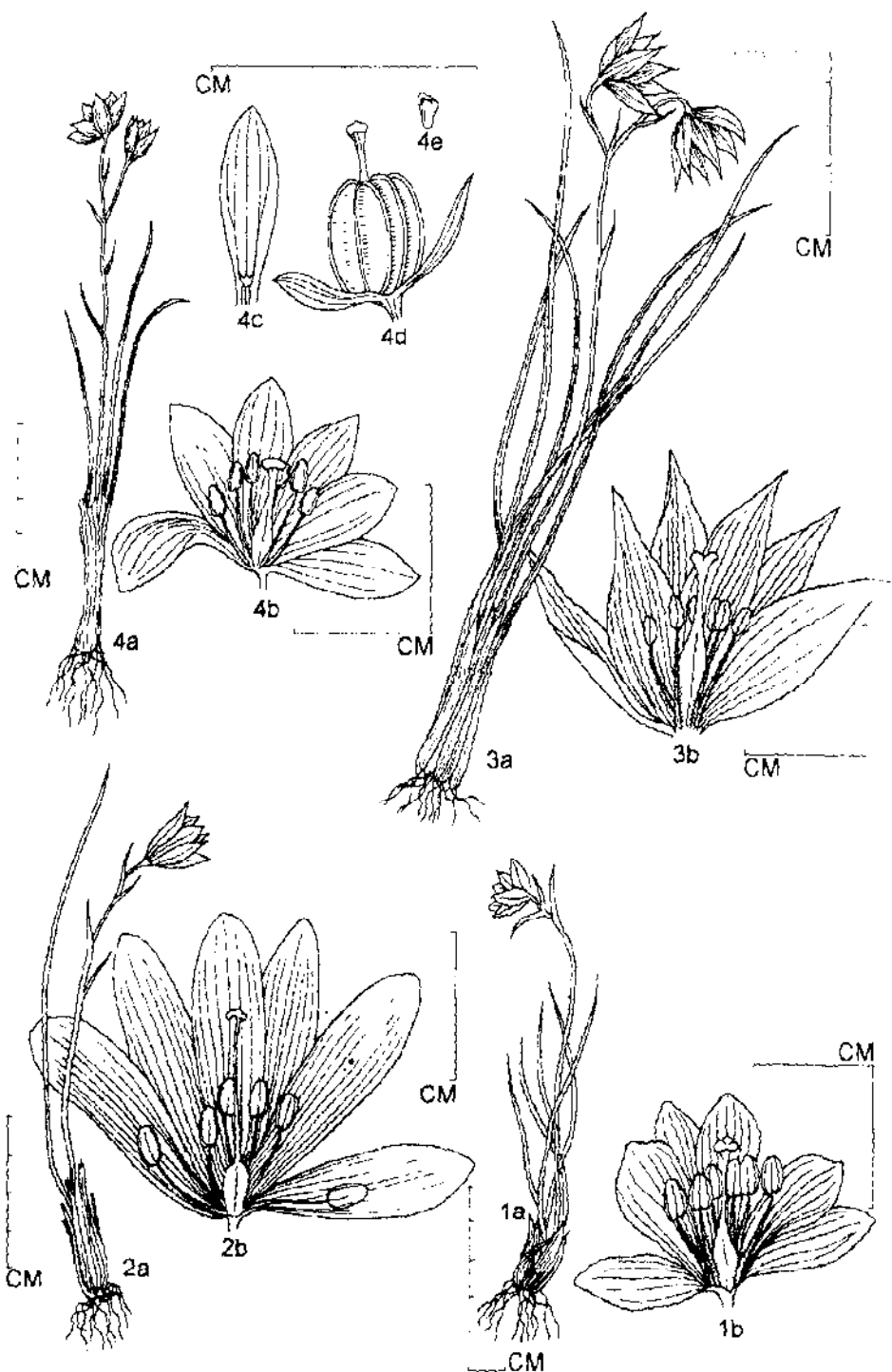


Fig 21. *Llyodia flavonutans* Hara 1a. Habit. 1b. Dissected flower. *L. himalensis* Royle 2a. Habit. 2b. Dissected flower. *L. longiscapa* Hook. 3a. Habit. 3b. Dissected flower. *L. serotina* (L.) Reichenb. 4a. Habit. 4b. Dissected flower. 4c. Tepal. 4d. Capsule. 4e. Seed.

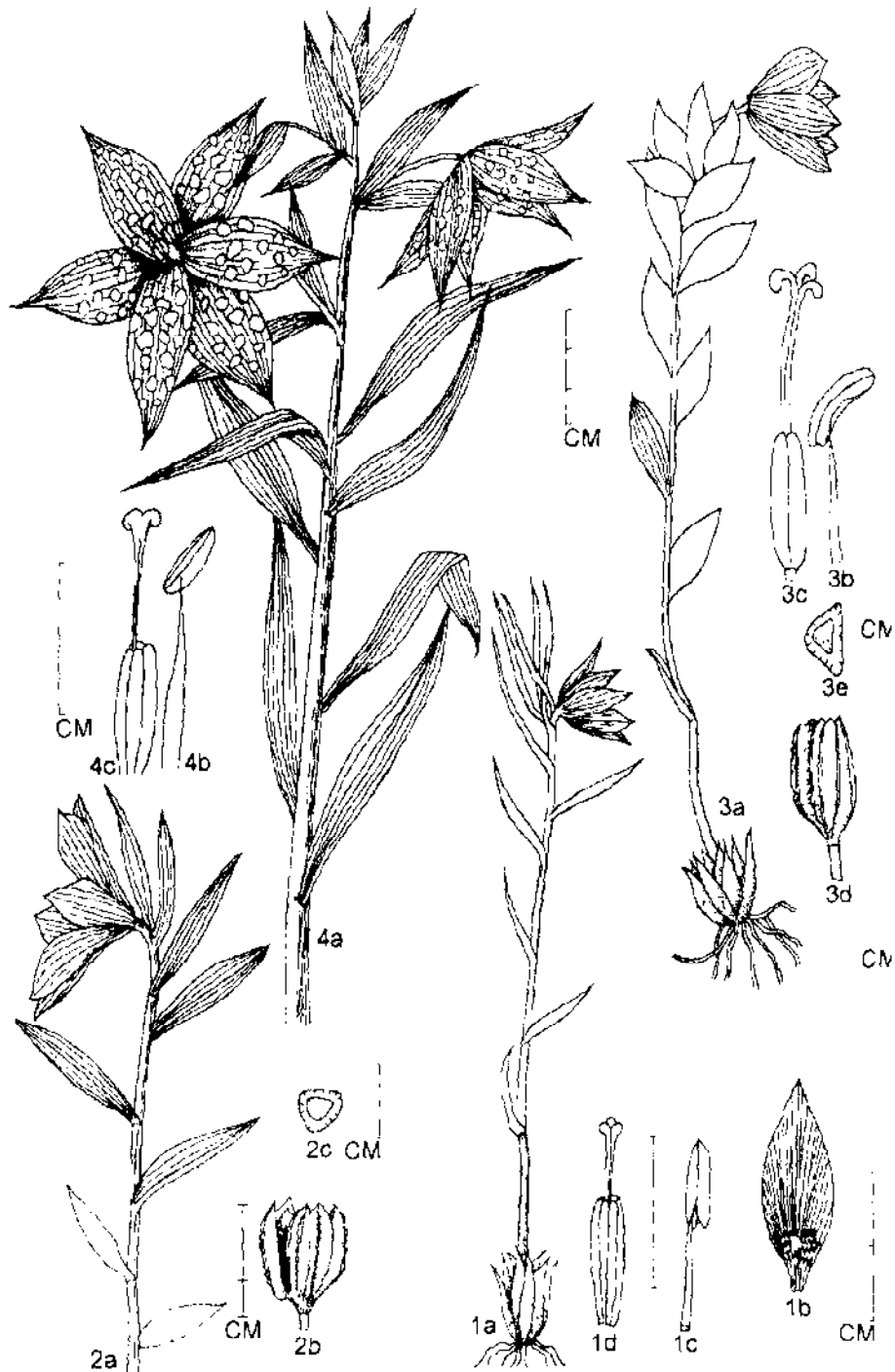


Fig. 22. *Nomocharis nana* (Klotzsch) E. H. Wilson 1a. Habit. 1b. Tepal. 1c. Stamen. 1d. Pistil. 1e. Capsule. *N. oxypetala* (Royle) Balf. 2a. Habit. 2b. Capsule. 2c. Seed. *N. soulei* (Franch.) W.W. Smith 3a. Habit. 3b. Stamen. 3c. Pistil. 3d. Capsule. 3e. Seed. *N. synaptica* Sealy 4a. Habit. 4b. Stamen. 4c. Pistil.

Srinagar, *C.R. Lancusher* 159 (BM); Uttaranchal : Kumaon, *N.C. Nair* 36785 (BSD); *T.A. Rao* 6890, 7010, 7073 (BSD); Pindari Morain, *T.A. Rao* 9529 (BSD); Garhwal, *M.A. Rau* 2890; 15724, 15795 (BSD); *B.D. Naithani* 44091 (BSD); *Bhattacharya* 39037 (BSD).

6. NOMOCHARIS

Franch. in *J. Bot. Paris* 3: 113. 1889; Balf. f. in *Trans. Proc. Bot. Soc. Edinburgh* 27: 273. 1918; W.E. Evans in *Notes Roy. Bot. Gard. Edinburgh* 15: 1. 1925; Sealy in *Kew Bull.* 5: 273. 1950; Hutch., *Fam. Fl. Pl.* (ed. 3): 754. 1973; S. Dasgupta & Deb in *J. Econ. Tax. Bot.* 4: 539. 1983.

Herbs bulbous, erect, with cauline leaves and solitary or few terminal flowers; bulbs cupular with thick, lanceolate, imbricate scales, loose above. Leaves spiral or verticillate, crowded at the top, sessile, lower ones obtuse at apex. Flowers terminal, solitary or few in racemes, cupular or saucer-shaped, pedicelled; bracts foliaceous. Tepals 6 in 2 whorls, oblong ovate to ovate-lanceolate, slight dissimilar, base nectariferous. Stamens and pistil much shorter than tepals. Filaments fleshy, terete below and needle-like above, or linear or subulate; anthers dorsifixed below the middle or towards base. Ovary trilobed, each lobe doubly winged; style as long as or shorter than ovary; stigma trilobed. Capsules broadly-oblong, truncate, retuse, 6-lobed, each lobe winged or puberulous. Seeds numerous, triangularly rotund, brown, compressed, finely winged.

Distrib.: 16 species, distributed in Sino-Indian Himalayas; 4 in India.

KEY TO THE SPECIES

- | | | |
|-----|---|------------------------|
| 1a. | Nectaries bilobed, crested or flabellate or glabrous | 2 |
| 1b. | Nectaries not lobed, glabrous | 3. N. souliei |
| 2a. | Nectaries crested; flowers solitary | 3 |
| 2b. | Nectaries flabellate; flowers 2 - 4 in loose racemes | 4. N. synaptica |
| 3a. | Leaves linear; flowers purple or mauve with darker spots | 1. N. nana |
| 3b. | Leaves lanceolate or oblong; flowers yellow or cream coloured | 2. N. oxypetala |

1. **Nomocharis nana** (Klotzsch) E.H. Wilson, *Lilies East. Asia*: 13. 1925; W.E. Evans in *Notes Roy. Bot. Gard. Edinburgh* 15: 16. t. 199, 200b, 202. 1925; S. Dasgupta & Deb in *J. Econ. Tax. Bot.* 4: 550. 1983. *Lilium nanum* Klotzsch in *Bot. Ergebn. Reise Waldemar*: 53. 1862; Hara in *Univ.*

Mus. Univ. Tokyo Bull. 8: 13. 1975. Type: Himalaya, 1845, *W. Hoffmeister* (ER). *Fritillaria oxypetala* Hook. in Curtis Bot. Mag. 79: t. 4731. 1853, non Royle 1840. Type: Kumaon, *Strachey & Winterbottom* 4 (K, CAL!). *L. oxypetalum* Baker in J. Linn. Soc. 14: 234. 1874, pro parte, Kumaon, *Strachey & Winterbottom* 4 only. *F. gardneriana* Baker in J. Linn. Soc. 14: 265. 1874. Type: Gossainthan, *Gardner s.n.* Wall Cat. 5080 (K, W). *F. stracheyi* Hook. f., Fl. Brit. India 6: 353. 1892. Type: Kumaon, *Strachey & Winterbottom* 4 (K, CAL!). *F. flavida* Rendle in J. Bot. 44: 45. 1906. Type: Tibet, Cho-leh-la, 3.7.1878, *Dungboo s.n.* (K, E, CAL!). *N. flavida* (Rendle) Balf. f. in Trans. Bot. Soc. Edinburgh 27: 293. 1918. **Fig. 22.1a – 1d**

Herbs 10 – 45 cm high, with cauline leaves and solitary, terminal flower; bulbs cupular, 2 - 4 x 1 - 3 cm; scales lanceolate, 5 - 10 mm broad, margin scarious. Stem glabrous. Leaves all linear, lower leaves 2.5 - 6 cm x 3 - 8 mm, upper leaves overtopping flowers, 6.5 - 11 cm x 3 - 5 mm, sometimes cirrhose. Flowers solitary, widely campanulate or saucer-shaped; pedicels 1.5 cm long, elongating in fruit. Tepals dissimilar, dull purple or mauve with dark spots inside, inner oblong, outer ovate-lanceolate, 1.5 - 4 cm x 5 - 15 mm, acute, midvein prominent; nectaries bilobed, crested. Filaments green, linear, 7 - 15 mm long; anthers brown or dark orange, linear-oblong, 2 - 6 x 0.5 - 1.5 mm, dorsifixed below middle. Ovary obovoid-oblong, 6.5 - 12 x 2.5 - 4 mm; style linear, 4.5 - 10 mm long. Capsules oblong or broadly oblong, 1.5 - 3.5 x 1.5 - 2 cm; lobes winged. Seeds 3 - 5.5 x 3 - 4.5 mm; wing 0.5 - 1 mm broad.

Fl.: June - July. *Fr.*: Sept. - Oct. often old fruits persist up to next June.

Distrib.: INDIA: Himalayan ranges in Himachal Pradesh, Uttaranchal, Sikkim, Arunachal Pradesh; NEPAL, BHUTAN, CHINA, MYANMAR.

Habitat: Grassy slopes or open pastures among rocks or rocky hill sides at an altitude of 3300 - 5700 m.

Chr. no.: 2n = 48 (Taylor in Cytologia 7: 248. 1936).

Specimens examined: Himachal Pradesh: Simla hill states, *G. Sherriff* 7920 (BM); Sikkim: Changu, *W.W. Smith* 3104 (CAL); Thangu, *Prain* 166 (CAL); Jongri, King's collector s.n. (CAL); Eumtso La, *Cave* 168 (CAL); Changu, *D. Chatterjee* 247 (CAL); Uttaranchal: Nilgiri, Hemkund, 2.10.1962, *U.C. Bhattacharya* 24272 (BSD); Pindari, *T.A. Rao* 4498 (BSD); Milam, *T.A. Rao* 7066 & 7113 (BSD); Garhwal, *M.A. Rau* 10239 (BSD).

2. **Nomocharis oxypetala** (Royle) Balf. f. in Trans. Proc. Bot. Soc. Edinburgh 27: 293. 1918; W.E. Evans in Notes Roy. Bot. Gard. Edinburgh 15: 7. t. 199 & 200. 1925 (type only); S. Dasgupta & Deb in J. Econ. Tax. Bot. 4: 552. 1983. *Fritillaria oxypetala* Royle, Ill. Bot. Himal. Mts.: 388. 1840; Hook. f., Fl. Brit. India 6: 352. 1892, type only. Type: W. Himalaya, Shalma, Royle s.n. (LIV). *Lilium triceps* Klotzsch in Bot. Ergebn. Reise Waldemar 53. t. 93. 1862. Type: Himalaya, 1845, Hoffmeister s.n. (ER). *L. oxypetalum* Baker in J. Linn. Soc. 14: 234. 1874, pro parte (*Hoffmeister s.n.* only). *L. oxypetalum* var. *insigne* Sealy in Curtis, Bot. Mag. 171. 1. 274. 1956 (Type: Himalaya, Frank Smythe 26, 27, 167 – cultivated K).

Fig. 22.2a – 2c

Herbs 40 – 80 cm high; bulbs 3.5 - 4 x 3.5 - 4.5 cm; scales unequal, one side thicker than other. Stem 3 - 8 mm in diam., basal half naked. Leaves spiral, smaller below, bigger and denser above, lanceolate or oblong-lanceolate, 2.5 - 8.5 x 0.5 - 1.5 cm. Flowers solitary, widely campanulate or saucer-shaped. Tepals golden yellow or cream coloured, oblong, 3 - 5.5 cm x 1.5 - 2 cm. Nectaries bilobed, crested. Filaments yellow, linear, 13 - 17 x 1 mm; anthers orange, linear-oblong, 6.5 - 8 x 1 - 2 mm. Ovary green, obovoid-oblong, 10 - 15 x 4 mm; style yellowish green, linear, 1 - 2 cm long; stigma trilobed, each lobe longitudinally folded. Capsules broadly obovoid-oblong, 3 - 4 x 2.5 - 3.5 cm, winged; wing 2 - 4 mm broad. Seeds triquetrous rotund, 7 - 10 x 6 mm; wing c. 1 mm broad.

Fl.: May - July. *Fr.*: Aug. - Sept.

Distrib.: INDIA: Himalayas in Uttaranchal - Himachal Pradesh; NEPAL.

Habitat: Open grassy meadows often in the slopes and near snow moraine at 3000 - 5000 m in altitude. Frequent fruiting in higher altitude.

Specimens examined: Himachal Pradesh: Simla hill states, G. Sherriff 7487 (BM); G. Sherriff 7349 (BSD); Sikkim: Soondardunga valley, T. Anderson s.n. (CAL); Himachal Pradesh: Simla hill states, G. Sherriff 7487 (BM); G. Sherriff 7349 (BSD); Sikkim: Soondardunga valley, T. Anderson s.n. (CAL); Uttaranchal : Kumaon, T.A. Rao 11858 (BSD); T.A. Rao 7117 (BSD); T.A. Rao 6796 (BSD); Garhwal, Hemkund, U.C. Bhattacharya 39012 (BSD); U.C. Bhattacharya 29443 (BSD); Badrinath, M.A. Rau 2837 (BSD); Kedarnath, M.A. Rau 8688 (BSD); On way to Jumnotri, M.A. Rau 15709 (BSD); Tehri Garghwal, on way to Pa, B.D. Naithani 48116 (BSD).

3. **Nomocharis souliei** (Franch.) W.W. Sm. & W.E. Evans in Notes Roy. Bot. Gard. Edinburgh 14: 102. 1924; W.E. Evans in Notes Roy. Gard. Edinburgh 15: 40. t. 210. 1925 & 15: 197. 1926; S. Dasgupta & Deb in J. Econ. Tax. Bot. 4: 556. 1983. *Fritillaria souliei* Franch. in J. Bot. Paris 12: 221. 1898. Type: China: Mekong, *R.P. Soulie* 1029 (P). *Lilium souliei* (Franch.) Sealy in Kew Bull. 5: 296. f. 3 J-S. 1950. **Fig. 22. 3a – 3e**

Herbs 16 – 40 cm high, bulbous with cauline leaves and solitary flower. Bulbs subglobose, 2 – 3.5 x 2.5 – 3 cm; scales loose above. Leaves alternate, sparse below, dense above, oblong or elliptic, 2.5 – 3.5 x 1 – 1.8 cm, attenuated at base, upper acute and lower obtuse at apex. Flowers solitary, widely campanulate; pedicels 1 – 9 cm long. Tepals deep brownish-crimson or red, oblong, 2.5 – 3.5 x 1 – 1.9 cm, obtuse; outer longer, narrower. Nectaries oblong, glabrous. Filaments linear, 10 – 11 x 1 mm; anthers linear-oblong, 7 – 8 x 1 mm. Ovary oblong, 9 – 11 x 2 – 4 mm; style 8 – 10 mm long, stout. Capsules globose, oblong, 1.5 – 3 x 1.5 – 1.8 cm. Seeds c. 4 x 3 mm, light brown.

Fl.: July. *Fr.*: October.

Distrib.: INDIA: Arunachal Pradesh; CHINA, MYANMAR.

Habitat: Damp alpine pastures at 2745 – 3960 m. in altitude.

Uses: Bulbs are eaten by the Tibetans.

Specimens examined: Arunachal Pradesh, Thachu valley, *Kingdon Ward* 19578 (BM, L).

4. **Nomocharis synaptica** Sealy in Kew Bull. 5: 296. t. 1. H – K, 1950; S. Dasgupta & Deb in J. Econ. Tax. Bot. 4: 553, 1983. Type: Arunachal Pradesh, Delei Valley, 10000 – 12000 ft., 9.7.1928, *F. Kingdon Ward* 8399 (K). **Fig. 22 .4a – 4c**

Plants up to 1 m high; bulbs ovoid, 3 – 4 x 2.5 – 3.5 cm. Stem 0.6 – 1 m long. Leaves spiral, denser above, lanceolate, 4 – 8 x 0.8 – 1.7 cm, acute at apex, attenuated at base. Flowers 2 – 4 in terminal raceme, purple blotched, saucer-shaped; pedicels 3.5 – 8 cm long, spreading; bracts 2 per flower. Tepals pink, irregularly blotched with purple, oblong-elliptic, 4 – 5 x 1.3 – 2.5 cm, acute or acuminate at apex; outer narrower; inner nectariferous at base. Nectaries bilobed, 5 x 8 mm, flabellate, deep purple with green margin. Filaments deep purple at base, subulate, 10 – 12 x 2 mm; anthers oblong, 4 – 5 x 1.5 mm, dorsifixed. Ovary oblong, 7 – 10 x 2 – 3 mm; style 8 – 9 mm long. Capsules obovoid oblong, c. 2 x 2 cm. Seeds 5 – 7 x 4 – 5 mm.

Fl.: July.

Distrib.: INDIA: Arunachal Pradesh; MYANMAR.

Habitat: In stony alpine meadows or on slopes of ridges at 3048-3695 m in altitude.

Specimens examined: Arunachal Pradesh: Thachu Valley, Kingdon Ward 19601 (BM).

Note: *Nomocharis meleagrina* and *N. saluensis* in S.E. Tibet, *N. henrici*, *N. georgei* and *N. aperta* in Burma (Myanmar) are very close to Indian boundaries.

7. NOTHOLIRION

Wall. ex Boiss., *Fl. Orient.* 5: 190. 1882; Hutchinson, *Fam. Fl. Pl.* ed. 2. 2: 609. 1959 & ed. 3. 754. 1973; S. Dasgupta & Deb in *Bull. Bot. Soc. Bengal* 41: 27. 1987. *Lilium* L. subgen. *Notholirion* Baker in *Gard. Chron.* 104. 1871; Krause in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. 15a: 329. 1930. *Fritillaria* L. subgen. *Notholirion* Baker in *J. Linn. Soc.* 14: 268. 1874.

Herbs erect, bulbous with both radical and cauline leaves and terminal racemose inflorescence; bulbs elongated-ovoid, tunicated, with fleshy ovate-lanceolate, inner scales gradually becoming scarious outside and often small bulbels arising in the axils of the scales. Radical leaves strap-shaped; veins parallel; cauline leaves linear-lanceolate, gradually passing into bracts. Flowers 4-23, in lax racemes, secund or in all directions, horizontal or nodding, narrowly campanulate, often slightly zygomorphic, pedicelled, bracteate. Tepals 6 in 2 whorls, oblanceolate, hooded, gibbous at base, veins wavy parallel. Nectaries at the base of inner tepals, obscure. Stamens and pistil as long as tepals, on one side of flower. Filaments linear, broader at base, adnate to the base of the tepals; anthers linear-oblong, mid-dorsifixed. Ovary sessile, oblong; style longer than ovary; stigma 3-fid, spreading. Capsules straw coloured, oblong or obovoid, trilobed, trilocular, retuse above, dehiscent margin fibrillar, seeds numerous. Seeds brown, semirotund or irregularly deltoid, rotund, compressed, thickened at margin, wingless.

Distrib.: About 6 species distributed from Iran to W. China; 3 in India.

KEY TO THE SPECIES

- 1a. Stigmatic fids 3 - 4 mm long; herbs less than 40 cm high; flowers 3 - 4, secund **2. N. macrophyllum**
- 1b. Stigmatic fids 1 - 2 mm long; herbs more than 40 cm high; flowers 7 - 23, spreading in all directions **2**
- 2a. Flowers narrowly campanulate; ascending tepals free, 4 - 6 mm broad; style 3.5 - 4.5 cm long **3. N. thomsonianum**
- 2b. Flowers broadly campanulate, slightly drooping; tepals overlapping, 7 - 15 mm broad; style 2 - 2.5 cm long **1. N. bulbiferum**

1. Notholirion bulbiferum (Lingelsh.) Stearn in Kew Bull. 5: 421. 1950; S. Dasgupta & Deb in Bull. Bot. Soc. Bengal 41: 32. 1987. *Paradisea bulbifera* Lingelsh. in Fedde Repert. Beih. 12: 316. 1922; Krause in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 15a: 279. 1930. Type: E. Tibet, near Tatsienlu, 1914, *Limpricht* (UPS). *Fritillaria hookeri* Baker in Bot. Mag. t. 6385. 1878, non Baker 1871. Type: Lachong valley, Sikkim, 1849, *Hook. f.* (K - photo!). *Lilium thomsonianum* Franch. in J. Bot. Paris 6: 320. 1892, non Lindl. 1845. Type: China, Yeman, *Delavay* 3061 (A). *L. roseum* Wright in J. Linn. Soc. 36: 133. 1903, pro parte, non Wall. 1832. *L. hyacinthinum* E.H. Wilson, Lilies east Asia: 100. 1925; Krause in Prantl, Nat. Pflanzenfam. Ed. 2. 15a: 331. 1930. Type: China, Tatsienlu, 7.8.1908, *Wilson* 1338 (A). *N. hyacinthinum* (E.H. Wilson) Stapf in Kew Bull. 1934: 96. 1934. *N. campanulatum* Cotton & Stearn in Lily Year Book, London 3: 19.t. 2 & 6. 1934. Type: Upper Burma, *Ferrer* 1872 & 1064 - in cultivation in Logan. **Fig. 23.1**

Bulbous herbs 80 - 120 cm high, with both radical and cauline leaves and terminal racemes. Bulbs ovate, 5 - 6 x 2 - 3 cm. Cauline leaves strap-shaped, 10 - 30 x 1 - 2 cm. Flowers 12 - 23, horizontal or slightly drooping, fragrant, zygomorphic; pedicels 1 - 1.5 cm long; bracts horizontal and then decurved, linear, 1 - 6 x 0.2 - 0.3 cm. Tepals lavender purple or red, oblanceolate, 3 - 4 x 0.7 - 1.5 cm. Filaments linear, broader at base, c. 3 cm long, recurved after anthesis; anthers linear oblong, 5 - 7 x 1.5 mm. Ovary oblong or cylindrical, 8 - 10 x 3 mm; style linear, 2 - 2.5 cm long; stigma brownish, each fid c. 1 mm long, papillose. Capsules oblong or ellipsoid, 1.5 - 2 x 0.7 - 1.5 cm, retuse.

Fl.: July - September. *Fr.*: October.

Distrib.: INDIA: Sikkim; NEPAL, BHUTAN, MYANMAR, CHINA.

Specimens examined: Sikkim: Lachung, *King's collector s.n.* (CAL); Dikchu valley, *W.W. Smith* 3711 (CAL, K).

Habitat: Grows on glutinous black, acidic soil, a mixture of clay and humus, at an altitude of 2743–4115 m in humid climate.

Chr. no.: $2n = 24$ (sub *N. campanulatum* Cotton & Stearn by La Cour in Darlington & Wylie, Chromosome Atlas of flowering plants 1955).

Note: *Notholirion campanulatum* Cotton & Stearn was distinguished from *N. hyacinthinum* (Wilson) Stapf in having crimson to purplish or claret red, big, actinomorphic flowers with smaller bracts in the former and pink coloured, smaller, zygomorphic flowers with longer bracts in the latter. It is observed that in the beginning flowers are ascending, gradually becoming horizontal and ultimately drooping. Mature flowers always seems zygomorphic. This is evident in the specimens *Ludlow & Sherriff* 3479 (BM), *King s.n.* (CAL), *Kingdon Ward* 9923 (BM), *Soulie* 336 (CAL), *Pratt* 670 (CAL), *Ludlow, Sherriff & Hicks* 19453 (BM) and that shows neither the distinguishing characters nor the distribution indicated by Cotton & Stearn is tenable even at an infraspecific level. Hence *N. campanulatum* is reduced to a synonym.

2. ***Notholirion macrophyllum*** (D. Don) Boiss., Fl. Orient. 5: 190. 1882, excl. descript. & syn.; Hara, Fl. E. Himal. 1: 409. 1966; S. Dasgupta & Deb in Bull. Bot. Soc. Beng. 41: 29, 1987. *Fritillaria macrophyllum* D. Don, Prodr. Fl. Nepal: 51. 1825. Type: Nepal: Gossainthan, August 1819, *E. Gardner s.n.* Wall. Cat. 5077A (BM! CAL!). *Lilium hookeri* Baker in Gard. Chron. 201. 1871. Type: Sikkim, *Hooker f. s.n.* (K–Photo!). *Fritillaria hookeri* Baker in J. Linn. Soc. 14: 69. 1874. Type: Sikkim, *Hooker f. s.n.* (K–Photo!). *Lilium roseum* Wall. ex Hook. f., Fl. Brit. India 6: 352. 1892. Type: Nepal, Gossainthan, August 1819, *E. Gardner s.n.*, Wall. Cat. 50774 (BM! CAL!), pro parte, spec. cited. Nepal & Sikkim. *Lilium macrophyllum* (D. Don) E.H. Wilson, Lilies east Asia: 102. 1925. **Fig. 23.2a – 2e**

Local name: *Pangoo* (Nepali).

Bulbous herbs 12–50 cm high, with both radical and cauline leaves. Bulbs ovoid, 1.5–7 x 0.5–4 cm, bulbels ovoid, 3–6 x 2–2.5 cm. Stems slender. Leaves linear-lanceolate, 3–18 x 0.5–1.2 cm. Flowers 3–4 in

raceme, second, horizontal. Tepals mauve to reddish purple, with a purple ring inside c. 1.3 cm from the base, oblanceolate, 3 – 5 x 1 cm. Filaments white or pale pink, or mauve or pink, filiform, 2.5 – 3 mm long; anthers yellow to orange, linear, falcate, 4 - 5 mm long. Ovary green, oblong, 6 - 12 x 2.5 – 4 mm; style white or pink, 2.5 – 3.5 cm long, exerted; stigma fids 3 – 4 mm long. Capsules oblong or globose-oblong, 1.2 - 1.5 x 0.8 - 1.5 cm. Seeds subrotund, 3 x 2.5 mm.

Fl.: June – October. *Fr.*: July – November.

Distrib.: INDIA: Sikkim; NEPAL, BHUTAN, CHINA.

Habitat: Shady moist places often near lakes, on sandy banks, amongst shrubs or in open coniferous or deciduous forests, dry steep rocky slopes, at an altitude of 1980 – 4000 m.

Specimens examined: Sikkim: Lachung, *King s.n.* (CAL); Tankara, *Gammie 366* (CAL); Temperate region of Sikkim, *Hooker s.n.* (CAL).

Chr. no.: $2n = 24$ (La cour in Darlington & Wylie, Chromosome Atlas of flowering plants, 1955).

3. **Notholirion thomsonianum** (D. Don) Stapf in Kew Bull. 1934: 95. 1934; S. Dasgupta & Deb in Bull. Bot. Soc. Bengal 41: 30. 1987. *Fritillaria thomsoniana* D. Don in Royle, Ill. Bot. Himal. Mts.: 388. t. 92 f. 1. 1840. Type: Neighbourhood of Mussoorie, *Royle s.n.* (LIV, K – Photo! CAL!). *Lilium thomsonianum* Lindl. Bot. Reg. 31: t. 1. 1845; Hook. f., Fl. Brit. India 6: 352. 1892; Collett, Fl. Simlens.: 527. 1902; Bamber, Pl. Punj.: 442. 1916, Type: Mussoorie, 1821, *R. Blinkworth s.n.* Wall. Cat 5077B (K – W flowered in guesthouse). *L. longifolium* Griff., Notul. 3: 241. 1851 & Icon. Pl. Asiat. t. 277. 1851. Type: Afghanistan, Kafiristan, 1840, *Griffith 87* (CAL!). *L. roseum* Wall. ex Hook. in Curtis, Bot. Mag. 79: t. 4725. 1853, Type: Almora, *Thomson & Strachey s.n.* (K – flowered in garden). *N. macrophyllum* (D. Don) Boiss., Fl. Orient. 5: 190. 1882. **Fig. 23.3a – 3e**

Herbs 50 – 80 cm high. Bulbs 2 – 6 x 1 – 3 cm, with few bulbels. Radical leaves 15 – 45 x 1 cm; cauline leaves linear or lanceolate, 3.5 – 10 x 0.4 – 1 cm. Flowers 7 – 12, loose, in raceme; pedicels 0.5 – 1 cm in flower, 1 – 2.5 in fruit; bracts tinged mauve to brown with white patch above point of insertion, linear-lanceolate, 1 - 5 x 0.2 - 1 cm. Tepals mauve to pale purple with or without peony purple patch inside lanceolate, 2.5

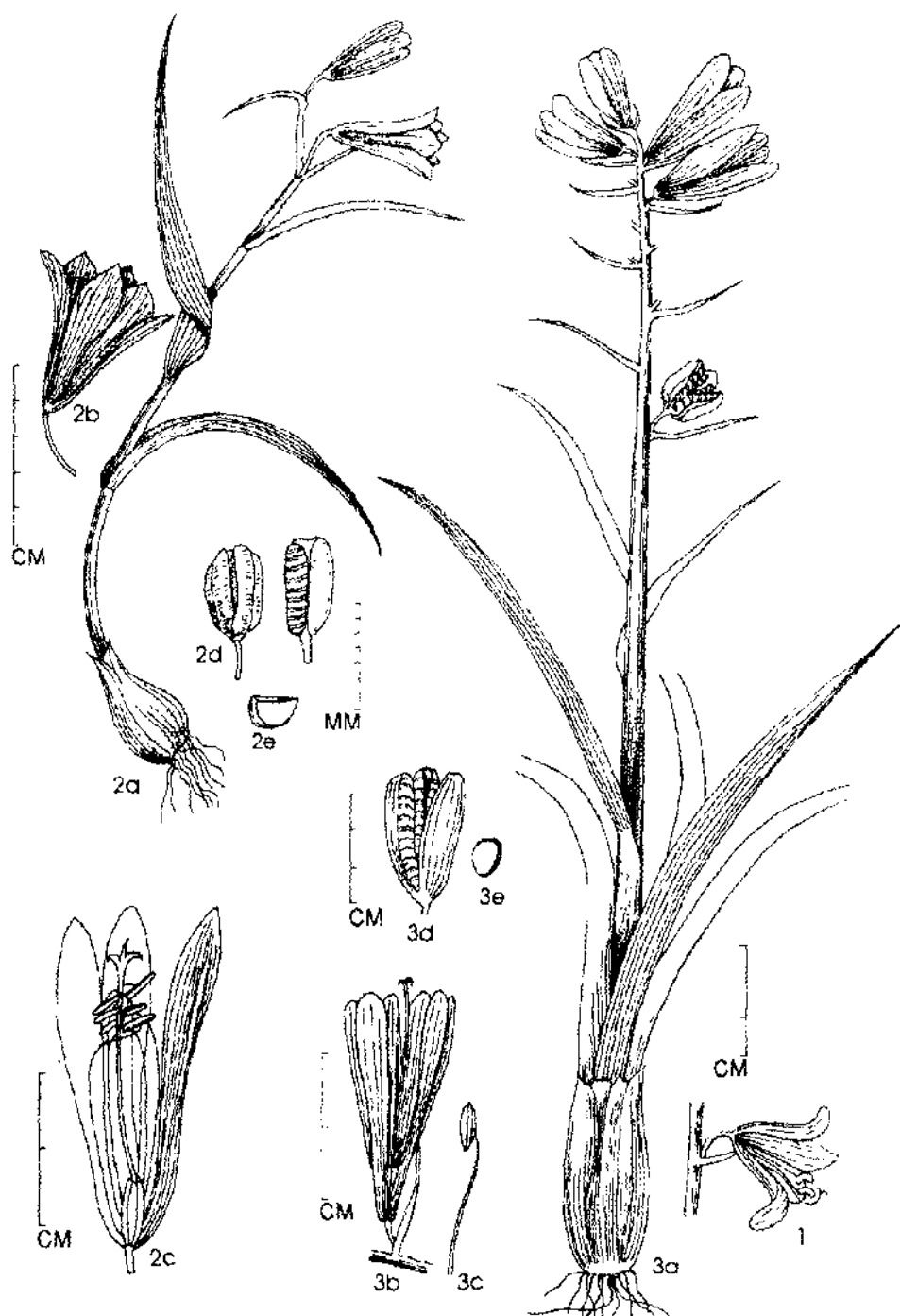


Fig. 23. *Notholirion bulbiferum* (Lingelsh.) Stearn 1. Flower. *N. macrophyllum* (D. Don) Boiss. 2a. Habit. 2b. Flower. 2c. Dissected flower. 2d. Capsule. 2e. Seed. *N. thomsonianum* (D. Don) Stapf. 3a. Habit. 3b. Flower. 3c. Stamen. 3d. Capsule. 3e. Seed.

5 x 0.4 - 0.8 cm. Filaments linear, 2.5 - 4 x 1 mm; anthers dull orange, linear oblong, 4 - 6 x 1 - 1.5 mm. Ovary green, 6 - 10 x 1.5 - 3 mm; style linear 3.5 - 4.5 cm long, exerted; stigmatic fid 1 - 1.5 cm long, spreading. Capsules oblong or ellipsoid or obovoid-oblong, 1 - 2 x 0.7 - 1.5 cm, truncate. Seeds obovate or rotund or deltoid, 2 - 3 x 1 - 2 mm.

Fl.: March - May. *Fr.*: April - August.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal ; PAKISTAN, AFGHANISTAN.

Specimens examined: Himachal Pradesh: Simla, *Hole* 98 (CAL); Chamb, *B.S. Aswal* 40189 (BSD); Kashmir: Delum valley, *G. Sherriff s.n.* (BM, K); Uttaranchal : Musoorie, *T. Anderswon s.n.* (E); Garhwal, *King s.n.* (CAL); Ranikhet, *M.A. Rau* 14218 (BSD).

Habitat: Shady damp vallies or open hill slopes or on border of terraced rice fields at an altitude of 1350 - 2000 m.

8. TULIPA

L., Sp. Pl. 303. 1753 & Gen. Pl. ed. 6. 145. 1754; Baker in J. Linn. Soc. 14: 275. 1874; Benth. in Benth. & Hook. f., Gen. Pl. 3: 818. 1883; Engl. in Engl. & Prantl, Nat. Pflanzenfam. Teil 2. Abt. 5: 62. 1888; Hook. f., Fl. Brit. India 6: 354. 1892; Krause in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 15a: 333. 1930; S. Dasgupta & Deb in Candollea 40: 158. 1985.

Herbs erect, bulbous with cauline leaves and terminal flowers; bulbs brown, oblong or ovoid, with imbricated scales; scales leathery, often hairy inside; often solitary, bulbel produced at tip of droper, which is formed by the tubular elongation of the base of the first vegetative leaf, become fibrous stolon. Stem partly subterranean, aerial portion leafy. Leaves linear or broadly lanceolate, often thick, undulated margin, without distinct midrib. Flowers terminal, solitary or few in racemes, variously coloured, cupular or wide campanulate; peduncle short or long; bracts absent. Tepals 6, 2 whorled, slightly dissimilar, elliptic or oblanceolate, acute or obtuse, parallel veins, often coloured blotch at base. Nectaries inconspicuous; stamens and pistil much smaller than tepals. Stamens 6; filaments subulate; anthers linear-oblong, basifixed, latrorose about as long as filaments. Pistil syncarpous. Ovary sessile, oblong or ellipsoid; ovules many in axile placenta. Style absent or short; stigma trilobed, truncate. Capsules oblong or subglobose,

beaked at tip, trilobed, many-seeded. Seeds compressed, with membranous testa.

About 100 species in temperate Eurasia, especially in Steppes of C. Asia; 2 species and 5 forms in India.

KEY TO THE SPECIES

- 1a. Bulb scales long hairy inside; tepals red with prominent deep coloured basal blotch, obovate, abruptly acuminate, midvein with parallel lateral veins at 45° angle **2. *T. lanata***
- 1b. Bulb scales profusely woolly inside at the apex; tepals not red, basal blotch absent or light coloured, elliptic or oblanceolate, acute or obtuse, veins parallel, diverging **1. *T. clusiana***

1. ***Tulipa clusiana*** DC. in Red. Liliacees 1. t. 37. 1803; Baker in J. Linn. Soc. 14: 281. 1874; Hall, Gen. Tulipa 86. 1940; S. Dasgupta & Deb in Candollea 40: 163. 1985. Type: Iran, 1607, *Clusius s.n.* (BAS). *T. chitralensis* Hall. Gen. Tulipa 85, 1940. Type: Chitral, *Hamilton s.n.* (K, DD!).

Bulbous herbs; bulbs globose or ovoid, 1.5–4 x 1–3.5 cm, often with young bulb at the end of a stolon; scales few-layered, deep brown, ovate, coriaceous, woolly inside at apex. Stems 8–50 cm high, 1/3 to 1/2 portion subterranean. Leaves linear or lanceolate, 2–20 x 0.2–1.5 cm, coriaceous, without midvein, undulated cartilaginous margin. Flowers solitary, broadly campanulate, peduncle 4–30 cm long, glabrous. Tepals dissimilar, variable in colour from white with pink shade to yellow with red shade outside, elliptic or oblanceolate, 2–6 x 0.5–1.8 cm, outer acute, inner obtuse, veins parallel, diverging. Filaments subulate, glabrous; anthers as long as filaments or longer or shorter, oblong. Ovary oblong; style absent; stigma trilobed. Capsules oblong or broadly oblong, 2–3.5 x 1.5–2.5 cm, trilobed, trilocular, beaked above. Seeds brown, semirotund, margin thickened.

Note: This is a polymorphic group having members slightly differing from one another. According to Hall (1973, 1990), members are evolved by natural polyploidy, and probably autopolyploids arising within the species without hybridization. He postulated that polyploids evolved from *T. aitchisonii* Hall with diploid chromosome numbers. From this, pentaploid *T. clusiana* DC., tetraploid *T. stellata* Hook. and *T. chrysantha* (Boiss.) Baker were evolved. In this study tall plants, scattered leaves, bigger flowers, perianth white with pink markings outside, anthers not longer than filaments have been taken as standard characters as evident in *T. clusiana* DC. f.

clusiana. Just opposite characters – small plants, crowded leaves, smaller flowers, yellow with red outside, anthers longer than filaments tally with *T. fernandezii* Beatt. It is observed that there are plants with different combination of characters in Chitral. *T. clusiana* DC. f. *clusiana*, *T. clusiana* f. *clusianoides* and *T. clusiana* f. *stellata* occur in Kashmir, Pakistan. More towards drier west in Pakistan, Afghanistan.

KEY TO THE FORMA

- | | | |
|-----|--|-------------------------------|
| 1a. | Anthers as long as or shorter than filaments | 2 |
| 1b. | Anthers longer than filaments | 4 |
| 2a. | Flowers white. Pinkish outside | 3 |
| 2b. | Flowers yellow suffused with red | 1d. porphyrochrysantha |
| 3a. | Basal blotch of tepals absent | 1a. clusiana |
| 3b. | Basal blotch of tepals yellow | 1e. stellata |
| 4a. | Flowers yellow, violet or red outside | 1c. fernandezii |
| 4b. | Flowers white, pinkish outside | 1b. clusianoides |

1a. forma clusiana

Stem 18–45 cm high, above ground. Leaves sparse or crowded. Peduncle 10–30 cm long. Tepals all pink or inner whorl white, with pink stripes pink outside, outer elliptic, 5–6 x 1.5–1 cm. Filaments 8–11 x 1.5 mm; anthers narrowly oblong, 8–10 x 1.5 mm. Ovary c. 11 x 3 mm.

Fl.: March–May.

Distrib.: INDIA: W. Himalayas, Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal; PAKISTAN.

Habitat: Open rocky ground or sandy soils on mountain ranges at 2700–3000 m in altitude and also in cultivated areas.

Specimens examined: Himachal Pradesh: Kunawar, Drummond 26543 (K). Kashmir: Liddar Valley, Ludlow 10 (BM). Uttaranchal: Dehra Dun, Hiralal s.n. (LWG).

Chr. no.: $2n = 60$ (Newton in J. Linn. Soc. Bot. 47: 339. 1927; Newton & Darlington in J. Genet. 21: 1. 1929 and Hall in the Gen. Tulipa 86. 1940).

1b. forma clusianoides (Wendelbo) S. Dasgupta & Deb in Candollea 40: 169. 1985. *T. aitchisonii* Hall. var. *clusianoides* Wendelbo in Koie &

Rech. Symb. Afghan. 4: 162. 1958. Type: Afghanistan, Karez Emir, auf. Feldren häufig, 20.4.1951, Volk 1466 (W, holo).

Stem 8–15 cm high, above ground. Leaves crowded or scattered. Peduncle 2–6 cm long. Tepals outer whorl white inside, red or pink outside with white margin, 3–5 x 1.3–1.5 cm; inner whorl white with pink basal blotch, smaller. Filaments pink, 4–9 x 1 mm; anthers pink, linear-oblong, 7–12 x 1.5–2 mm. Ovary 10–12 x 2 mm. Capsules oblong or broadly oblong, 2–3.5 x 1.8–2.5 cm, bluntly beaked. Seeds semirotund, 6 x 4 mm, compressed, apiculate.

Fl.: April–May.

Distrib.: INDIA: Western Himalayas; Jammu & Kashmir (Kashmir) and Uttaranchal; PAKISTAN, AFGHANISTAN.

Habitat: Open grassy slopes on mountains at 1700 to 3340 m in altitude.

Specimens examined: Jammu & Kashmir: Pirpanjal, Kaul & party 41612 (LWG); P.N. Kohli 5 (K). Uttaranchal : Chakrata, Meinertzhagen s.n. (BM).

1c. forma fernandezii (Blatt.) S. Dasgupta & Deb in Candollea 40: 169. 1985; *T. fernandezii* Blatt. in J. Bombay Nat. Hist. Soc. 37: 420. 1934. Type: Pakistan, Waziristan, Anghem village, Meynell 991 a, 991; Waziristan, slope of Shider, Fernandez 1526, 1526 a. (BLAT). **Fig.24.1a – 1d**

Stem 12–25 cm high. Leaves crowded on ground. Peduncle 2–12 cm long. Tepals yellow, violet or bright red outside of outer whorl, outer 2–3.5 x 0.5–0.7 cm, inner 1.5–3 x 0.7–1 cm. Filaments yellow, 3–8 x 1–2 mm; anthers yellow, linear-oblong, 5–9 x 1.5 mm. Ovary oblong, 6–14 x 2–4 mm. Capsules oblong, c. 2.5 x 1.5–2 cm, bluntly rounded end. Seeds brown, obovate, c. 3 x 2 mm, compressed, margin thickened.

Fl.: April–June.

Distrib.: INDIA: Jammu & Kashmir (Kashmir); PAKISTAN.

Habitat: Open grassy slopes of rocky mountain ranges, often under shade, at 1524–3350 m in altitude.

Specimens examined: Kashmir: Bandipur, Barnes s.n. (K).

Id. forma *porphyreochrysantha* (Blatt.) S. Dasgupta & Deb in *Candollea* 40: 168. 1985. *T. porphyreochrysantha* Blatt. in J. Bombay Nat. Hist. Soc. 37: 421. 1934. Type: N.W. India, Waziristan, Anghem village, 1930, *Meynell* 999 (BLAT). *T. chrysantha* Baker in J. Linn. Soc. 14: 229. 1874, pro parte, excl. type, incl. Afghanistan, *Griffith s.n.*; Hook. f. in Hook. f., *Fl. Brit. India* 6: 355. 1892, non Boiss. pro Afghanistan specimen. *T. aitchisonii* Hall in J. Bot. London 76: 315. 1938; Hall, *Gen. Tulipa* 83. 1940. Type: Chitral, schomburg s.n. (BM!); Toppin 33 (K – Photo!, CAL!); Conway s.n. (K!). *T. aitchisonii* Hall subsp. *cashmiriana* Hall in J. Bot. 76: 315. 1938. Type: Kashmir, Ladak, T. Hay s.n. (holo K Photo!), Kashmir, Dras, Osmaston 108 (para K – Photo!). *T. stellata* var. *chrysantha* Hall, *Gen. Tulipa* 85. 1940. *T. clusiana* var. *chrysantha* (Boiss.) Sealy in *Curtis Bot. Mag.* 165. t. 13. 1948.

Local name: Shandi Gul (Waziristan).

Stem 20–40 cm high. Leaves more or less crowded. Peduncle 12–30 cm long. Tepals bright yellow, suffused with red; outer 2–3.5 x 1–1.5 cm, inner 2–3 x 0.8–1.2 cm. Filaments yellow, 6–10 x 1–1.5 mm; anthers yellow, oblong, 4–8 x 1.5–2 mm. Ovary 5–9 x 2–3 mm, brown. Capsules globose or broadly oblong, c. 2 x 2 cm, prominently beaked. Seeds brown 6 x 4 mm.

Fl.: March–July. *Fr.*: March–July.

Distrib.: INDIA: Jammu & Kashmir (Kashmir) and Himachal Pradesh; PAKISTAN, AFGHANISTAN.

Habitat: On damp rock or grassy slopes of hills from 1219 to 3330 m in altitude.

Specimens examined: Himachal Pradesh: Kangra valley, *Watt* 15272 (CAL); N.W. Himalaya, *T. Thomson* 34 (CAL); Kashmir: Astor to Doyan, *Konway* 340 (K); Kajnagrange, *Duthie* 10938 (CAL); Ladak, *Schomburg* 40 (BM). Bhadrawali, T.A. Rao 9029 (CAL); Verinag, *Srivastava* 82897 (LWG).

Chr. no.: $2n = 24$ (Hall in J. Linn. Soc. London 50: 481. 1937 & J. Bot. London 76: 313. 1938; Sobti & Singh in *Proc. Indian Acad. Sci. Sec. B.* 54: 138. 1961; Podlech & Bader in *Pflanzen. II. Mit. Bot. Munchen* 11: 457. 1974); $2n = 24$ and 48 (Upcott & La Cour in J. Genet. 33: 237. 1936); and $2n = 36$ (Newton in J. Linn. Soc. London 47: 339. 1927).

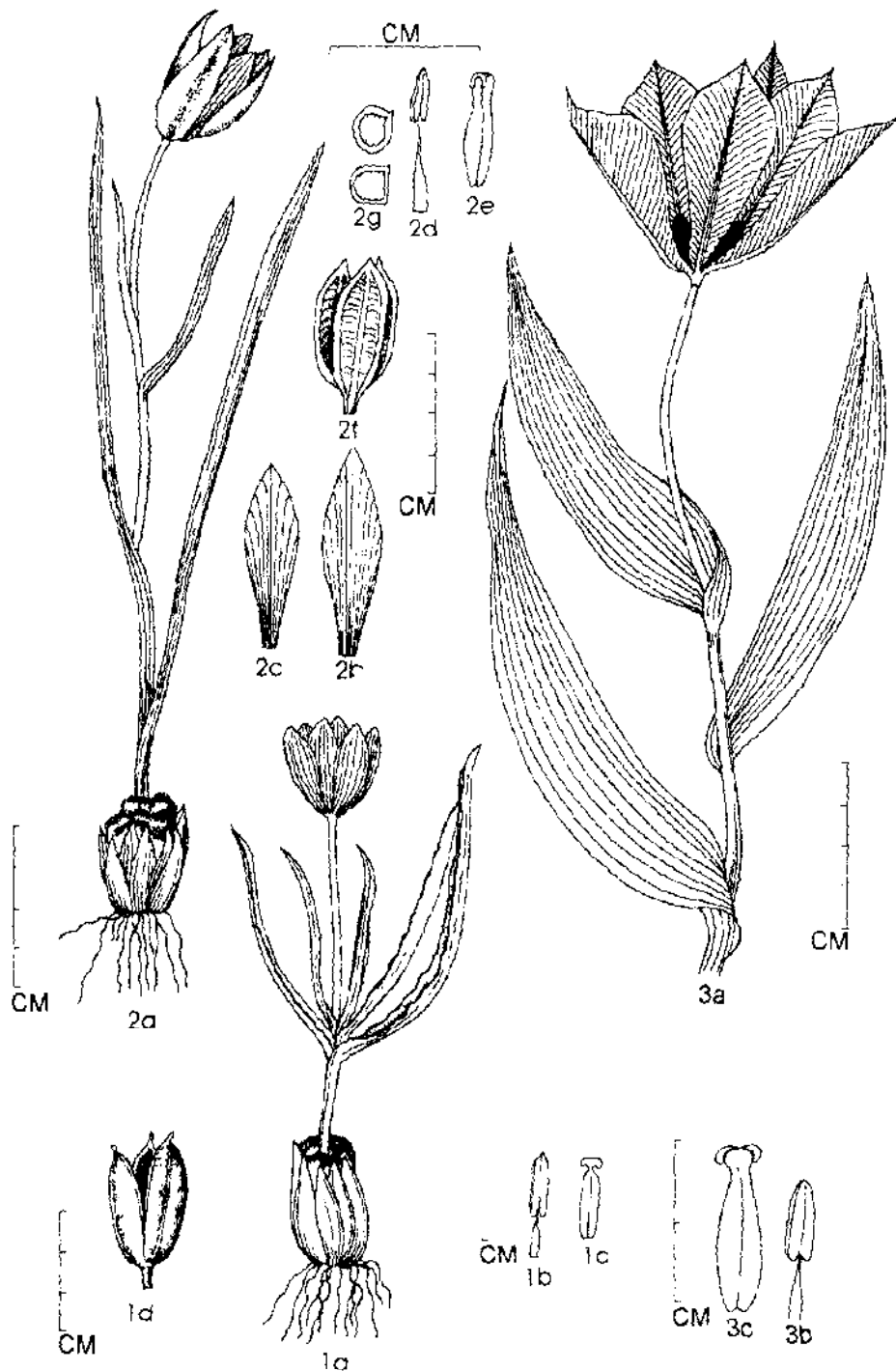


Fig. 24. *Tulipa clusiana* forma *fernandezii* (Blatt.) Dasgupta 1a. Habit. 1b. Stamen. 1c. Pistil. 1d. Capsule. *T. clusiana* forma *stellata* (Hook.) Dasgupta 2a. Habit. 2b. Outer tepal. 2c. Inner tepal. 2d. Stamen. 2e. Pistil. 2f. Capsule. 2g. Seeds. *T. lanata* Regel 3a. Habit. 3b. Stamen. 3c. Pistil.

Uses: The bulbs are eaten as vegetable in Kashmir.

Note: *Tulipa chrysantha* (Boiss.) Baker (1874) is based on *T. montana* Lindl. var. *chrysantha* Boiss. (1874) and Baker (*l.c.*) described this on the basis of the type Iran, *Kotschy* 78 and another gathering Afghanistan, *Griffith* 5788. Baker (1874) was followed by Hooker (1892). Study of these specimens it is concluded that *Kotschy* 78 has been reduced to a synonym of *T. lehmanniana* Merckl. Ex Bunge (1851). *T. chrysanthus* Boiss (1879) pro Afghanistan, *Griffith* 5788 has been reduced under *T. clusiana* f. *porphyreo chrysantha* (Blatt) S. Dasgupta & Deb as without type name is invalid.

1e. forma stellata (Hook.) S. Dasgupta & Deb in Candollea 40: 165. 1985. *T. stellata* Hook. Bot. Mag. 64: t. 2762. 1827; Baker in J. Linn. Soc. 14: 281. 1874 excl. *Kotschy* 99; Hook. f., Fl. Brit. India 6: 355. 1892; Collett, Fl. Simlens. 528. 1902; Bamber, Pl. Punj. 443. 1916; Coventry, Wild Fl. Kashmir Ser. 1, 99. 1923; Blatter, Beaut. Fl. Kashmir 2: 178. f. 5. 1928; Hall, Gen. Tulipa 84. 1940. Type: Kumaon, Wallich 5081A (K – W, flowered in Liverpool Botanic Garden). *T. clusiana* DC. var. *stellata* (Hook.) Regel in Acta. Horti. Petrop. 1: 54. 1873. **Fig.24.2a – 2g**

Local name: Unjavar (Kangra).

Stem 30 - 35 cm long, above ground. Leaves more or less crowded. Peduncle 10 - 22 cm long. Tepals white, yellow blotched at base, outer whorl crimson outside, 3.5 - 6 x 1 - 1.3 cm and inner 3 - 5 x 0.8 - 1 cm. Filaments 9 - 11 x 1.5 mm; anthers oblong, 5 - 7 x 1.5 mm. Ovary 1.3 - 1.5 x 0.25 - 0.3 cm. Capsules oblong, c. 3 x 2 cm, prominently beaked.

Fl.: February - May. *Fr.:* May.

Distrib.: INDIA: W. Himalayas; Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal ; PAKISTAN.

Habitat: Between rocks or sandy soil.

Specimens examined: Kashmir: Pahalgam, Ludlow & Sherriff 7600 (BM). Himachal Pradesh: Simla, Gamble 5882C (CAL); Collett s.n. (CAL); Sarahan, N.C. Nair 21919 (BSD). Uttaranchal : Kumaon, Strachey & Winterbottom s.n. (CAL); N. Gill 563 (CAL, LWG).

Chr. no.: 2n = 24 (Hall in J. Linn. Soc. London 50: 481. 1937 & J. Bot. London 76: 313. 1938; Sobti & Singh in Proc. Indian Acad. Sci. Sec.

B. 54: 138. 1961; Podlech & Bader in Pflanzen. II. Mit. Bot. Munchen 11: 457. 1974); $2n = 24$ and 48 (Darlington & Janaki Ammal in Bot. Gaz. 93: 296. 1932) and 36 (Malik in Sci. & Cult. 27: 197. 1961 and Mehra & Pandita in Taxon 27: 375. 1978).

2. ***Tulipa lanata*** Regel in Acta Horti Petrop. 8: 647. 1884; Hall, Gen. Tulipa: 118. t. 29. f. 20. 1940; S. Dasgupta & Deb in Candollea 40: 161. 1985. Type: U.S.S.R., Bukhara Baldschuan, *Regel s.n.* (LE). **Fig.24.3a – 3c**

Stoloniferous bulbous herb. Bulbs ovoid, 4–5 cm in diam.; scales brown, ovate, outer papery, inside hairy; hairs long. Stems up to 50 cm long. Leaves 4–5, lanceolate or oblong, 12–30 x 2–6 cm, acute or long acute, parallel veined, often pubescent above, often undulated margin. Flowers solitary, broadly cupular; peduncle 10–21 cm long, pubescent. Tepals brilliant scarlet, black blotched with yellow margin at base, light coloured outside, obovate, 6–8 x 3–3.5 cm, abruptly acuminate, midvein with parallel lateral veins. Filaments black except tip, subulate, 8–10 x 2–3 mm, glabrous; anthers deep purple, oblong, 10–15 x 3–4 mm. Ovary dark green, oblong, 15–25 x 4–5 mm; style absent; stigma 5 mm broad, papillose.

Fl.: April–May.

Distrib.: INDIA: Western Himalayas, Jammu & Kashmir (Kashmir); PAKISTAN, AFGANISTAN, IRAN, C.I.S.

Specimens examined: Jammu & Kashmir: Srinagar, *Mrs. Wather* 76 (K); *P.N. Kohli* 47 (K).

TRILLIACEAE

Chevall, Fl. Gen. Env. Paris 2 : 297. 1827 (*nom. cons.*)

Syamali Dasgupta*

Herbs, perennial, rhizomatous. Stems simple, erect, bearing sheathing scales below and whorl of simple leaves above. Leaves 3 – 12 in a whorl, above the middle of the stem; sessile or petiolate; lanceolate or elliptic or ovate or obovate; 3 – 5 nerved with reticulate venation. Flowers solitary, terminal, sessile or pedicelled, bisexual, 3 or 4 or more-merous, hypogynous. Tepals in 2 whorls, free, unequal, persistent, outer sepaloid, inner petaloid or filiform. Stamens as many as tepals, in 2 whorls; filaments attached to the base of the tepals; anthers basifixed, latrose or introrse, connective sometimes produced at the apex. Ovary subglobose, sessile, 1-locular with parietal placenta or 3-more-loculed with axile placenta; styles 3 or more, free, stigmatose within; ovules many. Fruit berry or loculicidal capsule. Seeds ovoid, sometimes with sarcotesta.

Temperate and mountain regions of N. Hemisphere, 4 genera and 65 species; 3 genera, 4 species and 3 varieties in India.

KEY TO THE GENERA

- 1a. Leaves 4 or more in a whorl; flowers 4 or more-merous; inner tepals filiform; fruit capsule; seeds with sarcotesta **1. Paris**
- 1b. Leaves 3 in each whorl; flowers 3-merous; inner tepals lanceolate to ovate, white or purplish; fruit berry; seeds without sarcotesta **2**
- 2a. Leaves broadly elliptic or obovate, subsessile; style coiled, shorter than ovary **3. Trillium**
- 2b. Leaves ovate or lanceolate, petioled; style not coiled, longer than ovary **2. Trillidium**

1. PARIS

L., Sp. Pl. 367. 1753 & Gen. Pl. ed. 5, 172. 1754; Hook. f. in Hook. f., Fl. Brit. India 6: 362. 1892; Hara in J. Fac. Sci. Univ. Tokyo Bot. 10: 141. t. 1-6. 1969; E.J. Ecker in Nasir & Ali, Fl. W. Pakistan 105: 3. 1976; Noltie in Grierson & Long, Fl. Bhutan 3(1): 21. 1994.

Herbs perennial. Rhizome with annular scars. Stems erect, simple. Leaves simple, 4 – 12 in a whorl above the middle of stem, lanceolate

*Central National Herbarium, Botanical Survey of India, Howrah

ovate or oblong, acuminate. Flowers solitary, terminal, pedicelled or sessile, 4 - 12-merous. Tepals 8 - 12 in 2 whorls, unequal, outer ovate to lanceolate, leafy, persistent; inner narrow, filiform, as many as outer or absent. Stamens as many as tepals, attached to the base; anthers linear, latrorse. Ovary subglobose; styles 4 - 10, free, linear. Fruit a capsule, many-seeded. Seeds subglobose, with fleshy scarlet sarcotesta.

About 20 species in temperate regions of Europe, Asia to N. America; one in India.

Paris polyphylla Sm. in Rees, Cycl. 26 (2): Paris n. 2. 1813. D. Don, Prodr. Fl. Nepal: 49. 1825; Wall. Pl. Asiat. Rar. 2: 24. t. 126. 1831; Hook. f., Fl. Brit. India 6: 362. 1892; Kitamura in Kihara, Fauna & Fl. Nepal. Himal.: 95. 1955; Banerjee in J. Bombay Nat. Hist. Soc. 55: 268. 1958; Hara in Hara, Fl. E. Himal. 1: 410. t. 3b. 1966. & 2: 167. 1971. & Ohashi, in Fl. E. Himal. 3: 134. f. 14a. 1975; E.J. Ecker in Nasir & Ali, Fl. W. Pakistan 105: 3. 1976; Hara & al., Enum. Fl. Pl. Nepal 3: 76. 1978; Noltie in Grierson & Long, Fl. Bhutan 3(1): 21. 1994. Type: Nepal, Narainhetty, 13.3.1803, *Buchanan-Hamilton s.n.* (LINN photo!).

Herbs, rhizome creeping, white, 1 - 2 cm in dia. Stem up to 90 cm tall, 3 - 10 mm dia., often chocolate coloured. Leaves 4 - 9, whorled, oblanceolate or oblong or obovate or lanceolate, 6 - 24 x 1 - 13 cm, acuminate, glabrous, venation reticulate; petiole absent or to 8 cm long. Flowers solitary, terminal; pedicel absent to 27 cm long. Tepals outer leafy, green, 3 - 12 x 1 - 3.3 cm, acuminate, venation reticulate; inner yellow or yellowish green, filiform, 1 - 4 mm broad. Filaments 4 - 10 mm long, flat; anthers dark brown, linear, 8 - 15 mm long, latrorse, basifixed. Ovary blue or purple, 3 - 7-locular; styles 3 - 7, free, stigma yellow, tips curved; ovules many in each locule. Capsule subglobose, c. 2.5 cm in dia., 3 - 7-valved. Seeds subglobose, c. 4 mm long, testa pulpy, orange red.

Fl.: March - September. *Fr.*: May - January.

Distrib.: INDIA: Himachal Pradesh, Uttaranchal, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur and Meghalaya; PAKISTAN, NEPAL, BHUTAN, MYANMAR, CHINA, JAPAN.

Habitat: Grows with *Aralia*, *Arisaema* under Pine-Schima-Oak, *Rhododendron* forest, on very muddy, moist humous rich soil along streams or bridle path, at an altitude of 2500 - 4000 m.

Uses: The seeds and roots are considered as poisonous. All the green parts have disagreeable narcotic smell like *Datura*.

Notes: Based on the study of materials represented in CAL from all areas of distribution this species is found to be highly polymorphic, with distinct extremes connected through intermediate variations. Plants of one extreme are very different from the plants of other extreme. It is observed that very small plants with sessile leaves whitish variegated above and purplish beneath, short peduncle, few tepals grow in E. Himalayas from Nepal, Sikkim, Bhutan, W. Bengal, Arunachal Pradesh to China and gradually increasing sizes of plants with very big, broad leaves are also reported from Arunachal Pradesh, Myanmar (Burma) and China.

Hara (1966, 1971, 1978), Takhtajan (1981) and Noltie (1994) distinguished some infraspecific taxa under *Paris polyphylla* Sm. But in the present study after examining 150 specimens extant at CAL with overlapping characters some of these taxa are found not to be tenable. Noltie (1994) though retained var. *stenophylla* Franch. observed variations in leaf shape in the same gathering, indicating doubt on the validity of this taxon. Hara (1966) proposed var. *appendiculata* Hara on the basis of anthers with long connective (3 - 6 mm long). It is also not tenable as in the same gathering length of connective vary from 0 - 5 mm. In this study the distinguishing characters considered are (1) Ratio of length and breadth of the leaves i.e. the shape; (2) Ratio of the length of anthers and filaments. On this basis 4 varieties have been proposed of which one variety is a new record to India.

Hara (1969) while reducing the Chinese species *P. fargesii* Franch. extended *P. polyphylla* circumscription by including specimens with smaller outer tepals and bigger stamens. Similar variations have been observed in some collections from Arunachal Pradesh and Myanmar, *Panigrahi* 6132 and *Shaik Mokim s.n.* have smaller outer tepals and bigger stamens, *I.H. Burkill* 36098 and *J.H. Lace* 6233 have bigger stamens and fewer leaves and are included in this fold.

KEY TO THE VARIETIES

- 1a. Leaf breadth 1/4 or less of the length; anther and filament ratio varies 2
- 1b. Leaf breadth 1/3 - 1/2 of the length; anthers longer than filaments. 3
- 2a. Leaves smaller, variegated, whitish markings along veins, dark purple beneath; anthers smaller than filaments **1c. violacea**
- 2b. Leaves bigger not variegated; anther and filament ratio varies **1a. polyphylla**

- 3a. Leaves lanceolate, petioles 1-6 cm long **1d. wallichii**
 3b. Leaves obovate or elliptic, petioles 5-15cm long **1b. fargesii**

1a. var. polyphylla

P. polyphylla var. *brachystemon* Franch. in J. de Bot. 12: 191. 1898; Hara, Fl. E. Himalaya 2: 167. 1971. Type: W. China, Setchuan, Techenkeon tim, *Farges s.n.* (P);.. *P. daiswus* Buch.- Ham. ex D. Don, Prodr. Fl. Nepal: 49. 1825, pro syn. *P. polyphylla* Sm. subsp. *polyphylla* var. *polyphylla* Hara in Enum. Fl. Pl. Nepal 3: 76. 1978; *P. polyphylla* Sm. var. *stenophylla* Franch. in Nouv. Arch. Muc. Paris ser. 2, 10: 97. 1888; Noltie in Grierson & Long, Fl. Bhutan 3(1): 22. 1994. Type: Yunan, *Delavay s.n.* (P). **Fig. 25.1**

Herbs, 16 - 60 cm high; rhizome short, creeping, fleshy. Leaves 4 - 13, lanceolate or narrowly oblanceolate, 7 - 12 x 1 - 4 cm, finely acuminate; petiole 0.3 - 5 cm long. Peduncle 2.5 - 5 cm long. Outer tepals 3 - 6, greenish orange to violet, lanceolate, 3.6 - 6.5 x 0.5 - 2.4 cm, acuminate. Stamens and pistil subequal; filaments 4 - 10 mm long; anthers 4 - 10 mm long, connective up to 1 mm long. Capsule ovoid, 1.5 x 1.2 cm, brown, glabrous. Seeds orange red.

Distribution: INDIA: Jammu & Kashmir, Himachal Pradesh, Uttaranchal, West Bengal, Sikkim, Arunachal Pradesh, Meghalaya, Nagaland and Manipur; PAKISTAN, NEPAL AND BHUTAN.

Specimens examined: Arunachal Pradesh: Kameng F.D., Nyukmadong, 7900 ft., 19.5.1957, *R.S. Rao* 7488 (CAL); Tirap F.D., Chegum to Wakka, 3.7.1961, *D.B. Deb* 26462 (CAL); Kameng F.D., Gigao to Pam river valley, 21.5.1958, *Panigrahi* 16014 (CAL); Himachal Pradesh: Dalhousie, 6000 ft., 22.9.1874, *Clarke* 22954 (CAL); 22953(CAL); Manipur: Khongri valley, 2 - 4000 ft., April 1882, *Watt* 6771 (CAL); Meghalaya: Shillong, Elephanta falls, 26.9.1986, *Panigrahi* 3376 (CAL); Shillong, 6000 ft., 17.6.1956, *R.S. Rao* 2751 (CAL); Shillong, 8.5.1959, *G.K. Deka* 18326 (CAL); K. & J. hills, Nongstain village, 20.6.1958, *Panigrahi* 16503 (CAL); Shillong, June 1920, *H.G. Carter* 1146 (CAL); Nagaland: Kohima, Keywema, 13.5.1895, *Watt* 11414 (CAL); Sikkim: Lachen, 9000 ft., May 1885, *King's collector s.n.* (CAL); Sikkim, *R.S. Rao* 403, 127, 1059 (CAL); Uttaranchal: Garhwal, Ramni forest, 2000 m, 12.6.1959, *M.A. Rau* 10140 (CAL); 10.6.1959, *M.A. Rau* 10076 (CAL); Tehri Garhwal, Shanchattii, 2000 m, 12.6.1961, *M.A. Rau* 15660 (CAL);

Sitapur, 1600 m, 21.5.1972, *B.D. Naithani* 47922 (CAL); W. Bengal: Senchal, 7500 ft., 2.9.1877, *King* 4166 (CAL); Senchal, 7000 ft., Indo Russian Expd. To N. Bengal, 20.4.1961, 198 (CAL); Senchal, 8000 ft., 12.5.1940, *K. Biswas* 3772 (CAL); Sandakphu to Tonglu, 13.5.1956, *D. Chatterjee* 82 (CAL); Darjeeling, Tonglu north, 3071 m. 19.9.1962, *Safui* 1615 (CAL).

1b. var. fargesii (Franch.) S. Dasgupta *stat. & comb. nov*

P. fargesii Franch. in J. de Bot. 12: 190. 1898. *P. polyphylla* Sm. subsp. *fargesii* (Franch.) Hara in J. Fac. Sci. Univ. Tokyo Bot. 10: 177. 1969. Type: W. China, Tchenkeoutin, *Farges* (P, photo!). **Fig. 25.2**

A succulent herb. Leaves and stem often chocolate coloured. Leaves 2-6, broadly obovate or elliptic, 9-23 x 6-13 cm, acuminate; petioles 5-15 cm long. Pedicels 7-30 cm long. Outer tepals 4-5, green, broadly lanceolate, 3.5-12 x 1.5-4 cm; inner tepals linear, slightly broader towards tips. Filaments greenish yellow, subulate, 5-7 mm long; anthers reddish, oblong, 10-15 mm long; connective 2 mm long. Pistil shorter than stamens; ovary ovoid-oblong, 7-10 x 5-6 mm; styles 5, 4-6 mm long. Capsule 3 cm long, with persistent curved stigma;. Seeds oblong, planoconvex, 5 x 4 x 0.3 mm, brown, glabrous.

Distrib.: INDIA: Arunachal Pradesh and Manipur; MYANMAR, CHINA.

Specimens examined: Arunachal Pradesh: Abor Expd., above Egar stream, 3400 m, 18.1.1912, *L.H. Burkill* 36098 (CAL); Kameng F.D., 26.3.1957, *Panigrahi* 6132 (CAL); Kameng F.D., 15.5.1958, *Panigrahi* 15595 (CAL); Manipur: Naga hills, 5000 ft., December 1907, *Meebold* 7278 (CAL).

1c. var. violacea (Lev.) S. Dasgupta *comb. & stat. nov.*

Paris violacea Lev. in Fedd. Repert. 11: 302. 1912; Noltie in Grierson & Long, Fl. Bhutan, 3(1): 23. 1994. Type: Yun-nan, Montagnes. de Lau-fang-Keoa, 3200 m, June 1910, *Maire* 7458 (P); *P. marmorata* Stearn in Bull. Brit. Mus. Nat. Hist. Bot. 2: 79. f. 11, t. 8. 1956. Type: Bhutan, Drugye Dzong, 2850 m, 12.5.1949, *Ludlow Sherriff & Hicks* 16213 (BM); S.E. Tibet, between Kumarg and Nyksang (Tsangpo gorge), 2700 m, 28.4.1947, *Ludlow, Sherriff & Elliot* 13564 (BM holo, photo!). *P. polyphylla* Sm. subsp. *marmorata* (Stearn) Hara in J. Fasc. Sci. Univ. Tokyo Bot. 10: 176. t. 2B-C, 6C. 1969. **Fig. 25.3**

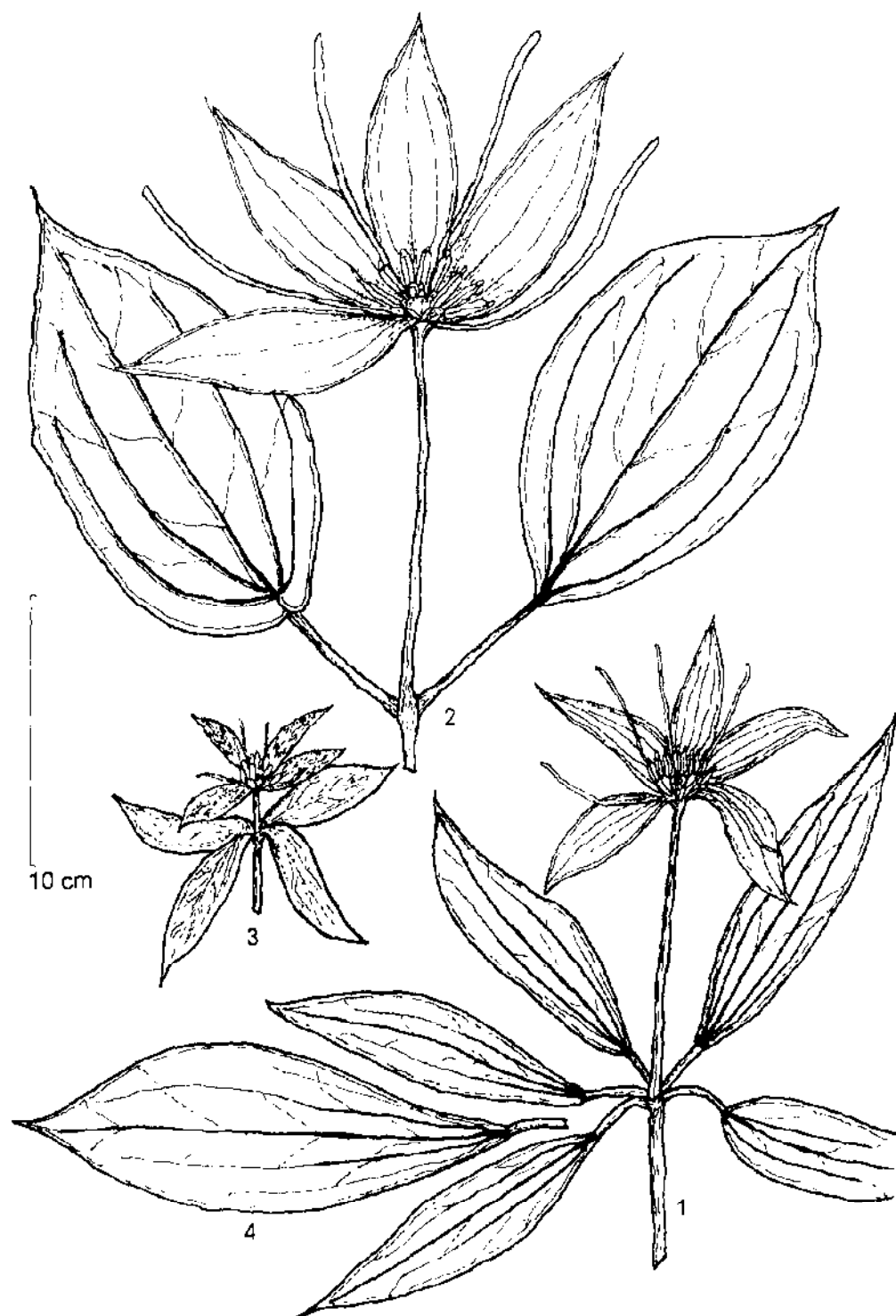


Fig. 25. *Paris polyphylla* Sm. var. *polyphylla* 1. Habit. *P. polyphylla* Sm. var. *fargesii* (Franch.) S. Dasgupta 2. Habit. *P. polyphylla* Sm. var. *violacea* (Lev.) S. Dasgupta 3. Habit. *P. polyphylla* Sm. var. *wallichii* Hara 4. Leaf.

Herb 7–18 cm high. Leaves 4–6, sessile, lanceolate, 6–8 x 1–2 cm, acuminate, variegated, veins whitish green above, dark purplish beneath. Petiole up to 2 mm long. Peduncle 1–2.5 cm long. Outer tepals 2–4, lanceolate, 2–3.5 x 0.5–1 cm. Filaments up to 10 mm long; anthers up to 6 mm long, connective up to 4 mm long.

Distrib.: INDIA: Sikkim, West Bengal and Arunachal Pradesh; BHUTAN, NEPAL, S.E. TIBET - CHINA.

Specimens examined: Arunachal Pradesh: Kameng F.D., Bomdila to Dirang Jung, 13.6.1957, *Panigrahi* 6843 (CAL); Sikkim: *R.S. Rao* 738, 737, 735 (CAL); West Bengal: Tonglu, 9000 ft., 7.5.1877, *Listor s.n.* (CAL).

Id. var. wallichii Hara in Ohashi, Fl. E. Himal. 3: 134. t. 14b. 1975; Noltie in Grierson & Long, Fl. Bhutan 3(1): 23. 1994. *P. polyphylla* sensu Wall. Pl. Asiat. Rar. 2: 24. t. 126. 1831. Type: Nepal, *E. Gardner* Wall. Cat. 3710 (CAL, photo!). **Fig.25.4**

Herbs 60–90 cm high. Leaves 4–8, lanceolate to oblanceolate, 14–23 x 6–8 cm, roundish at base; petiole 1–6 cm long. Pedicels 3–19 cm. Outer tepals 3–4, 4–12 x 1–3 cm; inner tepals 4–8 cm long. Filaments 4–7 mm long; anthers 7–15 mm long, connective 0.5–2 mm long. Capsule bright red, shining.

Distrib.: INDIA: Himachal Pradesh, Uttaranchal, West Bengal, Sikkim, Arunachal Pradesh, Meghalaya and Manipur; NEPAL, BHUTAN, MYANMAR.

Specimens examined Arunachal Pradesh: Kameng F.D., 6500 ft., 11.5.1957, *R.S. Rao* 7300 (CAL); Himachal Pradesh: below Pelus field, 18.6.1886, *E.R. Johnson s.n.* (CAL); Manipur: Sirohifurer, 8000 ft., 12.4.1882, *Watt* 6447 (CAL); Meghalaya: Khasia, *Simons s.n.* (CAL); Khasia, January 1886, *Mann s.n.* (CAL); Sikkim: Chumthang, 7000 ft., 22.5.1945, *K. Biswas* 6897 (CAL); Singhik, 4480 ft., 14.5.1945, *K. Biswas* 6807 (CAL); Neerie, 5000 ft., April 1877, *Lister s.n.* (CAL); Sikkim, 5000 ft., May 1885, *King's collector s.n.* (CAL); Damsang, 2000 m, 27.4.1965, *H. Santapau & S.K. Mukherjee* 143 (CAL); Karponag, 3200–3500 m, 3.11.1961, *G. Sengupta* 254 (CAL); West Bengal: Sandakhphu to Rimbick, 9.10.1941, *K. Biswas* 5656 (CAL); Darjeeling, 23.4.1903, *W.W. Smith s.n.*

(CAL); Lava, Pankhabari Range, 2000 – 2500 m, 8.11.1961, *G. Sengupta* 381 (CAL); Sureil, 5000 ft., 30.5.1947, *K. Biswas* 7446 (CAL).

2. TRILLIDIUM

Kunth, Enum. Pl. 5: 120. 1850; Ecker in Nasir & Ali, Fl. W. Pakistan 105: 1. 1976; Noltie in Grierson & Long, Fl. Bhutan 3(1): 21. 1994.

Herbs, rhizome thick, horizontal. Stem simple, erect with basal sheathing scaly leaves and a whorl of 3 simple leaves above. Leaves 3 in a whorl, ovate, ovate-lanceolate, petioled, reticulate. Flower solitary, terminal, pedicelled, trimerous. Tepals 6 in 2 whorls, greenish brown to purple, narrowly lanceolate, reflexed on maturity. Stamens 6 in 2 whorls, attached to the base of the tepals, shorter than tepals; anthers longitudinally dehiscent. Ovary ovoid, sessile, trilocular; styles 3, free, equal to or longer than ovary. Fruit globose or oblong, berry. Seeds many.

1 species in Himalayas; in India Pakistan and Nepal.

Trillidium govanianum (D. Don) Kunth, Enum. Pl. 5: 120. 1850; Hara in Hara et al., Enum. Fl. Pl. Nepal 1: 80. 1978. Noltie in Grierson & Long, Fl. Bhutan 3(1): 21. 1994. *Trillium govanianum* Wall. ex D. Don in Royle, Ill. Bot. Himal. Mts.: 384. t. 93, f. 1, 1839. Type: Temp. Himalaya, *Wallich* 812 (K-W); Hook. f., Fl. Brit. India 6: 361. 1892; Hara in Hara, Fl. E. Himal.: 418. f. 28. 1966 & 2: 174. 1971; E.J. Ecker in Nasir & Ali, Fl. W. Pakistan 105: 1. 1976.

Fig. 26.1a & 1b

Rhizomatous herbs with a whorl of 3 cauline leaves and a solitary apical flower; rhizome 1 - 2 cm in diam. Stem up to 42 cm high. Leaves 3, ovate or oblong or cordate, 3.5 - 18.8 x 1.8 - 10.2 cm, acute to acuminate, glabrous; petiole 0.3 - 2 cm long. Flower pedicels 0.9 - 2.3 cm, long, stout. Tepals dark purple, often greenish brown, narrowly lanceolate, 1.2 - 2.5 cm long; outer segments 2 - 5 mm broad, inner 1 - 2 mm broad, spreading in flower, reflexed in fruit. Filaments red or brown, 1 - 4 mm long; anthers yellow, 2 - 5 mm long, curved, longer than or equal to filaments. Ovary ovoid, 3 - 6 x 2 - 4 mm, dark red or brown; styles 3, free, 3 - 12 mm long. Berry red, globose, 1 - 2 cm diam, many-seeded. Seeds oblong, 2-2.5 mm long with pulpy lateral appendages.

Fl.: May - July. *Fr.*: August.

Distrib.: INDIA: Himalayas, Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal, West Bengal and Sikkim; PAKISTAN, NEPAL.

Habitat: Grows as moist shady undergrowth of Oak, *Rhododendron*, Bamboo, *Tsuga*, *Betula* forests, along the side of the glacier at altitudes from 2700 to 4000 m.

Specimens examined: Himachal Pradesh: Chamba, 14.6.1897, *J.H. Lace* 1576 (CAL); Rakchan, Baspa valley, 19.5.1972, *K.P. Janardhanan* 47330 (CAL); Jammu and Kashmir: Thajwas mountain, 18.6.1959, *T.A. Rao* 9564 (CAL); Kashmir, July 1956, *T.A. Rao* 591 (CAL); Sikkim: Zemu valley, 11000 ft., 10.7.1909, *Smith & Cave* 1113 (CAL); *R.S. Rao*, 987 (CAL); Uttaranchal: Bahna-Bajnora, Garhwal, 3500 m, 17.6.1959, *M.A. Rau* 10278 (CAL); Tehri Garhwal, Panwali, 3200 m, 3.6.1972, *B.D. Naithani* 481219 (CAL). West Bengal: Tonglu, 9000 ft., 29.5.1914, *G.H. Cave* (CAL).

3. TRILLIUM

L., Sp. Pl. 329. 1753 & Gen. Pl. ed. 5. 158. 1754; Hook.f., Fl. Brit. India 6: 361. 1892; E.J. Ecker in Nasir & Ali, Fl. W. Pakistan 105: 1. 1976; Noltie in Grierson & Long, Fl. Bhutan 3(1): 20. 1994.

Herbs; rhizome horizontal. Stem simple, erect, with sheathing scaly leaves below and a whorl of 3 simple leaves above. Leaves usually sessile, broadly obovate or elliptic with 3–5 main parallel veins and reticulate venation. Flowers solitary, terminal, sessile or pedicelled, trimerous, campanulate; Tepals 6 in 2 whorls, lanceolate, outer green; inner white or dull purple. Stamens 6 in 2 whorls, attached to the base of tepals; anthers introrse. Ovary conical; trilocular; styles 3, free, shorter than ovary; ovules many. Fruit globose or subglobose berry. Seeds numerous.

Distrib.: About 30 species in North America and Eurasia; 2 in India.

KEY TO THE SPECIES

- 1a. Inner tepals pink, obtuse, shorter than outer; rhizome globose 1. **T. smallii**
 1b. Inner tepals white, acute, equal to outer; rhizome not globose.

2. **T. tschonoskii**

1. **Trillium smallii** Maxim. in Bull. Acad. Petersbourg 29: 217. 1884. Type: Japonia, circa Hakodate, *Small s.n.* (K-M); prov. Nambu in Collibus.

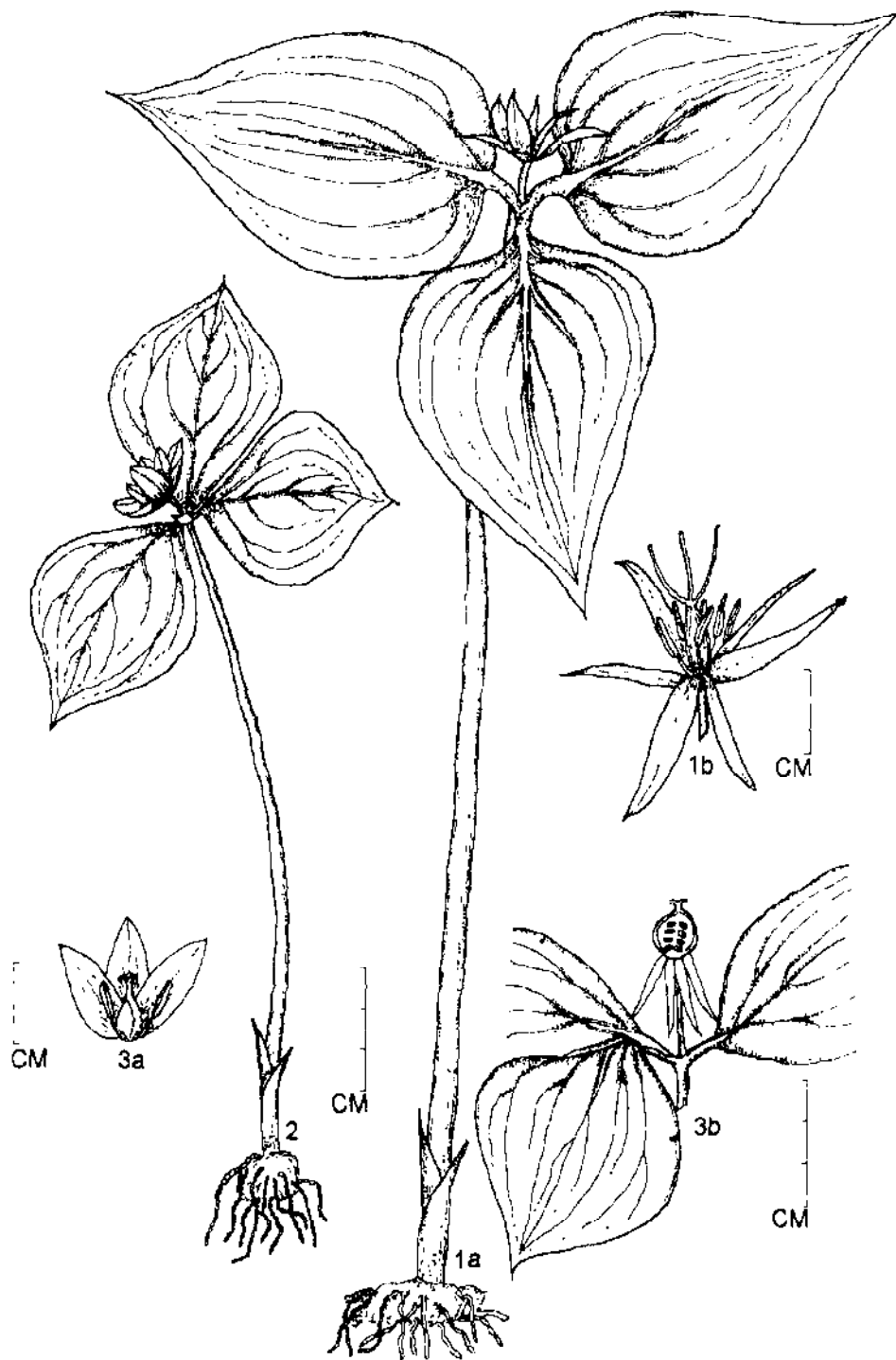


Fig. 26. *Trillidium govanianum* (D. Don) Kunth 1a. Habit. 1b. Flower. *Trillidium smallii* Maxim. 2. Habit. *T. tschonoski* Maxim. 3a. Flower split open. 3b. Fruiting twig

Nippon media, *Tschonoski s.n.* (P, LE); Haku-sau, 2500 m, *Rein s.n.* (P); prov. Tschoschiu, *Kramer ex Franchet s.n.* (P). **Fig. 26.2**

Herbs; rhizome 2 cm thick, horizontal often globose, with profuse, annulated adventitious roots. Stem c. 22 cm high, with sheathing basal leaves and a whorl of 3 leaves above. Leaves sessile, broadly obovate, 6 - 9 x 7 - 13 cm, acuminate, white beneath. Flower pedicels c. 1 cm long. Outer tepals 15 - 18 x 7 mm; inner tepals pink, 14 - 15 x 5 mm, obtuse. Filaments c. 3 mm long; anthers broadly linear; 3 mm long. Ovary conical, c. 5 x 3 mm; style c. 2 mm, deflexed, coiling. Fruit globose, 1- 1.2 cm in diam. Seeds 2.5 mm long, brown.

Fl. & Fr.: May.

Distrib.: INDIA: Sikkim; JAPAN.

Habitat: 3500 m altitude.

Note: First record for India.

Specimens examined: Sikkim: Rookah, 10000 ft., May 1885, *G. King's collector s.n.* (CAL) Byagha, 13.5.1905, *J.C. White* 141 (CAL).

2. ***Trillium tschonoskii*** Maxim. in Bull. Acad. Petersbourg 29: 218. 1884; Hook. f., Fl. Brit. India 6: 361. 1892. Type: Nippon, alpe, Nikko, 1864, *Tschonoski* (LE, CAL!). **Fig. 26.3a & b**

Herbs; rhizome 1 - 2 cm thick, horizontal; adventitious roots numerous, annulated. Stems erect, 30 - 40 cm high, with sheathing basal leaves and a whorl of 3 leaves above. Leaves sessile, broadly obovate or broadly elliptic, 7 - 12 x 7 - 12 cm, abruptly acute or acuminate, white beneath. Flowers pedicels c. 1 cm long, linear. Tepals white, lanceolate, 14 - 20 x 5 - 7 mm, similar, acute. Filaments 1 - 3 mm long; anthers broadly linear, 3 - 4 mm long. Ovary conical, 5 - 7 x 3 - 5 mm; style c. 2 mm, linear, deflexed. Fruit subglobose, 1 - 1.2 x 1 - 1.2 cm, many seeded.

Fl.: May. *Fr.*: August.

Distrib.: INDIA: Sikkim and Arunachal Pradesh; BHUTAN, JAPAN.

Habitat: 3050 m altitude.

Specimens examined: Sikkim: Lachung valley, 10000 ft., 6.8.1892. *G.A. Gammie* 643 (CAL); Sikkim, *R.S. Rao* 459, 496 (CAL).

UVULARIACEAE

A. Gray ex Kunth, Enum. Pl. 4 : 199. 1843 (*nom. cons.*)

Syamali Dasgupta*

Perennial, rhizomatous herbs; rootstock creeping or not. Stem erect, branched or unbranched. Leaves simple, alternate, cauline or subradical rosette, elliptic to oblanceolate, veins parallel converging. Inflorescence terminal raceme or umbel, simple or branched, or axillary 1-6-flowered fascicles or umbels. Flowers bisexual, actinomorphic, hypogynous. Tepals 6, in 2 whorls, free, often with nectar sacs at base. Stamens 6, in 2 whorls; filaments free or connate at base; anthers dorsifixed or basifixed, extrorse or latrorse. Ovary tricarpellary, syncarpous, 3-locular; style simple or 3-fid above, slender; stigma simple or 3-lobed. Fruit a septicidal capsule or berry; seeds 1-many.

North temperate and subtropical America and Asia. 4 genera and 6 species in India.

KEY TO THE GENERA

- 1a. Leaves basal rosette; inflorescence terminal **1. Clintonia**
- 1b. Leaves cauline; inflorescence terminal or axillary or on short lateral shoots **2**
- 2a. Outer tepals gibbous or saccate or spurred at base; flowers more than 2, erect, terminal or axillary **3**
- 2b. Outer tepals neither gibbous, saccate nor spurred at base; flowers 1-2, pendant, axillary **3. Streptopus**
- 3a. Flowers terminal, peduncle branched; stigma lobes bifid at apex; fruit a capsule **4. Tricyrtis**
- 3b. Flowers terminal or axillary, on short shoots; stigma lobes not bifid; fruit a berry **2. Disporum**

1. CLINTONIA

Raf. in Amer. Mon. Mag. 2: 266. 1818; Hook.f., Fl. Brit. India 6: 361. 1892; R.H. Wagner in Bot. Gaz. 134: 271. 1973; Noltie in Grierson & Long, Fl. Bhutan 3(1): 94. 1994.

Rhizomatous herbs; rootstock creeping. Leaves simple, subradical, in basal rosette. Scape naked or one leaved. Inflorescence terminal, raceme

*Central National Herbarium, Botanical Survey of India, Howrah

or umbel, rarely solitary. Flowers campanulate; bracts linear or absent. Tepals 6, similar. Stamens 6, inserted on the base of tepals; filaments filiform; anthers dorsifixed, subextrorse. Ovary 3-loculed; stigma trilobed. Berry fleshy, loculicidal, 2 many-seeded. Seeds ovate, brown or pale.

About 6 species in temperate Asia and N. America; 1 in India.

1. **Clintonia udensis** Trautv. & Meyer, Fl. Ochotensis: 92, t. 30. 1856. R.H. Wagner in Bot. Gaz. 134: 271. 1973. Type: Udae, 28 -29 June, *Trautver, s.n.* (LE, holo). *Smilacina alpina* Royle, Ill. Bot. Himal. Mts.: 380. 1839, nom. nud. *Clintonia alpina* Kunth ex Baker in J. Linn. Soc. Bot. 14: 585. 1875; Hook.f., Fl. Brit. India 6: 361. 1892. Kitamura in Kihara, Fauna & Fl. Nepal Himal.: 92. 1955; Schilling in J. Roy. Hort. Soc. 94: 230. 1969. Type: Kedarkanta, Urukta et Manma, *Royle s.n.* (K, holo). *C. alpina* Kunth ex Baker var. *udensis* (Trautv. & Meyer) Macbride in Contrib. Gray Herb. 56: 18. 1918. *C. udensis* Trautv. & Meyer var. *alpina* (Kunth ex Baker) Hara in J. Jap. Bot. 38: 72. 1963; Spring Fl. Sikkim Himalaya: t. 96. 1963; Hara, Fl. E. Himal. 1: 407. 1966 & 2: 166. 1971; Hara et. al., Enum. Fl. Pl. Nepal 1: 72. 1978. *C. udensis* Trautv. & Meyer subsp. *alpina* (Kunth ex Baker) Kitamura in Acta. Phytotax. Geobot. 22: 68. 1966; Noltie in Grierson & Long, Fl. Bhutan 3(1): 94. 1994. **Fig. 27. 1a -1c**

Herbs 10 – 43 cm high. Leaves 2 – 5 in basal rosette, elliptic to oblanceolate, 9 -30 x 4 – 8 cm, cuspidate, sheathing at base, with parallel converging veins linked by short transverse veinlets. Stem naked, reddish purple, appressed hairy above. Racemes terminal, 5 -10 (-20)-flowered, condensed, elongating up to 15 cm in fruits. Flowers campanulate; pedicels c. 5 - 25 mm long, elongating to 3 cm in fruits, appressed pubescent; bracts and bracteoles lanceolate, 5 – 10 mm, appressed hairy. Tepals white with a violet streak outside, or pale blue or greenish yellow, oblanceolate, 6 - 12 x 2 – 5 mm, margins membranous, appressed pubescent outside. Filaments white, linear, 4 - 10 mm long; anthers pale yellow, oblong, 0.7 – 1.5 x 0.5 – 1 mm. Ovary green, oblong, 3 - 4 x 1.5 - 2 mm; style white, 3 - 6 mm long; stigma prominently 3-lobed. Berries black, broadly oblong, c. 1 cm, 3-lobed, dehiscing from the tip, many-seeded. Seeds straw or brown coloured, ovate, 3 – 4 mm long, laterally compressed.

Fl.: April – July. *Fr.*: July – October.

Distrib.: INDIA: Jammu & Kashmir (Kashmir), Himachal Pradesh, Uttaranchal West Bengal, Sikkim, Arunachal Pradesh and Nagaland; BHUTAN, NEPAL, CHINA, JAPAN.

Habitat: On moist rocky slopes or crevices, along streams in the shade of Pine, Oak, Picea, and *Rhododendron* in evergreen forests between 3000–4000 m altitudes.

Specimens examined:); Arunachal Pradesh: Kameng, Diang to Sela, 22.5.1957, R.S. Rao 7706 (CAL); Himachal Pradesh: Chamba, 2.6.1899, J.H. Lace 1958 (CAL); Jammu & Kashmir: Kashmir, Baltal, 9500 ft., 30.7.?, Gammie s.n. (CAL); Manipur: Kohima, 7000 ft., May 1896, Watt 11617 (CAL); M.A. Rau; Nagaland: Japoo, 9000 ft., 16.5.1886, Colonel (CAL); Sikkim: Lachen to Thangu, 8000 to 13000 ft., 17.5.1945, K. Biswas 6629 (CAL); Sikkim, R.S. Rao 316, 455, 497, 502 (CAL); Uttaranchal : Garhwal, Mangu area, 3000 m, 30.5.1972, Naithani 48103 (CAL); Buhna Bishtola, 3500 m, 16.6.1959, 10244 (CAL); West Bengal: Sandakphu, 12000 ft., 14.6.1948, K. Biswas 8350 (CAL); Rhalut south, 3600 m, 20.9.1962, B. Safui 1790 (CAL).

Notes: *Clintonia alpina* Kunth ex Baker was described by Baker (1875) on the basis of specimens collected from Kedarnath, Urukta and Manma in Garhwal Himalayas. The other east Asian species *C. udensis* Trautv. & Meyer was described on the basis of specimens collected from Uda river in Siberia. Hook. f. (1892) considered that they hardly differ from each other. These two taxa were subsequently merged by Macbride (1918), but considered some differences at infraspecific level. Hara (1963, 1966, 1971 & 1978) and Kitamura (1966)) showed some differences at infraspecific level. This was supported by Noltie (1994) in retaining the subspecific rank as proposed by Kitamura (1966).

C. alpina differs from *C. udensis* in having smaller violet flowers (tepals 8–9 x 2 mm), equally long stamens and pistils, smaller (2.5–3.2 mm long), pale brown seeds. Whereas *C. udensis* has bigger greenish yellow flowers (tepal 10–12 x 3–4 mm), filaments ½ the length of pistil, bigger (3.5–4 mm long), dark brown seeds. All materials (58 field nos.) examined at CAL, showed overlapping combination of characters in their entire range of distribution. Therefore, *C. alpina* Kunth ex Baker is treated here as a synonym of *C. udensis* Trautv. & Meyer.

2. DISPORUM

Salisb. in Trans. Hort. Soc. 1: 331. 1812; D. Don in Trans. Linn. Soc. London 18: 513. 1841; Baker in J. Linn. Soc. Bot. 14: 588. 1875; Hook. f., Fl. Brit. India 6: 359. 1892; Jessop in Fl. Malesiana ser. I, 9: 217. 1979; Noltie in Grierson & Long, Fl. Bhutan 3(1): 95. 1994.

Rhizomatous herbs; aerial stem erect, simple or dichotomously branched. Leaves alternate, simple, lower scaly sheathing; upper usually ovate, petioled, often opposite. Inflorescence terminal or axillary, 1–7-flowered fascicles or umbels. Flowers campanulate, pedicelled. Tepals 6, similar, free, saccate or spurred at base. Stamens 6; filaments linear or lanceolate attached to the receptacle or the base of the tepals; anthers dorsifixed, extrorse. Ovary sessile, trilocular, 2 ovules per locule, axile; style filiform with 3 recurved stigmatic lobes. Berries black, 1–3-seeded; seeds compressed.

About 30 species, in Western U.S.A., Canada, Japan, China, India, Sri Lanka, Thailand to Western Malesia; one in India.

Disporum cantoniense (Lour.) Merr. in Philip. J. Sci. 15: 229. 1919. Jessop in Fl. Malesiana, ser. I, 9: 218. 1979; Noltie in Grierson & Long, Fl. Bhutan 3(1): 95. 1994. *Fritillaria cantoniensis* Lour., Fl. Cochinch.: 206. 1790. *Uvularia chinensis* Ker-Gawl. in Curtis, Bot. Mag. 23: t. 916. 1806. *Disporum pullum* Salisb. in Trans. Hort. Soc. 1: 331. 1812; Baker in J. Linn. Soc. Bot. 14: 589. 1875; Hook. f., Fl. Brit. India 6: 360. 1892. *Uvularia parviflora* Wall., Asiat. Research 13: 378. 1820. Type: Himalaya, Wallich Cat. 5091. (K–W microfische!) p.p. *D. horsfieldii* D. Don in Proc. Linn. Soc. 1: 45. 1839. Type: Nepal, Wallich Cat. 5088D (K–W, microfische!). *D. leschenaultianum* D. Don in Proc. Linn. Soc. 1: 45. 1839. *D. calcaratum* D. Don in Trans. Linn. Soc. London 18: 516. 1841; Baker in J. Linn. Soc. Bot. 14: 588. 1875; Hook. f., Fl. Brit. India 6: 359. 1892. Type: Wallich, Cat. 5087. (K–W, microfische!). **Fig. 27.2a-2f**

Stem erect, 30–120 cm high, 2.5–5 mm in diam., ribbed, often branched above; roots fibrous, fleshy. Leaves loosely sheathing towards base; upper leaves lanceolate, ovate, oblong to oblanceolate, 6–22 x 1–6 cm, acuminate, cuneate at base, veins 5–9 raised and papillose beneath; sessile or petiole up to 8 mm long, angular, often papillose. Umbel terminal or axillary, 2–7-flowered; sessile or with up to 3.5 cm long, angular,

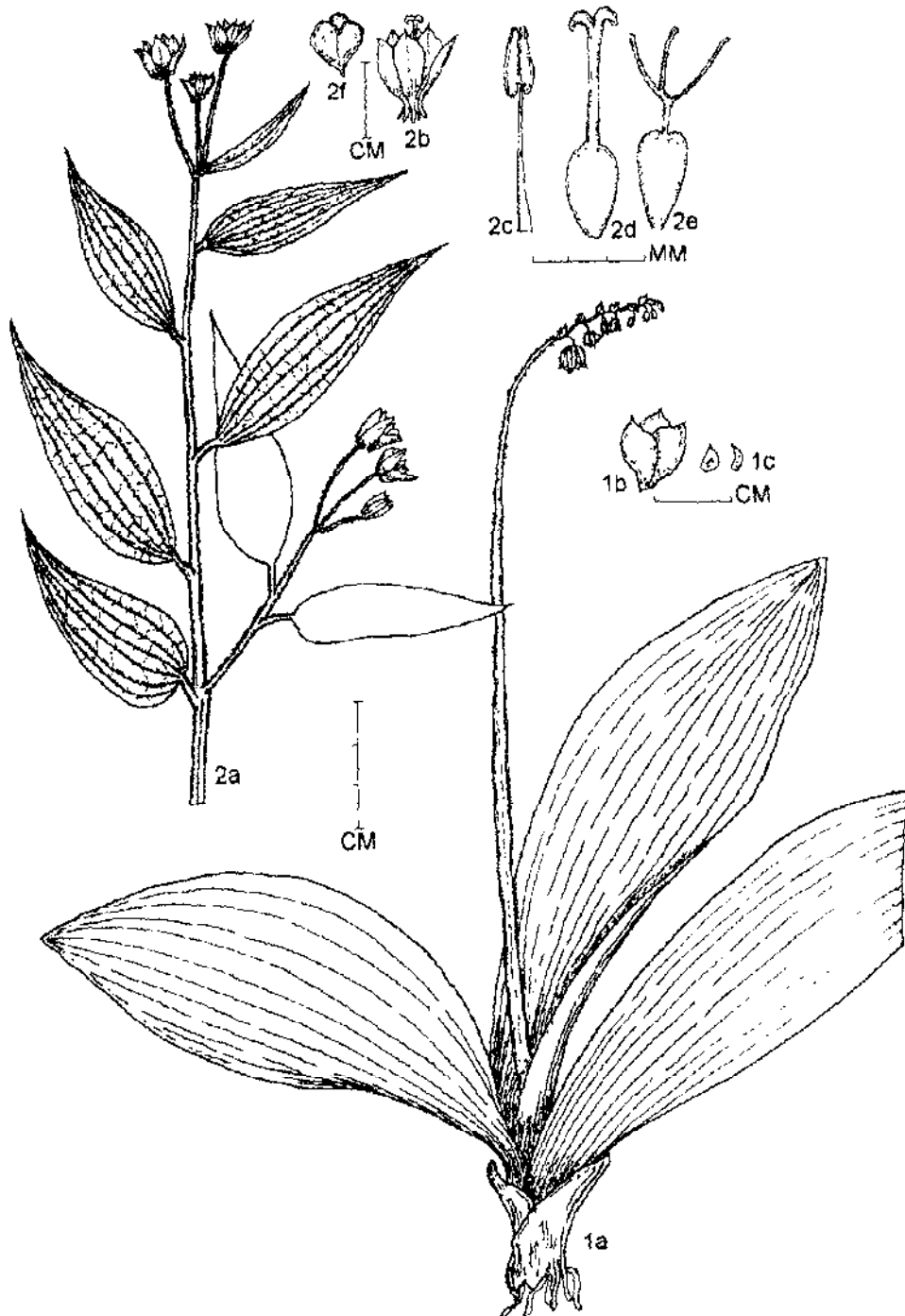


Fig. 27. *Clintonia udensis* Trautv. & Meyer 1a. Habit. 1b. Fruit. 1c. Seeds. *Disporum cantoniense* (Lour.) Merr. 2a. Habit. 2b. Flower with spurred tepals. 2c. Stamen. 2d. Pistil with lobed stigma. 2e. Pistil with long stigmatic arms. 2f. Berry.

often papillose peduncle. Flowers strong-scented, pale green, white or yellowish or dull purplish, campanulate, nutant; pedicels 1 - 4 cm long, papillose or narrowly winged and sparsely pilose, becoming rigid and deflexed in fruit. Tepals lanceolate to oblanceolate, 1 - 2.5 cm long, acuminate at apex, saccate (1 - 2 mm) or spurred (up to 5 mm long) at base. Filaments linear to lanceolate, 5 - 12 mm long, often half of the tepals; anthers yellow, oblong, 2.5 - 4 mm long. Ovary obovoid, 2.5 - 4 x 1 - 2 mm; style linear, 3.5 - 15 mm long, often exserted; stigmatic lobes variously sized, even in the same flower, 1 - 5 mm long, often recurved. Berries green when young, bluish-black on ripe, 8 - 10 x 8 - 10 mm, deeply trilobed, pulpy, 1 - 3-seeded. Seeds c. 3 mm in diam., arillate.

Fl. & Fr.: Throughout the year, peak flowering during January to October and fruits during February to November.

Distrib.: INDIA: Throughout; SRI LANKA, NEPAL, BHUTAN, CHINA, MYANMAR, MALESIA.

Habitat: In shady, cool, marshy, clayey soils and on banks among shrubs between 1200 and 1300 m altitude.

Specimens examined: Andhra Pradesh: E. Godavari district, Maredumili to Kakur, 450 m, 31.9.1980, *Subba Rao* 67591 (CAL); Visakhapatnam, Sunkarimetta, 1300 m, 19.9.1961, *N.P. Balakrishnan* 677 (CAL); Arunachal Pradesh: Lohit district, 14.12.1969, *J. Joseph* 48665 (CAL); Kameng, Kalaktang to Morsing, 18.5.1958, *Panigrahi* 15840 (CAL); Kameng, Jabrang, 6350 ft., 10.5.1957, *R.S. Rao* 7240 (CAL); Assam: Kamroom, Sathargaon, 900 ft., 14.6.1969, *A.S. Rao* 38826 (CAL); Bihar: Singhbhum, December 1902, *H.H. Haines* 500 (CAL); Manipur: Nungha, 5000 ft., February 1906, *Meebold* 10825 (CAL); Karnataka: Chikmagalur district, 1550 - 1650 m., 21.5.1980, *Saldanha* 11474 (CAL); Madhya Pradesh: Bastar district, way to Kutambar caves, 530 m, 10.2.1961, *Balakrishnan* 12047 (CAL) Meghalaya: Khasi hills, Beadon falls, 4500 ft., 16.8.1913, *Kanjilal* 2420 (CAL); Shillong, 20.6.1962, *D.B. Deb* 25066 (CAL); Nagaland: Naga hills, above Kohima, August, 1886, *Prain s.n.* (CAL); Orissa: Siklapari, 1300 mt., 27.7.1965, *D.C.S. Raju* 2114 (CAL); Sikkim: *R.S. Rao* 199, 368 (CAL); Tamil Nadu: Nilgiri district, Gandhipellai, 2067 m, 19.5.1957, *Sebastine* 3306 (CAL); Annamalai hills, 7500 ft., 31.3.1912, *C.E.C. Fischer* 3305 (CAL); Uttaranchal: Tehri Garhwal, Yamunchatti, 1500 mt., 10.6.1961, *M.A. Rau* 15624 (CAL); Garhwal,

Rhizomatous herbs; rootstock fleshy. Aerial stem about 60 cm high, much branched, glabrous with simple alternate leaves and axillary flowers in the upper leaves. Leaves ovato-lanceolate, 4 – 7 x 0.8 – 2 cm, amplexicaul, acuminate at apex, 7 – 9 parallel converging veins. Flowers 30 – 32, one in each axil of the upper leaves, campanulate, pendant; pedicel slender, drooping, 3 – 4 cm long. Tepals 6, similar, free, caducous, oblong, c. 1.5 cm long, much bigger than stamens and pistil. Stamens 6, similar, free; filaments deltoid, 2 mm long, inserted at the base of the tepals; anthers oblong, c. 3 x 1 mm, basifixed, latrorse. Ovary subrotund, c. 2 x 2 mm, sessile, 3 celled; style c. 1 mm long; stigma 3 cleft, each arm 5 mm long.

Fl.: July.

Habitat: 3800 m altitude.

Distrib.: INDIA: Sikkim.

Note: The species is very near to *Streptopus simplex* D. Don where plants 2 – 3 times branched, 5 – 29 flowered, style longer (2 – 3 mm), stigmatic arms 2 mm. In *S. chatterjeanaus* plants much branched, 30 – 32 flowered, style shorter (c. 1 mm), stigmatic arms 5 mm.

2. ***Streptopus parasimplex*** Hara & Ohashi in *J. Jap. Bot.* 48: 101, f. 2B. 1973. Noltie in Grierson & Long, *Fl. Bhutan* 3(1): 48. 1994. Type: E. Nepal, Thudam, 22-6-1972, *Kanai et al.* 723120 (TI).

Rhizomatous herbs. Aerial stem 10 - 15 cm high, glabrous simple or rarely branching above with simple alternate leaves and few axillary flowers. Leaves 5 – 6, ovate-lanceolate, 4 – 4.5 x 1 – 1.2 cm, amplexicaule. Flowers campanulate, solitary in each axil of leaves, nutant; pedicel 3 – 4 cm long. Tepals white, oblong, 9 – 11 x 3 – 4 mm. Filaments deltoid, c. 1.5 x 1 mm; anthers oblong, c. 2.5 x 1 mm. Ovary subglobose, c. 2 x 2 mm; style c. 3 mm long, stigma lobes less than 1 mm long.

Fl.: June – July.

Habitat: Often in *Abies – Rhododendron* forests between 3000 m and 4200 m altitude.

Distrib.: INDIA: Sikkim; NEPAL, BHUTAN.

Specimens examined: Sikkim: W. Jongri, Kapoor, June 1887, *King's Collector s.n.* (CAL); Emotso La, 14000 ft., 17.7.1909, *Smith & Cave* 1597 (CAL); N.E. Bhutan: Shingbe, He La 12000 ft., 27.6.1949, *Ludlow, Sherriff & Hicks* 20771 (CAL).

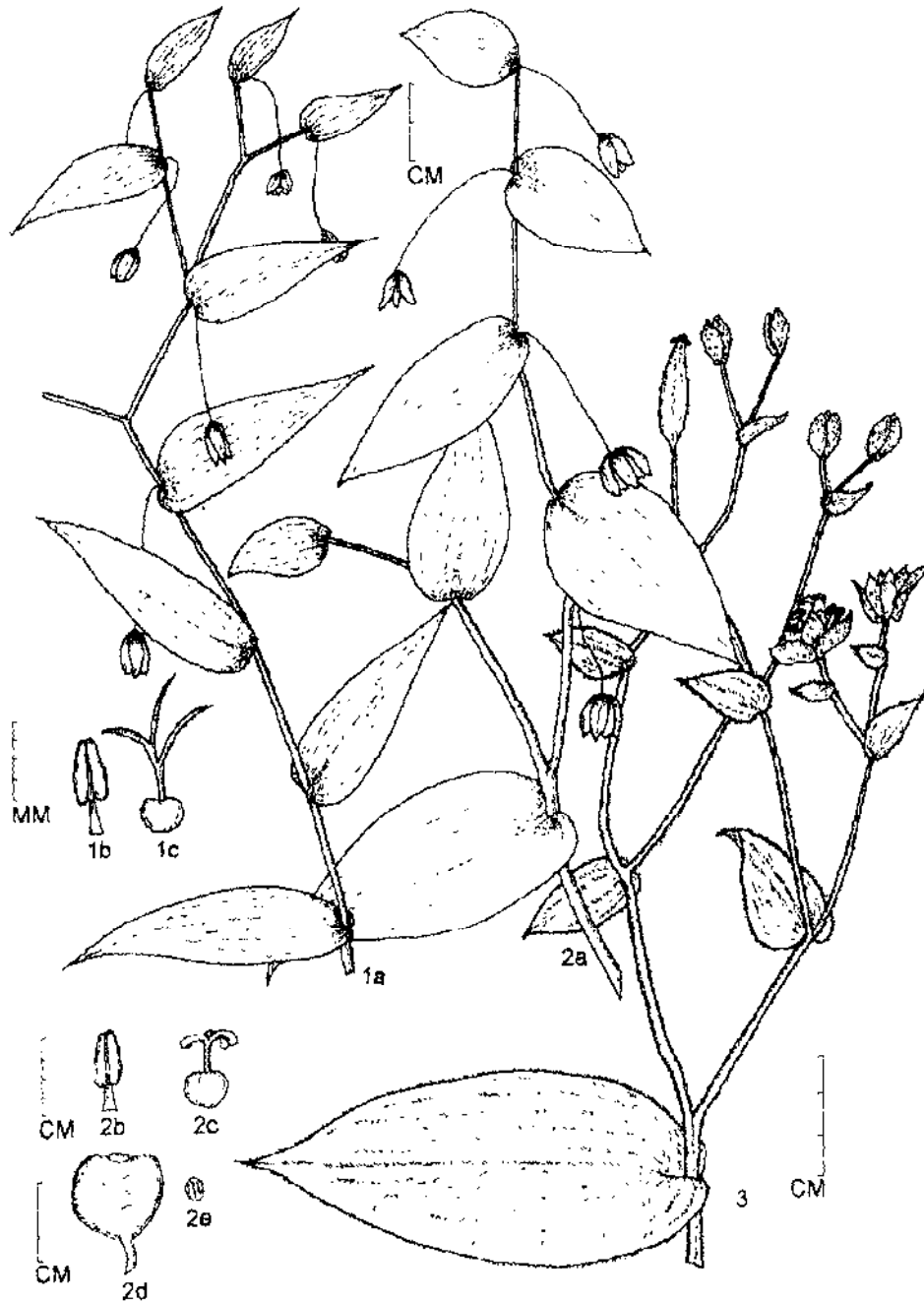


Fig.28. *Streptopus chatterjeeanus* Dasgupta 1a.Habit. 1b. Stamen. 1c. Pistil. *S. simplex* D. Don 2a. Habit. 2b. Stamen. 2c. Pistil. 2d. Berry. 2e. Seed. *Tricyrtis maculata* (D. Don) J.F. Macbr. 3. Habit.

3. **Streptopus simplex** D. Don, Prodr. Fl. Nepal: 48. 1825 & in Trans Linn. Soc. 18: 530. 1841; Baker in J. Linn. Soc. 14: 591. 1875; Hook. f., Fl. Brit. India 6: 322. 1892; Hara in Fl. E. Himal. 1:417. 1966; Noltie in Grierson & Long, Flora Bhutan 3(1): 97. 1994. Type: C. Nepal, Gossainthan, August 1821, *Wallich Cat.* 5112A (K-W, microfische!). **Fig. 28.2a 2e**

Rhizomatous herbs. Aerial stem 20 - 60 cm high, glabrous, with few ascending branches above. Leaves simple, alternate, ovate or ovate lanceolate, 4 - 13 x 1.5 - 6 cm, amplexicaule, acute or acuminate at apex, cordate at base, 5 - 9 parallel veined. Flowers 5-24, solitary rarely 2 in each axil of leaves, on a simple or dichotomously divided peduncle, campanulate, nutant; pedicels (2-) 3 - 7 cm long. Tepals white sometimes spotted with red, tinged with purplish blotch at base, oblong to elliptic, 10 - 17 x 3 - 6 mm, obtuse. Filaments white, deltoid, 1 - 2 mm long; anthers white, mottled purple, lanceolate, 2.5 - 4 x 1 - 1.5 mm. Ovary green, subglobose to obovoid, 1.5 - 2 mm long; style white, 2 - 3 mm long; stigmatic arms c. 2 mm long. Berry red, subrotund, 5 - 10 x 6 - 10 mm, many-seeded. Seeds oblong, 2 x 2 x 1.5 mm, longitudinally striated.

Fl.: May - July. *Fr.*: September.

Habitat: In dense, wet coniferous or deciduous forests between 3000 m and 5000 m. altitude, sometimes epiphytic.

Distrib.: INDIA: West Bengal and Sikkim; NEPAL, BHUTAN, TIBET-CHINA.

Specimens examined: Sikkim: Lachung, July 1879, *King's collector s.n.* (CAL); Jongri, 12000 ft., 15.10.1875, *C.B. Clarke* 26030 (CAL); Tonglu, 10000 ft., July 1882, *Gamble* 10405 (CAL).

4. **TRICYRTIS**

Wall., Tent. Fl. Nepal: 61. t. 46, 1826 non. cons.; Hook. f., Fl. Brit. India 6: 358. 1892; Jessop in Fl. Malesiana ser. I, 9: 195. 1979; Noltie in Grierson & Long, Fl. Bhutan 3(1): 98. 1994.

Rhizomatous herbs; rootstock creeping. Aerial stem erect, simple or dichotomously branched above. Leaves cauline, alternate, simple, sessile, amplexicaule with strong veins. Inflorescence terminal, branched, subcorymb or raceme. Flowers campanulate, pedicelled. Tepals 6 in 2 whorls, free or connate at base, lanceolate; outer 3 saccate at base. Stamens 6; filaments connivent at base; anthers oblong, dorsifixed, ex-

trorse. Ovary oblong, 3-loculed; style trifid above, each lobe bifid at apex; ovules many, uniseriate. Fruits septicial capsules, linear - oblong, triquetrous. Seeds minute, oblong or ovate, blackish brown, flat, reticulate.

About 20 species, mainly in Japan, Manchuria, Korea, China, India, Bhutan, Nepal, Taiwan and North Malesia; one in India.

Tricyrtis maculata (D. Don) J.F. Macbr. in Contrib. Gray Herb. n.s. 3, 53: 5. 1918; Hara in Fl. E. Himalaya 2: 174. 1971; Noltie in Grierson & Long, Fl. Bhutan 3(1): 98. 1994. *Compsoa maculata* D. Don, Prod. Fl. Nepal: 51. 1825. Type: Nepal, Wallich s.n. (K-W). *Tricyrtis pilosa* Wall., Tent. Fl. Nepal.: 61, t. 46. 1826; Hook. f. Fl. Brit. India 6: 359. 1892. Type: Nepal, Wallich s.n. (K-W). *Tricyrtis elegans* Wall., Tent. Fl. Nepal: 62, sub.t. 46. 1826. **Fig. 28.3**

Rhizomatous herbs. Aerial stems 30- 70 cm high, stout, erect, dichotomously branched, leafy shortly pilose. Leaves cordate, or oblanceolate or lanceolate, 5 - 16 x 4 - 6 cm, long-acuminate at apex, cordate, amplexicaule at base, pilose above and on veins beneath. Inflorescence terminal, dichotomously branched, subcorymbose, 3-many-flowered. Flowers campanulate; bract leafy, small; pedicel pilose, c. 5 cm long in fruits. Tepals white, spotted purple or brown, spreading, outer oblong or oblanceolate, c. 15 x 5 mm, with 2-lobed, 4 x 4 mm, saccate at base, papillose at apex, inner narrowly lanceolate or oblanceolate, glabrous. Filaments linear, broad at base, as long as or shorter than tepals, recurved near tips, pilose; anthers lilac, broadly oblong, c. 3 x 2 mm, dorsifixed. Ovary narrowly oblong, 7 - 10 x 1 - 3 mm, gradually tapered into style; style 4 - 5 mm long; stigma exerted c. 5 mm long, each lobe 2 mm long, spreading. Capsule oblong, c. 2.5 - 3.5 x 0.5 - 0.7 cm, pilose, gland-dotted, apex deflexed. Seeds blackish brown, oblong, 2 x 1.4 mm, compressed, reticulate.

Fl. & Fr.: June - August.

Distrib.: INDIA: Assam, Meghalaya and Sikkim; BHUTAN, NEPAL, BANGLADESH.

Specimens examined: Meghalaya: Shillong, 5000 ft., 30.7.1885, C.B. Clarke 38379D (CAL); Shillong, H. Deka 21819 (CAL); Sikkim: Cheongtonia, 5000 ft., 28.7.1892, G.A. Gammie 306 (CAL); Lachung valley, 6500 ft., 16.6.1892, G.A. Gammie s.n. (CAL).

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LINACEAE	13	1983
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CABOMBACEAE	20	1988
NELUMBONACEAE	20	1988
CORNACEAE	20	1988
LARDIZABALACEAE	20	1988
LOBELIACEAE	20	1988
MALVACEAE	20	1988
NYSSACEAE	20	1988
(LEGUMINOSAE-PAPILIONOIDEAE)	21	1995
TRIBE-INDIGOFEREAE		
SALVODORACEAE	22	1996
SONNERATIACEAE	22	1996
GOODENIACEAE	22	1996
CAMPANULACEAE	22	1996
ELLISIOPHULLACEAE	22	1996
APONOGETONACEAE	22	1996
ALLIACEAE	23	2006
LILIACEAE	23	2006
TRILLIACEAE	23	2006
UVULARIACEAE	23	2006
ASCLEPIADACEAE	24	1999
PERIPLOCACEAE	24	1999