

Diversity and distribution of *Acer* Linnaeus (Sapindaceae) in Darjiling and Sikkim Himalayas

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Abstract

The present study reports the diversity and distribution of thirteen species of *Acer* Linnaeus (Sapindaceae) along with two varieties from the Darjiling and Sikkim Himalayan region. A brief enumeration and key to the identification have been provided along with their flowering and fruiting periods, distribution, ecology and uses.

Key words: *Acer*, Darjiling-Sikkim Himalayas

INTRODUCTION

The Darjiling and Sikkim part of the Eastern Himalaya is extending between 26° 31' and 28° 10' N Latitude, and 87° 59' and 88° 53' E Longitude. Out of the total 1,22,802 sq km area of the Eastern Himalaya, these hills are covering an area of about 9020 sq km (Negi 1990). The district of Darjiling which lies on a spur of the Singalila Range in the IUCN recognized Himalaya Hotspot for biodiversity conservation and covers an altitudinal range of ca. 132 m at Sukna to 3660 m at Sandakphu. Whereas the Sikkim Himalaya covers an altitudinal range of ca. 300 m at Jorethang to 8598 m at the summit of Mt. Kanchenjunga (Negi 1990). The Darjiling and Sikkim Himalayas exhibit a very wide range of physiographic, climatic and edaphic conditions. These, coupled with biotic factors are responsible for the great floristic richness in the area (Lama 2004). The climate of this region varies greatly from nearly tropical at lower altitudes to permanent ice-covered alpine conditions at higher altitudes. However, most of these places receive well distributed high rainfall (Chopra 1985; Das 1995, 2004). The ambient temperature generally varies with hottest days during May to June and the coldest days during December to January. In the alpine snow covered regions, the temperature remain subzero level for most of the time. The evenly distributed highly humid climate is regarded as tree producing which is conducive to tree growth and as such the timber line or the upper vegetation in this sector goes upto 4750 m amsl (Sahni 1981).

The vegetation of Darjiling and Sikkim Himalayas and their extension into Terai and Duars are very rich and covers all major group of plants including several endemic and RET species (Biswas 1940; Chatterjee 1940; Das 1995, 2004; Das & Chanda 1987; Samanta 2000; Samanta & Das 1995; Ghosh & Das 2009).

The name 'Acer' was first coined by Tourefort in 1700 and it was officially assigned as a distinct genus by Linnaeus in the first edition of his *Genera Plantarum* (Linnaeus 1737). Lindley (1836) proposed the family Aceraceae after this generic name. However, in the current Angiosperm Phylogeny Group classification (APG III 2009), the genus has been placed in Sapindaceae under Sapindales.

The genus *Acer* Linnaeus (Sapindaceae) comprises of both living and extinct species. The genus is believed to have originated in Southwest and Western China. It has not only reached its abundance in terms of number of species and individuals, but has also covered the largest landmass ever to be covered by the genus (Lama 2004). The present day *Acer* is primarily an inhabitant of the Northern Hemisphere.

Mabberley (2008) recognized 114 species for *Acer* distributed in north temperate and tropical mountains of the world. And, only 13 species have been recorded from India and adjoining territory in *The Flora of British India* (Hooker 1896). However, in the meantime, Das & Chanda (1987) has recorded nine species from the subtropical and temperate hills of Darjiling.

The present investigation revealed the occurrence of 13 species of *Acer*, including the ornamental *A. palmatum* which has more or less naturalized, along with two varieties from the Darjiling and Sikkim Himalayas. The distributional range in altitude for different species varies from 950 m (constituting the sub-tropical zone) to 4100 m (in the alpine zone). However, most of the species remain distributed in the temperate and cold temperate belts of this region.

MATERIALS AND METHOD

After the initial collections by the senior author (APD) during 1980 – 1984, further survey for the species of *Acer* Linnaeus (Sapindaceae) in Darjiling and Sikkim Himalaya was initiated in 1998, and through this process a good number of different species of the genus were recorded. The specimens have been collected in different stages of their life cycle but preference was given to the flowering and fruiting stages. The collected voucher specimens were processed with conventional methodology (Jain & Rao 1977), identified primarily in the Taxonomy & Environmental Biology Laboratory, Department of Botany, University of North Bengal and matched at NBU and CAL. All the voucher specimens were deposited at NBU Herbarium.

SYSTEMATIC TREATMENTS

ACER Linnaeus

Key to species

- | | | |
|-----|--|--------------------------|
| 1. | Leaves unlobed or slightly lobed | 2 |
| 1a. | Leaves distinctly lobed | 6 |
| 2. | Flowers in panicle | <i>A. oblongum</i> |
| 2a. | Flowers in raceme, spicate raceme or in cyme | 3 |
| 3 | Stamens 4; disc unlobed | <i>A. stachyophyllum</i> |
| 3a. | Stamens 7 – 8; disc deeply lobed | 4 |
| 4. | Flowers with distinct pedicel | 5 |
| 4a. | Flowers almost sessile | <i>A. sikkimense</i> |

5. Flowers in cymes; angle of mericarps 35 – 40°; lamina lanceolate-oblong *A. laevigatum*
- 5a. Flowers in racemes; angle of mericarps 42 – 45°; lamina ovate to caudate *A. hookeri*
- 6 Flowers in racemes 7
- 6a. Flowers not in raceme 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 disc amphistaminal 9
- 8a. Position of 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 lax panicle, disc extrastaminal; angle of mericarps 68 – 70°; lamina elliptic-ovovate *A. osmastonii*
- 10a. Flowers in unbranched racemes; disc intrastaminal; angle of mericarps 35 – 40°; lamina 3-5 lobed *A. pectinatum*
11. Disc intrastaminal; mericarps forming acute angle; flowering with leaf flush *A. caudatum*
- 11a. Disc extrastaminal 12
12. Flowers in panicle, appearing after leaf flush; angle of mericarps 70 – 180°; lamina palmately 5 – 7 unequally lobed *A. campbellii*
- 12a. Flowers in corymb, appearing with leaf flush; angle of mericarps 20 – 25°; lamina usually 5-lobed, obovate *A. palmatum*

Acer acuminatum Wallich ex D. Don, Prodr. Fl. Nepal 249. 1825; Banerjee & Das in Ind. For. 97: 248.1971; Hara & Williams in En. Fl. Pl. Nep. 2: 97. 1979. *A. caudatum* Wallich, Cat. 33 n 1225. 1829 *nom. nud.*; Hiern in Hooker f., Fl. Brit. Ind. 1: 695. 1875.

Local Name: *Lekh Kapasi* (Nepali)

Small deciduous trees 4 – 7 m high. Leaves simple, exstipulate, membranous, lower surface pubescent when young, covered with whitish hairs, turning glabrous when mature, petiolate; petiole purplish red with swollen base 3 – 8.5 cm long fine pubescent; lamina palmately 3 – 5 lobed with basal lobes often insignificant, 6 – 12 x 5.5 – 12 cm, lobes ovate-caudate, marginserrate to biserrate, base cuneate to rounded with 5 basal veins, apex acuminate with a long slender tall or acumen. Inflorescence a corymb appearing after the leaves, young leaves 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, marginentire, apex acute pubescent on outer surface 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 0.17 – 0.25 cm long, white, anthers 0.1 – 0.15 cm long, yellowish, basifixed, dehiscence longitudinal; Disc shallowly 8 lobed, amphistaminal, yellowish green when young, brown at maturity, pubescent 0.15 – 0.2 cm in diameter; Carpels 2, stigma bifid, style short, ovate densely covered with white hairs 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 brown at maturity, glabrous, 1.9 – 2.1 x 1 – 1.4 cm, wing divergence 67 – 70°; locules convex, ovoid, 0.5 – 0.6 x 0.3 – 0.35 cm with one nut in each locule.

Flowering: May – June. **Fruiting:** September – October

Exsiccatae: Lachung, Sikkim, 3800 m, *Lama & AP Das 0211*, May 29, 2000.

Distribution: Himalayas: Pakistan, Kashmir, Sikkim, Nepal, Kamroop (Assam)

Ecology: Sparse, natural regeneration low, often forming small grooves in a few places with *A. stachyophyllum*; 2500 – 4000 m.

Note: Bark brownish gray, high degree of parthenocarpy with most fruits devoid of seeds.

Acer campbellii Hooker f. & Thomson ex Hiern in Fl. Brit. Ind. 1: 696. 1875. Hara, Fl. E. Him. 1: 191. 1966; 2: 72. 1971; Hara & Williams, En. Fl. Pl. Nep. 2: 97. 1979; Matthew, Fl. Pl. Kurseong 23. 1981; Nayar & Datta, Fasc. Fl. Ind. 9: 5. 1982; Das & Chanda in Trans. Bose Res. Inst. 51(4): 104. 1987; Grierson & Long, Fl. Bhutan 2(1): 67. 1991.

Local Name: *Kapasi* (Nepali); *Doom Kung* (Lepcha)

Subsp. *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 – 7unequally lobed, lobes lanceolate to oblong, margins serrate, apex acuminate, base cordate or truncate with 7 basal nerves. Inflorescence a panicle, appearing with leaves, 11 – 4 cm long pendulous. Flowers actinomorphic, dirregular, fimbriate, white, shorter than sepals, 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, 0.2 cm in diameter, filaments white 0.2 cm, anthers 0.2 cm, crimpson-orange, dehiscence longitudinal. Carpels 2, stigma bifid, ovary densely covered with white hairs, two chambered with one ovule in each, 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 70 – 130°; locules convex, rounded to ovoid, 0.55 – 0.6 x 0.3 – 0.4 cm.

Flowering: April – May. **Fruiting:** July – August

Exsiccatae: Queen's Hill, Darjiling, 2150 m, *AP Das 0930*, May 06, 1982; Jalpahar, Darjiling, 2200 m, *Lama & AP Das 0101*, May 09, 1999; Lachen, Sikkim, 3600 m, *Lama & AP Das 0228*, October 11, 2000; Jorebunglow, Darjiling, 2100 m, *Moktan & AP Das 0702*, September 09, 2010.

Distribution: Himalayas, Upper Myanmar, North Vietnam

Ecology: Abundant at places; 1600 – 3700 m.

Note: Timber useful; good fodder.

Subsp. *campbellii* var. *serratifolium* Banerji in J. Bomb. 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 0.8 cm in diameter; larger samara with wings forming a straight line at 130°.

Flowering: April – May. **Fruiting:** July – August

Exsiccatea: Tonglu, Darjiling, 3000 m, *Lama & AP Das 0131*, May 18, 1999; Meghma, Darjiling, 2600 m, *Moktan & AP Das 0998*, May 23, 2012.

Distribution: Himalayas: Nepal – Darjiling, Sikkim

Ecology: Most frequent taxon of the genus, planted along roadsides as ornamental; 1600 – 3500m

Note: Wood used as firewood and manufacture of tea boxes, leaves as fodder.

Acer caudatum Wallich, Pl. Asia. Rar. 2: 4 & 28, t. 132. 1831; Hooker *f.* in Fl. Brit. Ind. 1: 695. 1875, p.p.; Hara in Fl. E. Him. 1: 191. 1966: 2: 73. 1971; Hara & Williams in En. F. Pl. Nep. 2: 98. 1979; Nayar & Datta, Fasc. Fl. Ind. 9: 8. 1982; Grierson & Long in Fl. Bhutan 2(1): 67. 1991. *A. papilio* King in J. Asia. Soc. Beng. 65(2): 115. 1896; Banerjee & Das in Ind. For. 97: 249. 1979.

Local Name: *Lekh Kapasi* (Nepali)

Medium sized tree, 8 – 11 m 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 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 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 0.08 – 0.1 cm long, dehiscence longitudinal; disc intrastaminal, yellowish green when young turning orange to brown at maturity 0.1 cm in diameter. 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, 0.55 – 0.6 x 0.35 – 0.4 cm; style and stigma persistent even in mature fruit.

Flowering: April – May. **Fruiting:** September – October

Exsiccatae: Sandakphu, Darjiling, 3600 m, *Lama & AP Das 0037*, May 13, 1998; Lachen, Sikkim, 2900 m, *Lama & AP Das 0239*, November 14, 2000; Bikhay Bhanjyang, Darjiling, 3100 m, *Moktan & AP Das 0820*, May 21, 2012.

Distribution: Himalayas (Kumaon – Bhutan), Myanmar, Manchuria, Korea, Northern Japan, Southern Tibet, China.

Ecology: Sparse, found in small grooves along with *A. pectinatum* and *A. stachyophyllum*; 2500 – 4000m

Note: Used as firewood in high altitude areas.

Acer hookeri Miquel in Arch. Neeri. Sci. Nat. 2: 471. 1852; Hooker *f.* in Fl. Brit. Ind. 1: 694. 1875; Hara in Fl. E. Him. 1: 191. 1966: 2: 73. 1971; Hara & Williams in En. Fl. Pl. Nep. 2: 98. 1979; BSI, Nayar & Datta, Fasc. Fl. Ind. 9: 9. 1982; Das & Chanda in Trans. Bose Res. Inst. 51(4): 104. 1987; Grierson & Long in Fl. Bhutan 2(1): 64. 1991.

Local Name: *Laharey Kapasi*, *Lal Kapasi* (Nepali); *Phaley Kung* (Lepcha)

Trees upto 7 – 9 m high, leaves simple, opposite, exstipulate, deciduous; petiole 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, 0.8 – 1 cm in diameter; pedicel green, covered with white hairs, 0.4 – 0.6 cm long; sepals 5 oblong, green with three distinct nerves, 0.3 – 0.4 x 0.15 – 0.2 cm; petals 5, creamy white, ovate, undulate 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 0.25 cm, shorter 0.04 – 0.08 cm long; anthers four lobed, dehiscence longitudinal, light yellow 0.15 – 0.2 cm; disc intrastaminal, light green, turning orange to brown 0.25 – 0.3 cm in diameter; 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, 0.35 – 0.4 x 0.25 – 0.3 cm.

Flowering: March – April. **Fruiting:** September – October

Exsiccatae: Senchal, Darjiling, 2350 m, *AP Das 0374*, April 14, 1981; Tonglu, Darjiling, 3000 m, *Lama & AP Das 0065*, May 11, 1998; Lachen, Sikkim, 2900 m, *Lama & AP Das 0222*, October 10, 2000; 3rd Mile, Darjiling, 2100 m, *Moktan & AP Das 1084*, October 12, 2012.

Distribution: E. Himalaya: Nepal – Arunachal Pradesh

Ecology: Common between 2000 – 3200 m.

Note: Used as firewood in high altitude areas.

Acer laevigatum Wallich, Pl. Asia. Rar. 2: 3, t. 104. 1831; Hooker *f.* in Fl. Brit. Ind. 1: 699. 1875; Hara in Fl. E. Him. 1: 192. 1966; 1971; Hara & Williams in En. Fl. Pl. Nep. 2: 98. 1979; Nayar & Datta, Fasc. Fl. Ind. 9: 10. 1982; Das & Chanda in Trans. Bose. Res. Inst. 51(4): 104. 1987; Grierson & Long in Fl. Bhutan 2(1): 64. 1991.

Local Name: *Putli* (Nepali)

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, lax panicle, appearing with the leaves, 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 0.15 – 0.2 x 0.15 – 0.17 cm. Petals 5, lanceolate, white, repund, longer than sepals, 0.25 – 0.3 x 0.2 cm, with three distinct nerves. Stamens 8, sometimes 6 or 7, arising from within a 6 – 8 lobed disc; filaments white, 0.2 mm long; anthers yellowish 0.1 cm long with a pinkish subulate appendage. Disc extrastaminal, usually 8 lobed, sometimes 6 or seven lobed, orange when young turning brown with maturity, 0.15 cm in diameter. Carpels 2, stigma bifid, pinkish; ovary covered with dense white hairs 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, angle of divergence 35 – 40°; locules convex, ovoid to oblong, 0.5 – 0.7 x 0.3 – 0.35 cm.

Flowering: April – May. **Fruiting:** September – October

Exsiccatae: Kurseong, 1550 m, *AP Das 1365*, March 31, 1983; Takdah, Darjiling, 1500 m, *Lama & AP Das 0112*, April 21, 1999; Sombarey, Sikkim, 1700 m, *Lama & AP Das 0187*, September 09, 1999; Sonada, Darjiling, 1800 m, *Moktan & AP Das 0565*, September 08, 2010.

Distribution: Himalayas: Garwal – Arunachal Pradesh; Western and Southern China.

Ecology: Common, but does not form grooves; 1600 – 2000m.

Note: Woods used for making handle of tools

Acer oblongum Wallich *ex* A.P. de Candolle, Prodr. 1: 593. 1824; Hooker *f.* in Fl. Brit. Ind. 1: 693. 1875; Hara in Fl. E. Him. 1: 192. 1966; 2: 73. 1971; Hara & Williams in En. Fl. Pl. Nep. 2: 98. 1979; Nayar & Datta, Fasc. Fl. Ind. 9: 12. 1982; Das & Chanda in Trans. Bose Res. Inst. 51(4): 104. 1987; Grierson & Long in Fl. Bhutan 2(1): 63. 1991. *A. lanceolatum* Molliard, Bull. Soc. Bot. Fr. 50: 134, t.5. 1903.

Local Name: *Phirphiri, Kapasi* (Nepali)

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, pedicel 0.8 – 1 cm long, pubescent. Flowers actinomorphic, bisexual greenish white to greenish yellow 0.8 – 1 cm in diameter; Sepals 5, ovate, three lobed with two small lateral lobes, pubescent on both surfaces, 0.25 – 0.3 x 0.1 – 0.15 cm. Petals 5, oblong greenish white to greenish yellow, 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 0.15 – 0.3 arising from within a 7 – 9 lobed extrastaminal disc; anthers yellowish with crimson edges 0.2 – 0.3 cm long. Disc dark green, pubescent with glistening hairs on upper surface 0.2 cm in diameter. Carpels 2, stigma usually bifid sometimes tri, tetra or hexafid due to fusion of flowers; stigma and style elongating with stigma curling inward 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.

Flowering: April – May. **Fruiting:** September – October

Exsiccatea: Birch Hill, Darjiling, 2000 m, *AP Das 0865*, April 20, 1982; Pedong, Kalimpong, 1400 m, Sept. 21, 1999, *Lama & AP Das 0185*, Dentam, Sikkim, 1500 m, June 12, 2000, *Lama & AP Das 0201*, Kurseong 1500 m, April 16, 2010, *Moktan & AP Das 0462*.

Distribution: Himalayas: Kashmir – Arunachal Pradesh; China.

Ecology: Occurs between 1400 – 2200m

Note: Woods used as good construction material.

Acer osmastonii Gamble in Bull. Misc. Inform. Roy. Bot. Gard. Kew: 446. 1908; Nayar & Datta, Fasc. Fl. Ind. 9: 14. 1982; Das & Chanda in Trans. Bose Res. Inst. 51(4): 104. 1987; Grierson & Long in Fl. Bhutan 2(1): 66. 1991.

Local Name: *Kapasi* (Nepali)

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 to 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 0.6 – 1 cm long, pubescent. Flowers actinomorphic, bisexual, 1 – 1.2 cm in diameter. Sepals 5, ovate greenish, both surface pubescent, 0.15 – 0.18 x 0.1 – 0.15 cm. Petals 5, obovate, fimbriate, slightly larger than sepals, notched above, greenish white 0.17 – 0.2 x 0.13 – 0.17 cm. Stamens usually 8 sometimes 7 or 9 arising within a 7 – 9 lobed disc, filament white 0.15 cm long, anther yellowish basifixed, dehiscence longitudinal with a pinkish subulate appendage 0.1 cm long. Disc extrastaminal yellowish green when young turning chocolate brown, pubescent with, glistening hairs on upper surface, 0.15 – 0.2 cm in diameter. Carpels 2, 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, mericarp divergent, 3 – 3.2 x 1 – 1.3 cm, angle of divergence 68 – 70°; enclosed by thick woody pericarp; wings 2.5 – 2.8 x 1 – 1.3 cm green, locules convex, angular, 0.9 – 1 x 0.7 – 0.85 cm; style and stigma persistent even in mature fruit.

Flowering: May. **Fruiting:** September – October

Exsiccatea: Birch Hill, Darjiling, 2000 m, May 02, 1983, *AP Das 1398*, & May 13, 1999, *Lama & AP Das 0179*.

Distribution: Endemic to Darjiling (Grierson & Long 1991; Bhujel & Das 2002), and Dehradun (Nayar & Dutta 1982)

Ecology: Species closely resembles *A. campbellii* and may be a natural hybrid between it and *A. laevigatum* (Cowan & Cowan, 1929). Forms with unlobed leaves are similar to *A. oblongum* and *A. laevigatum* (Grierson & Long 1991)

Note: Species found to be restricted to Birch Hill at Darjiling.

Acer palmatum Thunberg *ex* Murray in Kaemp. Illustratus. Nova Acta Regiae Soc. Scientiarum 4: 36, 40. 1783; Systema Vegetabilium 1784; 14thed Stafleu & Cowan 3: 670. 1981; Das & Chanda in Trans. Bose Res. Inst. 51(4): 104. 1987:

Local Name: *Kapasi* (Nepali)

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, pedicel green pubescent, 0.2 cm long. Flowers actinomorphic, bisexual reddish white 0.25 cm in diameter. Sepals 5, light reddish purple, lanceolate, with broadly serrated margin, glabrous with 3 prominent veins, 0.2 – 0.25 x 0.1 – 0.15 cm. Petals creamish white, as long as the sepals, obovate, entire, 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 0.2 – 0.25 cm; anthers 0.1 cm long, light yellow basifixed, dehiscence longitudinal. Disc extrastaminal, unlobed glabrous, greenish yellow turning reddish at maturity, diameter 0.2 cm. Carpels 2, stigma bifid, ovary reddish glabrous, 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 23 – 25°; locules convex, rounded, 0.15 – 2 x 0.13 – 0.15 cm.

Flowering: February – March. **Fruiting:** September – October

Exsiccatea: Jalapahar, Darjiling, 2150 m, *AP Das 0930*, April 13, 1981; Birch Hill, Darjiling 2000m, Feb. 28, 1998, *Lama & AP Das 0013*

Distribution: Darjiling, Japan, Korea, Taiwan Eastern China

Ecology: Sparse, previously introduced plants have nicely acclimatized in Darjiling; grows nicely 1400 – 2400 m

Note: Chiefly used for making bonsai.

Acer pectinatum Wallich *ex* Nicholson in Gard. Chron. 1881(1): 365. F. 69. 1881: Hara in Fl. E. Him. 1: 192. 1966: 2: 73. 1971. *Non* Wall.; Hara & Williams in En. Fl. Pl. Nep. 2: 98. 1979; Nayar & Datta, Fasc. Fl. Ind. 9: 15. 1982; Grierson & Long in Fl. Bhutan 2(1): 67. 1991. *A. caudatum* *Sensu* Fl. Brit. Ind. 1: 695. 1875. p.p. *non* Wallich.

Local Name: *Lekh Kapasi* (Nepali); *Yatli Kung* (Lepcha)

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 0.3 – 0.4 cm long. Flowers actinomorphic, bisexual, reddish white 0.35 cm in diameter. Sepals 5, lightly reddish green, lanceolate, broadly serrated, glabrous with 3 prominent veins, 0.3 – 0.4 x 0.1 – 0.15 cm. Petals creamish white, shorter than sepals, obovate entire, with 3 prominent veins, 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 0.2 – 0.3 cm, anthers 0.1 cm long white yellow, basifixed, dehiscence longitudinal. Disc intrastaminal, deeply 8 – 10 lobed, glabrous greenish yellow, turning reddish at maturity, 0.2 cm in diameter. Carpels 2, stigma bifid, ovary reddish glabrous, 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 0.5 – 0.55 x 0.3 – 0.35 cm.

Flowering: April – May. **Fruiting:** September – October

Exsiccatea: Sandakphu, Darjiling, 3500 m, May 13, 1998, *Lama & AP Das 0041*; Men-Menchu Lake, Sikkim, 3100m, Nov. 14, 2000, *Lama & AP Das 0217*; Meghma 2600 m, May 23, 2012, *Moktan & AP Das 0984*

Distribution: Himalayas: (Darjiling – Nepal), Bhutan, Upper Burma, South China

Ecology: Occurs between 2600 – 3600m

Note: Bark, grayish, parthenocarpic tendency moderate.

Acer sikkimense Miquel in Arch. Neeri. Sci. Nat. 2: 471. 1852; Hooker *f.* in Fl. Brit Ind. 1: 694. 1875; Hara in Fl. E. Him. 1: 192. 1966: 2: 73. 1971; Hara & Williams in En. Fl. Pl. Nep. 2: 98. 1979; Nayar & Datta, Fasc. Fl. Ind. 9: 16. 1982; Das & Chanda in Trans. Bose Res. Inst. 51(4): 104. 1987; Grierson & Long in Fl. Bhutan 2(1): 64. 1991.

Local Name: *Bahuna* (Nepali)

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 3 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 leaves; pedicels short 0.03 – 0.05 cm, glabrous alternate and opposite. Flowers actinomorphic, bisexual, 0.35 cm in diameter; sepals 5 light green, ovate, glabrous obtuse, 0.2 – 0.25 x 1.5 – 2 cm. Petals creamish

white, equal or shorter than sepals, 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 0.1 cm long. Disc intrastaminal, deeply 8 lobed, glabrous greenish to orange, turning brownish at maturity, 0.2 cm in diameter. Carpels 2, stigma bifid, ovary glabrous 0.1 – 0.06 x 0.08 cm; mericarps divergent, 2 – 2.2 x 0.6 – 0.7 cm; wing divergence 44 – 46°; locules slightly flattened, ovoid 0.4 – 0.5 x 0.3 – 0.4 cm.

Flowering: March – April. **Fruiting:** September – October

Exsiccatea: Jalpahar, Darjiling, 2150 m, *AP Das 1630*, September 24, 1984; Jalpahar, Darjiling 2300 m, Feb. 02, 1998, *Lama & AP Das 0009*; Chungthang, Sikkim, 2500 m, Oct. 09, 2000, *Lama & AP Das 0201*; Senchel, Darjiling, 2300 m, Oct. 16, 2012, *Moktan & AP Das 2161*

Distribution: E. Himalaya (Darjiling – Bhutan), Tibet, Myanmar, West China.

Ecology: Common, gynoeceium of the flowers of lower branches becomes abortive and the entire inflorescence easily falls off after shedding pollens, altitudinal distribution between 1200 – 2600 m.

Note: Woods used as building material, also used as common bonsai plant in cooler region.

var. *serrulatum* Pax in Mono. der Gattung, *Acer bot. Jahrb.* 7: 262. 1886

Leaves 3 lobed, ovate-cuspidate, serrulate, dark green, reddish when young, shiny, thick, subcoriaceous, glabrous at maturity.

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

Local Name: *Yatli Kung* (Lepcha)

Small erect trees, 5 – 9 m high, with numerous branches aggregated in clumps. Leaves simple, exstipulate, deciduous, petioles 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 leaves, pedicel 0.4 – 0.5 cm long, green, slightly pubescent. Flowers actinomorphic, bisexual, 0.5 – 0.7 cm in diameter. Sepals 5, ovate, entire, acute, 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 0.2 – 0.25 cm long, white, anthers 0.1 – 0.15 cm long, yellowish, basifixed, dehiscence longitudinal. Disc unlobed, amphistaminal yellowish green when young turning brown at maturity, pubescent 0.15 – 0.2 cm in diameter. Carpels 2, stigma bifid, mericarps narrowly divergent, 2.1 – 2.5 x 1 – 1.4 cm; wings reddish when young, wing divergence 35 – 37°; slightly pubescent, locules flattened, ovoid, 0.45 – 0.5 x 0.35 – 0.4 cm.

Flowering: May. **Fruiting:** September – October

Exsiccatea: Lachung, Sikkim, 3300 m, May 28, 2000, *Lama & AP Das 0208*; Lachen, Sikkim, 3700 m, Oct. 11, 2000, *Lama & AP Das 0229*.

Distribution: Himalayas: (Sikkim – Hubei), Central China.

Ecology: Sparse, vegetative propagation with sucker like branches observed, distributed between 2700 – 3800 m.

Note: Bark grayish, inconspicuously striped, parthenocarpic tendency very high.

Acer sterculiaceum Wallich, Pl. Asia. Rar. 2: 3, t. 105 1831; Hara in Fl. E. Him. 1: 192. 1966: 2: 74. 1971; Hara & Williams in En. F. Pl. Nep. 2: 98. 1979; Nayar & Datta, Fasc. Fl. Ind. 9: 17. 1982; Grierson & Long in Fl. Bhutan 2(1): 68. 1991. *A. villosum* Wallich, Pl. Asia. Rar. 2: 104. 1831; Hooker *f.* in Fl. Brit. Ind. 1: 695. 1875.

Local Name: *Lekh Kapasi* (Nepali)

Trees, 10 – 15 cm 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 – 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 corymb, 10 – 15 cm, long appearing with new leaves; peduncles green, pubescent 1.5 – 3.5 cm long. Flowers actinomorphic, bisexual, 1 – 1.25 cm in diameter. Sepals 5, oblanceolate, dull green, pubescent, 0.35 – 0.4 x 0.2 – 0.25 cm. Petals 5, lanceolate, greenish white, 0.3 x 0.15 – 0.2 cm. Stamens 8, anthers yellow 0.1 – 0.15 cm long, filaments white, 0.2 – 0.3 cm, arising from a slightly 8 lobed yellowish orange amphistaminal slightly pubescent glabrous disc, 0.2 cm in diameter. Carpels 2, very often fusion of flowers leading to tricarpeillary 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 45 – 47°; locules enclosed by thick woody pericarp, green, convex, ovoid, 0.9 – 1 x 0.7 – 0.85 cm, style and stigma persistent even in mature fruit.

Flowering: April – May. **Fruiting:** September – October

Exsiccata: Gairibans, Darjiling, 2700 m, May 12, 1998, *Lama & AP Das 0038*; Bakhim, Sikkim, 2600 m, April 27, 1999, *Lama & AP Das 0152*; Kalpokhari 2900 m, May 21, 2012, *Moktan & AP Das 0864*

Distribution: Darjiling – Sikkim; Bhutan.

Ecology: Frequent, lower nodes of some stem in contact with soil give rise to adventitious roots, distributed between 1800 – 2900 m.

Note: Bark grayish black, slightly fissured, fusion of flowers leading to tricarpeillary condition is common.

Acer thomsonii Miquel in Arch Neeri. Sci. Nat. 2: 470. 1867; Hara, in Fl. E. Him. 1: 193. 1966: 2: 73. 1971; Hara & Williams in En. Fl. Pl. Nep. 2: 98. 1979; Nayar & Datta, Fasc. Fl. Ind. 9: 18. 1982; Das & Chanda in Trans. Bose Res. Inst. 51(4): 104. 1987; Grierson & Long in Fl. Bhutan 2(1): 66. 1991. *A. villosum* Wallich var *thomsonii* (Miquel) Hiern in Fl. Brit Ind. 1: 695. 1875.

Local Name: *Melo Kapasi* (Nepali)

Trees, upto 16 – 20 m high. Leaves simple, exstipulate; petiole pubescent green, 6 – 18 cm long; lamina large 9 – 23 x 7 – 20 cm, broadly ovate to suborbicular, usually 3 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 vein and margin, subcoriaceous. Inflorescence terminal raceme, 8 – 11 cm long, appearing with new leaves, querulous; pedicel 0.8 – 1 cm long, pubescent. Flowers actinomorphic, bisexual or unisexual, 1 – 1.5 cm in diameter. Sepals 5, oblong 0.28 – 0.3 x 0.15 cm, light green, pubescent within. Petals 5, greenish white, exerted, 0.1 – 0.15 cm long; filaments white 0.15 – 0.3 cm, arising from an unlobed yellowish amphistaminal disc; disc yellowish, glabrous, 0.2 cm in diameter. Carpels absent in male flowers, two in bisexual flowers; stigma bifid, white; ovary 2 chambered with two ovules in each chamber. Mericarps ascending, parallel, 6.2 – 6.8 x 1.5 – 1.8 cm; wings somewhat divergent to mericarps parallel, sometimes overlapping or showing angle of divergence 39 – 42°; locules convex, ovoid, 1 – 1.1 x 0.8 – 0.9 cm.

Flowering: October – November. **Fruiting:** April – May

Exsiccatea: St. Mary's Hill, Kurseong, 1550 m, *AP Das 1264*, March 18, 1983; Paglajhora, Darjiling, 1550 m, Nov. 09, 1998, *Lama & AP Das 0092*; Pelong, Sikkim, 1700 m, Oct. 09, 2000, *Lama & AP Das 0202*, Paglajhora, 1550 m May 14, 2010, *Moktan & AP Das 0239*.

Distribution: E. Himalaya (Nepal – Bhutan), Tibet, Myanmar, Western China

Ecology: Common, occurs in stream slopes, large number of fruit produced, parthenocarpic fruit is high; altitudinally distributed between 1200 – 2200 m.

Note: Wood used for building; leaves used for making plates 'tapari' by local people.

DISCUSSION

People from all over the world have been fascinated by the genus *Acer* Linnaeus due to its beautiful appearance and foliage mainly because of its annual changes in leaf colour. It is interesting to note that the present study recorded quite a good number of species of *Acer* from the Darjiling and Sikkim Himalayan belt. The study reveals that the species of *Acer* of this region are distributed from the fringes of the sub-tropical region to the alpine zone. The lowest altitudinal distribution is occupied by *A. thomsonii*. Species like *A. oblongum* and *A. sterculiaceum* shows narrow latitudinal distribution and *A. pectinatum* and *A. caudatum* were distributed in the cold temperate zones while latter occupying higher ranges with respect to its lower and upper range of distribution. The widest ecological amplitude is exhibited by *A. campbellii* and species like *A. sikkimense* and *A. hookeri* exhibits more or less similar distribution. *A. stachyophyllum* and *A. acuminatum* were found to be distributed only in the northern part of Sikkim towards the sub-alpine zone whereas *A. osmastonii* is endemic to Darjiling. It is understood that most of the species occur in the temperate zone and it is also interesting to note that most of the species of *Acer* were found to favour the west and the south facing slopes with few along the east and north facing slopes. Moreover, the different species exhibited higher altitudinal ranges in Sikkim as compared to Darjiling. The steeper slopes in Sikkim may be the reason for such a distribution.

Out of the thirteen species including two varieties, six species are used as construction material and two species are widely used as ornamentals. Although there are enormous data, several taxa belonging to the genus still remains poorly defined.

The endemic *A. osmastonii* is now known by less than 10 individuals only and needs immediate serious attention for its conservation.

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