

CHAPTER -3

For an all too brief period each autumn the woods of North America and the Orient, and many other gardens throughout the temperate world, are ablaze with scarlet, gold and yellow when maples, the most spectacular of all trees, adorn the countryside.

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3.1. THE GENUS *Acer*:

People from all over the world have been fascinated and enchanted by the genus *Acer* L since time immemorial. Tournefort (1700) coined the name *Acer* that was accepted and officially assigned as a distinct genus by Linnaeus in the first edition of his *Genera Plantarum* (1737). In *Species Plantarum* (1753), he described nine species with *Acer pseudoplatanus* L. as the type species for the genus. It is believed that the generic name must have been derived from the Proto-Indo-European word *ac* meaning 'sharp, to be sharp or to sharpen'. Loudon (1838) believed that woods of some species of *Acer* were used to make pikes and lances and thus the genus derived its name after these instruments. Oterdoom, (1996) has proposed an alternative explanation. He is of the opinion that the word's association with the genus possibly comes from the pointed nature of its leaves.

Lindley (1836), first used the name *Aceraceae* for the order as Jussieu (1789) had proposed the name *Acera* for the family. However, in keeping with the International Code of Botanical nomenclature the name proposed by Lindley was accepted for the family. The family included two genera *Acer* and *Dipteronia* and was placed under the order Sapindales as it was closely allied to Sapindaceae and Hippocastanaceae (Cronquist 1968, Taktajan 1969, Steven 1999). However, most modern workers believe in the monophyly of Sapindaceae and the group is broadly defined to include *Aceraceae*, *Sapindaceae* and *Hippocastanaceae* (Judd *et al.* 1994). The monophyly finds support through morphology and *rbcl* sequences (Gadek *et al.* 1996). Moreover the presence of hypoglycin, an unusual and toxic non-protein amino acid may be regarded as another synapomorphic feature of the group (Judd *et al.* 1999). Intrafamilial phylogenetic relationship as suggested by many workers (Muller and Leenhouts 1976; Wolfe and Tanai 1987; Judd *et al.* 1994) has led them to recognize four well-supported clades within the group.

Although there are enormous body of knowledge and data several taxa belonging to the genus still remain poorly defined.

3.2. SYSTEMATIC TREATMENT

KEY TO THE SPECIES:

1. Leaves unlobed or slightly lobed.....2
1a. Leaves distinctly lobed.....6
2. Flowers in panicle.....*A. oblongum*
2a. Flowers in racemes, spicate raceme or in cyme.....3
3. Number of stamens 4; disc unlobed.....*A. stachyophyllum*
3a. Number of stamens 7-8; disc deeply lobed.....4
4. Flowers with distinct pedicel.....5
4a. Flowers almost sessile.....*A. sikkimense*
5. Flowers in cymes; angle of mericarps 35 - 40°*A. laevigatum*
5a. Flowers in racemes; angle of mericarps 42-45°*A. hookeri*
6. Flowers in racemes.....7
6a. Flowers not in racemes.....11
7. Disc unlobed; mericarps generally in a straight line.....*A. thomsonii*
7a. Disc distinctly lobed; mericarps always forming an angle.....8
8. Position of the disc amphistaminal.....9
9a. Position of the disc extrastaminal or intrastaminal.....10
9. Inflorescence lateral, appearing after the leaf flush.....*A. acuminatum*
9a. Inflorescence terminal, appearing with the leaf flush.....*A. sterculiaceum*
10. Flowers in panicle; discs extrastaminal; mericarp angle 68-70°*A. osmastonii*
10a. Flowers in racemes; discs intrastaminal; mericarp angle 35-40°*A. pectinatum*
11. Disc intrastaminal; mericarps forming acute angle; flowering with leaf flush...*A. caudatum*
11a. Disc extrastaminal.....12
12. Flowers appearing after leaf flush, panicle; mericarp angle 70-180°*A. campbellii*
12a. Flowers appearing with leaf flush, in corymb; mericarp angle 20-25°*A. palmatum*

Acer acuminatum Wall. ex D. Don. Prodr. 249. 1825; Banerjee & Das in Ind. For. 97: 248. 1971; En. Fl. Pl. Nep. 2: 97. 1979; Fl. Bhutan 2(1): 67. 1991. *A. caudatum* Wall. Cat. 33 n 1225 1829 *nom. nud.*; Heirn. in Fl. Brit. Ind. 1: 695. 1875.

Nep. Lekh Kapasi, Bhu. Yatli kung. Fl. 05 - 06. Fr. M. 09 - 10. (Plate 3.1. a, 3.2. a; Fig 3.1. a-h)

Small deciduous trees 4-7m high. Leaves simple, exstipulate, membranous, lower surface pubescent when young, covered by whitish hairs, turning glabrous when mature, petiolate; petiole purplish red with swollen base 3 - 8.5 cm long finely pubescent; lamina palmately 3 - 5 lobed with basal lobes often insignificant, 6 - 12 x 5.5 - 12 cm, lobes ovate-caudate, margin serrate to biserrate, base cuneate to rounded with 5 basal veins, apex acuminate with a long slender tail or acumen. Inflorescence, a corymb appearing after the leaves, when the leaves are young ca 4 - 7 cm long. Flowers actinomorphic bi- or unisexual with male flowers borne on longer inflorescence, pedicel greenish pubescent 0.3 - 0.4 cm long; Sepals 4, ovate, margin entire, apex acute pubescent on outer surface ca 0.3 - 0.35 x 0.35 - 0.4 cm; Petals 4, yellowish green obovate cuneate, slightly shorter than sepals 0.3 - 0.35 cm; Stamens 8, arising from a yellowish disc, filaments ca 0.17 - 0.25 cm long, white, anthers ca. 0.1-0.15 cm long, yellowish, basifixed, dehiscence longitudinal; Disc shallowly 8 lobed, amphistaminal, yellowish green when young turning brownish at maturity, pubescent ca. 0.15 - 0.2 cm in diam.; Carpels 2, stigma bifid, style short, ovary densely covered with white hairs, ca. 0.08 - 0.1 x 0.1 cm. Samara erect mericarps divergent, 2.1 - 2.6 x 1 - 1.4 cm; wings pinkish when young turning light brown at maturity, glabrous, 1.9 - 2.1 x 1 - 1.4 cm, wing divergence ca. 67 - 70°; locules convex, ovoid, ca 0.5 - 0.6 x 0.3 - 0.35 cm with one nut in each locule.

Sp. Cited: Lachung (Kathak) 3800m, Lama & Das 0211 dated 29.05.2000, Lachen 3900m, Lama & Das 0232 dated 11.10.2000.
Status: Sparse, often forming small grooves in a few places with *A. stachyophyllum*.
Local Distrib. : Jalapahar, Lachen, Lachung (North Sikkim 3600 - 4000 m).
Gen. Distrib. : Himalayas; Pakistan, Kashmir, Nepal, Sikkim and Kamroop (Assam).

Note:

1. Young shoots purplish red.
2. Bark brownish grey.
3. High degree of parthenocarpy with most fruits devoid of seeds.
4. Natural regeneration very low.
5. Often forms small patches with *Acer stachyophyllum*

Acer campbellii Hook., f. & Thomson ex Hiern in Fl. Brit. Ind. 1: 696. 1875; Fl. E. Him. 1: 191. 1966; 2: 72.1971; En. Fl. Pl. Nep. 2: 97.1979; Fl. Pl. Kurseong 23. 1981; Fasc. Fl. Ind. 9: 5.1982; Das & Chanda, Trans. Bose Res. Inst. 51(4): 104. 1987; Fl. Bhutan 2(1): 67. 1991.

Nep.: *Kapasi*. *Bhu. Eyali* *Lep. Doom kung. Fl.* 04 - 05 *Fr. M.* 07-08.

(Plate 3.1. b, 3.2, b; Fig 3.2. a-h)

ssp campbellii var. campbellii

Large trees, 15 – 20 m high; Leaves simple, exstipulate, deciduous, young leaves pendulous, reddish, turning green, glabrescent; petiole reddish with swollen base and with median longitudinal groove on upper side, 5 - 10 cm long; lamina 6 - 12.5 x 11.5 - 14 cm, palmately 5 – 7 unequally lobed, lobes lanceolate to oblong, margins serrate, apex acuminate, base cordate or truncate, with 7 basal nerves. Inflorescence a panicle, appearing with leaves, 11 - 14 cm long, pendulous. Flowers actinomorphic, bisexual ca. 0.6 mm in diam. Sepals 5, lanceolate, reddish, pubescent, ca. 0.35 x 0.4 cm. Petals 5, irregular, fimbriate, white, shorter than sepals, ca. 0.2 - 0.25 x 0.2 cm. Stamens 8, included arising from inside a shallowly 8 lobed disc; disc initially yellowish orange turning chocolate brown at maturity covered with dense white hairs, ca 0.2 cm in diam., filaments white ca 0.2 cm, anthers ca 0.2 cm crimson - orange, dehiscence longitudinal. Carpels two, stigma bifid, ovary densely covered with white hairs, two chambered with one ovule in each, ca 0.1 x 0.1 cm. Samara horizontally placed; mericarps divergent, 2.5 - 3.1 x 1 - 1.4 cm; wings light brown at maturity, glabrous, contracted at the base on the inner side and abruptly broadened upwards with outer margin straight slightly curved at apex which is more or less truncate, 1.8 - 2 x 1 - 1.1 cm, wing divergence ca 70 - 130°; locules convex, rounded to ovoid, ca 0.55 - 0.6 x 0.3 - 0.4 cm.

Sp. cited : Jalapahar 2200 m, *Lama & Das 0101* dated 09.05.1999; Takdah 1700m, *Lama & Das 0118* dated 15.05.1999; Jalapahar 2200 m, *Lama & Das 0131* dated 21.09.1999; Lachen 3600m *Lama & Das 0228* dated 11.10.2000

Status : Abundant at places.

Local Distrib.: Darjiling, Jalapahar, Birch Hill, Lebong, Ghoom, Jorebunglow, 3rd mile, Sonada, Takdah, Sukhia, Simana, Tung, Dhotray-Rimbick, Megma, Gairibans (Darjiling); Mirik, Mamring (Kurseong); Munsong, Labha-Kolbo, Rechela, Neora Valley (Kalimpong); Namchi, Pelling, Yoksum-Bakhim; Gangtok-Chungthang, Pakyong, Lachen, Lachung (Sikkim)

Gen. Distrib. : Himalayas (Garwal – Arunchal Pradesh), Meghalaya, Manipur, Upper Myanmar, North Vietnam and western and southern China.

ssp. campbellii var. serratifolium Banerji Journ. Bom. Nat. His. Soc. 58: 305 - 307. 1961.

Similar to var. *campbellii*, but leaves usually 7 lobed, base truncate never cordate undersurface

densely pubescent when young, glabrous with distinct tufts of hairs at vein junctions at maturity; inflorescence laxer, pubescent with fewer flowers; flowers larger ca 0.8 cm in diameter; larger samara with wings forming a straight line at 130 °.

- Sp. cited : Tonglu 3000m, Lama & Das 0131 dated 18.05.1999; Gairibans 2700m Lama & Das 0164 dated 15.10.1999;
- Status : Frequent.
- Local Distrib.: Megma, Tonglu, Gairibans; Neora Valley; Memenchu.
- Gen. Distrib. : Himalayas (Nepal – Darjiling). Sikkim

Note :

1. This is the most common species of *Acer* in the region.
2. Woods used as firewood. The lightwood, which is even grained and works well is also used for planking houses by local people and also finds use in manufacture of tea boxes.
3. Leaves used as fodder.
4. Planted along roadsides and fields as ornamental.
5. Chromosome number $2n=26$. (Mehra 1972)
6. *var. serratifolium* more restricted in its distribution.

Acer caudatum Wallich, Pl. Asia. Rar. 2: 4 & 28, t.132. 1831; Fl. Brit. Ind. 1:695.1875, p.p.; Fl. E. Him. 1: 191. 1966: 2: 73. 1971; En. Fl. Pl. Nep. 2: 98. 1979; Fasc. Fl. Ind. 9: 8. 1982; Fl. Bhutan 2(1): 67. 1991. *A. papilio* King in Journ. Asia. Soc. Beng. 65.(2): 115.1896; Banerjee & Das in Ind. For. 97: 249. 1979.

Nep.: *Lekh Kapasi*. Bhu. *Yatli kung*. Fl. 04 - 05. Fr. M. 9 - 10. (Plate 3.1. c, 3.2. c; Fig 3.3. a-h)

Medium sized tree, 8 - 11m high. Leaves simple, opposite, exstipulate, deciduous; petioles greenish pubescent with swollen base and a longitudinal groove on the upper surface, 5-10 cm long. Lamina palmately 5 or sometimes 7 lobed; lobes ovate caudate, lower surface pubescent covered with wooly hairs especially on veins, margin biserrate, base cordate with 5 prominent veins, apex acuminate with long acumen, 7 - 14 x 6 - 13 cm. Inflorescence a terminal raceme, appearing with the new leaves, pubescent 5 - 7 cm long. Flowers actinomorphic, bisexual, whitish; pedicel 0.2 - 0.5 cm long, pubescent. Sepals 5, reddish, pubescent ca 0.35 - 0.4 x 0.2 - 0.3 cm. Petals 5, greenish white, ovate 0.35 - 0.4 x 0.3 - 0.35 cm. Stamens 8 arising from the outer side of a shallowly 8 lobed disc; filament 0.15 - 0.2 cm long, anther scarcely exerted, yellowish basifixed ca 0.08 - 0.1 cm long, dehiscence longitudinal; disc intrastaminal, yellowish green when young turning orange to brown at maturity ca 0.1 cm in diam. Carpels 2, style short, stigma bifid, ovary densely pubescent covered with dense white hairs, 0.09 - 0.1 x 0.06 - 0.08 cm. Samara erect placed on a pendant raceme; mericarps ascending, narrowly

divergent, 2.2 - 2.5 x 0.8 - 1.2 cm; wings narrowly divergent, angle of divergence 37 - 40°, pinkish brown at maturity, 1.8 - 2 x 0.8 - 1.2 cm; locules flattened, ovoid, with a groove, ca 0.55 - 0.6 x 0.35 - 0.4 cm; style and stigma persistent even in mature fruit.

- Sp. cited : Sandakphu 3600m *Lama & Das 0037* dated 13.05.1998; Neora Valley 3000 m *Lama & Das 0042* dated 23.05.1998, Lachen (2900m) *Lama & Das 0230* dated 11.10.2000, Men-Menchu Lake *Lama & Das 0239* dated 14.11.2000.
- Status : Sparse
- Local Distrib. : Bikhay Bhanjyang-Sankadphu, Phalut,(Darjiling); Neora Valley (Kalimpong); Gamothang, Olothang, Rechella ,Tshoka-Dzongrii, Lachen, Lachung, Men-Men chu.(Sikkim)
- Gen. Distrib. : Himalayas (Kumaon-Bhutan); Myanmar, Manchuria, Korea, Northern Japan, Southern Tibet, China.

Note:

1. Bark greyish.
2. Winter buds densely pubescent.
3. Found in small grooves along with *A. pectinatum* and *A. stachyophyllum*.
4. Used as firewood in high altitude areas.
5. Chromosome number $2n=26$ (Kriekieb 1957; Wright, 1957; Mehra *et al* 1972).

Acer hookeri Miquel in Arch. Neerl. Sci. Nat. 2: 471. 1852; Fl. Brit. Ind. 1: 694. 1875; Fl. E. Him. 1: 191. 1966; 2: 73. 1971; En. Fl. Pl. Nep. 2: 98. 1979; Fasc. Ind. 9: 9. 1982; Das & Chanda, l.c. 104. 1987; Fl. Bhutan 2(1): 64. 1991.

Nep.: *Laharay Kapasi, Lal Kapasi* Lep. *Phaley kung*. *Fl.* 03 - 04. *Fr. M.* 09 - 10.
(Plate 3.1.d, 3.2. d; Fig 3.4. a-h)

Trees upto 7-9 m high. Leaves simple, opposite, exstipulate, deciduous; petioles reddish with swollen base and with shallow longitudinal groove on upper side, 3 - 5 cm long; lamina 5-14 x 4-8 cm, usually 3 lobed with, two small lateral lobes sometimes unlobed, ovate to caudate, serrate to biserrate, acuminate, base shallowly cordate, finely pubescent when young, usually glabrous when mature, tufts of inconspicuous hairs in vein axils below; veins palmately reticulate with 5-7 basal nerves. Inflorescence appearing with new leaves, simple racemes, puberulous, 6 - 9 cm long; flowers actinomorphic, bisexual, white ca 0.8 - 1 cm in diam.; pedicel green, covered with white hairs, ca 0.4 - 0.6 cm long; sepals 5, oblong, green with three distinct nerves, ca 0.3 - 0.4 x 0.15 - 0.2 cm; petals 5, creamy white, ovate, undulate ca 0.3 - 0.45 x 0.15 - 0.2 cm; stamens 7 - 8 inserted outside the base of gaps of a 7 - 8 deeply lobed disc, scarcely exerted, unequal, 2 or 3 longer than others; filaments white, longer ca 0.25 cm, shorter 0.04 - 0.08 cm long; anthers four lobed, dehiscence longitudinal, light yellow ca 0.15 - 0.2 cm; disc intrastaminal, light green, turning orange to brown 0.25 - 0.3 cm in diam.; Carpels 2, stigma bifid, white with pink

tips, ovary glabrous 0.1 - 0.15 x 0.2 - 0.25 cm; mericarps divergent, 1.7 - 1.8 x 0.4 - 0.5 cm; divergence angle 45 - 47°; locules convex, ovoid, ca 0.35 - 0.4 x 0.25 - 0.3 cm.

Sp. Cited: Jalapahar (2200m), *Lama & Das 0023* dated 07.04.1998; Tonglu (3000m), *Lama & Das 0065* dated 11.05.1998; *Lama & Das 0189* dated 11.09.1999; Pahakhola (3000m) *Lama & Das 0251* dated 14.10.2000. Lachen (2900m), *Lama & Das 0222* dated 10.10.2000.

Status: Common.

Local Distrib. : Ghoom, 3rd mile, Sonada, Senchal, Sukhiapokhri, Ramam, Tonglu -Gairibans (Darjiling); Mundakothee, Mamring(Kurseong); Neora Valley, Kolbong, Rechela (Kalimpong); Bakhim - Tshoka Bakhim Damthang -Tedong, Rabong la, Chungthang - Lachung Chungthang -Lachen Pangolokha - Menmenchu (Sikkim)

Gen. Distrib. : E. Himalaya (Nepal - Arunachal Pradesh).

Note:

1. Bark brown, cracked rather deeply.
2. Shows a wide variation with respect to the size of the leaves.
3. While fruit setting occurs annually in some plants it occurs after every two years in others.
4. Inflorescence of lower branches usually shed prior to fruit setting.
5. Observation made by Cowan & Cowan (1929) that it apparently grows epiphytically on larger trees due to lodging and germination of seeds on larger trees observed in a number of sites like Neora, Chitray, Gairibans, Bakhim, where some specimens observed to grow epiphytically on larger trees of *Rhododendron* spp. and *Quercus* spp. with some even in flowering and fruiting in this condition. (Plate 4.1. k)
6. Chromosome number $2n = 26$ (Mehra *et al*, 1972).

Acer laevigatum Wallich, Pl. Asia. Rar. 2:3, t. 104. 1831; Fl. Brit. Ind. 1: 693. 1875; Fl. E. Him. 1: 192. 1966; En. Fl. Pl. Nep. 2: 98. 1979; Fasc. Fl. Ind. 9:10. 1982; Das & Chanda, J.c. 104. 1987; Fl. Bhutan 2(1): 64. 1991.

Nep.: *Putli* Fl. 04 - 05. *Fr. M.* 09 - 10. (Plate 3.1. e, 3.2. e; Fig 3.5. a-h)

Trees, 10 - 14 m high. Leaves simple opposite, exstipulate, semi-deciduous; petioles green to reddish, with swollen base, 1 - 1.5 cm long; lamina shining green, lower leaves often reddish, coriaceous, 7 - 15.5 x 3 - 4.5 cm; usually unlobed, rarely 2-3 lobed, lanceolate-oblong, entire to distantly serrulate, more towards the apex, acuminate, base rounded, usually thick, glabrous above with tufts of white hairs often turning reddish in the vein axils below; veins palmately reticulate with three basal nerves. Inflorescence terminal, a very lax panicle, appearing with the

leaves, ca 7 - 9 cm long, more or less glabrous. Flowers actinomorphic, bisexual, greenish white; pedicels green, glabrous, 0.4 - 0.7 cm long. Sepals 5, ovate-lanceolate, green, pubescent ca 0.15 - 0.2 x 0.15 - 0.17 cm. Petals 5, lanceolate, white, repund, longer than sepals ca 0.25 - 0.3 x 0.2, with three distinct nerves. Stamens 8, sometimes 6 or 7, arising from within a 6 - 8 lobed disc; filaments white, ca 0.2 mm long; anthers yellowish ca. 0.1 cm long with a pinkish subulate appendage. Disc extrastaminal, usually 8 lobed, sometimes 6 or 7 lobed, orange when young turning brown with maturity, ca 0.15 cm in diam. Carples 2, stigma bifid, pinkish; ovary covered with dense white hairs, ca 0.1 - 0.15 cm; mericarps divergent, 2.3 - 2.7 x 0.7 - 0.8 cm; wings greenish when young turning reddish to light brown at maturity, divergent, angle of divergence 35 - 40°; locules convex, ovoid to oblong, ca 0.5 - 0.7 x 0.3 - 0.35 cm.

Sp. cited: Takdah (1500m), *Lama & Das 0112*, dated 21.04.1999; Jalapahar (2300m), *Lama & Das 0127*, dated. 02.05.1999; Sombaray (1700m), *Lama & Das 0187*, dated. 21.09.1999; Labha (1600m) *Lama & Das 0192*, dated 25.10.1999.

Status: Common

Local Distrib: Ging, Lebong, Jalapahar, Pattabong, Takdah, Ghoom, Mungpoo, Maney Bhangyang, Srikhola, Rungbul, Sonada, Dilaram (Darjiling); Moondakothee, Mamring, Mirik (Kurseong); Pedong Labha, Thosum (Kalimpong); Yoksum, Gazing - Pemayangste, Temi, Damthang, Sombaray, Namchi, Pakyong (Sikkim)

Gen. Distrib.: Himalayas (Garwal - Arunachal Pradesh), Meghalaya, Manipur, Western and Southern China.

Note :

1. Bark greyish, with horizontal furrows; wood lightly reddish brown.
2. Distributed at altitudes between 1600 - 2000m, but does not form grooves by itself.
3. The leaves of seedlings are larger and more markedly serrated.
4. Wood used for building for making handles of tools.
5. Samara often with one abortive seed (Plate. 6.1. g)
6. Chromosome number $2n=26$ (Mehra 1969).

Acer oblongum Wallich ex DC., Prodr. 1: 593. 1824; Fl. Brit. Ind. 1: 693. 1875; Fl. E. Him. 1: 192. 1966; 2: 73. 1871; En. Fl. Pl. Nep. 2: 98. 1979; Fasc. Fl. Lnd. 9: 12. 1982; Das & Chanda in Trans. Bose Res. Inst. I.c. 104. 1987; Fl. Bhutan 2(l): 63. 1991.

Nep.: Phirphiri, Kapasi. *Fl.* 04 - 05. *Fr. M.* 09 - 10. (Plate 3.1. f, 3.2.f, Fig. 3.6. a-i)

Trees, upto 12 - 18 m high. Leaves simple, exstipulate, evergreen, pubescent and pinkish yellow when young, covered with short crisped hairs on both surfaces, glabrescent and green when mature; petiole pubescent when young, glabrous later, light green, 2 - 6 cm long; lamina 5 - 17 x 3 - 7 cm, unlobed, oblong - elliptic, entire, apex acuminate, base obtuse to rounded,

upper surface glossy green, lower glaucous, with 3 basal veins. Inflorescence terminal, a broad lax cyme appearing with new leaves, puberulous, 8 - 11 cm long; pedicle ca. 0.8-1 cm long, pubescent. Flowers actinomorphic, bisexual, greenish white to greenish yellow, ca 0.8 - 1 cm in diam.; Sepals 5, ovate, three lobed with two small lateral lobes, pubescent on both surfaces, ca 0.25 - 0.3 x 0.1 - 0.15 cm. Petals 5, oblong, greenish white to greenish yellow, ca 0.45-0.5 x 0.2 - 0.25 cm. Stamens usually 8 sometimes 7 or 9, unequal, five shorter and rest longer in bud; filaments white ca 0.15 - 0.3 cm, arising from within a 7 - 9 lobed extrastaminal disc; anthers yellowish with crimson edges, ca 0.2 - 0.3 cm long. Disc dark green, pubescent with glistening hairs on upper surface ca 0.2 cm in diam. Carpels two, stigma usually bifid sometimes tri, tetra or hexafid due to fusion of flowers; stigma and style elongating with stigma curling inwards as flowers mature reaching 0.45 - 0.5 cm long; ovaries usually two chambered sometimes 3 to 4 chambered covered with dense glistening white hairs, with two or sometimes one ovule in each chamber; wings nearly parallel to slightly divergent 20 - 25°; locules enclosed by thick hard pericarp with dense white hairs in the inner surface, 0.25 - 0.3 x 0.3 cm; nuts convex angular.

Sp. Cited : Damsang (1600m), *Lama & Das 0131*, dated 29.05.1999; Darjiling (2000m), *Lama & Das 0129*, dated 02.05.1999; Pedong (1400), *Lama & Das 0185*, dated .21.09.1999; Dentham (1500m), *Lama & Das 0201*, dated 12.06.2000

Status : Sparse.

Local Distrib. : Algara, Labha, Pudung, Pedong (Kalimpong), Dentham, Renok, Damsang (Sikkim)

Gen. Distrib. : Himalayas (Kashmir-Arunachal Pradesh), Meghalaya, Nagaland, China
Indo-China.

Note:

1. Bark grayish brown, peeling off in irregular plates; wood yellowish and hard.
2. Wood considered as a good construction material
3. Fusion of carpels very common and produce 3 - 4 winged samaras; very high frequency of parthenocarpic fruits observed with less divergent samara in the plant growing at the Llyod Botanical garden, Darjeeling. (Plate. 6.1.d)
4. Chromosome Number: $2n = 26$ (Mehra 1969).

Acer osmastonii Gamble in Bull. Misc. Inform. Roy. Bot. Gard. Kew :446. 1908; Fasc. Fl. 1nd. 9: 14. 1982; Das & Chanda, l.c. 104. 1987; Fl. Bhutan 2(1): 66. 1991.

Nep.: *Kapasi*. *Fl.* 05. *Fr.* *M.* 09 - 10. (Plate 3.1 g, 3.2 g; Fig 3.7. a-h)

Trees, 12 - 20 m high. Leaves simple, exstipulate, evergreen, slightly pubescent when young, mature leaves usually glabrescent with whitish hairs which turn reddish with maturity at vein axils and at point of insertion of petiole on the undersurface; petioles reddish to green,

pubescent when young being glabrous later, 1.5 - 4 cm long; lamina 6 - 15 x 4 - 11.5 cm, usually 3 lobed, sometimes unlobed or 2 - 5 lobed, lobes unequal, variable in size, elliptic to obovate, serrulate, acuminate, base rounded with 3 basal veins. Inflorescence terminal, a broad lax panicle appearing after the leaves, 8 - 11 cm long; pedicels ca 0.6 - 1 cm long, pubescent. Flowers actinomorphic, bisexual, ca 1 - 1.2 cm in diam., Sepals 5, ovate, greenish, both surfaces pubescent, ca 0.15 - 0.18 x 0.1 - 0.15 cm. Petals 5, obovate, fimbriate, slightly larger than sepals, notched above, greenish white, ca 17 - 0.2 x 0.13 - 0.17 cm. Stamens usually 8 sometimes 7 or 9 arising within a 7-9 lobed disc, filament white ca. 0.15 cm long, anther yellowish basifixed, dehiscence longitudinal, with a pinkish subulate appendage ca. 0.1cm long. Disc extrastaminal yellowish green when young turning chocolate brown, pubescent with glistening hairs on upper surface, ca. 0.15- 0.2 cm in diam. Carpels two, style short, stigma bifid, elongating and curling inwards as flowers mature, reaching 0.2 - 0.25 cm long; ovary usually two chambered covered with dense glistening white hairs, with two or sometimes one ovule in each chamber, mericarps divergent, 3 - 3.2 x 1 - 1.3 cm, angle of divergence ca 68-70°; enclosed by thick woody pericarp; wings 2.5 - 2.8 x 1 - 1.3 cm green, locules convex, angular, ca 0.9 - 1 x 0.7 - 0.85 cm; style and stigma persistent even in mature fruit

Sp. cited:	Birch Hill (2000m), <i>Lama & Das 0139</i> , dated. 13.05.1999; <i>0179</i> , dated 07.09.1999
Status:	Sparse
Local Distrib.:	Birch Hill
Gen.Distrib.:	Reported from Dehradun W.Himalaya. Darjiling (E. Himalaya) Endemic to Darjeeling (Grierson & Long 1991), & Dehradun (Nayar & Dutta 1982).

Note:

1. The species closely resembles *A. campbellii* and may be a natural hybrid between it and *A. laevigatum* (Cowan & Cowan, 1929).
2. Forms with unlobed leaves are similar to *A. oblongum* and *A. laevigatum* (Grierson & Long).
3. Although its distribution in Mirik, with a Herbarium collection in Llyod Botanical Garden, and reports of its occurrence in Takdah, Sikkim (Chauhan, 1998) specimens could only be found to be restricted to Birch Hill, Darjeeling. However, its distribution to Dehradun area is quite doubtful.
4. Samara often 3 winged (Plate 6.1.h)
5. Although a large no of germinated seedlings in the forest floor were observed in and around the parent tree during June none were found to survive. Seedlings may be highly

susceptible to the amount water with both low and excessive amounts being detrimental.

Acer palmatum Thunberg ex Murray in Kaemp. Illustratus. Nova Acta Regiae Soc. Scientiarum 4: 36, 40. 1783; Systema Vegetabilium 1784; 14th ed Stafleu & Cowan 1981, 3: 670; Nep. Kapasi. *Fl.* 02 - 03. *Fr. M.* 09 - 10. (Plate 3.1.h; Fig 3.8. a-h)

Trees, upto 8-10 m high. Leaves simple, exstipulate, deciduous; petiole 2.5 - 3 cm long, reddish to brownish glabrous, with swollen base and a longitudinal median groove on upper surface; lamina 4 - 5.5 x 3.5 - 5 cm, usually 5 lobed, sometimes 7 lobed, obovate, biserrate, acuminate, base cordate with 5 basal veins, lobes unequal with the central one relatively longer than the others; basal lobes small, glabrous at maturity, upper surface fresh green, lower surface paler. Inflorescence terminal corymbs appearing with the leaves, 5-6 cm long, slightly pubescent, reddish pedicel green pubescent ca 0.2 cm long. Flowers actinomorphic, bisexual, reddish white ca 0.25 cm in diam. Sepals 5, light reddish purple, lanceolate, with broadly serrated margin, glabrous, with 3 prominent veins, ca 0.2 - 0.25 x 0.1-0.15 cm. Petals creamish white as long as the sepals, obovate, entire, ca 0.2 - 0.25 x 0.13 cm. Stamens 8 - 10 equal, arising from the lobes of a deeply 8 - 10 lobed disc, not exerted, filaments ca 0.2 - 0.25 cm; anthers ca 0.1 cm long, light yellow, basifixed, dehiscence longitudinal. Disc extrastaminal, unlobed, glabrous, greenish yellow turning reddish at maturity, diam. ca 0.2 cm. Carpels 2, stigma bifid, ovary reddish glabrous, ca 0.08 - 0.09 x 0.06 - 0.08 cm, mericarps ascending narrowly, divergent, 1.2 - 1.4 x 0.4 - 0.45 cm, angle of divergence ca 23 - 25°; locules convex, rounded, ca 0.15 - 2 x 0.13 - 0.15 cm.

Sp. Cited: Darjiling (2000m), *Lama & Das 0013*, dated 28.02.1998; Japanese Temple, Darjiling (2300m), *Lama & Das 0021*, dated. 03.03.1998, 0059 dated 21.09.1998

Status: Sparse

Local Distrib.: Darjiling; Grown as ornamental

Gen. Distrib.: Japan, Korea, Taiwan, Eastern China.

Note:

1. A few plants, which were previously introduced have nicely acclimatized in Darjiling.
2. Most common ornamental *Acer* in cultivation throughout the world, chiefly used for making bonsai.
3. Bark grayish brown.
4. Chromosome Number: $2n = 26$

Acer pectinatum Wallich ex. Nicholson in Gard. Chron. 1881(I): 365. f. 69. 1881; Fl. E. Him. 1: 192. 1966; 2: 73. 1971. non Wall- En. Fl. P1. Nep 2: 98. 1979; Fasc. Fl. Ind. 9: 15. 1982; Fl. Bhutan 2(1): 67. 1991. *A. caudatum* Sensus Fl. Brit. Ind 1: 695. 1875. p.p. non Wall.

Nep.: *Lekh kapasi*. Bhu. *Eyali Lep. Yatli kung*. *Jl.* 04 - 05. *Fr. M.* 09 - 10. (Plate 3.1.i, 3.2 i; Fig 3.9. a-h)

Trees, upto 8 - 12 m high. Leaves simple, exstipulate, deciduous; petioles 4-8 cm long, reddish to brownish, glabrous, with swollen base and a longitudinal median groove on upper surface; lamina 6 - 14 x 4 - 8 cm, usually 3 - 5 lobed, lobes unequal with the central lobe being relatively longer than the others, basal ones smaller, lobes with biserrate margin and acuminate apex, lower surface pubescent when young, more or less glabrous at maturity with tufted hairs at the vein axils, base of lamina cordate with 5 basal veins. Inflorescence terminal, loose racemes, appearing with the leaves, 7 - 10 cm; pedicels green, pubescent ca 0.3 - 0.4 cm long. Flowers actinomorphic, bisexual, reddish white ca 0.35 cm in diam.,. Sepals 5 lightly reddish green, lanceolate, broadly serrated, glabrous, with 3 prominent veins, ca 0.3 - 0.4 x 0.1 - 0.15 cm. Petals creamish white, shorter than sepals, obovate, entire, with 3 prominent veins, ca 0.2 - 0.25 x 0.13 - 0.15 cm. Stamens 8 - 10, equal, arising from the base of the lobes of a deeply 8-10 lobed disc, not exerted, filaments ca 0.2 - 0.3 cm, anthers ca 0.1 cm long light yellow, basifixed, dehiscence longitudinal. Disc intrastaminal, deeply 8 - 10 lobed, glabrous, greenish yellow, turning reddish at maturity, diam. ca 0.2 cm. Carpels 2, stigma bifid, ovary reddish glabrous, ca 0.08 - 0.09 x 0.06 - 0.08 cm, mericarps ascending, narrowly divergent, 2.2 - 2.5 x 0.7 - 1 cm; wings narrowly divergent, angle of divergence 35 - 40°; locules flattened, ovoid, with a groove, ca 0.5 - 0.55 x 0.3 - 0.35 cm.

Sp. cited	Magma (2500m), <i>Lama & Das 0033</i> , dated 11.05.1998; <i>0071</i> dated. 21.09.1998. Sandakphu (3500m), <i>Lama & Das 0041</i> , dated 13.05.1998, Rechella (2900m) <i>0127</i> dated. 12.09.1999, Olothang (3000m), <i>Lama & Das 0134</i> dated. 23.9.1999, Men-Men chu Lake (3100m), <i>Lama & Das 0217</i> dated. 14.11.2000.
Status	Common
Local	Magma, Tonglu, Tumling, Bikhay Bhanjyang, Sandakphu, (Darjiling) Rechella (Kalimpong), Bakhim, Tshoka Olothang Men-Men chu,
Distrib	Pangalokha, Lachen, Lachung, Bichuu, Varsey Hilley (Sikkim)
Gen. Distrib	Himalayas Nepal, Bhutan, Upper Burma, southern China

Note:

1. Bark grayish, inconspicuously striped.
2. Parthenocarpic tendency moderate.
3. Wide variation with respect to the shape of the leaf.
4. Chromosome number $2n=26$ (Mehra *et al* 1972)

Acer sikkimense Miquel in Arcli. Neerl. Sci. Nat. 2: 471. 1852- Fl. Brit. Ind. I: 694. 1875; Fl. E. Him. 1:1 92. 1966; 2: 73. 1971; En. Fl. Pl. Nep. 2: 98. 1979; Fasc. Fl. Ind. 9: 16. 1982; Das & Chanda. L.c. 104. 1987; Fl. Bhutan 2(1): 64. 1991

Nep., *Bahuna. Fl.* 03 - 04. *Fr. M.* 09 - 10. (Plate 3.1.j, 3.2.j; Fig 3.10. a-h)

Trees, 10-12 m high. Leaves simple, exstipulate, deciduous; petiole 2 - 4.5 cm long, greenish to reddish when young, slightly stripped with white, with swollen base and a longitudinal median groove on upper surface; lamina 7 - 15 x 4 - 9.5 cm, usually unlobed sometimes three lobed, ovate-cuspidate, subentire, undulate, acuminate, base cordate, light green to reddish when young, shiny, thick, subcoriaceous, glabrous at maturity with the presence of tufts of white hairs at the base of vein axils on lower surface which turns orange later, venation palmately reticulate with 5 basal veins. Inflorescence terminal, spicate raceme, appearing with the leaves; pedicels short ca 0.03 - 0.05 cm, glabrous, alternate and opposite. Flowers actinomorphic, bisexual, ca 0.35 cm in diam. Sepals 5, light green, ovate glabrous, obtuse, ca 0.2 - 0.25 x 1.5 - 2 cm. Petals creamish white, equal or shorter than sepals ca 0.2 - 0.1 x 0.15 cm. Stamens 8 unequal, five shorter, 3 longer, inserted at the base of disc; filaments white, longer 0.15 cm, shorter 0.8 - 0.1 cm long; anthers yellow ca 0.1 cm long. Disc intrastaminal, deeply 8 lobed, glabrous, greenish to orange, turning brownish at maturity ca 0.2 cm in diam. Carpels 2, stigma bifid, ovary glabrous, ca 0.1 x 0.06 - 0.08 cm, mericarps divergent, 2 - 2.2 x 0.6 - 0.7 cm, wing divergence 44 - 46°; locules slightly flattened, ovoid, ca 0.4 - 0.5 x 0.3 - 0.4 cm.

Sp. Cited: Jalapahar (2300m), *Lama & Das 0009*, dated.21.02.1998; 0047, dated15.09.1998; Pelling (1900m) *Lama & Das 0127*, dated. 02.03.1999; Chungthang 2500m, *Lama & Das 0201*, dated. 09.10.2000.

Status: Common

Local Distrib.: Jalapahar, Ghoom, Senchal, Sonada, Dhotray - Ramam (Darjiling); Mundakotho Mamring (Kurseong); Rashet, Kolbong, Rechela (Kalimpong); Bakhim, Tshoka, Damthang, Tedong, Rabong la, Chungthang, Lachung Menmenchu Lagsap (Sikkim).

Gen. Distrib. : E. Himalaya (Nepal-Bhutan). Tibet, Myanmar, Western China.

Note:

1. Bark whitish grey, thin with whitish stripes.
2. Wood used as building material.
3. Commonly used as an ornamental.
4. Bud scales red to green. Young leaves arising from red bud reddish and those green greenish. The discs of flowers red scales plants are orange and those of green scales are yellowish green.
5. Gynoecium of the flowers of lower branches become abortive and the entire

inflorescence easily falls off after shedding pollens, fruits thus usually appear only on upper portion of the trees.

6. The scales of winter buds are caducous but sometimes they persists and small lamina develop at their tips which are small and green.
7. Now being used as a common bonsai plant in cooler regions.
8. Chromosome number $2n = 26$ (Mehra *et al* 1972).

var. serrulatum Pax in Monö. der Gattung, Acer Bot. Jahrb.7:262.1886.

Leaves three lobed, ovate-cuspidate, serrulate, dark green to reddish when young, shiny, thick, subcoriaceous, glabrous at maturity.

Acer stachyophyllum Hiern in Fl. Br. Ind. 1:696. 1875. Fl. E. Him. 1: 193. 1966; 2: 73. 1971; En. Fl. Pl. Nep. 2: 98. 1979; Fl. Bhutan 2(1): 66. 1991.

Bhu. Eyali Lep. Yatli kung. Fl. 05. Fr. M. 09 - 10. (Plate 3.1.k, 3.2.k; Fig 3.11. a-h)

Small erect trees, 5 - 9 m high, with numerous branches aggregated in clumps. Leaves simple, exstipulate, deciduous; petiole 2 - 3 cm long, yellowish to reddish brown, pubescent when young, swollen base with median longitudinal groove on upper surface; lamina 5.5 - 8.5 x 3.5 - 6 cm, unlobed to unequally 3-lobed with small basal lobes, ovate, deeply biserrate, acuminate with long acumen, base caudate to rounded, pubescent, more or less glabrous with tufts of hairs on vein axils, greenish yellow when young turning green at maturity, with 3 basal veins. Inflorescence raceme, terminal, appearing with the leaves; pedicle 0.4 - 0.5 cm long, green, slightly pubescent. Flowers actinomorphic, bisexual, ca 0.5 - 0.7 cm in diam. Sepals 5, ovate, entire, acute, ca 0.3 x 0.4 cm, pubescent on outer surface. Petals 5, yellowish green, obovate - cuneate, nearly equaling sepals. Stamens 4, arising from a yellowish disc; filaments ca 0.2 - 0.25 cm long, white; anthers ca 0.1-0.15 cm long, yellowish, basifixed, dehiscence longitudinal. Disc unlobed, amphistaminal yellowish green when young turning brownish at maturity, pubescent ca 0.15 - 0.2 cm in diam. Carpels 2, stigma bifid. Mericarps narrowly divergent, 2.1 - 2.5 x 1 - 1.4 cm; wings reddish when young, wing-divergence ca 35 - 37°; slightly pubescent, locules flattened, ovoid, ca 0.45 - 0.5 x 0.35 - 0.4 cm.

Sp. Cited: Lachung (Kathak) 3300m, Lama & Das 0208, dated 28.05.2000;
Lachen 3700m, Lama & Das 0229, dated 11.10.2000.

Status: Sparse

Local Distrib.: Lachen, Lachung (Sikkim)

Gen. Distrib. : Himalayas (Sikkim to Hubei), central China.

Note:

1. Bark greyish, inconspicuously striped.
2. Parthenocarpic tendency very high.
3. Vegetative propagation with sucker like branches observed.
4. Chromosome number $2n=26$ (Mehra *et al*, 1972)

Acer sterculiaceum Wallich, Pl. Asia. Rar. 2: 3, t. 105. 1831; Fl. E. Him. 1: 192. 1966. 2: 74. 1971; En. Fl. Pl. Nep. 2: 98. 1979; Fasc. Fl. Ind. 9: 17. 1982; Fl. Bhutan 2(1): 68. 1991. *A. villosum* Wall., l.c. 4. 1831; Fl. Brit. Ind. 1: 695. 1875.

Nep. Lekh Kapasi. *Fl.* 04 - 05. *Fr. M.* 09 - 10. (Plate 3.1.1, 3.2.1; Fig 3.12. a-h)

Trees, 10 - 15m high, with spreading large crown and stout thick branches. Leaves simple, exstipulate, deciduous; petioles 4 - 14.5 cm long, green, pubescent, swollen at the base; lamina 9 - 14.5 x 7.5 x 11 cm, palmately 3 - 5 unequally lobed, young leaves dull green tomentose on both sides, mature leaves glabrous, dull green above, pale green and softly pubescent at least along veins and vein axils; ovate, serrate, base cordate with 3 - 5 basal nerves. Inflorescence lateral, pendulous corymbs, 10 - 15 cm long, appearing with new leaves; peduncle green, pubescent 1.5-3.5 cm long. Flowers actinomorphic, bisexual, ca 1 - 1.25 cm diam., Sepals 5, oblanceolate, dull green, pubescent, ca 0.35 - 0.4 x 0.2 - 0.25 cm. Petals 5, lanceolate, greenish white, ca 0.3 x 0.15 - 0.2 cm. Stamens 8; anthers yellow, ca 0.1 - 0.15 cm long; filaments white, ca 0.2 - 0.3 cm, arising from a slightly 8 lobed yellowish orange amphistaminal slightly pubescent, glabrous disc, ca 0.2 cm in diam. Carpels 2, very often fusion of flowers leading to tricarpellary condition, stigmas bifid or trifid, white; ovary 2 chambered with one ovule in each chamber. Mericarps divergent, 4.1 - 4.8 x 1.3 - 1.5 cm; angle of divergence ca 45 - 47°; locules enclosed by thick woody pericarp, green, convex, ovoid, ca 0.9 - 1 x 0.7 - 0.85 cm; style and stigma persistent even in mature fruit.

Sp. cited Gairibans (2700m), Lama & Das 0038, dated 12.05.1998; 0077 dated 22.09.1998; Bakhim (2600m), Lama & Das 0152, dated. 27.04.1999.

Status Frequent

Local Distrib.: Gairibans, Kalpokri, Kayakatta (Darjiling); Rechela (Kalimpong). Tshoka, Bakhim, Tedong, Lachung (Sikkim)

Gen. Distrib. : Himalayas (Kashmir - Bhutan).

Note:

1. Bark grayish black, slightly fissured.
2. Fusion of flowers leading to tricarpellary conditions is common.
3. Chromosome number $2n=26$ (Mehra *et al*, 1972)

4. Lower nodes of some of the stem in contact with soil giving rise to adventitious roots.
5. Samara often 3 winged (Plate 6.1.f).

Acer thomsonii Miquel in *Acer* notes nos. 1 - 6. *Kalmia* 1: 1- 42. 1969; *A. thomsonii* Miquel in *Arch. Neerl. Sci. Nat.* 2: 470. 1867; *Fl. E. Him.* 1: 193. 1966; 2: 73. 1971; *En. Fl. Pl. Nep.* 2: 98. 1979; *Fasc. Fl. Ind.* 9: 18. 1982; Das & Chanda. *l.c.* 104. 1987; *Fl. Bhutan* 2(1): 66. 1991. *A. villosum* Wall. var *thomsonii* (Miquel) Hiern in *Fl. Brit. Ind.* 1: 695. 1875.

Nep.: *Melo kapasi*. *Fl.* 10 - 11. *Fr. M.* 04 - 05. (Plate 3.1. m, 3.2. m; Fig. 12. a-h)

Trees, upto 16 - 20m high. Leaves simple, exstipulate; petiole pubescent green, 6 - 18 cm long; lamina large 9-23 x 7-20cm, broadly ovate to suborbicular, usually three lobed sometimes unlobed, lobes unequal with lateral lobes being small, distantly serrate, acuminate, base cordate to rounded with 5 basal veins, pubescent when young, more or less glabrescent when mature with hairs on the veins and margin, subcoraiceous. Inflorescence terminal raceme, 8 - 11 cm long, appearing with new leaves, querulous; pedicel ca 0.8 - 1 cm long, pubescent. Flowers actinomorphic, bisexual or unisexual, ca 1 - 1.5 cm in diam. Sepals 5, oblong ca 0.28 - 0.3 x 0.15 cm, light green, pubescent within. Petals 5, greenish white, oblong, 0.25 - 0.3 x 0.1 - 0.15 cm. Stamens usually 8, sometimes 7 or 9, anthers yellowish, exerted, ca 0.1 - 0.15 cm long; filaments white ca 0.15 - 0.3 cm, arising from an unlobed yellowish amphistaminal disc; disc yellowish, glabrous, ca 0.2 cm in diam. Carpels absent in male flowers, two in bisexual flowers; stigma bifid, white; ovary two chambered with two ovules in each chamber. mericarps ascending, parallel, 6.2 - 6.8 x 1.5 - 1.8 cm; wings somewhat divergent or mericarps parallel, sometimes overlapping or showing angle of divergence ca 39 - 42°; locules convex, ovoid, ca 1 - 1.1 - 1 x 0.8 - 0.9 cm.

Sp. Cited: Paglajhora (1550m), *Lama & Das 0092*, dated 09.11.1998; *Lama & Das 0114*, dated 12.04.1999; Pedong (1700m), *Lama and Das 0202*, dated 09.10.2000.

Status: Common

Local Distrib.: Ging, Lebong, Darjiling, Pattabong, Mungpoo (Darjiling), lower Kurseong, Paglajhora, Mamring, Soureni Manju, Bunkulung, Phuguri (Kurseong); Raset, Rhenok, Kafer, Fagu, Munsong, Paktam (Kalimpong); Mangan, Pelong, Rhenok, Pakyong Namchi, Dentam (Sikkim)

Gen. Distrib.: E. Himalaya (Nepal - Bhutan). Tibet, Myanmar, Western China.

Note:

1. Wood soft and white, used for building
2. Leaves used for making leaf plates 'tapari' by locals people.
3. Used as shade tree in cardamom fields and tea gardens

4. While some trees are monoecious others unisexual and male.
5. Large number of fruits is produced in each tree.
6. Incidence of parthenocarpic fruits is high.

3.3. RESULT AND DISCUSSION

The present investigation recorded the presence of 13 species of *Acer* (including the exotic species *A. palmatum*, which has more or less naturalized to the region), along with two varieties, in the Darjiling - Sikkim Himalaya.

Although, a long and distinguished group of taxonomists have been involved with the taxonomy of the genus since the time of acceptance of *Acer* as a distinct genus by Linnaeus in 1737, and although there is an enormous body of knowledge and data accumulated for the taxon, several taxa belonging to the genus still remain poorly defined. (de Jong 1994). Several classifications have been proposed which show a marked difference due to the differences in the species concept adopted by the workers. The systematics of *Acer* has attracted a large number of plant taxonomists and systematists. Although, prior to Pax (1855-56, 1902) monographs of the genus had been prepared by different workers Lauth (1781), Thunberg (1793), Spach (1834), Rafinesque (1836), Koch (1869), Maximowicz (1880)] the work of Pax remains outstanding as he divided the genus into 'categories' based upon certain morphological characteristics. He recognized 13 sections under the genus grouped into four 'categories' based on the study of 114 species from eastern Asia. Since then, a large number of workers have contributed to the taxonomic study of the genus which include Pajarkova (1933), Momotani (1961, 1962), Ogata (1967), Murray (1970) de Jong (1976), Krussmann (1976, 1984), Delendick (1981) with regional surveys of the genus being carried out by Fang (1939, 1966, 1979a, 1979b, 1981a, 1981b), Hu & Chen (1948), Gams (1925) Walters (1968), Gannepain (1960), Murray (1969) and others.

de Jong (1994), modified his earlier work (1976) and took into consideration new concepts from flavanoid chemistry (Delendick's 1981), isoenzyme studies of peroxidase activities in cambial tissue (Santamour 1982) and carpomorphological studies (Mai 1983, 1984). His basic tenets have been followed with certain adaptations in the present study. According to him, the genus has been divided into 16 Sections, 8 of which are further subdivided into 19 series. These sections and series accommodate 230 taxa: 124 species, 95 subspecies (including typical subspecies) 8 varieties and one forma.

In the present work his classification has been recognized and based upon his classification, the

different species and varieties (including the typical varieties) of *Acer* that are found to occur in the Darjiling – Sikkim Himalaya, can be grouped under 6 series, belonging to 6 sections given below in Table 3.1.

TABLE 3.1. TAXONOMIC POSITIONS OF DIFFERENT SPECIES OF *Acer* L. FROM THE DARJILING-SIKKIM HIMALAYA.

SECTION	SERIES	Name of the Species
<i>Parviflora</i> Koidzumi	<i>Caudata</i> Pax	<i>Acer caudatum</i> Wallich
<i>Palmata</i> Pax	<i>Palmata</i>	<i>Acer palmatum</i> Thunb. ex Murray
	<i>Sinensia</i> Pojarkova	<i>Acer campbellii</i> Hook. f. & Thoms. ex Hiern ssp. <i>campbellii</i> var. <i>campbellii</i> var. <i>serratifolia</i> Banerjee <i>Acer osmastonii</i> Gamble
	<i>Penninervia</i> Metcalf	<i>Acer laevigatum</i> Wallich
<i>Macrantha</i> Pax	No series	<i>Acer pectinatum</i> Wallich ex. Nicholson <i>Acer sikkimense</i> Miquel ssp. <i>sikkimense</i> var. <i>sikkimense</i> var. <i>serrulatum</i> Pax <i>Acer hookeri</i> Miquel
<i>Glabra</i> Pax	<i>Arugata</i> (Rehder) Rehder	<i>Acer acuminatum</i> Wallich ex DC <i>Acer stachyophyllum</i> Hiern
<i>Pentaphylla</i> Hu & Cheng	<i>Trifida</i> Pax	<i>Acer oblongum</i> Wallich ex DC
<i>Lithocarpa</i> Pax	<i>Lithocarpa</i> Pax	<i>Acer sterculiaceum</i> Wallich <i>Acer thomsonii</i> Miquel

Although extensive studies have been made on the genus throughout the world, a number of taxa still remain poorly defined and problematic. These debatable groups have been discussed below.

The position of *A. osmastonii* Gamble remains unclear. The name *A. osmastonii* was given by Gamble to a taxon without flowers or fruits and according to Geldren (1994) although a large number of herbarium materials are available in Kew it still remains poorly known. Shimizu *et al* (1981) put this taxa along with *A. calcaratum* and *A. craibianum* under a single taxon with *A. craibianum* and regarded *A. osmastonii* a synonym. They believe that the resemblance is very high and although Delendick agrees that the *A. craibianum* of Shimizu *et al* to be a synonym of *A. calcaratum*, he cannot vouch the same in case of *A. osmastonii*. On the other hand,

(Cowan and Cowan, 1929) have merely put forth a suggestion that *A. osmastonii* may be a natural hybrid between *A. campbellii* and *A. laevigatum*. *A. osmastonii* does seem to share certain traits with *A. campbellii* and *A. laevigatum*, although it bears certain characteristics of its own. The different traits of the three species have been tabulated in Table 3.2. below.

TABLE.3.2. COMPARATIVE ACCOUNT OF THE DIFFERENT MORPHOLOGICAL CHARACTERISTICS OF *Acer campbellii*, *A. osmastonii* AND *A. laevigatum*.

Morphological Characters	<i>A. campbellii</i>	<i>A. osmastonii</i>	<i>A. laevigatum</i>
Leaf a) Form	5-7 lobed chartaceous-coriaceous, light green	3-5 lobed rarely unlobed to 2 lobed coriaceous light green	Unlobed, rarely 2-3 lobed Coriaceous dark green
b) Base	Symmetrical Cordate – truncate	Symmetrical/Asymmetrical Rounded	Symmetrical/Asymmetrical Rounded
c) Margin	Serrated	Serrulate	Distantly serrulate sometimes entire
d) Major veins	Perfect basal, 7	Perfect basal, 3	Imperfect marginal, 3
Winter bud a) Shape	Elliptic, apex pointed	Elliptic apex rounded	Elliptic apex rounded
b) No. of pairs of scales and arrangement	5 Imbricate	5 Imbricate	4 Imbricate
Inflorescence a) Emergence b) Type	After leaf flush Panicle	After leaf flush Larger Panicle	With leaf flush Lax cyme
Flowering Flower a) Colour b) Sepals	04 - 05 Lanceolate, reddish green	05 Ovate, green	04 - 05 Ovate-lanceolate, green
c) Petals	5, creamy white, irregular, fimbriate shorter than sepals	5, white, obovate, fimbriate, notched above, longer than sepals	Greenish white 5, white, lanceolate, repund, longer than sepals
Staminal disc	Extrastaminal; Shallowly 8-lobed	Extrastaminal; Deeply 7-9 lobed	Extrastaminal; Shallowly 6-8 lobed
Stamens a) Number b) Appendage on anther	8 Absent	Usually 8 sometimes 7-9 Subulate pinkish	Usually 8 sometimes 6-8 Subulate pinkish
Mericaip	2.5 – 3.1 x 1-1.4 cm Angle of divergence 70-130°	3 – 3.2 x 1 -1.3 cm, Angle of divergence 68-70°	2.3 – 2.7 x 0.7 – 0.8 cm Angle of divergence 35 - 40°
Locules	Convex ovoid 0.55-0.6 x 0.3-0.4cm	Convex angular 0.7-0.9 x 0.5 – 0.6 cm	Convex ovoid 0.5-0.7 x 0.3-0.35 cm

Thus, with respect to its inflorescence, leaf margin, number of pairs of bud scales, emergence and type of inflorescence, fruit structure and bark characteristics, the species is akin to *A. campbellii*. However, with respect to the nature of the leaf base, shape of the winter bud, number of major basal veins, presence of appendage on the anther along with the rare

presence of the unlobed leaves and petals being longer than sepals *A. osmastonii* shows similarities with *A. laevigatum*. However, *A. osmastonii* exhibits a number of characters which are distinct such as light green leaves which are generally 3-5 lobed (rarely un-lobed) that are coriaceous with 3 major veins showing perfect basal pattern; serrulate marginal teeth smaller than those of *A. campbellii* but larger than those in *A. laevigatum*; erect panicles laxer and smaller than those of *A. campbellii* with fewer flowers; ovate green sepals; obovate fimbriate petals that are notched at the tip being larger than the sepals; deeply 7-9 lobed staminal disc and much larger mericarps (3-3.2 x 1-1.3 cm) with an angle of divergence of 68-70°. However, it is found that the distribution of *A. campbellii* and *A. laevigatum* are found to be overlapping not only in the hills of Darjiling and Sikkim but in most parts of its general distribution that include Garwal to Arunachal Pradesh, Meghalaya, Manipur and parts of China. The occurrence of *A. osmastonii* only in a restricted pocket of the Darjiling hills, is the main point of the doubt of the hybrid nature of this species. However, studies at molecular level may have a more acceptable answer to this problem as it has been conceived by Cowan and Cowan (1929). The observations on its morphological characters and distribution pattern and perfect regeneration from seeds allows no area of doubt for the acceptance of this group as a separate species as has been done in the present study. It should thus, be placed under the Section *Palmata*, as there is the presence of 5 pairs of bud scales with frequently aborted terminal bud, and Series *Sinesia* as the leaves are usually 3-5 lobed with the inflorescence being a large panicle and the nutlets without veins.

Desmond Clarke in Bean (1970) has argued that the name *A. caudatum* be rejected in favour of *A. papilio* King. He is of the opinion that the name *A. caudatum* began with Wallich, who catalogued two specimens in the then East India Company's Herbarium *A. caudatum* (no.1225) and *A. pectinatum* (no.1226). In his account of *A. caudatum*, Wallich made clear that he had come to regard this material as representing a single variable *A. caudatum* and cited *A. pectinatum* as a synonym. However, in his earlier judgement which was the correct one, he had recognised no. 1226 as a distinct species, *A. pectinatum* and no.1225, (with one exception figured under t.132) as *A. acuminatum*. Neither Wallich nor Rehder designated a type for *A. caudatum*. However, in Bean 1988 Clarke changed his position on *A. caudatum* and pointed out that this name be preserved as the valid name and *A. papilio* be sunk to synonymy. Hara (1975), chose a lectotype for this species, which is in the British Museum. Thus the specific name *A. caudatum* has been retained in this present study and the name *A. papilio* has not been used.

de Jong *et al* (1994) is of the opinion that *A. sikkimense* and *A. hookeri* be merged based upon his studies on herbarium material. Although the two species share a number of characters that are very much similar they can be readily distinguished. The major differences of the two species have been tabulated below in Table 3.3

TABLE 3.3. COMPARATIVE ACCOUNT OF THE DIFFERENT MORPHOLOGICAL CHARACTERISTICS OF *Acer sikkimense* AND *A. hookeri*

Morphological characters	<i>A. sikkimense</i>	<i>A. hookeri</i>
Habit	Trees 10 – 12 m	Trees upto 7-9 m
Leaf	Usually unlobed sometimes with two basal lobes	Usually 3 lobed with small basal lobes sometimes unlobed
a) Shape		Chart.
b) Form	Sub-corac.	Upper surface light green
c) Colour	Dark green upper surface	Shallowly cordate
d) Base	Cordate	Usually biserrate teeth of D1 type
e) Serration	Entire to uniserrulate, teeth of C1 type	lax raceme with flowers possessing distinct pedicles
Inflorescence	spicate raceme	
Mericarps	0.35 angle of divergence 44 - 46°;	0.8 ~ 1cm angle of divergence 45 - 47°

They have therefore, been recognised and treated as separate species in the present study.

Gelderen *et al* (1994) is of the opinion that the var. *serrulatum* under the species *A. sikkimense* should not be recognised as being a distinct one, as the species is highly variable. This appears logical, as the structure of the leaf of this species on which this differentiation is primarily based does indeed exhibit a very wide range of variation.

Murray (1969) regarded *A. thomsonii* a subspecies of *A. sterculiaceum*. This view has been supported by Gelderen (1994). Thus, the population is known as *A. sterculiaceum* ssp. *thomsonii*.

However, in the present investigation it was observed that the two show a number of major differences with respect to their distribution, morphological characteristics and phenology. The differences between the two have been tabulated in Table 3.4 below:

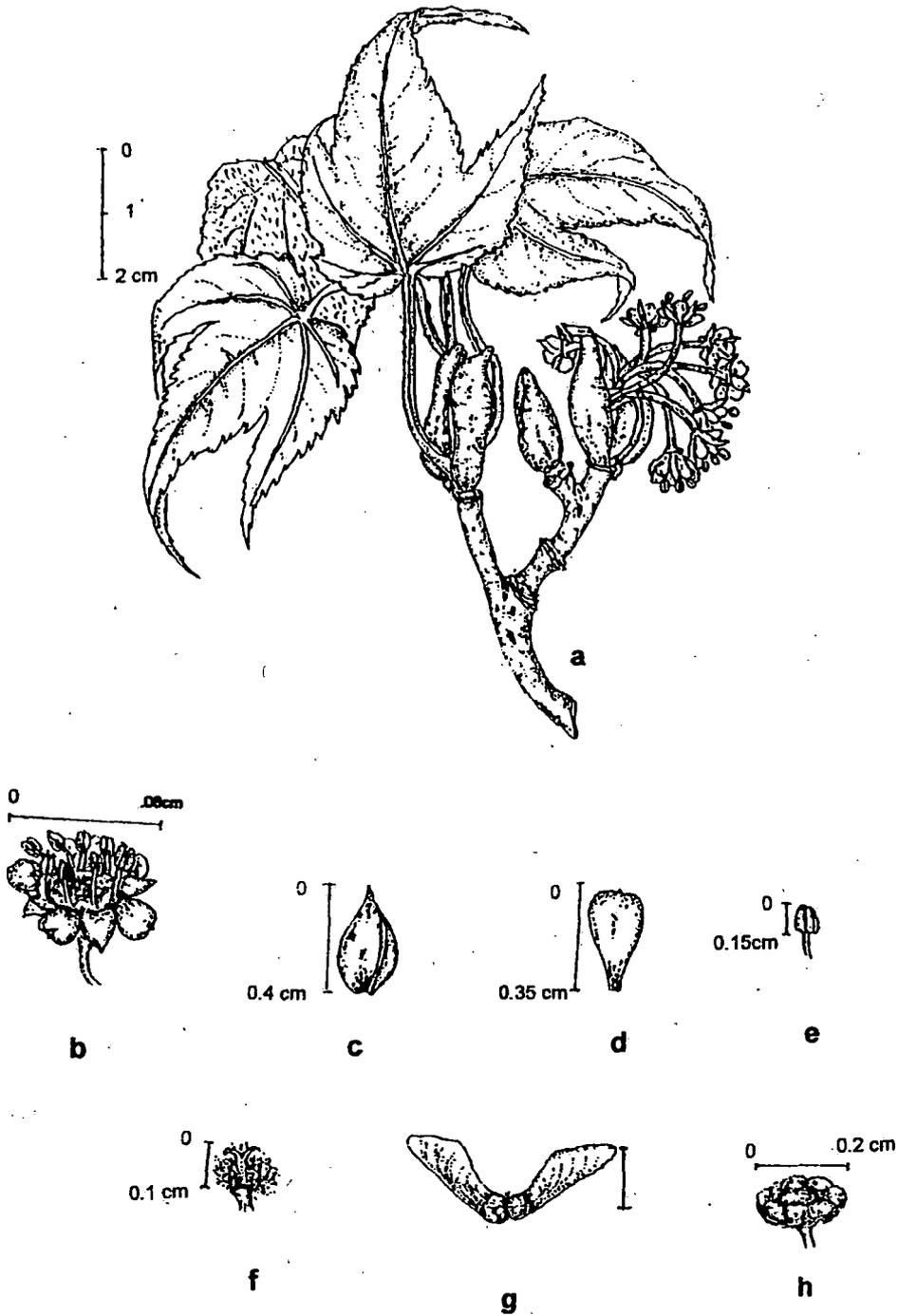
TABLE 3.4. COMPARATIVE ACCOUNT OF THE DIFFERENT MORPHOLOGICAL CHARACTERISTICS OF *Acer sterculiaceum* AND *A. thomsonii*

Characteristics	<i>A. sterculiaceum</i>	<i>A. thomsonii</i>
Altitudinal range of Distribution	Narrow 2400-2900m being more predominant between 2500-2800m.	Wide ranging from 1000m to 2200m. predominant between at the 1500 m – 1800m
Flowering time	04-05	10-11
Leaf	3-5lobed	usually 3 sometimes unlobed
a) Margin	serrate	distantly serrate
b) Basal nerves	3-5	5
Inflorescence	pendulous corymb	terminal raceme
Flowers	Yellowish white	Greenish white
Staminal disc	Slightly pubescent	Glabrous
Mericaip	Angle of divergence 44-46°	Angle of divergence 44-46° Parallel to overlapping or showing angle of divergence of 39-42°

The differences between the two are quite wide, and therefore they have been treated as two distinct species in the present investigation.

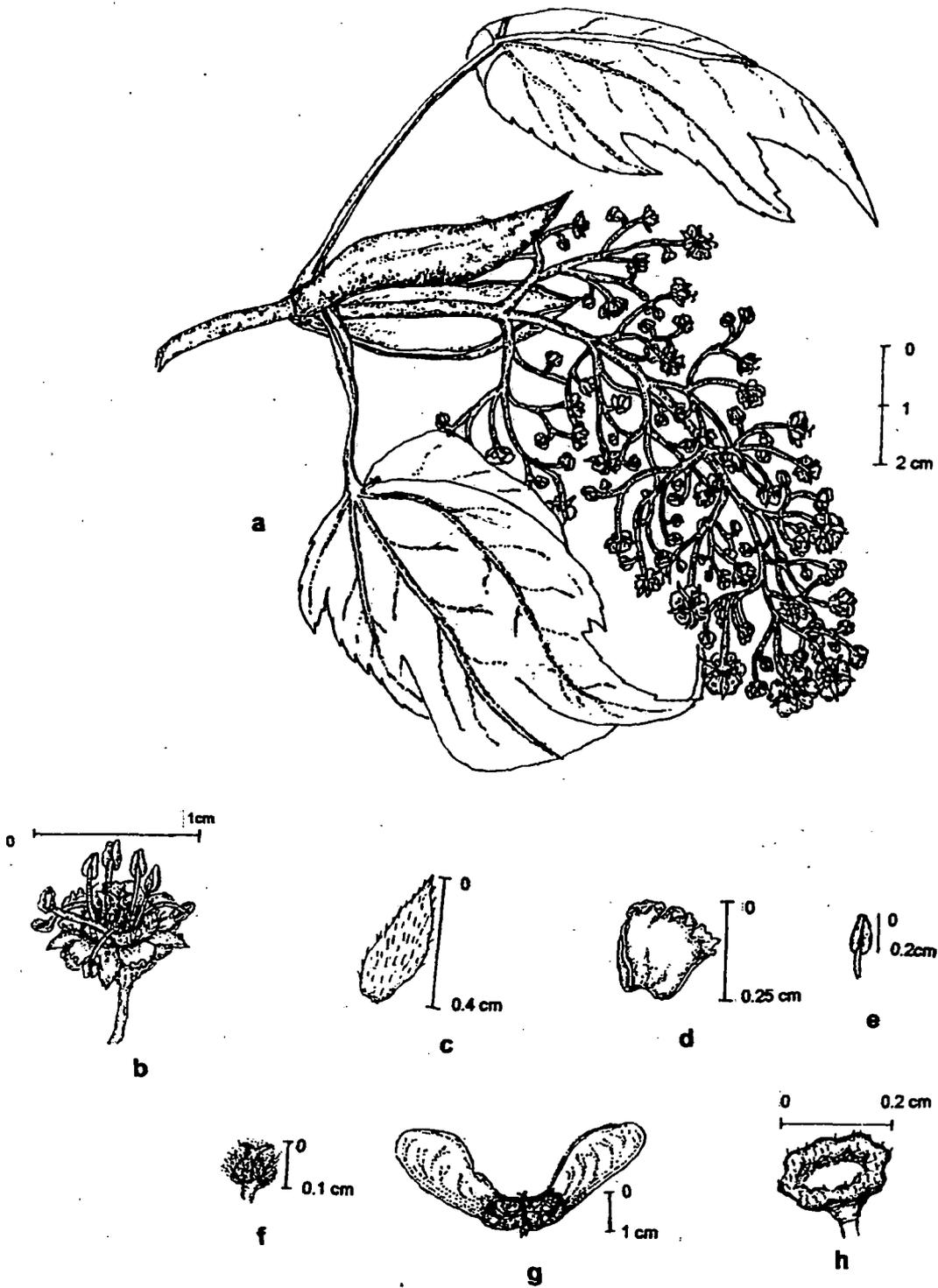
TABLE 3.5. MAJOR CHARACTERISTICS OF DIFFERENT SPECIES OF *Acer* L. FROM THE DARJILING-SIKKIM HIMALAYAS

Species of <i>Acer</i>	Size of	Leaf form	Inflorescence			Number of floral parts			Form of the disc		Angle divergen ce of fruit	Partheno -carpic tendecy
			Emergence	Arrange ment	Type	sepals	petals	stamens	Nature	Position		
<i>A. acuminatum</i>	6-9 m	3-5 lobed	After leaf flush	Terminal Lateral	Corymb	5	5	8	Shallowly 8-lobed	Amphistaminal	67-70°	Very high
<i>A. campbellii</i>	15-20 m	5-7 lobed	After leaf flush	Terminal	Panicle	5	5	8	Shallowly 8-lobed	Extrastaminal	70-180°	Weak
<i>A. caudatum</i>	8-11 m	5-7 lobed	With leaf flush	Terminal	Fasciculate Panicle	5	5	8	Shallowly 8-lobed	Intrastaminal	37-40°	Moderate
<i>A. hookeri</i>	8-10 m	Unlobed to 3-lobed	With leaf flush	Terminal	Raceme	5	5	8 rarely 7	Deeply 7- 8 lobed	intrastaminal	42-45°	Weak
<i>A. laevigatum</i>	10-14 m	Unlobed, rarely 2-3 lobed	With leaf flush	Terminal	Lax cyme or panicle	5	5	8 or 6-7	Shallowly 6-8lobed	Estrastaminal	35-40°	Weak
<i>A. oblongum</i>	12-18 m	unlobed	With leaf flush	Terminal	Lax Panicle	5	5	8 or 7-9	Shallowly 7- 9 lobed	Extrastaminal	Nearly Parallel 20-25°	High
<i>A. osmastonii</i>	12-20 m	3-5 lobed rarely unlobed	After leaf flush	Terminal	Panicle	5	5	8 Or 7-9	Deeply 7-9 lobed	Extrastaminal	68-70°	Weak
<i>A. palmatum</i>	8-10 m	7 lobed	With leaf flush	Terminal	Corymb	5	5	8 rarely 10	Shallowly 8- 10lobed	Estrastaminal	23-25°	Weak
<i>A. pectinatum</i>	8-12 m	3-5 lobed	With leaf flush	Terminal	Loose Raceme	5	5	8 rarely 10	Deeply 8- 10lobed	Intrastaminal	35-40°	Moderate
<i>A. sikkimense</i>	10-12 m	unlobed rarely 3 lobed	With leaf flush	Terminal	Spicate Raceme	5	5	8	Deeply 8 lobed	Intrastaminal	44-46°	Weak
<i>A. stachyophyllum</i>	5-9 m	unlobed to slightly 3-lobed	With leaf flush	Terminal	Raceme	5	5	4	Unlobed	Amphistaminal	35-37°	High
<i>A. sterculiaceum</i>	10-15 m	3-5lobed	With leaf flush	Terminal	Raceme	5	5	8	Slightly 8 lobed	Amphistaminal	44-46°	High
<i>A. thomsonii</i>	16-20 m	3-5 lobed, rarely unlobed	With leaf flush	Terminal	Raceme	5	5	8 or 7-9	Unlobed	Amphistaminal	Parallel to 39-42°	High



a. Portion of a flowering twig; **b.** A flower with parts displaced to show the disc;
c. Sepal; **d.** Petal; **e.** Stamen; **f.** Gynoecium; **g.** Fruit; **h.** Disc

Fig. 3.1. *Acer acuminatum* Wall. ex D. Don.



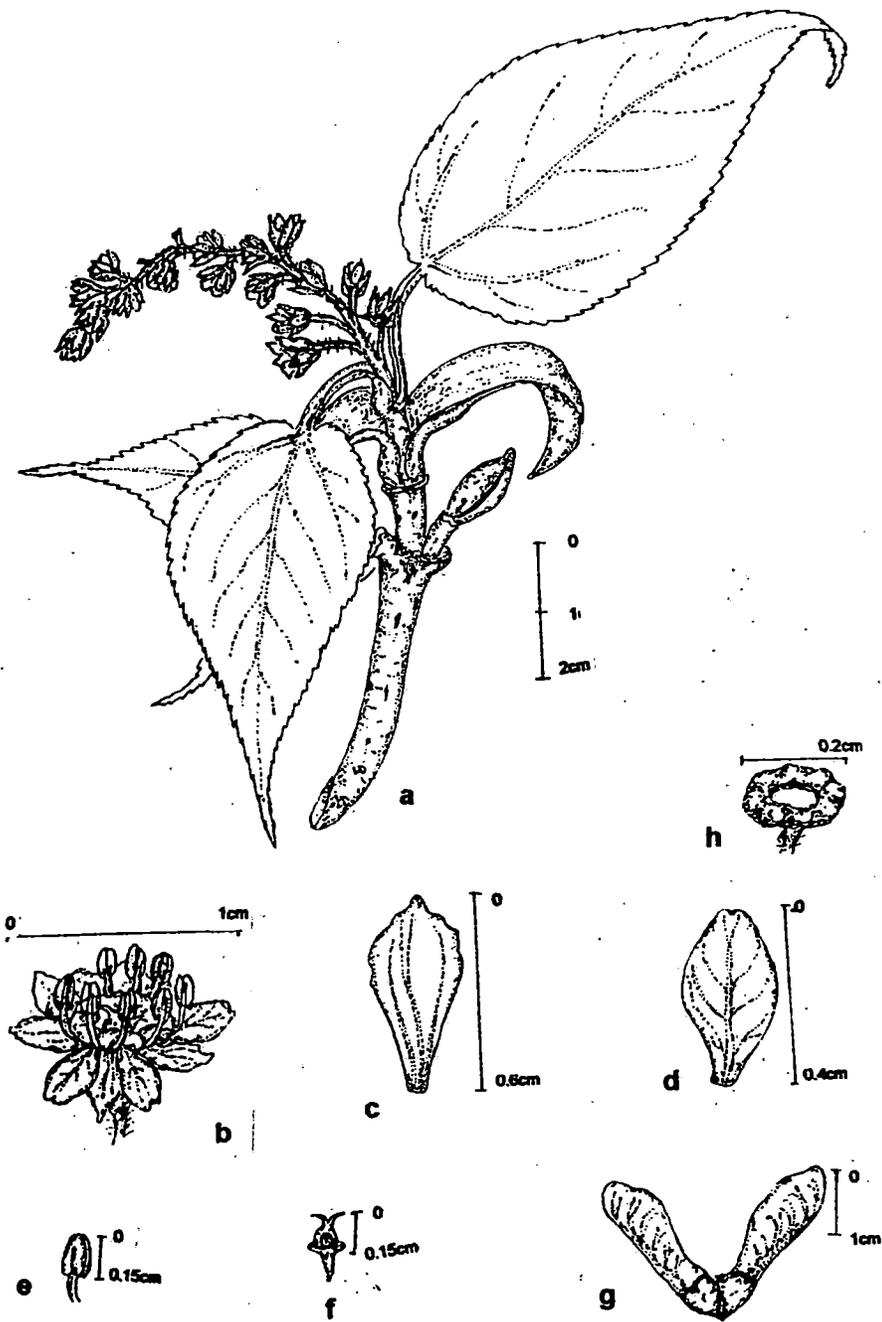
a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.2. *Acer campbellii* Hook., f. & Thomson ex Hiern.



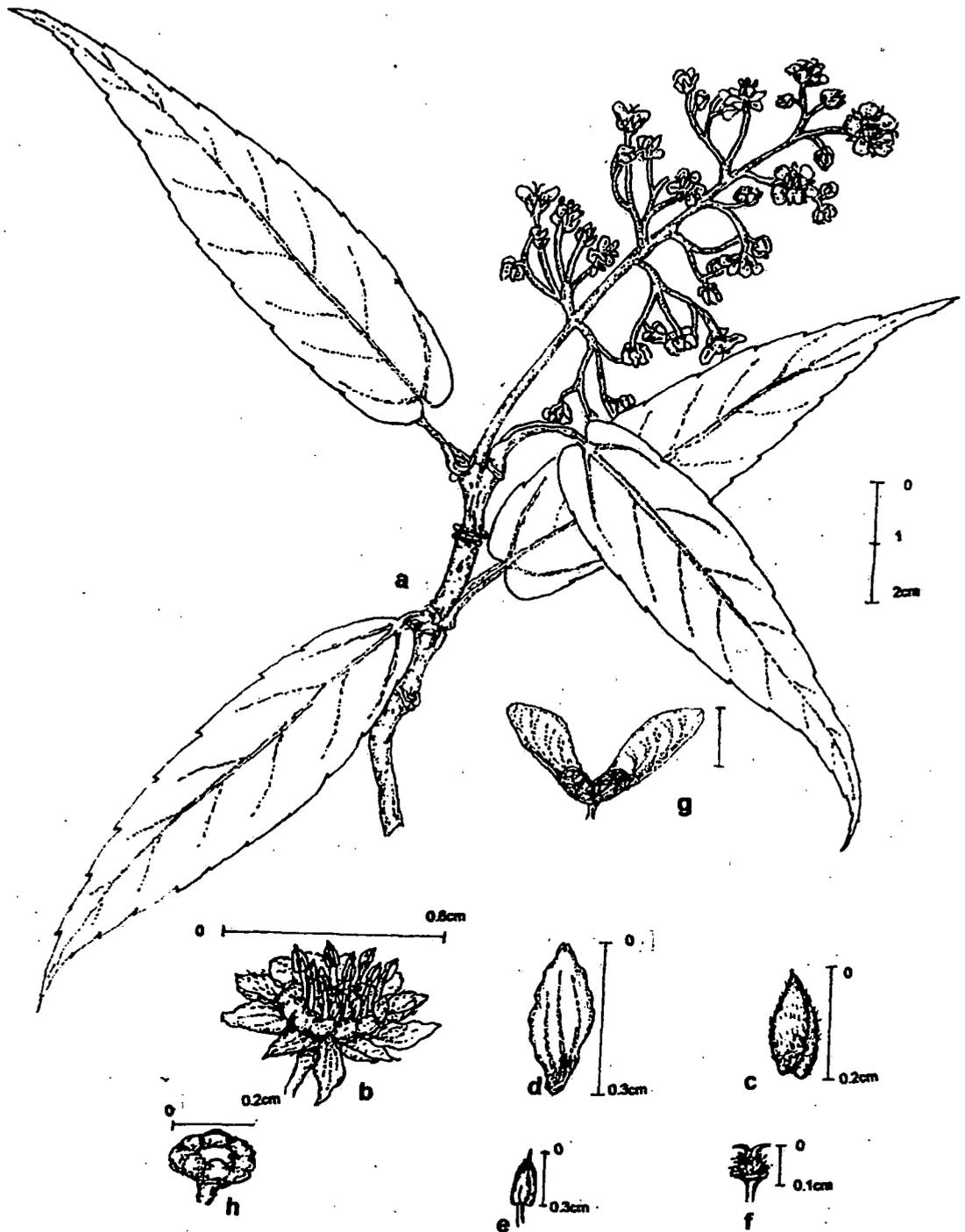
a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.3. *Acer caudatum* Wallich



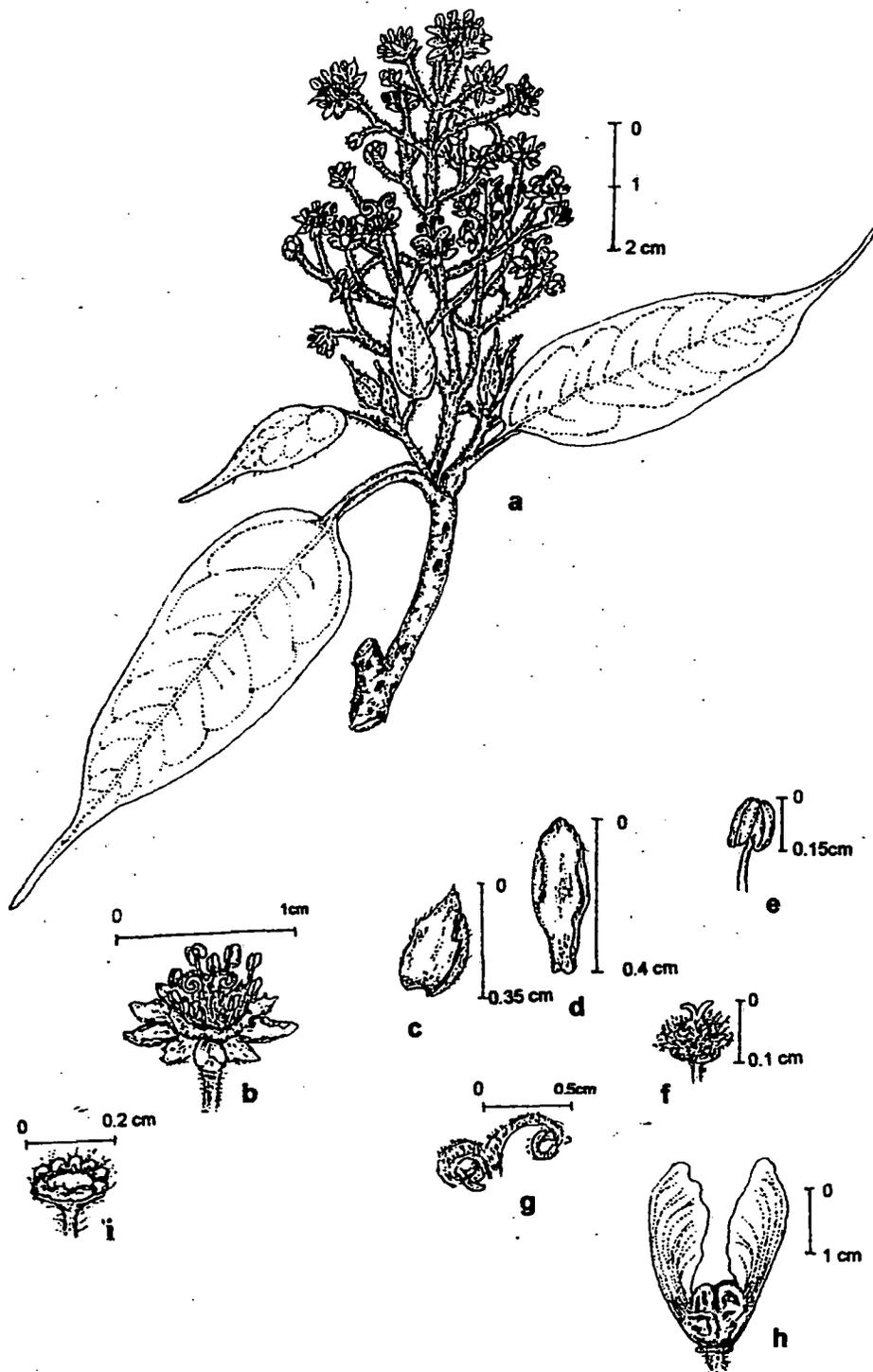
a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.4. *Acer hookeri* Miquel



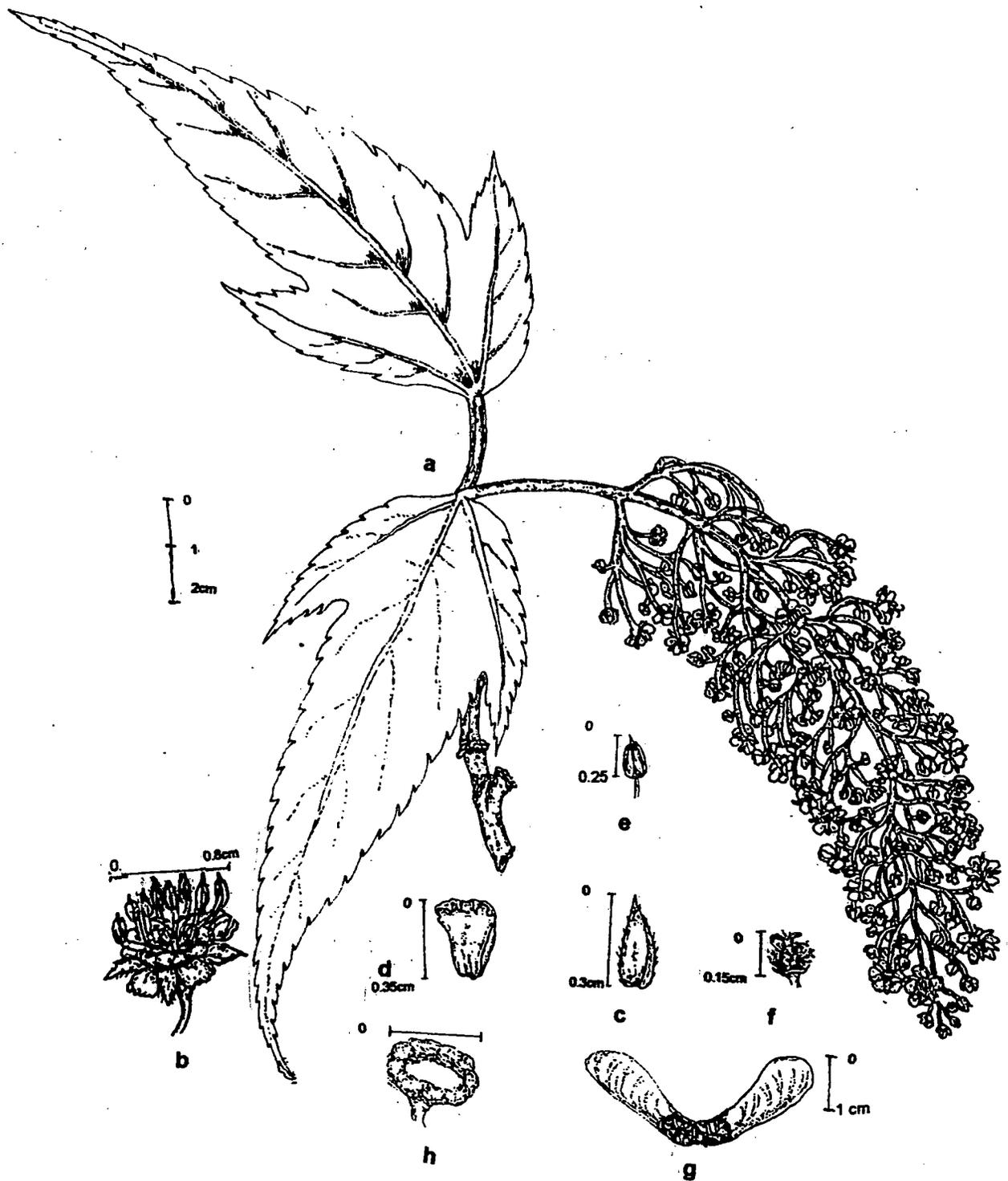
a. Portion of a flowering twig; **b.** A flower with parts displaced to show the disc;
c. Sepal; **d.** Petal; **e.** Stamen; **f.** Gynoecium; **g.** Fruit; **h.** Disc

Fig. 3.5. *Acer laevigatum* Wallich



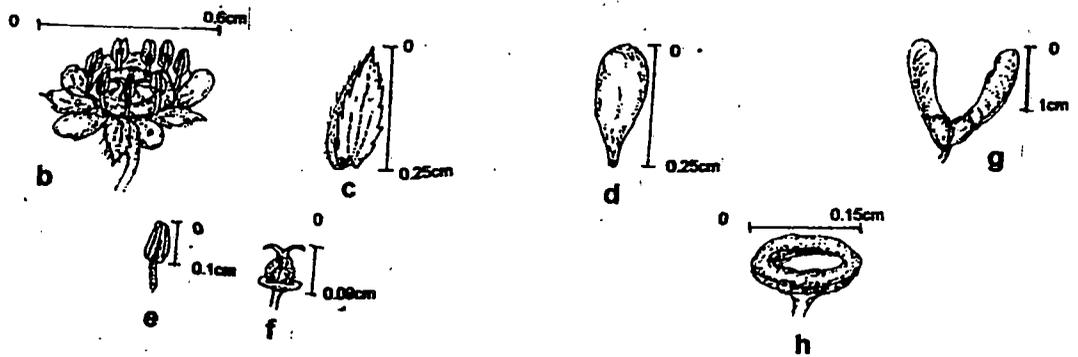
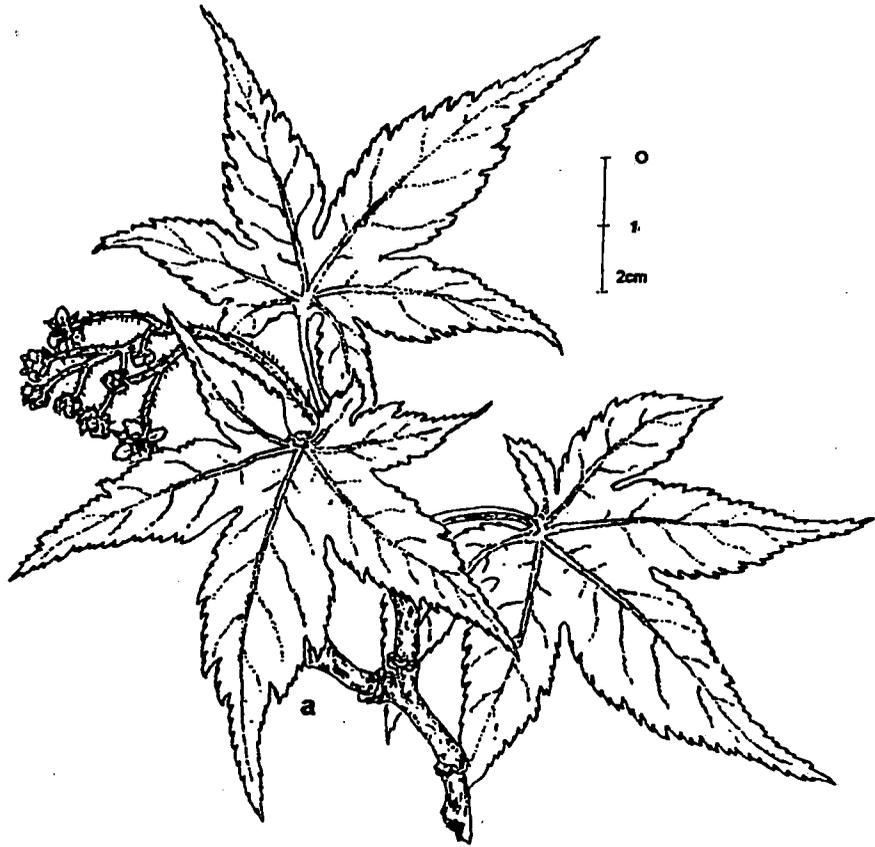
a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Elongated style & stigma; h. Fruit; i. Disc

Fig. 3.6. *Acer oblongum* Wallich ex. DC.



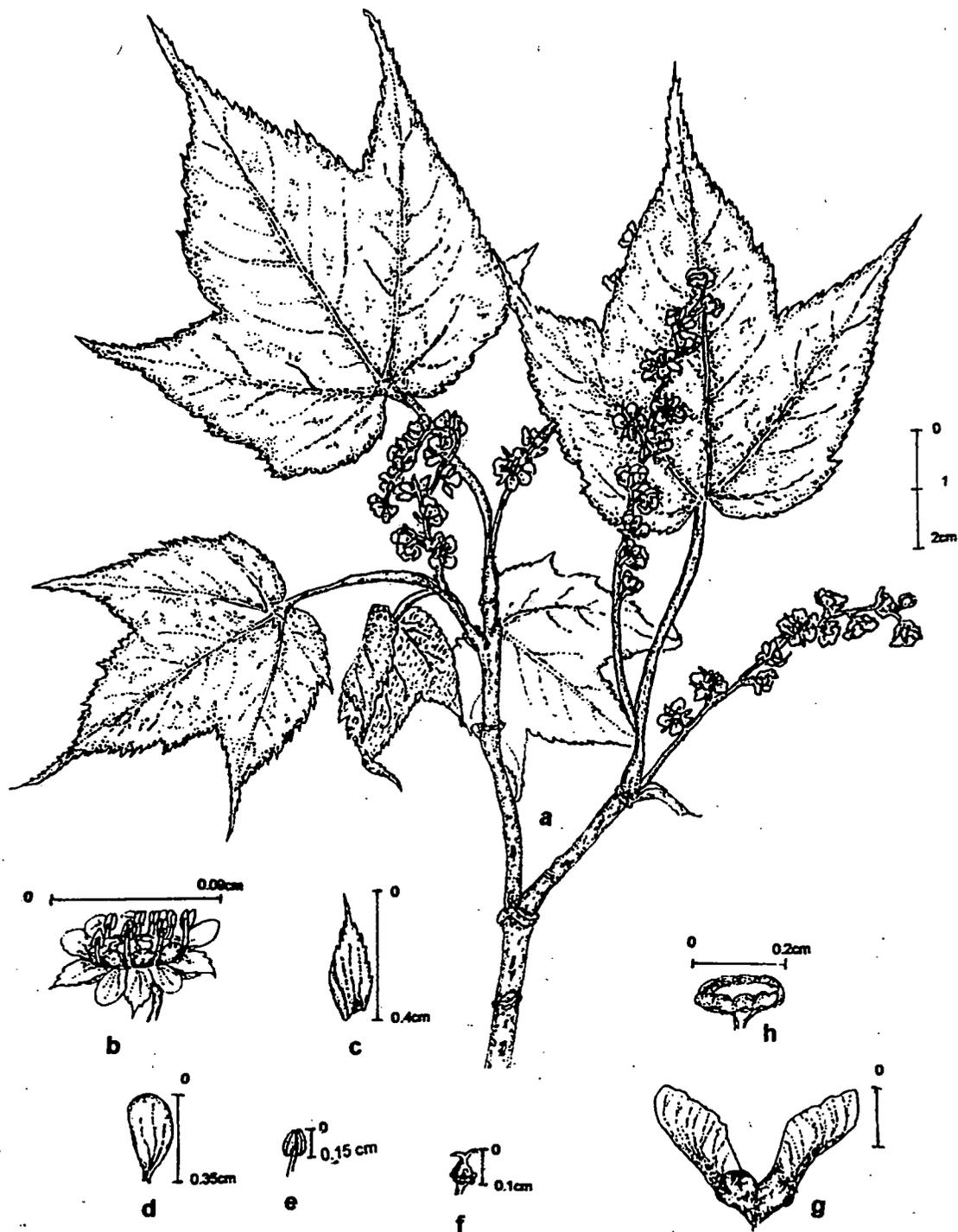
a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.7. *Acer osmastonii* Gamble



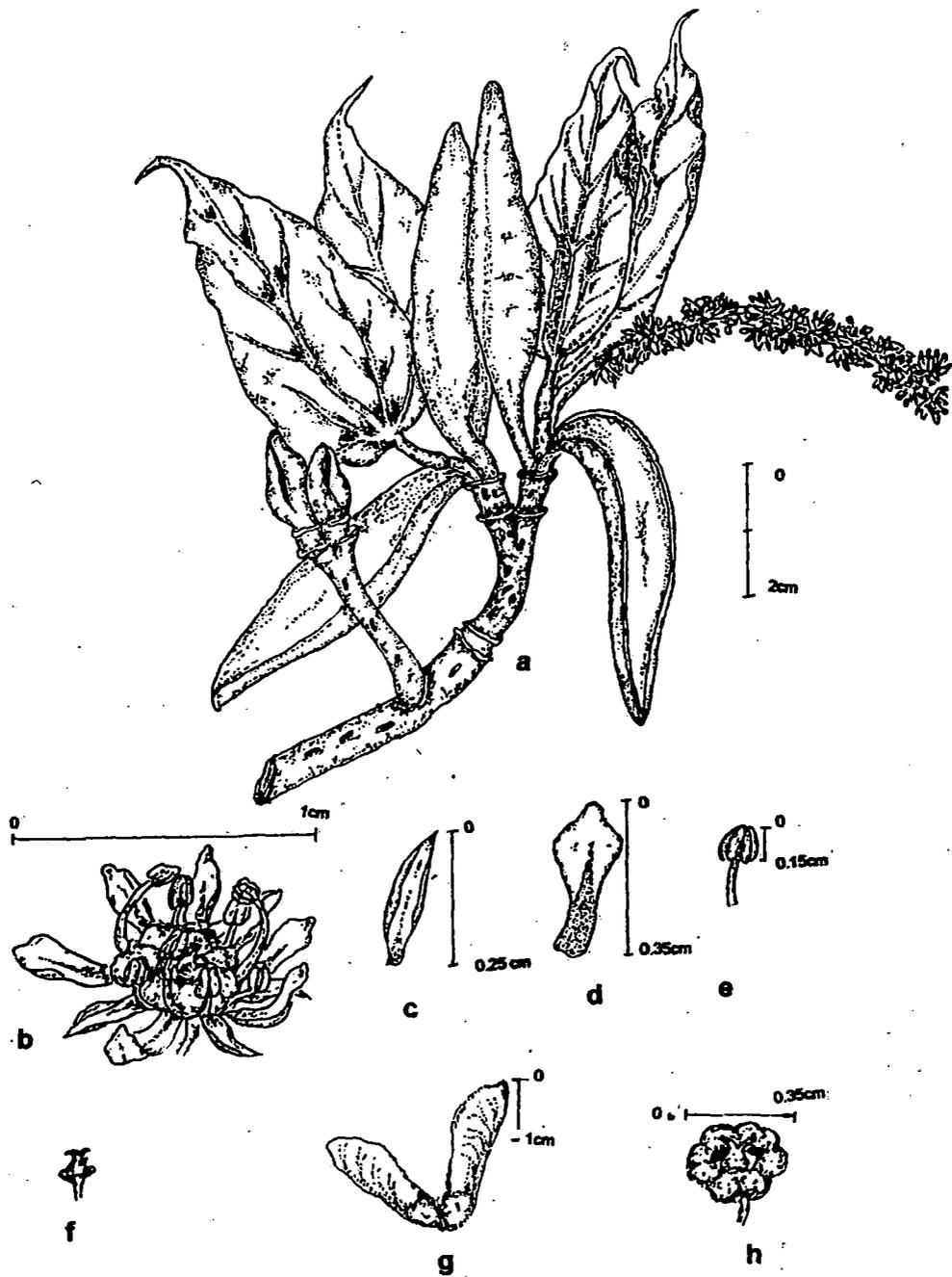
a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.8. *Acer palmatum* Thunberg ex Murray



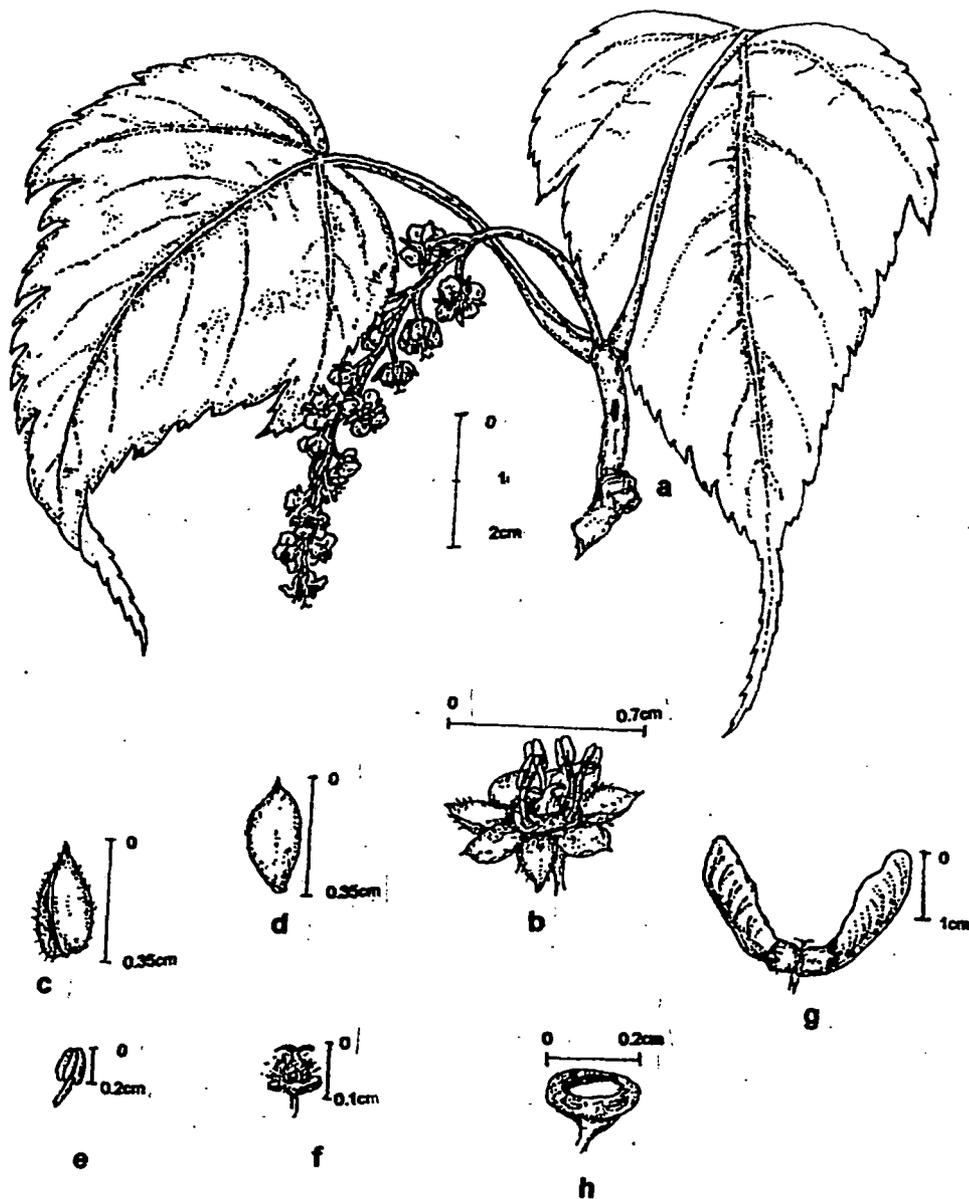
a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.9. *Acer pectinatum* Wallich ex Nicholson



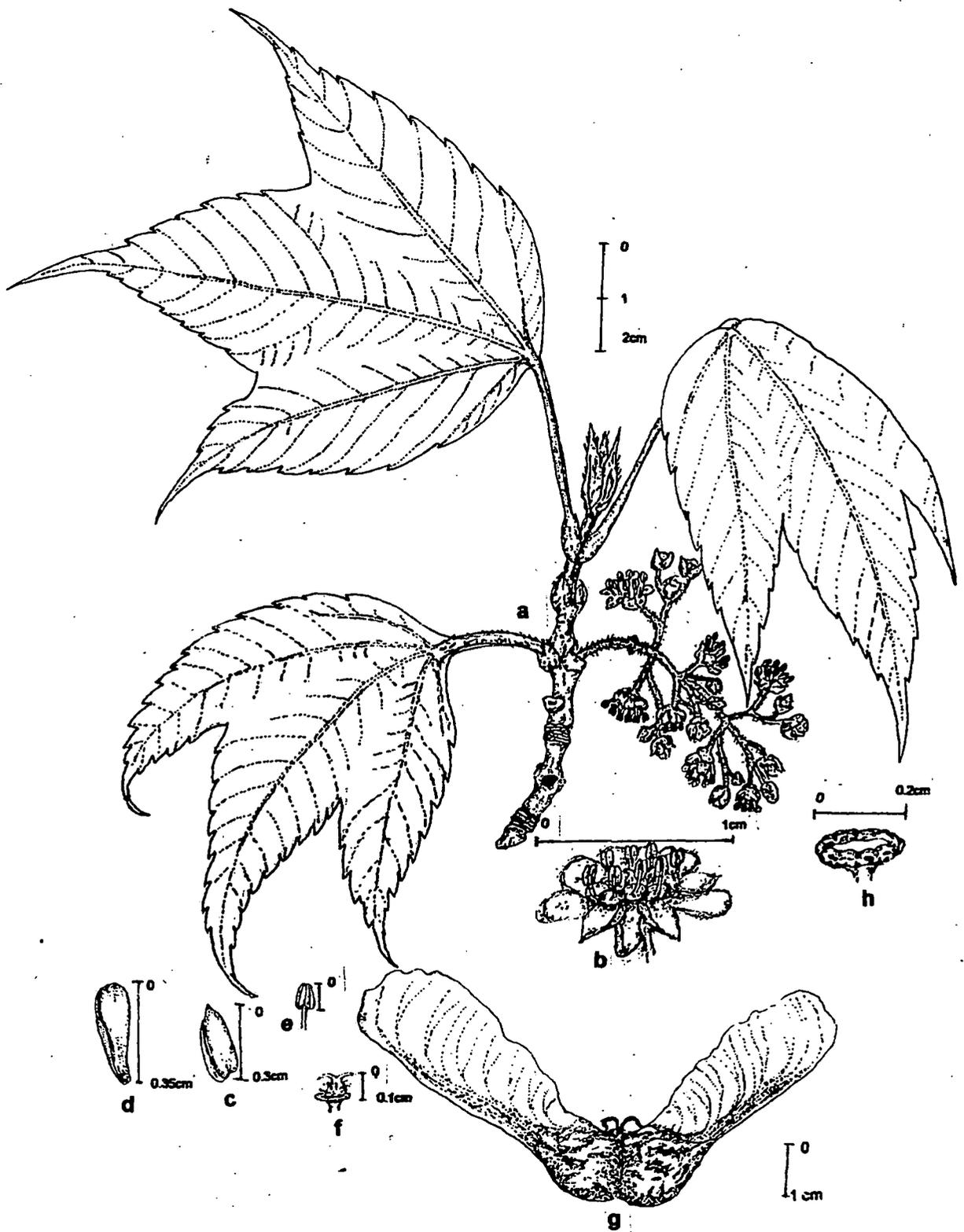
a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.10. *Acer sikkimense* Miquel



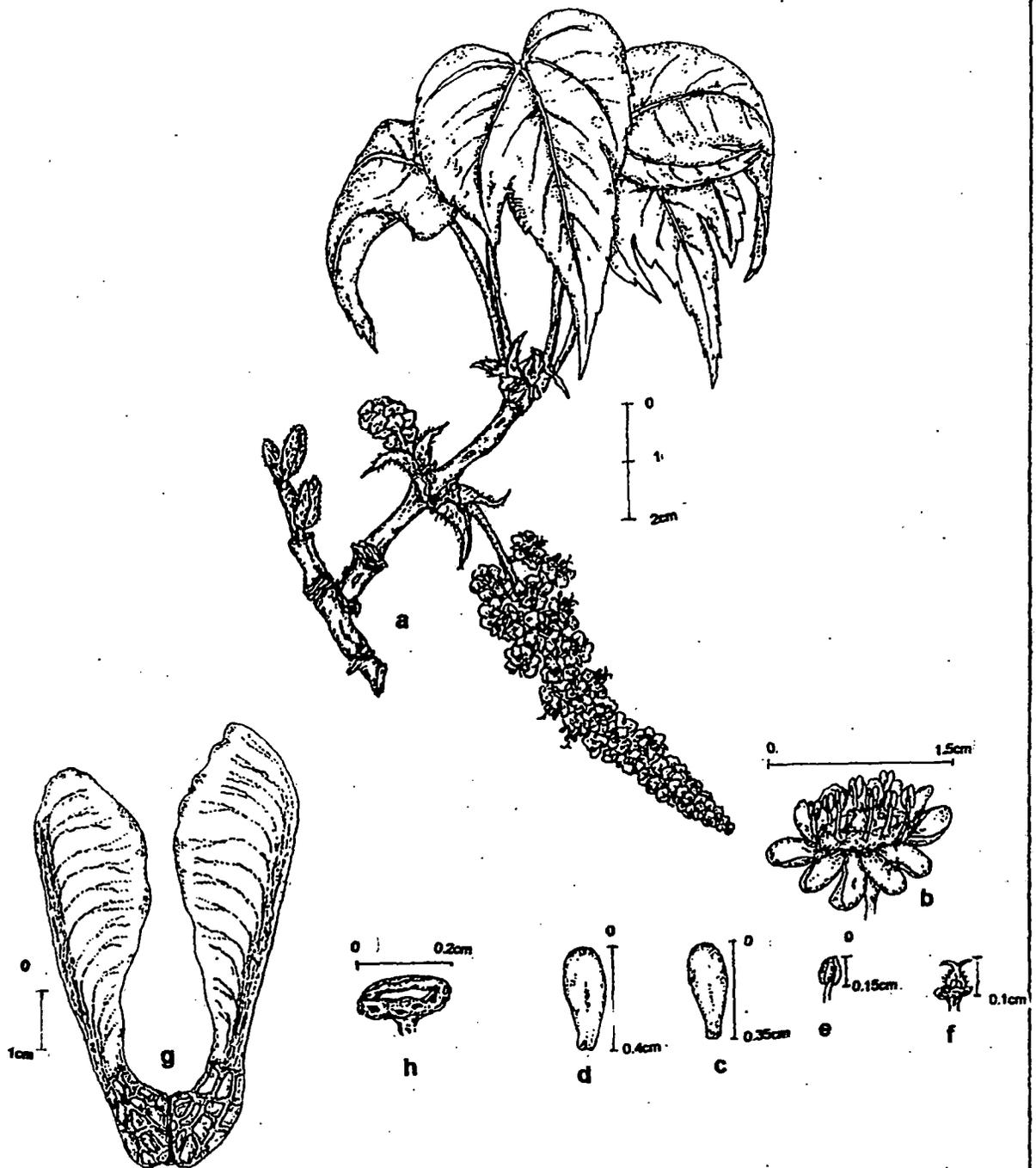
a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.11. *Acer stachyophyllum* Hiem



a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.12. *Acer sterculiaceum* Wallich



a. Portion of a flowering twig; b. A flower with parts displaced to show the disc;
 c. Sepal; d. Petal; e. Stamen; f. Gynoecium; g. Fruit; h. Disc

Fig. 3.13. *Acer thomsonii* Miquel

PLATE 3.1. FLOWERING TWIGS OF THE DIFFERENT SPECIES OF *Acer*



a. *Acer acuminatum*



b. *Acer caudatum*



c. *Acer cambellii*



d. *Acer hookeri*



e. *Acer laevigatum*



f. *Acer oblongum*



g. *Acer osmastonii*



h. *Acer pectinatum*



i. *Acer sikkimense*



j. *Acer stachyophyllum*



k. *Acer sterculiaceum*



l. *Acer thomsonii*

PLATE 3.2 HABIT OF DIFFERENT SPECIES OF *Acer* L.



a. *Acer acuminatum*



b. *Acer campbellii*



c. *Acer caudatum*



d. *Acer hookeri*



e. *Acer laevigatum*



f. *Acer oblongum*



g. *Acer osmastonii*



h. *Acer palmatum*



i. *Acer pectinatum*



j. *Acer sikkimense*



k. *Acer stachyophyllum*



l. *Acer sterculiaceum*



m. *Acer thomsonii*