

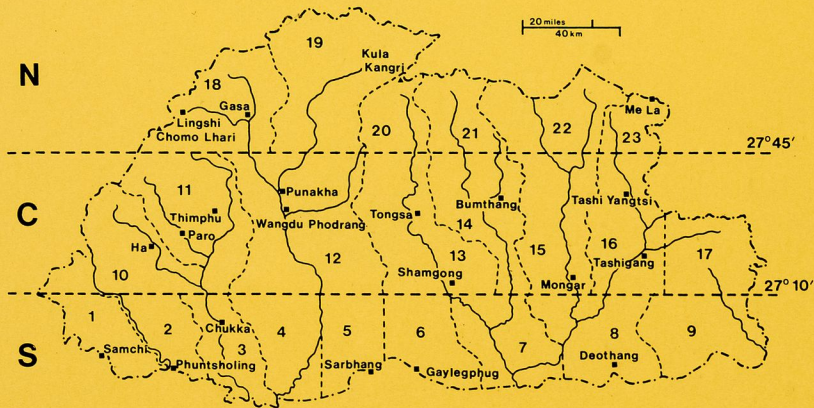
FLORA OF BHUTAN

VOLUME 2 PART 1

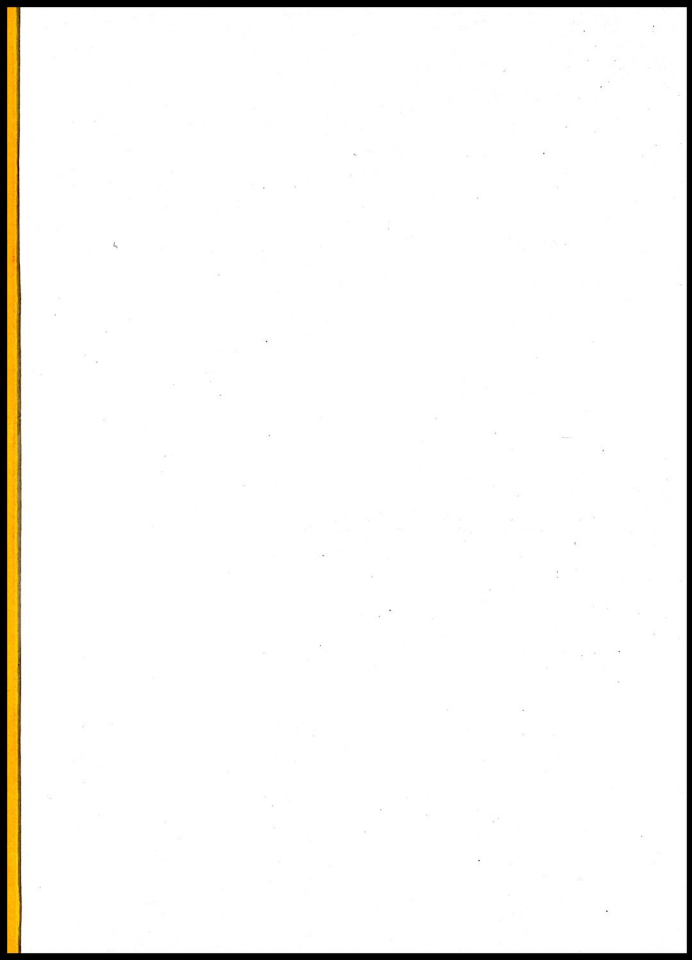
A. J. C. GRIERSON & D. G. LONG
ILLUSTRATIONS BY MARY BATES
AND GLENN RODRIGUES

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ROYAL BOTANIC GARDEN, EDINBURGH
1991



Map of Bhutan showing important rivers and main towns, divided into three zones: south (S), central (C) and north (N), and into 23 botanical districts: 1 Samchi, 2 Phuntsholing, 3 Chukka, 4 Sankosh, 5 Sarbhāng, 6 Gaylegphug, 7 Manas, 8 Deothang, 9 Dhansiri, 10 Ha, 11 Thimphu, 12 Punakha, 13 Tongsa, 14 Bumthang, 15 Mongar, 16 Tashigang, 17 Sakden, 18 Upper Mo Chu, 19 Upper Pho Chu, 20 Upper Mangde Chu, 21 Upper Bumthang Chu, 22 Upper Kuru Chu, 23 Upper Kulong Chu. Drawn by S.J. Rae.



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ROYAL BOTANIC GARDEN, EDINBURGH
1991

FLORA OF BHUTAN

VOLUME 2 (PART 1)

A. J. C. CORRISSON & D. C. BENTON
ILLUSTRATIONS BY MARY BENTON
AND CLIVE BENTON

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Rhododendron kesangiae photographed in Bhutan by K. Rushforth.



Rhododendron kesangiae photographed in Bhutan by K.Rushforth...

the 1990s, the number of people with a mental health problem has increased in the UK (Mental Health Act 1983).

There is a growing awareness of the need to improve the lives of people with mental health problems. The Department of Health (1999) has set out a strategy for mental health care in the UK. The strategy is based on the following principles:

- People with mental health problems should be treated as individuals, with their own needs and wishes.
- People with mental health problems should be given the opportunity to participate in decisions about their care.
- People with mental health problems should be given the opportunity to live in their own homes and communities.

The strategy also sets out a number of objectives for mental health care in the UK:

- To reduce the number of people with mental health problems who are admitted to hospital.
- To improve the quality of care for people with mental health problems.
- To improve the lives of people with mental health problems.

The strategy also sets out a number of actions that need to be taken to achieve these objectives:

- To improve the training and skills of mental health professionals.
- To improve the availability of mental health services.
- To improve the support and care of people with mental health problems.

The strategy also sets out a number of measures that need to be taken to improve the lives of people with mental health problems:

- To improve the housing and accommodation of people with mental health problems.
- To improve the employment and training opportunities for people with mental health problems.
- To improve the social and community support of people with mental health problems.

The strategy also sets out a number of measures that need to be taken to improve the quality of care for people with mental health problems:

- To improve the standards of care for people with mental health problems.
- To improve the safety of people with mental health problems.
- To improve the effectiveness of care for people with mental health problems.

The strategy also sets out a number of measures that need to be taken to improve the availability of mental health services:

- To improve the availability of mental health services in rural areas.
- To improve the availability of mental health services for people with severe mental illness.
- To improve the availability of mental health services for people with learning disabilities.

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1. The first part of the report deals with the general situation in the country.

2. The second part deals with the economic situation.

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INTRODUCTION

We gratefully acknowledge encouragement from the Royal Family of Bhutan, in particular from Her Royal Highness, Queen Ashi Kesang. The spectacular new rhododendron, *R. kesangiae*, one of the most conspicuous and attractive species in the temperate forests of Bhutan, has been named in her honour (see Frontispiece). The efforts of the Royal Family of Bhutan and the Royal Society for the Protection of Nature in preserving the magnificent natural resources of the country cannot be over-estimated and are strongly supported. It is our belief that this *Flora* provides an essential tool in such conservation work, providing, as it does, a basic account of the the plant species occurring in Bhutan and a means of their accurate identification.

We are very sad to have to report the death of our senior author, Andrew Grierson in September, 1990. In spite of recurrent illness over the last two years of his life, his input into the *Flora* remained high, the present part containing much of his work. He also left several important completed manuscripts, including taxonomic papers and the account of the family which was his special interest – Compositae, which will be published in a future part. The continued production of this *Flora* serves as a tribute to his contributions to Himalayan botany, and his determination and hard work in the initiation of this project, and during several, subsequent, difficult periods.

Financial support for this part of the *Flora of Bhutan* from the Overseas Development Administration, London, is gratefully acknowledged, as is the continued co-operation of the Directors, Curators and staff of the Royal Botanic Gardens, Kew, and Natural History Museum, London, for providing facilities for study, assistance with many taxonomic problems, and loans of Himalayan specimens.

During the period of writing of this part, the research team on the *Flora* has been expanded to include Henry Noltie on Monocotyledons and Rosemary Clement (née King) on Dicotyledons. Sally Rae has continued both to contribute taxonomic accounts and to provide invaluable technical and editorial support for the project.

It is a pleasure to acknowledge the work of the following contributors for providing accounts of families in which they have particular expertise: Susyn Andrews (Kew), Christopher Grey-Wilson (formerly Kew), David Boufford and Peter Hoch (both of Missouri Botanical Garden), Anthony Miller (Edinburgh) and Kit Tan (Copenhagen and Edinburgh). Tony Schilling, Wakehurst Place, kindly provided the photograph for the frontispiece.

Changes in style from Volume 1 have been kept to a minimum. The most important change has been a more detailed treatment of species from adjacent countries in the belief that many of these will eventually be discovered in Bhutan. Records from the broad area known as 'Sikkim' since the time of the *Flora of British India*, and treated as such in earlier parts of this *Flora*, are now more accurately assigned to Darjeeling District (West Bengal) or to the state of Sikkim.

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The bibliography continues those provided in Volume 1 Parts 1, 2 and 3. It is divided into two sections, firstly works referred to in this part of the *Flora*, and secondly additional useful references on plants of the East Himalaya, which are not directly referred to in the text.

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ABBREVIATIONS

Abbreviations for languages and dialects of common names of plants used in this volume are:

- Dz: Dzongkha language (W Bhutan and official language)
 Eng: English
 Med: Bhutanese medicinal name
 Nep: Nepali
 Sha: Shachop dialect (E Bhutan).

For other abbreviations, e.g. botanical authorities, users are referred to Volume 1 Part 1, p.34.

Family 86. RUTACEAE

by A.J.C. Grierson

Trees or shrubs, rarely herbs; leaves, flowers and fruits usually bearing numerous oil glands. Leaves opposite or alternate, simple or compound, exstipulate. Monoecious or dioecious; flowers actinomorphic, unisexual or bisexual, in axillary or terminal racemes, corymbs or panicles, sometimes solitary. Calyx 4-5-lobed. Petals 4-5, free, valvate or imbricate. Stamens 4-5 or 8-10 or more (*Aegle* and *Citrus*); filaments free or connate; in female flowers stamens reduced to staminodes. Ovary superior, of 4-5 or more free or connate carpels; in male flowers ovary reduced to pistillode. Fruit a capsule, cluster of follicles, berry or drupe; seeds solitary or few in each cell.

- | | |
|---|---|
| 1. Leaves compound (rarely unifoliolate in <i>Glycosmis</i>) | 2 |
| + Leaves simple | 12 |
| 2. Herbs with bi- or triternate leaves | 1. Boenninghausenia |
| + Shrubs or trees with trifoliolate or pinnate leaves | 3 |
| 3. Leaves all trifoliolate | 4 |
| + Leaves pinnate (rarely some leaves trifoliolate in <i>Zanthoxylum</i> and some unifoliolate in <i>Glycosmis</i>) | 7 |
| 4. Leaves opposite; capsule 4-lobed | 3. Melicope |
| + Leaves alternate; capsule ellipsoid-globose or carpels united only at base . | 5 |
| 5. Leaves pinnately trifoliolate (terminal petiolule longer than laterals); petals c 2cm; stamens numerous; fruit large, 3-5.5cm across | 4. Aegle |
| + Leaves palmately trifoliolate (petiolules equal); petals less than 5mm; stamens or staminodes 4-5; fruit 1cm or less across | 6 |
| 6. Stems usually bearing recurved spines; petals c 3mm; fruit 3-6-grooved | 5. Toddalia |
| + Stems usually unarmed; petals c 2mm; fruit a rounded 1-seeded carpel | 6. Zanthoxylum (<i>Z. ovalifolium</i>) |
| 7. Leaves opposite; fruit 4-5-lobed | 2. Tetradium |
| + Leaves alternate; fruit ellipsoid or subglobose or carpels only united at base | 8 |
| 8. Shoots and/or leaf rachises usually bearing spines; flowers sometimes without petals; carpels united only at base | 6. Zanthoxylum |

- + Unarmed; flowers always with petals; carpels united throughout their length 9
- 9. Petals less than 5mm 10
- + Petals 7 – 17mm 11
- 10. Leaflets usually 5, ± symmetrically cuneate at base; ovary not stipitate **7. Glycosmis**
- + Leaflets usually 7 – 21, asymmetrically cuneate at base; ovary shortly stipitate **8. Clausena**
- 11. Leaflets large, 6 – 15cm; petals thick, whitish puberulous; ovary shortly stipitate **9. Micromelum**
- + Leaflets smaller, 3.8cm; petals thin, ± glabrous; ovary not stipitate **10. Murraya**
- 12. Leaves opposite; flowers in broad corymbs **11. Acronychia**
- + Leaves alternate; flowers in racemes or panicles or sometimes solitary 13
- 13. Erect shrubs always unarmed; flowers in terminal panicles; petals 3 – 5mm; fruit 7 – 10mm **12. Skimmia**
- + Scrambling or erect shrubs or trees, usually spinous; flowers axillary, solitary or in racemes; petals 10 – 20mm; fruit more than 25mm across 14
- 14. Scrambling shrubs usually with short recurved spines; petioles unwinged and obscurely articulated with lamina; fruit 3 – 5-celled **13. Paramignya**
- + Erect shrubs or trees, usually with straight spines; petioles usually broadened and winged and obviously articulated with lamina; fruit 8 – 15-celled **14. Citrus**

1. BOENNINGHAUSENIA Reichenbach

Perennial herbs. Leaves alternate, bi- or triternate; leaflets entire. Flowers bisexual, in terminal cymes. Calyx cup-shaped, 4–5-lobed. Petals 4–5, oblanceolate. Stamens 6–8, inserted on a short disc. Ovary 3–5-lobed, lobes connate only at base, borne on a slender gynophore, each lobe bearing a short ventral style. Fruit a capsule borne on elongated gynophore; seeds 6–8 in each cell.

1. B. albiflora (Hooker) Reichenbach. Med: *Yerma Shing*. Fig. 1 a – d

Stems 45 – 60cm. Leaves 3 – 12cm; leaflets elliptic-obovate, 5 – 20 x 3 – 15mm, pale green, glabrous. Calyx 1 – 1.5mm. Petals 5 – 8 x 3mm, white or pink striped. Stamens slightly longer than petals. Gynophore lengthening in fruit to c 7mm; capsule c 4mm.

Bhutan: S – Gayleghug district, C – Ha, Thimphu, Punakha, Tongsa and Tashigang districts, N – Upper Mo Chu district; **Sikkim; Darjeeling.** Cliffs and dry hill slopes, 1350 – 3050m. August – October.

2. TETRADIUM Loureiro

Evergreen trees. Leaves opposite, usually odd pinnate. Usually dioecious; flowers unisexual, 4 – 5-merous, in terminal corymbs. Stamens the same number as petals. Ovary of 4 – 5 carpels, each 1 – 2-ovulate. Fruit 4 – 5-lobed, lobes follicular, ± connate at base; seeds glossy and smooth, tending to remain attached to follicle after dehiscence.

1. Perianth, stamens and ovary mostly 4-partite; follicles 2-seeded
1. T. fraxinifolium
- + Perianth, stamens and ovary mostly 5-partite; follicles 1-seeded 2
2. Lower surface of leaflets white pubescent **2. T. ruticarpum**
- + Lower surface of leaflets with pubescent midrib at first, later glabrous
3. T. glabrifolium

1. T. fraxinifolium (Hook.) Hartley; *Evodia fraxinifolia* (Hook.) Benth. Dz: *Khanak Pa* (117), *Khanakpa* (34).

Tree to 12m. Leaves 25 – 60cm; leaflets 2 – 7 pairs, ovate-elliptic, 10 – 25 x 3.5 – 8.5cm, acuminate, base ± asymmetrically rounded, margin crenulate, glabrous or sparsely pubescent on both surfaces, marginal oil glands larger than those scattered about lamina. Inflorescence 10 – 25cm, branches pubescent. Flowers usually 4-merous. Calyx 4-lobed, 0.5 – 1.5mm. Petals greenish, 3.5 – 6.5mm. Stamens slightly longer than petals. Ovary glabrous or appressed pubescent; ovules 2 per carpel. Fruits mostly 4-carpellate, connate at base forming a 4-lobed follicle c 10mm across; seeds 2 per cell, subtrigonus c 4mm, black.

Bhutan: S – Gayleghug district (Batasi and Sher Camp), C – Tongsa district (Shamgong) and Tashigang district (Ningala and Shali); **Sikkim; Darjeeling.** Subtropical forest slopes, 860 – 1900m. June.

Fruit used to make chutney and in treatment of dysentery (34).

2. T. ruticarpum (Jussieu) Hartley; *Evodia ruticarpa* (Jussieu) Benth.

Shrub or small tree to 10m. Leaves 15 – 40cm; leaflets 2 – 6 pairs, ovate-elliptic,

FIG. 1. Rutaceae. a – d, *Boenninghausenia albiflora*: a, portion of flowering shoot; b, flower; c, capsule; d, lobe of fruit with persistent style. e – h, *Toddalia asiatica*: e, portion of flowering shoot; f, female inflorescence; g, male flower; h, fruit. i – l, *Zanthoxylum acanthopodium*: i, portion of flowering shoot; j, male flower; k, female flower; l, fruit. m – p, *Citrus sinensis*: m, portion on flowering shoot; n, flower with two petals and part of staminal tube removed; o, fruit; p, part of t.s. of fruit. Scale: a, i x 1/3; e, m, o, p x 1/2; f x 1; n x 2; h, l x 2 1/2; c x 3; b x 4; d, g, j x 6; k x 8. Drawn by M. Bates.



4.5 – 17 x 2 – 8cm, acuminate, base rounded, margin entire, sparsely pubescent above, white pubescent beneath. Flowers mostly 5-merous. Calyx pubescent, 0.5 – 1mm. Petals yellowish, c 4mm. Stamens slightly longer than petals; filaments pubescent. Fruit mostly 5-lobed, c 8mm diameter; seeds black, 1 per lobe.

Bhutan: C – Punakha district (Tamji) and Tongsa district (near Shamgong), N – Upper Mo Chu district (Gasa Dzong); **Sikkim.** On open hillsides, 1950 – 2440m. June.

3. T. glabrifolium (Benth) Hartley; *Evodia meliifolia* (Walpers) Benth; Nep: *Thulo Khanakpa* (34).

Similar to *T. ruticarpum* but a larger tree up to 20m; leaves 15 – 40cm; leaflets 2 – 9 pairs, ovate-elliptic, 5 – 15 x 2 – 6cm, acuminate, base \pm asymmetrically rounded, sparsely pubescent on midrib beneath, later glabrous.

Bhutan: S – Phuntsholing district (Kamji, 117); **Darjeeling:** Sivoke, Tista valley. Subtropical and terai forests, 200m. July.

3. MELICOPE J. R. & G. Forster

Trees. Leaves opposite, trifoliolate. Inflorescence axillary, flowers bisexual, 4-merous. Stamens the same number as petals. Carpels 2-ovulate, fruit capsular; seeds glossy tending to remain attached to dehisced fruit.

1. M. lunu-ankenda (Gaertner) Hartley; *Evodia lunu-ankenda* (Gaertner) Merrill, *E. roxburghiana* Benth. Nep: *Putle Kat*.

Tree 3 – 10m. Leaflets ovate-elliptic, 18 – 25 x 10cm, acute or shortly acuminate, base rounded or cuneate, margin entire, glabrous, pale green beneath, minutely pellucid-glandular; petioles c 10cm. Flowers in dense corymbs. Calyx c 1.5mm. Petals greenish-yellow, ovate 2.5 – 3mm. Stamens slightly longer than petals. Ovary and style densely pubescent.

Bhutan: S – Gayleghug district (Sher Camp); **Darjeeling.** Subtropical forest slopes, 600 – 850m. May.

4. AEGLE Correa

Small spinous trees. Leaves alternate, pinnately trifoliolate. Flowers bisexual, in axillary racemes or panicles. Calyx 4 – 5-toothed. Petals 4 – 5, imbricate. Stamens numerous; anthers elongated. Ovary oblong; style thick. Fruit ellipsoid or broadly ovoid; seeds numerous in 9 – 12 rows surrounded by an amorphous creamy pulp; rind woody, reddish.

1. A. marmelos (L.) Correa. Eng: *Bael*

Tree up to 10m; shoots dimorphic, some spineless others bearing straight spines 1.5 – 2.5cm. Leaves 7 – 18cm; leaflets ovate-elliptic, 5 – 12 x 2 – 5cm, bluntly acuminate, base cuneate, margins crenate, glabrous or sparsely pubescent; petiole

3–4cm unwinged. Calyx cup-shaped, 1–1.5mm. Petals elliptic-oblong, 1–1.3cm, white. Ovary oblong, 3–4mm. Fruit ellipsoid or broadly ovoid, 5 x 3cm, or (when cultivated) 15 x 10cm.

Darjeeling: Sivoke Terai. Cultivated. May–June.

Stem yields a useful gum (126); fruit is used medicinally in treatment of diarrhoea and dysentery (48, 126).

5. TODDALIA Jussieu

Scrambling shrubs; stems often armed with curved spines. Leaves palmately 3-foliolate. Flowers unisexual, axillary; male flowers paniculate; female flowers racemose, 5-merous. Fruit broadly ovoid, 3–6-grooved, orange coloured.

1. T. asiatica (L.) Lamarck; *T. aculeata* Persoon; Sha: *Kapore Ru, Khaytore Shing*; Nep: *Shingane, Mein Khanra* (34). Fig. 1 e–h

Shoots brownish puberulous; spines c 2mm. Leaflets elliptic or oblanceolate, 3.5–10 x 2–3.5cm, acute or acuminate, base cuneate, \pm sessile, margin crenate or serrulate, glabrous; petiole 2.5–4.5cm. Calyx c 1mm. Petals greenish, c 3.5mm, caducous in female flowers. Stamens slightly longer than petals, arranged around shorter pistillode. Ovary ovoid, c 3mm, surrounded by staminodes c 1mm. Fruit broadly ovoid, 0.75–1cm, \pm acute, orange coloured.

Bhutan: S – Phuntsholing, Chukka and Gaylegphug districts, C – Mongar district, N – Upper Mo Chu district; **Darjeeling.** Scrambling on shrubs, 200–2060m. February.

Fruit edible (34).

6. ZANTHOXYLUM L.

Shrubs, often armed with stout spines. Leaves alternate, trifoliolate or odd-pinnate; rachis often winged between leaflets and sometimes bearing a spine at their points of insertion. Dioecious; flowers unisexual, in terminal or axillary panicles. Perianth either uniseriate with 4–8 undifferentiated segments or biseriate with 4–5 sepals and 4–5 petals. Stamens 4–8, male flowers usually with 1–4 reduced carpels. Female flowers with 1–4 distinct carpels surrounded by minute staminodes. Fruit of 1–5 globose, coriaceous or fleshy 1-seeded carpels.

1. Perianth uniseriate or \pm irregularly biseriate with 4–8 equal undifferentiated segments; branches usually armed with pseudostipular, straight, \pm compressed spines; petioles and leaf rachis usually winged (except *Z. bungeanum*) 2
- + Perianth biseriate, clearly differentiated into 4–5 sepals and 4–5 petals; branches armed with scattered, short, straight or hooked spines; petioles and leaf rachises unwinged 4

2. Branches usually ferruginous pubescent or sometimes glabrous; lateral veins up to 30 pairs; inflorescences axillary, 0.5 – 2cm; carpels 2 – 5
3. *Z. acanthopodium*
- + Branches mostly completely glabrous; lateral veins up to 15 pairs; inflorescences terminal on short lateral branches 3 – 8cm; carpels 1 – 3 3
3. Leaf rachis winged between leaflets **1. *Z. armatum***
 + Leaf rachis unwinged between leaflets **2. *Z. bungeanum***
4. Leaves always palmately 3-foliolate; carpel solitary **4. *Z. ovalifolium***
 + Leaves pinnate, or if 3-foliolate then carpel more than one 5
5. Tall erect trees with septate pith; inflorescence terminal, corymbose; spines on branches with broad stout conical bases 6
 + Scrambling shrubs with non-septate pith; inflorescence terminal or axillary; spines without conical bases 7
6. Flowers 4-merous; carpels solitary **5. *Z. rhetsa***
 + Flowers 5-merous; carpels 4, abortive ones persisting at base of follicle
6. *Z. myriacanthum*
7. Leaflets 2 – 3 pairs, 5 – 15 x 2.5 – 6cm **7. *Z. nitidum***
 + Leaflets 6 – 10 pairs, 3.5 – 6 x 1 – 3cm 8
8. Branchlets and inflorescence \pm glabrous; flowers to 0.7cm, subumbellate
8. *Z. oxyphyllum*
 + Branchlets and inflorescence brownish tomentose; flowers c 0.5cm, in sparsely branched panicles **9. *Z. tomentellum***

1. *Z. armatum* DC.; *Z. alatum* Roxb. Dz: *Thingney*; Sha: *Gi*; Nep: *Bale Timur* (34), *Timbur*.

Shrub or tree to 7m; shoots glabrous, bearing stipular spines up to 0.5cm, rarely unarmed. Leaves pinnate, 8 – 12cm; leaflets 3 – 5 pairs, elliptic-lanceolate, (1.5 –)3 – 7.5 x (0.75 –)1 – 2.5cm, acuminate, base rounded or cuneate, \pm sessile, margins usually entire, sometimes crenate-serrate with a large gland associated with each tooth; petiole and rachis often winged between leaflets and sometimes bearing a spine at the point of insertion. Flowers in terminal panicles on short lateral shoots. Perianth segments 0.5 – 1mm. Male flowers with 6 – 8 stamens; filaments c 2mm arranged around globose pistillode. Female flowers with 2(– 4) ovoid carpels with a style \pm as long. Fruit reddish, ovoid, 5 – 6mm, glandular-warted, each containing a single black seed 2 – 3mm.

Bhutan: S – Phuntsholing and Chukka districts, C – Thimphu, Punakha and Tongsa districts, N – Upper Mo Chu district; **Darjeeling;** **Chumbi.** Broad leaved forests, 250 – 3500m. April – May.

Wood used to make walking sticks; fruit used in treatment of toothache (48).

2. **Z. bungeanum** Maximowicz; ?*Z. nepalense* Babu. Dz: *Thinge*; Sha: *Gee Shing*; Nep: *Timbur*.

Very similar to *Z. armatum* but spines usually larger and broader, up to 1.5 x 1cm; leaf rachis unwinged; leaflets 2 – 4.5 x 1 – 1.5cm, ovate, acute, margins crenate.

Bhutan: C – Ha, Thimphu and Tashigang districts. Dry hillsides, 2375 – 3000m. April – May.

3. **Z. acanthopodium** DC. Nep: *Boke Timur* (34), *Boke Timbur*. Fig. 1 i – l

Similar to *Z. armatum* but branchlets densely brown tomentose, rarely glabrous; leaves up to 30cm; leaflets ovate or lanceolate, up to 10 x 3cm, acuminate, base rounded, margin serrate; wings up to 1cm broad between leaflets; inflorescence axillary, in short dense clusters c 1 – 1.5cm.

Bhutan: S – Phuntsholing, Chukka and Deothang districts, C – Punakha, Tongsa and Mongar districts, N – Upper Mo Chu district; **Darjeeling.** Warm mixed forests, 1220 – 2440m. October – February.

4. **Z. ovalifolium** Wight. Nep: *Nange Timur* (34).

Erect usually unarmed shrub or small tree up to 8m. Leaves palmately 3-foliolate; leaflets elliptic-oblong or obovate, 8 – 15 x 2.5 – 5cm, abruptly acute, base attenuate, margin shallowly crenate, glabrous; petioles 1.5 – 3cm. Panicles axillary and terminal, up to 15cm; flowers 4-merous. Male flowers: calyx c 0.5mm; petals elliptic c 2mm; stamens 2mm; pistillode c 0.5mm. Female flowers: calyx and petals similar to male; staminodes 4, c 1mm; carpel solitary, ovoid, c 2mm. Fruit broadly ovoid, c 7mm.

Darjeeling: Rongsong, Tista, Rieng, etc. Subtropical forests, 300 – 600m. May – June.

5. **Z. rhetsa** (Roxb.) DC.; *Z. budrunga* (Roxb.) DC.

Erect deciduous tree up to 30m; main stem armed with 2 – 4cm spines with broad (4 – 5cm) bases; branches with septate pith and bearing straight or curved spines 2 – 4mm. Leaves appearing with flowers, crowded at branch ends, odd-pinnate, 20 – 60cm; leaflets 4 – 15 pairs, ovate, 7 – 15 x 3 – 5cm, acuminate, base asymmetrically rounded, entire to remotely crenate with glands at the base of teeth, glabrous with or without pellucid glands. Panicles terminal and axillary, corymbose, up to 25cm, often spiny. Male flowers: calyx 4-lobed, c 0.5mm; petals 4, oblong, 2 – 2.5mm; stamens 4, 2 – 3mm. Female flowers: calyx and petals as in male flowers; staminodes absent; carpel solitary. Follicles subglobose, 0.8 – 1cm.

Darjeeling. Subtropical forests, 190 – 290m. March – May.

6. **Z. myriacanthum** Hook. f.

Similar to *Z. rhetsa* but flowers 5-merous; carpels 1 – 4; follicles 1 – 4, subglobose, c 5mm across, with 1 – 3 persistent abortive carpels at base.

Bhutan: C – Mongar district (Ngasam and Zimgang); **Darjeeling.** Warm broad-leaved forests, 650 – 1500m.

7. **Z. nitidum** (Roxb.) DC.; *Z. hamiltonianum* Hook. f. Nep: *Parpar Timur* (34).

Scrambling shrub; twigs glabrous or tomentose, generally armed with scattered hooked spines. Leaves odd-pinnate; leaflets 1 – 3 (– 4) pairs, ovate-elliptic to oblong, 5 – 15 x 3.5 – 7cm, ± abruptly acuminate, base rounded or crenate, entire to remotely glandular crenate, glabrous or pubescent beneath; leaf rachis usually armed with a few spines. Panicles axillary. Male flowers: calyx 4-lobed, c 1mm; petals 4, elliptic, c 3mm; stamens 4, 4 – 5mm; pistillodes 4, linear, c 1mm. Female flowers; calyx and petals as in male flowers; staminodes absent; carpels 4, ovoid, 2–2.5mm. Follicles up to 4, globose or subcompressed, with up to 3 abortive carpels persisting at base. Seeds rounded, c 4mm.

Darjeeling. Broad-leaved forests. May.

Fruit edible (34).

8. **Z. oxyphyllum** Edgeworth. Dz: *Dretsang*; Nep: *Bhainsi Timur* (34), *Lahara Timur* (34).

Scrambling shrub; twigs usually armed with hooked spines. Leaves odd-pinnate, 5 – 30cm; leaflets 1 – 10 pairs, ovate-lanceolate to oblong, 3 – 7 x 1.5 – 3cm, acute or acuminate, base rounded or cuneate, margin glandular crenate, glabrous; leaf rachis and leaflets usually bearing spines beneath. Flowers in subumbellate panicles. Male flowers: calyx 4-lobed, 1.5 – 2mm; petals 4, ovate-elliptic, 3.5 – 5 x 2 – 3mm; stamens 4, 7 – 8mm; pistillodes 1 or 2, 1 – 1.5mm. Female flowers: calyx and petals as in male flowers; staminodes absent; carpels 4, ovoid, 4 – 4.5mm; styles cohering. Follicles up to 4, subglobose, 5 – 6mm; abortive carpels persisting at base.

Bhutan: S – Chukka district, C – Thimphu, Punakha and Tongsa districts, N – Upper Mo Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim;** **Darjeeling.** Wooded valleys and riverbank shingle, 1980 – 2745m. April – May.

9. **Z. tomentellum** Hook. f.

Similar to *Z. oxyphyllum* but branches brownish tomentose, armed with scattered hooked spines; leaves odd-pinnate, 15 – 30cm; petiole and leaf rachis brown tomentose, armed beneath with hooked spines; leaflets 6 – 8 pairs, ovate-oblong to elliptic, 3.8 x 1.5 – 3.5cm, acute or shortly acuminate, base rounded, sparsely pubescent above, brown tomentose especially along veins beneath; panicles terminal or axillary, sparsely branched, tomentose; male flowers: calyx 4-lobed, c 2mm; petals 4, oblong, 3 – 3.5mm; stamens 4, c 5mm; pistillode ovoid, 1.5 – 2mm; female flowers: calyx and petals as in male flowers; staminodes absent; carpels 4, ovoid, c 2mm; follicles 1 – 4, c 5mm across, with persistent abortive carpels at base; seeds black.

Bhutan: C – Punakha, Tongsa and Bumthang districts. 2000 – 2100m. April.

7. GLYCOSMIS Correa

Evergreen shrubs or small trees, unarmed. Leaves alternate, odd-pinnate. Flowers bisexual, in axillary cymes or panicles. Calyx 4–5-lobed. Petals 4–5, glandular. Stamens 8; filaments broadened above. Ovary ovoid, glandular; stigma sessile. Fruit a fleshy berry with a single seed.

1. Leaflets elliptic; flowers in panicles \pm as long as leaves ... **1. G. pentaphylla**
 + Leaflets ovate, gradually acuminate; flowers in compact cymes much shorter than leaves **2. G. cymosa**

1. G. pentaphylla (Retzius) DC.; *G. arborea* (Roxb.) DC.

Shrub or tree to 6m. Leaves up to 30cm; leaflets usually 5, elliptic, 12–15 x 3–5cm, acuminate, base cuneate, glandular crenate, glabrous. Panicles \pm as long as leaves. Calyx lobes 5, ovate, c 1.5mm. Petals white, obovate, c 5 x 3mm. Stamens 10, alternately long and short, 3–4mm. Ovary ovoid, c 1.5mm; style very short; stigma capitate. Fruit subglobose, 8–10mm diameter, red, 1-seeded.

Bhutan: S–Samchi, Phuntsholing, Sankosh and Sarbhang districts, C–Tongsa district; **Darjeeling:** Subtropical forests, 300–600m. March.

2. G. cymosa (Kurz) Narayanaswami; *G. pentaphylla* sensu F.B.I. p.p. non (Retzius) DC., *G. cyanocarpa* sensu Tanaka non (Blume) Sprengel.

Similar to *G. pentaphylla* but leaflets ovate, up to 18 x 6cm, gradually acuminate, base rounded; cymes 3–6cm; calyx lobes ovate, c 1.5mm, pubescent; petals obovate, c 5 x 3mm; stamens 3–4mm; ovary c 1.5mm; fruit oblong, 10–15 x 8–10mm, 1-seeded.

Bhutan: S–Samchi district (Buduni and Khagra Valley) and Sarbhang district (Lam Pati and Longa Khola); **Sikkim; Darjeeling; W Bengal Duars.** Subtropical forest, 300–500m. March.

8. CLAUSENA Burman

Unarmed shrubs or trees. Leaves alternate, odd-pinnate. Flowers bisexual, in terminal or axillary panicles or racemes. Calyx 4–5-lobed. Petals 4–5, free. Stamens 8–10, inserted on an elongated disc, alternately longer and shorter; filaments broadened below. Ovary ovoid, shortly stipitate; style thick, \pm as long as ovary. Berry small, 1-seeded.

1. Leaves 3–7-foliolate; leaflets 12–22cm **3. C. pentaphylla**
 + Leaves 9–30-foliolate; leaflets 4–8cm **2**
2. Inflorescence terminal **1. C. excavata**
 + Inflorescence axillary **2. C. dentata**

1. *C. excavata* Burman

Shrub or small tree; branchlets and leaf rachises spreading pubescent. Leaves up to 30cm; leaflets 7 – 15 pairs, ovate, 3.5 – 7 x 1.5 – 2.5cm, acuminate, base very asymmetrically cuneate, margin entire, pubescent especially beneath. Flowers in terminal panicles 15 – 20cm. Calyx lobes ovate, 0.5 – 1mm, pubescent. Petals obovate, c 4 x 2mm, sparsely pubescent and pellucid-glandular. Stamens 2.5 – 3mm. Ovary ovoid, c 1mm, on stipe c 0.5mm; style c 1mm. Fruit broadly oblong, c 15mm.

Bhutan: locality unknown; **Darjeeling:** below Sivoke Terai, Siliguri. Terai forests. April – May.

2. *C. dentata* (Willdenow) Roemer; *C. willdenowii* Wight & Arnott.

Similar to *C. excavata* but leaves 15 – 30cm; leaflets 4 – 6 pairs, ovate, 3 – 9 x 1.5 – 5cm, acuminate, base asymmetrically rounded, margin crenate-serrate, sparsely pubescent especially beneath; flowers in axillary racemes 5 – 15cm; calyx c 0.5mm; petals elliptic-oblongate, 3 – 4mm; stamens c 2mm; ovary c 0.5mm, on stipe c 0.5mm; style c 1.5mm; fruit 1.5cm diameter.

Darjeeling. Terai forests, 600m. April – May.

3. *C. pentaphylla* DC.

Shrub. Leaflets 1 – 3 pairs, ovate-elliptic, 12.5 – 22cm, acuminate, base \pm asymmetrically cuneate, entire or obscurely crenate, pubescent beneath. Panicles 10 – 25cm, pubescent. Flowers c 5mm diameter. Fruit oblong, c 8mm diameter, pale orange, pellucid glandular.

Darjeeling.

This record (34) requires confirmation.

9. MICROMELUM Blume

Unarmed trees. Leaves odd-pinnate; leaflets alternate. Flowers bisexual, in corymbose panicles. Calyx tube cup-shaped, shortly 5-lobed. Petals 5, free, valvate. Stamens 10, alternately longer and shorter. Ovary ovoid, pubescent, shortly stipitate; style thick, \pm as long as ovary. Fruit a 1 – 2-seeded berry.

1. *M. integerrimum* (Colebrooke) Roemer; *M. pubescens* sensu F.B.I. non Blume.

Tree up to 6m. Leaves 15 – 50cm, 7 – 10-foliolate; leaflets ovate-elliptic, 6 – 15 x 3 – 4cm, acuminate, base asymmetrically rounded or cuneate, entire, sparsely pubescent at least on midrib above and beneath. Panicles many-flowered, fragrant, pubescent. Calyx cup c 1mm. Petals white, oblong, c 8mm, puberulous. Stamens 5 – 6mm. Fruit ellipsoid, c 10 x 6mm, orange.

Bhutan: S – Samchi, Phuntsholing and Gaylegphug district, C – Tongsa district; **Darjeeling.** Subtropical jungle slopes and terai, 300 – 1050m. February – March.

10. MURRAYA L.

Unarmed shrubs or small trees. Leaves pinnate; leaflets alternate. Flowers bisexual, in lateral or terminal corymbs. Calyx cup-shaped, 5-lobed. Petals 5, free, imbricate. Stamens 10, alternately longer and shorter. Ovary 2–5-celled, narrowed into style; stigma capitate. Berry oblong, 1–2-seeded.

1. Leaves 3–7-foliolate; leaflets 3–10 x 1.5–5cm; petals 1.8–2cm

1. *M. paniculata*

+ Leaves 13–23-foliolate; leaflets 1.5–6.5 x 0.8–2.5cm; petals c 0.6cm

2. *M. koenigii*

1. *M. paniculata* (L.) Jack; *M. exotica* L.

Evergreen shrub or tree to 6m. Leaves 12–15cm, 3–7-foliolate; leaflets ovate, 5–10 x 2–5cm, bluntly acuminate, base \pm asymmetrically cuneate, margin entire, glabrous. Inflorescence up to 20-flowered. Calyx c 1mm. Petals greenish white, oblanceolate, c 1.8 x 0.5cm. Stamens 8–10mm. Style c 12mm. Berry ovate, c 8 x 5mm.

Bhutan: S – Samchi, Phuntsholing, Sankosh and Gaylegphug districts, C – Tongsa and Mongar districts; **Darjeeling.** Subtropical forest slopes, 200–1250m. March – April.

2. *M. koenigii* (L.) Sprengel. Sha: *Ngebtang Shing*; Nep: *Mechia Sag* (34), *Murraya*.

Similar to *M. paniculata* but a shrub or tree to 3m; leaves 15–25(–30)cm; leaflets 13–23, ovate 1.5–6.5 x 0.8–2.5cm, acuminate, base \pm asymmetrically rounded or cuneate, margins minutely crenate, sparsely pubescent or glabrous; corymbs with more numerous flowers; calyx c 1mm; petals c 5 x 1.5mm; stamens 4–5mm; style c 5mm; fruit ovoid, 8–9 x 7–8mm, crimson.

Bhutan: S – Samchi and Phuntsholing districts, C – Tongsa, Mongar and Tashigang districts; **Darjeeling.** Subtropical forest slopes, 200–2850m. February – March.

Leaves used in curries (34).

11. ACRONYCHIA Forster

Trees or shrubs. Leaves opposite, simple, articulated at base. Flowers bisexual, in corymbs. Calyx 4-lobed. Petals 4, free, valvate. Stamens 8, alternately longer and shorter. Ovary 4-celled. Fruit a fleshy capsule with 2 seeds per cell.

1. *A. pedunculata* (L.) Miquel; *A. laurifolia* Blume. Nep: *Puanle* (34).

Leaves ovate or elliptic, 8–25 x 3–7.5cm, bluntly acuminate, base cuneate, entire, glabrous. Inflorescence few to many-flowered. Calyx 1–1.5mm. Petals oblong, 4.5–6mm, becoming reflexed. Stamens 3–4mm. Ovary densely pubescent,

c 3mm; style c 2mm, glabrous. Capsule subglobose, 8 – 10mm, apex acute with 4 appressed teeth.

Bhutan: S – Chukka district (Gedu and Chukka); **Darjeeling:** Sivoke Terai, Tista valley. Subtropical forests, 900 – 1120m. July.

12. SKIMMIA Thunberg

Small shrubs or trees. Leaves alternate, simple, entire. Dioecious; flowers in terminal racemes or panicles, unisexual. Calyx 5-lobed. Petals 5, oblong, ± imbricate. Stamens 5, reduced to staminodes in female flowers. Ovary obovoid, 2 – 5-celled; style terminal; stigma capitate; ovary reduced to a pistillode in male flowers. Drupe ovoid, fleshy, red or black, containing 2 – 5 hard 1-seeded stones.

The following key is partly based on unpublished information kindly supplied by N.P. Taylor, Kew.

1. Creeping semi-stoloniferous shrub seldom exceeding 1m.
 - 1a. S. laureola** subsp. **laureola**
 - + Erect shrub or tree, 1 – 10(– 15)m, arising from a single stem or trunk 2
2. Primary lateral veins of leaves (excluding those whose ramifications do not approach margins) 10 – 20 pairs; leaf apex acute to caudate; panicles pyramidal, branched throughout; fruit black
 - 1b. S. laureola** subsp. **multinervia**
 - + Primary lateral veins of leaves 5 – 8 pairs; leaf apex caudate; panicles globose to linear often with only 1 – 2 branches at base; fruit red 3
3. Leaves thin, usually dull beneath ... **2a. S. arborescens** subsp. **arborescens**
 - + Leaves leathery, often glossy beneath **2b. S. arborescens** subsp. **nitida**

1a. S. laureola (DC.) Walpers subsp. **laureola**; *S. melanocarpa* Rehder & Wilson, *S. wallichii* Hook.f. & Thomson. Nep: *Jainberiphul* (34).

Semi-prostrate shrub, seldom exceeding 1m. Leaves elliptic-oblongate, 4 – 10 x 2 – 3cm, acute, base cuneate. Flowers in short racemes. Calyx c 1.5mm. Petals greenish yellow, oblongate, 4.5 – 5 x 1.5mm. Stamens c 3mm. Ovary ovoid, c 2mm. Fruit subglobose, 7 – 8mm diameter, black.

Bhutan: C – Ha, Thimphu, Tongsa and Tashigang districts, N – Upper Kuru Chu district; **Sikkim;** **Darjeeling.** Banks in Fir/Rhododendron forests, 2895 – 3200m. April – May.

1b. S. laureola (DC.) Walpers subsp. **multinervia** (Huang) Taylor & Airy Shaw.

Tree to 8m. Leaves coriaceous, oblongate 10 – 18 x 2.5 – 5.5cm acute to caudate, base attenuate, primary lateral veins 10 – 20 pairs. Panicles large, much-branched. Flowers and fruits similar to those of subsp. *laureola*.

Bhutan: C – Punakha, Tongsa and Tashigang districts, N – Upper Kulong Chu district; **Darjeeling:** Rechi La. Rhododendron forests, 2440 – 2750m. April – May.

2a. *S. arborescens* Gamble subsp. ***arborescens***; *S. laureola* sensu F.B.I. p.p. non (DC.) Walpers. Nep: *Tsaulane*, *Chumlani* (34), *Limbuniphul* (34).

Similar to *S. laureola* but a shrub or tree 2 – 10m; leaves elliptic-oblongate, 6 – 15 x 2 – 5.5cm, caudate acuminate, base cuneate, ± membranous, primary lateral veins 5 – 8 pairs; racemes small; calyx 1 – 1.5mm; petals 3 – 5mm; stamens 2 – 4mm; ovary c 1.5mm; fruit ellipsoid, c 8 x 6mm, red.

Bhutan: S – Chukka district, C – Thimphu, Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Kuru Chu district; **Darjeeling.** In shaded broad-leaved forests, 1525 – 2560m. April – May.

2b. *S. arborescens* Gamble subsp. ***nitida*** Taylor & Airy Shaw.

Similar to subsp. ***arborescens*** but leaves more coriaceous and glossy beneath.

Bhutan: S – Chukka, Sarbhang and Gaylegphug districts, C – Thimphu district; **Darjeeling.** Broad-leaved forest slopes, 1760 – 2133m. February – March.

13. PARAMIGNYA Wight

Scrambling evergreen shrub, usually armed with recurved axillary spines. Leaves subcoriaceous, alternate, simple, entire. Flowers bisexual, axillary, solitary or in racemes. Calyx cup-shaped, 4 – 5-lobed. Petals 4 – 5, free, imbricate. Stamens 8 – 10, free, inserted around columnar disc. Ovary densely pubescent, 3 – 5-celled, with 1 or 2 ovules in each cell. Berry obovoid or globose, usually 1-seeded.

1. *P. monophylla* Wight. Nep: *Natkanta* (34).

Leaves oblong-elliptic, 5 – 11 x 2 – 5.5cm, acute or shortly acuminate, base rounded or cuneate; petioles 5 – 15mm. Calyx c 3mm with rounded lobes. Petals white, oblong-elliptic, 1.5 x 0.4cm. Stamens, c 1cm. Ovary and style c 1cm. Fruit globose, 2.5 – 3.5cm; rind thick, yellow.

Bhutan: C – Punakha district (Neptengka) and Tongsa district (Pertimi); **Darjeeling:** Jalpaiguri, Tista. Subtropical and Warm broad-leaved forest scrub, 300 – 1500m. March – April.

14. CITRUS L.

Small trees, branches usually armed with straight spines. Leaves simple; petioles winged and articulated with lamina. Flowers bisexual, rarely unisexual, solitary or in short axillary racemes. Calyx 4 – 5-lobed. Petals 4 – 5, free, gland-dotted, imbricate. Stamens numerous, free or united at base. Ovary globose or cylindrical; style distinct or tapering into ovary; stigma capitate. Fruit a berry, with segments filled with stalked pulp vesicles and bearing seeds at inner angles, the whole surrounded by gland-dotted peel, green, often turning yellow or orange at maturity.

The species of *Citrus* hybridise among themselves and with species of closely related genera. There also exist many cultivars. For these reasons specimens may not accord in all respects with the descriptions given below and probably the best guide to the 'species' is the fruit.

1. Petioles as broad as leaf lamina **1. C. latipes**
+ Petioles not broadened or not as broad as leaf lamina 2
2. Leaves oblong-elliptic; articulation with petiole sometimes indistinct; petals pink outside **2. C. medica**
+ Leaves ovate-elliptic, articulation with petiole usually obvious; petals white outside (but purplish in *C. limon*) 3
3. Fruit orange or scarlet-orange when ripe 4
+ Fruit yellow or greenish when ripe 5
4. Peel thin or thickish, closely attached, orange **3. C. sinensis**
+ Peel thin, loosely attached, bright orange or scarlet orange .. **4. C. reticulata**
5. Leaves 5 – 10cm; petiole broadly winged; fruit very large, more than 9.5cm diameter, with thick (c 2.5cm) peel **5. C. maxima**
+ Leaves 4 – 9.5cm; petioles narrowly winged; fruit up to 5 – 6cm diameter, with thinner peel 6
6. Petals white on outside; fruit small, ovoid or subglobose, often with a small apical mamilla, greenish-yellow when ripe; peel very thin
6. C. aurantifolia
+ Petals purplish outside; fruit ovoid-subcylindric, with a broad apical mamilla, yellow when ripe; peel rather thick **7. C. limon**

1. C. latipes (Swingle) Tanaka. Shamgong: *Kenga*; Nep: *Namphar*.

Tree 4 – 10m, with spiny trunk; twigs with small spines 4 – 5mm. Leaves ovate, 4 – 7 x 1.5 – 2.5cm, acuminate, base rounded, margin minutely crenate-serrate, glabrous; petiole obovate, often larger than the lamina, 3.5 – 7 x 2 – 3cm. Flowers solitary or in short racemes, 4-merous. Calyx c 4mm. Petals 10 x 6mm, purplish outside, white within. Stamens c 9mm. Ovary subglobose, c 2.5mm; style c 5mm rather stout, distinctly articulated with ovary; stigma capitate, c 4mm broad. Fruit subglobose, c 5cm diameter; peel somewhat thick; segments c 9, seeds numerous.

Bhutan: C – Tongsa district (near Tongsa and Shamgong). Broad-leaved forest slopes, 1920 – 2100. May.

2. *C. medica* L. Dz: *Phumpa, Humpa*; Sha: *Kapoor-zaymo, Numpang*; Nep: *Bogati, Bimira, Bimera, Samphor* (117); Eng: *Citron*.

Shrub or small tree to 3m; twigs with stout spines up to 4.5cm. Leaves elliptic-oblong, 6–11 x 2–5cm, obtuse or acute, base rounded or cuneate, margin crenate-serrate; petiole up to 10mm, usually unwinged. Flowers in small racemes, 5-merous. Calyx c 5mm. Petals pink outside, white within, elliptic, c 1.5 x 1cm. Filaments c 10mm; anthers elongate, 4–5mm. Ovary oblong, c 6mm, tapering into thick style 6–7mm; stigma subglobose, c 3mm. Fruit oblong up to 18 x 10cm, ridged and furrowed longitudinally and transversely, c 10-celled; peel thick and hard, yellow; seeds numerous.

Bhutan: S – Samchi, Phuntsholing, Chukka, Sarbhang and Deothang districts, C – Punakha, Tongsa and Tashigang districts; **Darjeeling.** Subtropical and warm broad-leaved forests, 285 – 1680m. February – June.

Cultivated for its edible fruit.

3. *C. sinensis* (L.) Osbeck. Sha: *Tore Churpo*; Nep: *Jambir, Soklatey*; Eng: *Sweet Orange*. Fig. 1 m – p

Tree up to 10m; twigs spineless or with short spines 2–3mm. Leaves ovate-elliptic, 7–9 x 3–4cm, bluntly acuminate, base rounded, margin obscurely crenate-serrate; petiole c 1cm, narrowly winged. Flowers in short racemes or solitary, axillary, 5-merous. Calyx 2–3mm. Petals white, oblong, c 15 x 6mm. Stamens c 14mm. Ovary subglobose; style slender, clearly delimited from ovary, soon deciduous. Fruit subglobose or ovoid, 6–8cm, 10–13-celled; peel orange, thin, closely attached, smooth; central axis solid; seeds usually few.

Bhutan: S – Sarbhang and Deothang districts, C – Mongar district; **Darjeeling.** Cultivated, 450 – 1300m. March.

Cultivated for its edible fruit. Records of *C. aurantium* L. (34) from Darjeeling refer to this species.

4. *C. reticulata* Blanco. Dz: *Tshelu*; Sha: *Tshalu*; Nep: *Suntala* (117); Eng: *Mandarin Orange*.

Tree c 3m; twigs mostly spineless. Leaves ovate-lanceolate, 5–7 x 2–3cm, acute but with blunt tip, base cuneate, margin obscurely crenate; petiole c 0.7cm, narrowly winged. Flowers solitary or in axillary clusters, similar to those of *C. sinensis*. Fruit globose or depressed-globose, 5–10cm diameter; peel thin, loosely attached, easily separating from 8–9 segments, bright orange or scarlet orange.

Bhutan: S – Samchi district (Tamangdhanra Forest), C – Thimphu district (Pao and Thimphu, 117). Cultivated, 650 – 2400m.

Cultivated for its edible fruit.

5. *C. maxima* (Burman) Merrill; *C. grandis* (L.) Osbeck, *C. decumana* L. Dz: *Drehumpa*; Sha: *Noom-pang, Solonji*; Nep: *Poksey, Sangkatra* (34), *San Katra*; Eng: *Pummelo, Shaddock*.

Tree 6–7m; twigs spiny or not. Leaves 5–10 x 3.5–5cm, obtuse, base rounded,

margin obscurely crenate, pubescent along midrib beneath; petiole c 1.5cm, broadly winged, 5mm or more broad. Flowers solitary or in axillary clusters, 5-merous. Calyx c 4mm. Petals white, oblong, c 2 x 0.6cm. Stamens c 15mm. Ovary subglobose, sharply delimited from deciduous style. Fruit globose or subpyriform, 10 – 15cm diameter, 13 – 14-celled; peel yellow, 3 – 4cm thick.

Bhutan: S – Sarbhang district (Kami Khola) and Deothang district (Deothang);
Darjeeling: terai (34). Cultivated, 420 – 1000m. March.
Cultivated for its edible fruit.

6. *C. aurantifolia* (Christmann) Swingle. Nep: *Nimbu*; Eng: *Lime*.

Tree 3 – 5m, twigs with spines up to 1cm. Leaves ovate-elliptic, 4 – 6 x 2.5 – 3cm, acute but with blunt tip, base rounded, margin crenulate; petiole c 1cm, narrowly winged. Flowers in axillary clusters or short racemes, 4 – 5-merous. Calyx c 2mm. Petals white, oblanceolate, c 8mm. Stamens c 7mm. Ovary subglobose, clearly delimited from style c 4mm; stigma capitate. Fruit ovoid or subglobose, 3 – 5cm diameter, often with a small apical mamilla, peel very thin, greenish yellow.

Bhutan: S – Samchi district (Khana Barti Khola); **Darjeeling** (34). Cultivated, 450m. March.

Commonly cultivated for its edible fruit.

7. *C. limon* (L.) Burman f. Eng: *Lemon*

Small tree to 4m; twigs with spines up to 1.5cm. Leaves ovate, 5 – 9.5 x 3 – 5cm, acute or obtuse, base rounded, distantly serrate; petiole 2cm, very narrowly winged. Flowers solitary or few, axillary, 5-merous, purplish outside in bud. Calyx 4 – 5mm. Petals oblong, c 17 x 5mm. Stamens c 15mm. Ovary oblong, 5mm, tapering gradually into style. Fruit oblong or obovoid, 8 – 12 x 6 – 8cm, distinctly mamillate at apex; peel yellow, closely attached, 7 – 15mm thick.

Darjeeling: cultivated (34).

Occasionally cultivated for its edible fruit.

Family 87. SIMAROUBACEAE

by A.J.C. Grierson

Trees or shrubs. Leaves alternate, trifoliolate or pinnate; stipules caducous or absent. Flowers in axillary or terminal corymbose cymes or racemes, actinomorphic, unisexual or bisexual. Sepals 4 – 5, usually connate at base. Petals 4 – 5, free, valvate or imbricate. Stamens 4 – 10. Carpels 2 – 5, ± free, partially immersed in disc; ovules solitary or paired. Fruit a cluster of drupes or samaras.

1. Large trees 30 – 45m; leaves even-pinnate; stamens 10; fruit a cluster of samaras **1. Ailanthus**
- + Shrubs or small trees 10 – 20m; leaves trifoliolate or odd-pinnate; stamens 5; fruit a cluster of drupes **2**

2. Flowers in broad corymbose cymes; petals c 4mm, persisting in fruit (sometimes increasing in size); drupes obovoid or subglobose, obtuse **2. Picrasma**
 + Flowers in narrow panicles; petals c 2mm, not persisting in fruit; drupes ovoid, pointed **3. Brucea**

1. AILANTHUS Desfontaines

Trees. Leaves even-pinnate. Flowers in axillary or terminal panicles, unisexual. Calyx 5-lobed. Petals 5, valvate. Disc flat, thick, 10-lobed. Stamens 10, inserted at base of disc, reduced or absent in female flowers. Carpels 2-5, laterally compressed, rudimentary or absent in male flowers; stigma capitate. Fruit a cluster of 1-seeded samaras.

1. *A. integrifolia* Lamarck; *A. grandis* Prain. Nep: *Gokul* (34). Fig. 2i&j.

Tree 30-45m. Leaves 60-100cm; leaflets 3-7 pairs, ovate-oblong, 12-20 x 6-10cm, acuminate, base obliquely cuneate, margin entire, usually bearing a gland on main lateral veins near margin. Panicles up to 40cm. Calyx c 2mm. Petals oblong, c 4 x 1.5mm, pubescent at margins. Stamens c 4mm. Ovary hairy; styles 5 connate; stigmas spreading. Samaras oblong, c 10 x 3.5cm; seed discoid, c 1.5cm across, ± central.

Bhutan: S - Samchi district (Tamangdhanra Forest); **Darjeeling:** Ryang. Subtropical forest slopes, 460-650m.

A valuable crop for firewood (130).

2. PICRASMA Blume

Trees or scrambling shrubs. Leaves trifoliolate or odd-pinnate. Flowers 4-5-merous, functionally unisexual or apparently bisexual, in axillary corymbose cymes. Sepals 4-5, connate at base. Petals 4-5, valvate, persisting and sometimes increasing in size in fruit. Stamens 4-5, inserted at base of disc. Disc entire or lobed, pubescent, sometimes enlarging in fruit. Carpels 4-5 free; styles distinct at base, connate above; stigmas linear free. Fruit a cluster of 1-5 subglobose drupes.

1. Leaves trifoliolate or pinnate with up to 3 pairs of entire leaflets; flowers 4-merous; fruit c 10mm or more **1. P. javanica**
 + Leaves pinnate with 4-7 pairs of serrate-crenate leaflets; flowers 5-merous; fruit c 7mm **2. P. quassioides**

1. *P. javanica* Blume; *P. nepalensis* Bennett. Fig. 2a-c.

Tree 10-20m. Leaves 15-25cm; leaflets 1-3 pairs, elliptic or oblanceolate, 7-15 x 2.5-5cm, acuminate to a blunt tip, base rounded, margin entire or sometimes fluted, glabrous. Flowers whitish, 4-merous, in minutely pubescent cymes 7-15cm. Sepals c 1mm. Petals 4, ovate, c 4 x 2mm, increasing to 12 x 6mm in fruit. Stamens 4-5mm; filaments pubescent at base. Ovaries globose, c 1.5mm

diameter; styles c 2mm. Drupes subglobose, c 10 x 8mm, black when ripe.

Bhutan: S – Gaylephug district (Tatapani), C – Mongar district (Shongar);
Darjeeling: Tista valley. Subtropical forest slopes, 600 – 1000m. May.

2. *P. quassioides* (D. Don) Bennett

Similar to *P. javanica* but leaflets up to 7 pairs, ovate, up to 9 x 3cm, acuminate, base rounded, margin serrate, pubescent beneath; cymes 8 – 10cm; flowers 5-merous; petals c 4 x 2mm, persisting but not increasing much in size; drupes obovoid, c 7 x 6mm, black.

Bhutan: C – Punakha district (Rinchu), N – Upper Mo Chu district (Khosa). 1500 – 2000m.

Wood contains the glucoside 'quassiin' which is valued medicinally (16).

3. BRUCEA Miller

Shrubs or small trees. Leaves odd-pinnate. Flowers 4 – 5-merous, unisexual or bisexual, in axillary panicles. Sepals connate at base. Petals free, oblong. Disc cupular, glabrous. Stamens inserted at base of disc, rudimentary in female flowers. Carpels 4, free; styles free or coherent at base; stigmas club-shaped, rudimentary in male flowers. Drupes 1 – 4, ovoid, scarcely fleshy.

1. *B. mollis* Kurz. Fig. 2e – h.

Shrub 1 – 4m; branches with many pale lenticels; young growth appressed pubescent. Leaves 20 – 40cm; leaflets 4 – 6 pairs, ovate-elliptic, 6 – 13 x 2 – 4cm, acuminate, base rounded, margins entire, pubescent on both surfaces; petiolules 5 – 10mm. Panicles narrow, 15 – 30cm. Flowers 2 – 3mm diameter, brownish pubescent. Carpels 4, glabrous. Drupes 1 – 2, more rarely 3 – 4, ovoid, c 1 x 0.75cm, pointed at apex, rounded at base, scarlet when ripe.

Bhutan: S – Phuntsholing and Sarbhong districts, C – Tongsa, Mongar and Tashigang districts; **Darjeeling;** **W. Bengal Duars:** Buxa. Subtropical forest slopes, 200-1525m. March – May.

FIG. 2. Simaroubaceae and Burseraceae. Simaroubaceae. a – d, *Picrasma javanica*: a, portion on flowering shoot; b, functionally male flower; c, functionally female flower; d, young fruit. e – h, *Brucea mollis*: e, portion of flowering shoot; f, male flower; g, female flower; h, fruit. i & j, *Ailanthus integrifolia*: i, leaf; j, samara. Burseraceae. k – n, *Garuga pinnata*: k, portion of flowering shoot; l, flower; m, dissected flower; n, fruit. Scale: i x 1/7; k x 1/4. a, j x 1/3; h, n x 1; d x 1/2; b, c, e, l, m x 4; f, g x 8. Drawn by M. Bates.



Family 88. BURSERACEAE

by A.J.C. Grierson

Resinous trees or shrubs. Leaves alternate, odd-pinnate, exstipulate or with deciduous stipules. Monoecious or dioecious; flowers in panicles or racemes, actinomorphic, bisexual or unisexual. Sepals and petals each 3 – 5(– 6); sepals usually connate at base. Stamens 6 – 10(– 12), reduced to staminodes in female flowers. Ovary superior, 3 – 5-celled; ovules 1 – 2 per cell; ovary reduced to a pistillode in male flowers. Fruit a drupe with 1 – 5, 1-seeded stones.

1. Flowers 3-merous; stamens 6; filaments connate to half their length; drupe obovoid or ellipsoid **1. Canarium**
 + Flowers 5 – 6-merous; stamens 10(– 12); filaments free; drupes subglobose 2
2. Leaflets 3 – 4(– 5) pairs, usually entire, rarely bluntly serrate; petiolules 7 – 12mm **2. Protium**
 + Leaflets (4 –)7 – 10 pairs, usually serrate, rarely almost entire; petiolules up to 3mm **3. Garuga**

1. CANARIUM Stickman

Trees. Leaves large; leaflets opposite. Inflorescence an elongated panicle, axillary or terminal. Dioecious; flowers 3-merous, unisexual. Sepals connate below. Petals free, imbricate, rather thick. Stamens 6; filaments connate in lower half, reduced to staminodes in female flowers. Disc 6-lobed. Ovary in female flowers ovoid, tapering above into style; stigma capitate, faintly 3-lobed. Drupes ovoid; stone ellipsoid, triangular in section, 3-celled, each cell containing a seed or with 1 – 2 cells sterile.

1. C. strictum Roxb.; *C. sikkimense* King. Sha: *Poikar Shing*; Med: *Poikar*; Nep: *Dhuna, Gokuldhup* (34).

Evergreen tree up to 50m. Leaves to c 45cm; leaflets 3 – 5 pairs, ovate or elliptic, 10 – 15 x 4 – 6.5(– 10)cm, acuminate, sometimes abruptly so, base asymmetrically rounded or subcordate, sometimes slightly decurrent on very short petiolules, margin faintly undulate to slightly dentate, veins 12 – 22 pairs, glabrous above, ferruginous pubescent beneath. Male panicles 15 – 40cm; female panicles 7 – 20cm, brownish pubescent. Calyx 4 – 5.5mm, brownish pubescent, increasing to 12.5mm in fruit. Petals oblong, whitish, 7 – 9 x 1.5 – 2mm. Stamens 6; filaments connate in lower half; anthers acuminate. Fruit obovoid to ellipsoid, 3 – 4.5 x 1.75 – 2cm; stone bluntly triangular in section, fertile cell solitary, sterile ones reduced.

Darjeeling: Rungbee. Subtropical forests, 610 – 760m.

Young foliage has a characteristic bright red colour. Wood useful; gum used for

incense (17, 34). Griffith specimens of *C. bengalense* Roxb. labelled 'Bhutan' probably originate from Assam.

2. PROTIUM Burman f.

Trees. Flowers bisexual, in panicles. Calyx small, 5(-6)-lobed. Petals 5(-6), valvate, free, reflexed. Disc crenate, pubescent. Stamens 10(-12), free, inserted at base of disc. Ovary ovoid or subglobose, 1-3-celled; stigma lobed; ovules 2 in each cell. Fruit a subglobose drupe.

1. *P. serratum* (Colebrooke) Engler; *Bursera serrata* Colebrooke

Evergreen tree c 20m. Leaves 15-22cm; leaflets 3-5 pairs, ovate-elliptic, 8-12 x 3-4cm, acuminate to a blunt tip, rounded or cuneate at base, margin usually entire, rarely bluntly and shallowly serrate, sparsely pubescent on veins; petiolules 0.7-1.2cm. Panicles 10-20cm, pubescent. Calyx c 0.5mm, pubescent. Petals greenish-yellow, oblong, c 2 x 0.75mm, pubescent outside. Stamens shorter than petals. Ovary c 1mm diameter. Drupes subglobose, c 1cm diameter; stones 1-3.

Darjeeling. Subtropical forests, 600m. June.

3. GARUGA Roxb.

Shrubs or trees. Leaves pinnate; stipules deciduous. Flowers bisexual, in panicles, appearing with or before young leaves. Sepals and petals both 5, free, borne on margin of a cup-shaped receptacle. Stamens 10, in 2 whorls, inserted on receptacle. Ovary 5-celled; stigma 5-lobed. Fruit a 1-5-stoned drupe.

1. Flowers 3-6mm; fruit 0.5-1.2cm diameter **1. *G. floribunda***
 + Flowers 6-10mm; fruit up to 2.3cm diameter **2. *G. pinnata***

1. *G. floribunda* Decaisne; *G. gamblei* Smith. Nep: *Dabdabe* (34).

Deciduous tree or shrub to 18m. Leaflets (4-7)-10 pairs, elliptic or lanceolate, 5-20 x 2-5cm, acuminate, base asymmetrically rounded, margin crenate-serrate, rarely almost entire, pubescent at first; stipules oblong, 5-8mm, deciduous. Panicles axillary at ends of branches, 10-30cm, densely tomentose. Receptacle c 1.5mm. Sepals triangular, c 1.5mm. Petals pale yellow, ovate, c 4 x 1.5mm, pubescent outside, tomentose at base within. Inner stamens slightly longer than outer, c 2mm; anthers blue. Ovary globose. Drupes 5-9 x 5-12mm, greenish.

Bhutan: C - Mongar district (Lhuntse) and Tashigang district (Dangme Chu);
Darjeeling: Rongsong, Sittong and Tista Valley. Warm broad-leaved forests, 300-1525m. April - May.

The above description and records refer to var. *gamblei* (Smith) Kalkman.

2. *G. pinnata* Roxb. Nep: *Aule Dabdabe* (34). Fig. 2k - n.

Similar to *G. floribunda* but leaflets narrower and more sharply serrate; panicle

branches pubescent; flowers larger; receptacle 3.5 – 5mm; calyx teeth triangular 2 – 3.5mm; petals elliptic, 4 – 5 x 1mm, pubescent on both surfaces; outer stamens longer; drupes subglobose, up to 2.3cm diameter, yellowish when mature.

Darjeeling: banks of Tista, Kalimpong, Darjeeling, etc. Subtropical and terai forests, 300 – 900m. March – April.

Leaves lopped for fodder (34); fruit edible (34, 48).

Family 89. MELIACEAE

by A.J.C. Grierson

Trees or shrubs. Leaves alternate, trifoliolate or pinnate, rarely 2 – 3-pinnate. Monoecious or dioecious; flowers in axillary or terminal panicles, thyrses or racemes, bisexual or unisexual (rudiments of opposite sexual parts well-developed in unisexual flowers). Calyx 3 – 5-lobed. Petals 3 – 6, free or connate at base. Filaments partly or completely connate into a tube, with or without appendages, anthers 5 – 10 (antherodes in female flowers not dehiscent or producing pollen). Ovary 2 – 6-celled, each cell 1 – 2-ovulate (pistillode in male flowers with longer more slender style and very small ovules). Fruit a capsule, berry or drupe. Seeds winged or unwinged and then usually with a fleshy arillode.

1. Dwarf shrubs 15 – 100cm tall; leaflets bearing bifid hairs; petals c 3cm
 1. Munronia
- + Trees or shrubs 2m or more tall; leaflets glabrous or bearing simple or stellate hairs or peltate scales; petals usually much smaller 2
2. Leaves 2 – 3-pinnate; flowers white or purplish **2. Melia**
- + Leaves trifoliolate or pinnate; flowers white or yellowish 3
3. Leaflets always sharply serrate **3. Azadirachta**
- + Leaflets entire, sometimes bluntly serrate in *Cipadessa* and *Toona* 4
4. Indumentum of scattered, stellate hairs or peltate scales **7. Aglaia**
- + Indumentum of simple hairs or leaves glabrous 5
5. Leaves even-pinnate, rarely odd-pinnate in *Toona* 6
- + Leaves odd-pinnate 7
6. Flowers c 1.2cm; capsules globose, without a columella; seeds usually 2 – 5, triangular in section, black **10. Chisocheton**
- + Flowers c 0.5cm; capsules oblong, c 2 x 0.75cm, with a central columella; seeds many, winged, flat **12. Toona**

7. Capsules ovoid-ellipsoid, with a central columella; seeds many, winged
13. Chukrasia
 + Capsules ellipsoid to obovoid or globose without a central columella, or fruit a drupe or berry; seeds unwinged 8
8. Flowers 0.75 – 1.3cm; capsules 5.5 – 8cm diameter, globose; seeds with arillode **11. Dysoxylum**
 + Flowers less than 0.75cm; fruit a drupe or berry, or if a capsule, then smaller; seeds with or without arillode 9
9. Leaves 15 – 40cm, trifoliolate or pinnate with 2 pairs of leaflets; fruit a berry 12 – 16mm diameter **5. Walsura**
 + Leaves 15 – 75cm, pinnate with (2–)3–7 pairs of leaflets; fruit a drupe 5 – 6mm or capsule 10
10. Leaves 15 – 50cm, with up to 5 pairs of leaflets; drupes small, 0.5 – 0.6cm or capsules ellipsoid, c 1.3 x 1.2cm 11
 + Leaves 45 – 75cm, with 6 – 7 pairs of leaflets; capsules obovoid, c 3 x 2.5cm 12
11. Leaflets 4.5 – 12(–20) x 2 – 5(–7.5)cm, usually with scattered glands on either side of midrib; fruit a capsule usually 2-valved, 1 – 2-seeded **4. Heynea**
 + Leaflets 3 – 9 x 2 – 4cm, without glands; fruit a drupe usually with 5 seeds
6. Cipadessa
12. Petals 3, united by staminal tube; anthers 6; ovary 5-celled, usually with 2 ovules in each cell **8. Aphanamixis**
 + Petals 5, free from staminal tube; anthers 10, in 2 whorls of 5; ovary 5-celled, each cell with 1 ovule **9. Sphaerosacme**

1. MUNRONIA Wight

Shrubs; indumentum of simple and bifid hairs. Leaves odd-pinnate; leaflet margins entire or toothed. Flowers bisexual in axillary panicles. Calyx deeply 5-lobed. Petals 5, united below with staminal tube. Staminal tube cylindrical with 10 filiform appendages at margin; anthers 10. Disc tubular. Ovary 5-celled, each cell with 2 superposed ovules. Fruit a 5-valved loculicidal capsule; cells 1 – 2-seeded.

1. *M. pinnata* (Wall.) Theobald; *M. wallichii* Wight

Dwarf shrub; stems 15 – 100cm, mostly naked, little branched. Leaves 18 – 30cm, clustered at branch ends; leaflets 2 – 3 pairs, ovate, 5 – 10 x 2.5 – 5cm, acute or acuminate, base rounded, margin entire or rarely coarsely toothed, sparsely pubescent beneath. Panicles subumbellate, 6 – 9cm. Calyx lobes 5 – 6 x 2mm, free

almost to base, pubescent. Petals white or rose-coloured, lanceolate, c 3 x 0.7cm, united with staminal tube in lower third. Staminal tube c 2.25cm; apical appendages linear-lanceolate, c 2mm. Fruit globose, 1-1.5cm diameter.

Darjeeling: Tista Valley, Kalighora, Sivoke etc. Subtropical and terai forests, 300m. March - April.

2. MELIA L.

Trees; indumentum of simple and tufted hairs when young. Leaves 2-3-pinnate; leaflet margins serrate. Inflorescence an axillary thyrses. Calyx 5-lobed to near base. Petals 5, free, imbricate. Staminal tube cylindrical, expanding near mouth, 10-ribbed with bifid filiform appendages at mouth; anthers 10. Disc small, annular. Ovary 5-7-celled, each cell with 2 superposed ovules; stigma capitate, 5-lobed. Drupe with a 5-7-celled stone, each cell 1-2-seeded.

1. M. azedarach L.; *M. composita* Willdenow, *M. buxayun* Royle. Sha: *Ja Shing*; Nep: *Bakaina*, *Bakain* (34), *Lapsi* (34); Eng: *Persian Lilac*. Fig. 3a-f.

Tree 6-15m. Leaves 40-80cm, lateral rachises 3-7 pairs; leaflets ovate or elliptic, 4-5 x 1.5-2.5cm, acuminate, base rounded, margin serrate, indumentum of scattered stellate hairs beneath when young, later glabrous. Calyx lobes ovate, c 2mm. Petals white or purplish, oblanceolate, 8-9 x 1.5-2mm, spreading. Staminal tube c 8mm; appendages c 1mm. Ovary ovoid, c 2mm diameter, lobed. Drupe ovoid-ellipsoid, c 1.25cm diameter, yellow; stone c 1 x 0.7cm, 5-7-ribbed.

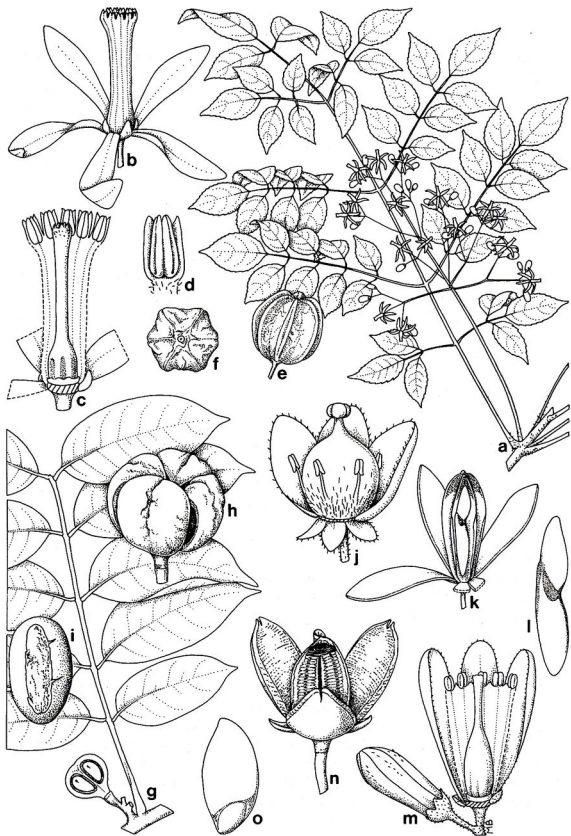
Bhutan: C - Thimphu district (near Thimphu) and Punakha district (Wangdu Phodrang and Punakha); **Darjeeling.** Commonly planted at roadsides, 300-2320m. March - May.

A rapid-growing species often planted as an ornamental tree; wood used to make furniture (48); stones from fruit used as beads (126).

3. AZADIRACHTA Jussieu

Similar to *Melia azedarach* but with pinnate leaves and indumentum of simple hairs; flowers both bisexual and male on same plant, smaller than those of *Melia*; ovary 3-celled, each cell with 2 collateral ovules; stigma 3-lobed; drupe 3-lobed.

FIG. 3. *Meliaceae*. a-f, *Melia azedarach*: a, portion of flowering shoot; b, flower; c, dissected flower; d, anther and staminal appendages; e, fruit, lateral view; f, fruit, apical view. g-i, *Dysoxylum binectariferum*: g, leaf and young fruit in longitudinal section; h, ripe fruit; i, seed with arilode around attachment area. j-l, *Toona ciliata*: j, female flower with two petals removed; k, dehiscent capsule with two valves removed; l, seed. m-o, *Chukrasia tabularis*: m, female flower with two petals removed; n, dehiscent capsule; o, seed. Scale: g x ¼; a, h x ½; i, x ¼; k, o x 1; e, f x 1½; l x 2; m x 3; b x 4; j x 5; /c x 6; d x 15. Drawn by M. Bates.



1. A. indica Jussieu; *Melia azadirachta* L. Eng: *Neem Tree*.

Tree 8–25m. Leaves 15–30cm; leaflets 5–9 pairs (terminal leaflets sometimes lacking), ovate-lanceolate, 5–8 x 1.5–2cm, acuminate, base cuneate, margin serrate, glabrous at maturity. Thyrses axillary, c 20cm; flowers white. Calyx c 1mm. Petals oblanceolate, c 5 x 2mm. Staminal tube c 4mm. Drupes ovoid, c 2 x 1.5cm, greenish-yellow, 1-seeded.

Darjeeling. Cultivated, up to 1200m (34).

Often planted as a roadside tree and valuable for firewood (130); seeds yield an oil used medicinally and as an anthelmintic for cattle (16, 126).

4. HEYNEA Sims

Trees or shrubs, usually with simple hairs. Leaves pinnate; leaflet margins entire. Dioecious; flowers unisexual, in axillary panicles. Calyx 4–5-lobed. Petals 4–5, free. Stamens 10; filaments united at base, free above middle, bearing 2 appendages at apex; anthers in female flowers narrow, not producing pollen. Disc ring-like. Ovary 2–3-celled, each cell with 1–2 ovules; stigma clavate. Fruit an ellipsoid, 1-celled capsule.

1. H. trijuga Sims; *Trichilia connaroides* (Wight & Arnott) Bentvelzen. Nep: *Ankhataruwa* (34).

Shrub or tree, 2–6m. Leaves 20–40(–50)cm; leaflets 2–5 pairs, ovate, 4.5–12(–20) x 2–5(–7.5)cm, acuminate, base rounded, glabrous, usually with several scattered glands on either side of midrib. Panicles cymose or subumbellate, up to 40cm. Calyx c 1mm. Petals white, oblong, c 4 x 1.25mm, incurved at apex. Stamens 10; filaments alternating in length, appendages linear, acute, as long as anthers. Ovary c 0.5mm, 2–3-celled. Capsules ellipsoid, c 1.3 x 1.2cm, 1-celled (other cells aborted), 2-valved almost to base, reddish; seed ovoid, c 1 x 0.75cm, ± compressed; arillose thin, white.

Bhutan: C – Punakha district (near Punakha, Wangdu Phodrang and Chusom);

Darjeeling: foothills and terai. River banks, 500–1525m. April–May.

Seeds yield a useful oil (34).

5. WALSURA Roxb.

Trees; indumentum of simple and/or bifid hairs. Leaves trifoliolate or odd-pinnate; leaflets entire. Thyrses axillary. Flowers bisexual or unisexual (then plants dioecious). Calyx 5-lobed. Petals 5, free, valvate to imbricate. Stamens 10; filaments connate below and often with a pair of lanceolate apical appendages; antherodes in female flowers smaller and without pollen. Disc annular. Ovary usually 2-celled; stigma capitate, pistillode in male flowers small, flattened; stigma broader than in female and bisexual flowers. Berry 1–2-seeded.

1. Leaves trifoliolate; filaments linear 1. *W. tubulata*
 + Leaflets 3 - 5; filaments subulate 2. *W. robusta*

1. *W. tubulata* Hiern. Nep: *Phalame* (34).

Leaves 20 - 40cm, trifoliolate; leaflets narrowly ovate or elliptic-oblong, 8 - 25 x 3.5 - 8cm, acuminate to a blunt tip, base cuneate, glabrous, glossy on upper surface. Thyrses scarcely equalling leaves. Flowers c 6mm. Staminal tube glabrous outside, thinly pubescent within.

Darjeeling: duars (34, 80). Terai forests. March.

2. *W. robusta* Roxb.

Tree to 33m. Leaves 15 - 30cm; leaflets 5 or sometimes 3, ovate or elliptic, 5 - 15 x 2.5 - 8cm, acuminate, base rounded, glossy above. Thyrses almost as long as leaves, densely pubescent. Flowers c 4mm. Staminal tube white, pubescent below. Fruit subglobose, 12 - 16mm diameter.

W Bengal Duars: Buxa. Terai forests, 600m. April.

6. CIPADESSA Blume

Trees. Leaves odd-pinnate; leaflets entire or serrate. Indumentum of simple hairs. Monoecious; flowers bisexual or unisexual. Calyx 5-lobed. Petals 5 free, valvate. Stamens 10; filaments connate near base with a pair of filiform appendages. Disc dish-shaped. Ovary 5-celled, each cell 1 (- 2)-ovuled, stout; stigma capitate. Drupe small, slightly fleshy, subglobose, usually with 5 stones.

1. *C. baccifera* (Roth) Miquel; *C. fruticosa* Blume

Shrub or tree 2 - 4m. Leaves 15 - 40cm; leaflets 3 - 6 pairs, ovate-elliptic, 3 - 9 x 2 - 4cm, acuminate, base rounded, margins entire or bluntly serrate, sparsely pubescent along veins beneath. Thyrses small, 4 - 10cm. Calyx lobes c 1mm. Petals white, c 3 x 1.5mm. Stamens c 2.5mm. Drupes 5 - 6mm diameter, 5-lobed, scarlet.

Darjeeling: Singla, probably cultivated (34). 600m. May.

7. AGLAIA Loureiro

Trees; indumentum of stellate hairs or peltate scales at least on young parts. Leaves pinnate. Dioecious; flowers unisexual; male inflorescences paniculate, many-flowered; female inflorescences fewer-flowered, \pm racemose. Calyx 4 - 5-lobed. Petals 4 - 5, free or connate. Staminal tube 0.5 - 5mm; anthers 5 - 10; antherodes similar, without pollen. Disc absent. Ovary 1 - 3-celled, each cell with 1 or 2 ovules; stigma sessile, capitate. Pistillodes minute. Fruit 1-celled, indehiscent or a 2 - 4-valved capsule; seeds 1 - 4, partly or completely surrounded by a fleshy arillode.

Dr. C. Pannell, Oxford, kindly provided unpublished data and identifications of the Bhutanese *Aglaia* species recognised here.

1. Leaflets mostly 5–9, base cuneate 2
 + Leaflets mostly 9–15, base usually rounded at least on one side 3
2. Young parts with pale yellow-brown, peltate scales; leaflets mostly 7–9; fruit obovoid, 2.5–3 x 2–2.5cm, 2–3-seeded **1. A. lawii**
 + Young parts with red-brown peltate scales; leaflets mostly 5; fruit subglobose, 2.5–4 x 2.5–3.5cm, 1–2-seeded **2. A. korthalsii**
3. Leaflets 12–18 x 4–6cm; fruit asymmetrically ellipsoid, 2.3–2.7 x 1.5–1.7cm, 1-seeded **3. A. perviridis**
 + Leaflets 15–25(–30) x 7–9(–15)cm; fruit broadly pyriform, 3–5 x 3–4cm, 2–3-seeded **4. A. spectabilis**

1. A. lawii (Wight) Ramamoorthy; *A. chittagonga* auct. p.p. non Miquel, *Amoora lawii* (Wight) Beddome; *A. chittagonga* sensu F.B.I. p.p. non (Miquel) Hiern

Tree 10–15m; young parts with dense pale yellow-brown, peltate scales. Leaves 20–45cm; leaflets 5–9, ovate-elliptic, 9–15 x 3–6cm, acuminate, base cuneate, peltate-scaly when young. Male panicles up to 20cm. Calyx 4-toothed, c 1mm. Petals 3–4, c 2mm, orange. Anthers 6–8. Female panicles 8–10cm. Calyx c 3mm, thickly peltate-scaly. Capsule obovoid, 2.5–3 x 2–2.5cm, 3-valved, 2–3-seeded, densely scaly.

Bhutan: S—Chukka district (Gedu and Marichong), Gaylegphug district (Sham Khara), C—Punakha district (Punakha) and Tongsa district (near Pertimi). Warm broad-leaved forests, 900–1450m. June–July.

2. *A. korthalsii* Miquel

Similar to *A. lawii* but young parts clothed with red-brown scales; leaflets usually 5, acute; panicles red-brown scaly; fruit subglobose, 2.5–4 x 2.5–3.5cm, 2-celled, 1–2-seeded.

Bhutan: S—Samchi district (Khagra valley near Gokti) and Chukka district (Marichong). Subtropical forests, 550–900m. March–April.

3. *A. perviridis* Hiern. Nep: *Sanu Lahasune* (34), *Bale Mauwa* (34), *Bandare*.

Tree to 15m; young parts red-brown scaly. Leaves 40–50cm; leaflets 9–15, ovate-lanceolate, 12–18 x 4–6cm, acuminate, base obliquely rounded, sparsely peltate-scaly along veins. Male panicles broad, c 15 x 15cm; petals 5, c 1mm. Fruiting panicles 20–25cm, pendulous. Fruit asymmetrically ellipsoid, 2.3–2.7 x 1.5–1.7cm, 1-celled, 1-seeded, densely brownish peltate-scaly.

Bhutan: S—Samchi district (Tamangdhanra Forest), Chukka district (Marichong) and Sarbhang district (below Getchu), C—Tongsa district (between Pertimi and Tintibi Bridge); **Darjeeling:** Sureil, Kurseong and Punkabari. Subtropical forests, 760–1670m. June–July.

4. *A. spectabilis* (Miquel) Jain & Bennet; *Amoora spectabilis* Miquel, *A. wallichii* King. Nep: *Lali* (34), *Amari*.

Similar to *A. perviridis* but a large tree to 25m; leaves up to 85cm; leaflets ovate-oblong, 15–25(–30) x 7–9(–15)cm, bluntly apiculate or shortly acuminate, base rounded, glabrous; male panicles 30–45cm; female panicles 7–10cm; fruit broadly pyriform, 3–5 x 3–4cm, 3–4-celled, 2–3-seeded.

Darjeeling: Mal Forest and Tista valley. Subtropical and terai forests, 300–360m. August–September.

Timber useful (16).

8. APHANAMIXIS Blume

Trees; indumentum of simple hairs. Leaves pinnate; leaflets entire. Dioecious; male panicles large with spicate branches; female inflorescences spicate; male flowers smaller than female. Calyx 5-lobed. Petals 3, free, fused in lower half to staminal tube. Staminal tube short, globose; anthers 6; antherodes in female flower without pollen. Disc absent. Ovary 3-celled, each cell with 2 ovules; style very short; stigma conical, 3-angular; pistillodes in male flowers rudimentary. Fruit 2–3-valved; seeds 1 or 2 per cell, each covered by an arillode.

1. *A. polystachya* (Wall.) Parker; *Amoora rohituka* Wight & Arnott. Sha: *Wagorey Doro Shing*; Nep: *Lahasune* (34).

Tree 6–10m. Leaves 60–75cm; leaflets 6–7 pairs, ovate 13–20 x 6–7.5cm, acute, base obliquely rounded, glabrous. Male panicles 15–30cm; female inflorescences ± as long as leaves. Male flowers c 3mm; female flowers c 6mm. Fruit obovoid, c 3 x 2.5cm, glabrous; seeds ellipsoid, c 2 x 1.5cm, brown, covered by orange-red arillode.

Bhutan: S – Phuntsholing district (near Phuntsholing) and Chukka district (Rydak Valley); **Darjeeling:** Jalpaiguri, Rungit Valley, Kalimpong, Tista Valley. Subtropical and terai forests, 200–1220m. April–October (34).

9. SPHAEROSACME Royle

Trees; indumentum of simple hairs. Leaves odd-pinnate; leaflets entire. Dioecious; male inflorescences paniculate with racemose branches; female inflorescences racemose, ± as long as leaves. Calyx 5-lobed. Petals 5, imbricate. Staminal tube ± globose, anthers 10 in 2 whorls of 5. Disc absent. Ovary 5-celled, each cell 1-ovulate. Fruit 2–5-valved; seeds surrounded by an arillode.

1. *S. decandra* (Wall.) Pennington; *Amoora decandra* (Wall.) Hiern, *Lansium decandrum* (Wall.) Briquet. Nep: *Bandre* (34), *Rite* (34), *Lasunni*.

Tree 15m. Leaves c 45cm; leaflets elliptic or oblanceolate, c 7 pairs, 6–15 x 4–5cm, shortly acuminate, base obliquely rounded, finely pubescent on both surfaces. Male inflorescences c 25cm. Calyx c 1mm. Petals broadly elliptic, c 4mm.

Staminal tube \pm as long as petals. Capsules obovoid, c 3 x 2.5cm, mostly 3-seeded; seeds broadly ellipsoid, c 1.5 x 1.5cm, completely enclosed by orange arillode.

Bhutan: S – Chukka district (Marichong and Chukka) and Sarbhang district (Phipsoo), C – Tongsa district (Dakpai); **Darjeeling.** Subtropical forest, 285 – 1650m. June – July.

10. CHISOCHETON Blume

Trees; indumentum of simple hairs. Leaves even pinnate; leaflets entire. Dioecious; inflorescence of axillary panicles or racemes. Calyx with an almost entire margin. Petals 4 – 5, free, imbricate, adnate to staminal tube below. Staminal tube cylindrical; anthers 6, alternating with lobes of tube; antherodes in female flowers rudimentary. Disc annular. Ovary several-celled; ovules 1 – 2 per cell; stigma small capitate; pistillode in male flowers slender. Fruit a 2 – 5-celled capsule; seed partly surrounded by an arillode.

1. C. cumingianus (C.DC.) Harms; *C. paniculatus* Hiern *nom. illeg.* Nep: *Bandrephal* (34), *Lasuni*.

Tree c 12m. Leaves 60 – 70cm; leaflets ovate-lanceolate, c 28 x 9cm, acuminate, base cuneate, pubescent at least on veins. Male panicles c 60cm with racemose branches, flowers \pm tubular c 1.2cm. Female inflorescence racemose, c 50cm, later pendulous. Fruit globose, 6.5 – 8cm diameter, reddish; seeds black, glossy, covered at base by orange arillode.

Bhutan: S – Samchi, Phuntsholing, Gaylegphug and Deothang districts; **Darjeeling:** terai and foothills. Subtropical forest slopes, 380 – 870m. June.

East Himalayan plants are referred to subsp. **balansae** (C.DC.) Mabblerley.

11. DYSOXYLUM Blume

Trees; indumentum of simple hairs. Leaves pinnate; leaflets entire. Dioecious; flowers in axillary thyrses. Calyx 3 – 5-lobed. Petals 3 – 6, free or fused to staminal tube. Staminal tube cylindrical. Disc tubular. Ovary 2 – 5-celled, each cell with 1 – 2 ovules; stigma discoid or capitate. Fruit a 2 – 5-valved capsule; seeds partly or completely surrounded by arillode.

- | | |
|--|-----------------------------|
| 1. Leaflets large, 15 – 41 x 6 – 13cm | 2 |
| + Leaflets small, 7 – 20 x 3 – 8cm | 4 |
| 2. Leaflets pubescent or softly tomentose beneath | 4. D. grande |
| + Leaflets glabrous beneath | 3 |
| 3. Thyrses up to 7cm; calyx subentire; petals c 7.5mm ... | 1. D. binectariferum |
| + Thyrses 45 – 50cm; calyx distinctly toothed; petals c 15mm | 3. D. excelsum |

4. Leaflets 11 – 13 pairs **5. D. mollissimum**
 + Leaflets 2 – 7 pairs 5

5. Leaflets reticulate beneath; staminal tube pubescent **2. D. reticulatum**
 + Leaflets not reticulate beneath; staminal tube glabrous **6. D. pallens**

1. D. binectariferum (Roxb.) Beddome. Nep: *Lahasune* (34). Fig. 3g – i.

Tree 12 – 15m. Leaves 50 – 75cm; leaflets 5 pairs, ovate or oblanceolate, 15 – 30 x 7 – 13cm, acuminate, base rounded, entire, glabrous. Thyrses up to 7cm. Flowers 9 – 10mm, 4-merous. Calyx subtire, 2 – 3mm. Petals white, oblong, c 7.5mm, pubescent. Staminal tube c 6mm. Capsule globose, 5.5 – 6cm, orange-yellow, 4 – 5-celled; seeds blackish-red, glossy, with orange arillode around attachment area.

Bhutan: S – Samchi district (Khagra valley), Phuntsholing district (Phuntsholing) and Sankosh district (Pinkhua); **Darjeeling:** Jalpaiguri. Subtropical and terai forests, 340 – 550m. September (34).

2. D. reticulatum King

Similar to *D. binectariferum* but leaves 22 – 45cm; leaflets 4 – 7 pairs, 8 – 17 x 4 – 6cm, shortly acuminate, base asymmetrically cuneate, distinctly reticulate beneath; flowers c 6.5mm, in simple racemes 15 – 20cm; capsule pyriform, c 8 x 6.5cm; seeds triangular, c 3cm.

Darjeeling: Riang, Tista Valley. Subtropical forests.

3. D. excelsum Blume; *D. procerum* Hiern. Nep: *Lahasune* (34).

Similar to *D. binectariferum* but thyrses 45 – 50cm; calyx c 1.5mm, distinctly toothed; petals c 1.5cm; staminal tube \pm as long as petals; capsule 1 – 3-seeded, ovoid or globose, c 4cm diameter, creamy-white; seeds orange.

Bhutan: S – Sarbhang district (above Sarbhang); **Darjeeling:** widespread; **W. Bengal Duars:** Buxa. Dense subtropical forests, 600 – 1670m. November – January.

Flowers strongly scented of garlic (16).

4. D. grande Hiern; *Chisocheton? costatus* Hiern

Tree, 12m or taller. Leaves up to 1m; leaflets 5 – 7 pairs, elliptic, 16 – 41 x 6 – 13cm, acuminate, base rounded, pubescent or softly tomentose beneath; lateral veins 18 – 25 pairs, prominent beneath. Flowers in thyrses, 4-merous, c 4mm. Fruit ellipsoid, c 4cm diameter, longitudinally ribbed.

Bhutan: S – Sarbhang district (Lao Pani). Subtropical forest, 400m.

5. D. mollissimum Blume; *D. hamiltonii* Hiern. Nep: *Chhalegach* (34).

Tree c 10m. Leaves 60 – 75cm; leaflets 11 – 13 pairs, lanceolate, 9 – 11 x 3 – 4cm, acuminate, base obliquely rounded, margin entire, glabrous or pubescent in vein axils beneath. Male inflorescences 22 – 35cm, paniculate, slender; flowers 4-

merous. Calyx 1.5mm. Petals c 9mm. Staminal tube c 8mm. Female inflorescences up to 13cm, racemose. Capsule 1 – 3-seeded, pyriform-globose, 1.75 – 2.5cm diameter.

Bhutan: S – Samchi district (Tamangdhanra Forest); **Darjeeling:** Birick, Singla, Tista Valley, etc. Subtropical forest, 600m. June.

Flowers strongly scented of garlic (16).

6. *D. pallens* Hiern

Small tree. Leaves 22 – 80cm; leaflets 2 – 5 pairs, oblong or elliptic, 7 – 20 x 3 – 8cm, acuminate, glabrous. Inflorescences racemose, flowers 4-merous. Calyx cup-shaped c 1mm. Petals c 8mm. Staminal tube glabrous. Capsule pyriform, 3 x 2.5cm, slightly pubescent.

Darjeeling: locality unknown (34, 80).

A poorly known plant which may not be distinct from *D. cyrtobotryum* Miquel.

12. TOONA (Endlicher) Roemer

Deciduous or evergreen trees. Leaves even- or rarely odd-pinnate; leaflets entire, glabrous or with simple hairs. Flowers in thyrses, 5-merous, unisexual, but with vestiges of opposite sexual parts present. Stamens $5 \pm$ free, borne on an elongated disc, antherodes in female flowers shrivelled. Ovary 5-celled, each cell with 6 – 10 ovules, densely hairy. Capsules thinly or thickly woody, opening from apex by 5 valves; seeds borne on a 5-angled columella as long as capsule.

1. Capsule valves without lenticels; petiolules up to 1.5cm; sepals free

1. *T. ciliata*

+ Capsule valves lenticellate; petiolules 5 – 6mm; sepals free or united 2

2. Capsule valves thinly woody, smooth; sepals united into a low, lobed cup

2. *T. sureni*

+ Capsule valves thickly woody, warted; sepals free 3. *T. microcarpa*

1. *T. ciliata* Roemer; *Cedrela toona* Rottler & Willdenow, *C. kingii* C.DC. Sha: *Rawa Shing*; Nep: *Toon, Tun, Tuni* (34); Eng: *Indian Mahogany*. Fig. 3j – 1.

Large tree 20 – 27m. Leaves to c 40(–70)cm; leaflets (3 –)6 – 12 pairs, ovate-lanceolate, 11 – 12 x 3.5 – 4(–6)cm, acuminate, base obliquely rounded, glabrous or pilose on veins beneath, veins c 18 pairs. Thyrses \pm as long as leaves, sparsely pubescent. Sepals ovate, c 0.8mm, pubescent. Petals ovate-oblong, 3.5 – 4.5(–5.5) x 2 – 2.5(–3)mm, \pm ciliate. Anthers shorter than filaments. Capsule oblong, (1.5 –)2(–3.5)cm; seeds c 15mm, \pm equally winged at both ends.

Bhutan: S – Chukka district (above Chukka) and Sarbhang district (Phipsoo Khola); **Darjeeling:** Subtropical forest, 300 – 1760m. November – March.

Timber valuable and distinctively scented (16, 48). Several varieties of this species have been reported from Sikkim and Darjeeling but appear to be of little taxonomic significance.

2. *T. sureni* (Blume) Merrill; *Cedrela febrifuga* Blume. Nep: *Toon*.

Similar to *T. ciliata* but leaflets \pm coriaceous, up to 20 x 7.5cm; calyx cup-like c 1mm, 5-lobed; capsule thinly woody, dark brown, smooth, covered with pale lenticels.

Bhutan: S—Chukka district (Marichong); **Darjeeling:** Darjeeling and Kalimpong districts. Warm broad-leaved forests, 1200 – 1830m. July (34).

3. *T. microcarpa* (C.DC.) Harms; *Cedrela microcarpa* C.DC. Nep: *Tun, Tuni* (34).

Similar to *T. ciliata* but leaflets mostly 9 pairs, up to 14 x 6cm; sepals \pm free; capsules thickly woody, dark brown, with prominent lenticels.

Darjeeling: Kalimpong, Pankabari and Rangirum. Warm broad-leaved forest, 1220 – 1670m. November – December.

13. CHUKRASIA Jussieu

Deciduous trees. Leaves odd-pinnate; leaflets entire (leaves of young trees mostly bipinnate with lobed leaflets), glabrous or with simple hairs. Flowers large, 4 – 5-merous, functionally unisexual but appearing bisexual. Calyx 4 – 5-lobed. Petals 4 – 5, free, becoming reflexed later. Staminal tube broadly cylindrical, narrowed at apex; anthers or antherodes attached to margin. Disc in functionally male flowers scarcely developed, in functionally female flowers cushion-like. Ovary 3-celled, each cell with numerous ovules; style slender; stigma capitate; pistillode scarcely distinguishable from ovary but style and stigma more slender. Capsule woody, ellipsoid, 3 – 5-valved; columella with 3 flat ridges; seeds with terminal wing, 80 – 100 per cell, arranged laterally in two tiers.

1. *C. tabularis* Jussieu. Nep: *Hallonre, Hallonre Tun* (34), *Katli* (34), *Chukrassi, Bogipoma*. Fig. 3m – o.

Tree c 20m. Leaves 40 – 75cm; leaflets 6 – 8 pairs, ovate or oblong, 9 – 14 x 4.5 – 6cm, acuminate, base obliquely rounded, pubescent. Panicles terminal, c 30cm. Calyx 2 – 3mm. Petals yellow, oblong, c 12 x 3mm. Staminal tube c 10 x 5mm. Ovary flask-shaped, c 7mm, tapering into style. Capsule ovoid-ellipsoid, c 5 x 2.75cm, columella \pm as long; seeds c 2 x 1.2cm, embryo elliptic, c 8 x 5mm.

Bhutan: S – Phuntsholing district (near Phuntsholing), C – Tongsa district (Wangde Khola); **Darjeeling:** Ryang and Tista Valleys. Warm broad-leaved forests, 350 – 1070m. May.

Cultivated in S Bhutan for its valuable timber.

Family 90. MALPIGHIACEAE

by A.J.C. Grierson

Scrambling or twining shrubs. Leaves opposite, simple, entire, pinnately veined, exstipulate. Flowers actinomorphic or weakly zygomorphic, bisexual, in axillary or terminal racemes or panicles on jointed bibracteate pedicels, 5-merous. Calyx glandular or not. Petals free, clawed or not. Stamens 10; filaments connate at base. Ovary superior, 3-lobed; styles 1 or 3. Fruit simple or mericarpic usually of 3, 1-seeded samaras.

1. Calyx with a large gland at base; style 1; fruit simple, samara with 3 radiating wings **1. Hiptage**
 + Calyx without glands; styles 3; fruit mericarpic, samaras surrounded by an oblong or suborbicular wing **2. Aspidopterys**

1. HIPTAGE Gaertner

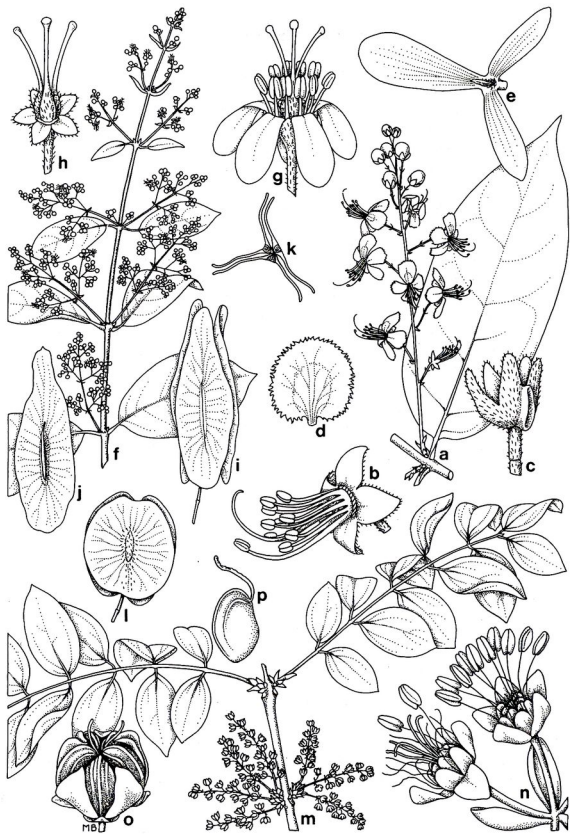
Description as for Malpighiaceae; distinguishing characters set out in key.

1. H. bengalensis (L.) Kurz; *H. madablota* Gaertner. Nep: *Charpate Lahara* (34), *Madhabi-lata* (34). Fig. 4a - e.

Scrambling shrub. Leaves coriaceous, ovate, 8 - 18 x 2.5 - 6.5cm, acuminate, base cuneate, glabrous. Racemes 5 - 7cm; pedicels c 7 mm; bracts narrowly lanceolate, c 2mm. Calyx with a dark oval gland, c 2 x 1mm, at base; lobes oblong, c 4 x 2mm, rounded. Petals reflexed, white; upper one yellow, elliptic, c 10 x 8mm, fimbriate, base narrowed into a claw \pm as long as calyx. Stamens declinate, one longer than others, all fertile. Style upturned at end. Samaras with stiff oblanceolate wings; lateral ones c 2.5 x 1cm; central one c 3.5 x 1.75cm.

Bhutan: S - Samchi and Sarbhong districts, C - Tongsa and Tashigang districts; **Darjeeling.** Subtropical and warm broad-leaved forest slopes, 550 - 970m. March - April.

FIG. 4. **Malpighiaceae** and **Coriariaceae**. **Malpighiaceae.** a - e, *Hiptage bengalensis*: a, portion of flowering shoot; b, flower; c, calyx showing gland; d, upper petal; e, fruit. f - k, *Aspidopterys glabruscula*: f, flowering shoot; g, flower; h, flower with petals and stamens removed; i, fruit; j, samara showing seed; k, t.s. fruit. l, *Aspidopterys nutans*: fruit. **Coriariaceae.** m - p, *Coriaria napalensis*: m, flowering shoot; n, two flowers; o, fruit with fleshy persistent petals; p, achene. Scale: a, f x 1/2; e, m x 1/2; j, l x 1/2; i, j x 1; k x 1/2; d x 2; b, c x 3; n x 5; o, p x 6; g, h x 7. Drawn by M. Bates.



2. ASPIDOPTERYS Jussieu

Description as for Malpighiaceae; distinguishing characters set out in key.

1. Leaves pubescent on veins beneath, otherwise glabrous; samaras surrounded by an oblong or oblanceolate wing longer than broad **1. A. glabriuscula**
 + Leaves whitish pubescent beneath; samaras surrounded by a broadly elliptic wing \pm as broad as long **2. A. nutans**

1. A. glabriuscula Jussieu; *A. roxburghiana* sensu F.B.I. p.p. non Jussieu. Fig. 4f - k.

Twining shrub. Leaves ovate or elliptic, 5 - 9 x 3.5 - 5cm, acuminate, base rounded, pubescent on veins beneath; petioles up to 1cm. Inflorescence branches \pm subumbellate; pedicels 3 - 5 mm; bracts subulate, c 1mm. Calyx oblong, c 1.5mm. Petals oblanceolate, c 3mm. Stamens erect, c 2.5mm. Samaras surrounded by a membranous wing c 3 x 1.3cm, glabrous; seed \pm central.

Bhutan: S - Gayleghug district (117), C - Tongsa district (Shamgong) and Mongar district (Shongar); **Darjeeling.** Climber on warm broad-leaved forest slopes, 1500 - 1650 m. August.

2. A. nutans (Roxb.) Hook. f. Nep: *Shubung Lahara* (34). Fig. 4 l.

Similar to *A. glabriuscula* but leaves more broadly ovate, 9 - 13 x 4.5 - 11cm, acuminate, base rounded or subcordate, appressed whitish pubescent beneath; petioles up to 3.5cm; samaras broadly elliptic, c 2.5 x 2 - 2.5cm, appressed whitish pubescent.

Darjeeling: Badamtam, Sukna and Rungit and Tista Valleys. Subtropical forests, 335 - 610m. July - September.

Family 91. POLYGALACEAE

by Kit Tan

Annual or perennial (sometimes saprophytic) herbs, shrubs or small trees. Leaves alternate, rarely opposite, simple, entire, exstipulate, sometimes scale-like or absent. Flowers bisexual, zygomorphic. Bracts and bracteoles present or absent. Sepals 5, all free or lower 2 connate, \pm equal or 2 inner ones wing-like, larger than 3 outer. Petals 3 (in Bhutan), unequal, free or variously united; lower keeled, often lobed or crested. Stamens (2 -)4 - 8(- 10); anthers basifixed, opening by an apical, oblique pore or longitudinal slit. Ovary superior, 2-celled, sessile or stipitate; ovules 1 per cell, anatropous, pendulous; style 1, straight or curved, dilated or lobed at apex. Fruit a 2-seeded loculicidal capsule or berry. Seeds arillate or exarillate.

1. Inner sepals wing-like, much larger than 3 outer; stamens 8; seeds arillate
1. Polygala
- + All sepals \pm equal, not petaloid or wing-like; stamens 2–6; seeds inconspicuously arillate or exarillate 2
2. Autotrophic; leaves green; fruit dehiscent, not enclosed by sepals; style sigmoid **2. Salomonina**
- + Saprophytic; leaves absent or reduced to brownish-violet scales; fruit indehiscent, enclosed by sepals; style straight or very slightly curved **3. Epirixanthes**

1. POLYGALA L.

Herbaceous annuals, suffrutescent perennials, shrubs or small trees. Leaves alternate or verticillate. Bracts and bracteoles present. Sepals persistent or caducous; inner two wing-like, larger than 3 outer; outer sepals all similar or two similar and one dissimilar. Petals united and adnate to staminal sheath; keel petal with lacinate crest. Stamens 8; filaments united for at least half their length. Capsule flattened, usually \pm winged, often notched, with entire margins, dehiscent. Seeds glabrous to pilose; aril usually conspicuous.

1. Wing sepals caducous 2
 + Wing sepals persistent 6
2. Herbaceous annuals; wing sepals 2 – 3mm 3
 + Erect shrubs or small trees; wing sepals 13 – 17mm 4
3. Flowers white, suffused or tipped pink; seeds oblong-ellipsoid
1. P. tatarinowii
 + Flowers yellow to pale orange; seeds ovoid-globose **2. P. furcata**
4. Flowers white tipped purple; capsules unribbed **5. P. karenium**
 + Flowers yellow to deep orange, sometimes suffused reddish-purple; capsules prominently ribbed at maturity 5
5. Inflorescence unbranched; aril irregularly lobed **3. P. arillata**
 + Inflorescence branched; aril helmet-shaped **4. P. tricholopha**
6. Wing sepals green 7
 + Wing sepals coloured, petaloid 8
7. Flowers yellow **10. P. linarifolia**
 + Flowers white suffused pink **11. P. glomerata**

8. Annuals 9
 + Suffrutescent perennials 10
9. Bracts and bracteoles persistent; wing sepals (5 -)6.5 - 7mm; capsules ciliate
 8. *P. persicariifolia*
 + Bracts and bracteoles caducous; wing sepals 3 - 4mm; capsules glabrous
 9. *P. longifolia*
10. Leaves hirsute-villous; capsules ciliate **6. *P. crotalarioides***
 + Leaves sparsely pubescent, puberulent to subglabrous; capsules not ciliate
 7. *P. sibirica*

1. *P. tatarinowii* Regel; *Semeiocardium hamiltonii* Hasskarl, *P. triphylla* auct. p.p. non D. Don. Fig. 5a - c.

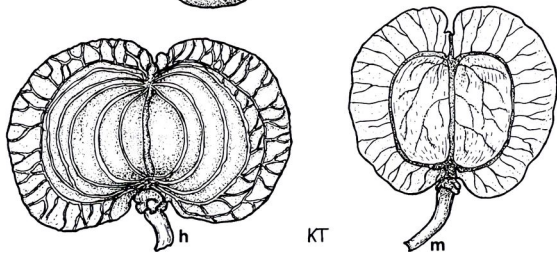
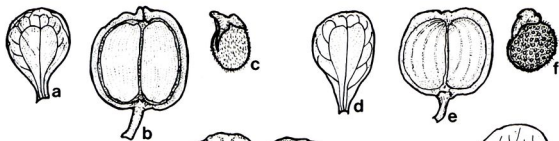
Herbaceous annual 1.5 - 12cm. Stems erect, slender, simple or sparingly branched at base, glabrous, narrowly winged. Leaves broadly obovate to suborbicular, to 2 x 2cm, mucronate, green, glabrous or with some scattered hairs above, subglaucous beneath, ciliate; petioles 0.5 - 1cm. Racemes terminal, dense, elongating to 5cm in fruit. Bracts and bracteoles ovate-lanceolate, c 0.5mm, caducous. Flowers white, suffused or tipped pink; pedicels 0.5 - 0.8mm, elongating to 1.5mm in fruit. Sepals glabrous; outer ovate, boat-shaped, c 1.5mm, obtuse to subacute; wing sepals suborbicular to obovate-spathulate, c 2mm, caducous. Upper petals and staminal sheath glabrous. Keel petal shorter than upper petals, uncrested. Filaments free in upper 1/4. Style curved. Capsule narrowly winged, suborbicular to quadrangular, 2 - 2.5 x 2.8 - 3mm, emarginate, green, glabrous. Seeds oblong-ellipsoid, 1.5 - 1.6 x 0.7 - 1mm, shiny black, pubescent-pilose; aril obliquely 2-lobed, to 0.6mm, cream.

Bhutan: S - Deothang district, C - Thimphu, Punakha, Mongar and Tashigang districts; **Sikkim;** **Chumbi.** Open grassy places, roadsides, 1500 - 4000m. August - October.

2. *P. furcata* Royle; *P. triphylla* D. Don, *P. glaucescens* Wall. *nom. nud.*, *P. triphylla* D. Don var. *glaucescens* (Royle) Bennett p.p. Fig. 5d - f.

Herbaceous annual 3 - 17cm. Stems slender, simple or branched and narrowly winged in upper part, glabrous. Leaves broadly ovate to elliptic-ovate, 2 - 3.5 x 0.5 - 1.5cm, subacute, green and sparsely pubescent above, glaucous beneath, ciliate; petioles 3 - 4cm. Racemes terminal, dense, c 2cm. Bracts and bracteoles caducous. Flowers yellow to pale orange, glabrous. Outer paired sepals broadly ovate; outer solitary one boat-shaped, 1 - 1.3mm, obtuse, persistent; wing sepals spatulate-suborbicular, 2.6 - 2.8mm, caducous. Upper petals equalling keel. Keel petal 3 -

FIG. 5. **Polygalaceae.** (wing sepals, capsules, seeds). a - c, *Polygala tatarinowii*. d - f, *P. furcata*. g - i, *P. arillata*. j & k, *P. tricholopha*. l - n, *P. karensium*. Scale: a - f x 11; g - n x 6. Drawn by K. Tan.



KT

3.3mm excluding crest; crest broadly 4-fid, papillate. Filaments free in upper 1/3. Style curved. Capsule suborbicular, 2–2.6 x 2–2.5mm, glabrous, emarginate, wing broadest at apex. Seeds ovoid-globose, 1 – 1.3 x 0.7 – 0.9mm, shiny black, pubescent; aril helmet-shaped, 0.6mm, bilobed, cream.

Bhutan: C – Punakha district (Punakha); **Sikkim.** Open grassy slopes, 1500m. Rare.

3. *P. arillata* D. Don; *Chamaebuxus arillata* (D. Don) Hasskarl, *P. angustifolia* (Chodat) R. N. Banerjee. Dz: *Baahu*; Sha: *Yangrim*; Nep: *Marcha* (34), *Lapinku*. Fig. 5g – i.

Erect shrub or small straggly tree 1.5 – 5m. Young twigs densely fulvous-tomentose to pubescent. Leaves elliptic-ovate to oblong-lanceolate, 4 – 20 x 1.5 – 4cm, acuminate-cuspidate, dark green above, puberulent, ciliate; petioles 5 – 12mm. Racemes terminal and axillary, 6 – 15cm, lax to ± dense-flowered. Bracts and bracteoles ovate- to linear-lanceolate, caducous. Pedicels 2 – 5mm, recurved. Flowers yellow to deep orange, sometimes tipped purple. Sepals ciliolate, caducous; outer paired ones broadly ovate, 3 – 4mm; outer solitary sepal boat-shaped, 5 – 7mm; wing sepals obovate, 14 – 17mm, rounded at apex. Keel petal 14 – 20mm, glabrous; crest lacinate. Filaments free in upper 1/3. Style curved. Capsule winged, oblong-elliptic to suborbicular, (5–)8–12 x (6–)9–17mm, coriaceous, pubescent to subglabrous, dark reddish-purple, conspicuously ribbed at maturity. Seeds subglobose, c 5 x 4mm, dull black, puberulent at apex; aril irregularly lobed, orange to yellow.

Bhutan: S – Chukka and Deothang districts, C – Thimphu, Punakha, Mongar and Tashigang districts, N – Upper Kuru Chu district; **Sikkim:** Gangtok and Lachen; **Darjeeling:** widespread. Common in scrub, clearings and margins of mixed broad-leaved forest, 1065 – 3000m. May – August; fruit maturing August – late November.

A very variable species; the above description refers only to Bhutanese material. *Grierson & Long* 2225 and *Ludlow & Sherriff* 6785 represent less hairy variants. The recently described var. *laevicarpa* R. N. Banerjee & G. S. Giri from C Nepal and Sikkim, falls well within the range of variation of the species especially regarding leaf size and shape and density of indumentum on young twigs, inflorescence, fruits and leaves.

Roots used in fermentation of beer (34).

4. *P. tricholopha* Chodat; *P. hasskarlii* Merrill & Chun. Fig. 5j&k.

Erect shrub. Branches terete, densely puberulent, glabrescent. Leaves thin, oblong-elliptic, 5 – 15 x 2–6cm, short-caudate, puberulent on midvein above, glabrous and subglaucous beneath; petiole 5 – 10mm. Panicle terminal, erect, 10 – 15cm. Bracts and bracteoles caducous. Flowers yellow, suffused reddish-purple. Sepals ciliolate, caducous; outer paired ones ovate-suborbicular, c 5mm, emarginate; outer solitary sepal boat-shaped, gibbous, c 8.5mm; inner wing sepals elliptic-ovate, 13 – 15 x 7.5mm, slightly hooded. Upper petals 9.5mm, villous at base. Keel

petal 12mm, excluding deeply lacinate crest. Filaments free in upper 1/3. Style curved in upper 1/3; stigma unequally bilobed. Capsule winged, elliptic to suborbicular, 4 – 5 x 8 – 10mm, glabrous, dark reddish-purple and ribbed at maturity. Aril helmet-shaped.

Darjeeling: Kurseong, Hillsides, 1300 – 2000m. July, August.

5. *P. karensium* Kurz; *P. caterviflora* Craib. Fig. 51 – n.

Erect shrub c 1.5m. Branches slender, pubescent, later glabrous. Leaves thin, elliptic-ovate, 5–8(–10) x 1.5–2.5(–4)cm, caudate-acuminate, greyish-green and with few sparsely scattered hairs above, subglaucous, ± glabrous beneath, ciliolate; petioles 1 – 1.5(–2)cm. Racemes terminal or leaf-opposed, c 10cm. Bracts and bracteoles c 3.5mm, caducous. Pedicels 3.5–4mm, recurved. Flowers white, tipped purple. Sepals ciliolate, caducous; outer paired ones obovate, 2.5 – 3mm; outer solitary sepal boat-shaped, hooded, 3.5mm; wing sepals obovate, c 13mm, slightly shorter than keel petal, slightly incurved, glabrous. Upper petals c 6.5mm, glabrous. Keel petal c 13.5mm, glabrous; crest 2-lobed, not fimbriate-lacinate. Filaments free in upper 1/3, glabrous. Ovary glabrous; style curved in upper 1/3. Capsule broadly winged, c 1cm broad, emarginate, unribbed. Seeds obovoid, densely white-pilose; aril white.

Bhutan: S – Deothang district (N of Deothang). Habitat unknown, 1150m. June.

6. *P. crotalarioides* DC. Fig. 6a – c.

Suffrutescent perennial 8 – 25(–50)cm. Stems ascending-erect, branched at base, golden brown or purplish, hirsute to crispate-pubescent. Leaves elliptic- to oblong-ovate, 10–50 x 5–20mm, obtuse to submucronate, greyish-green, hirsute-villous, ciliate; petiole c 1mm. Racemes axillary, 1 – 2cm, dense-flowered. Bracts and bracteoles linear-lanceolate, persistent. Flowers short-pedicellate, deep pink, magenta or purplish, with darker tips. Sepals ciliate to ciliolate, persistent; outer ovate, 5mm, obtuse, with hirsute midvein; wing sepals slightly asymmetrical, obovate, c 8 x 5mm, obtuse-rounded. Upper petals villous in lower 1/3. Keel petal 5mm excluding crest. Filaments free in upper 1/3. Style curved. Capsule narrowly winged, suborbicular, 4–4.5 x 5–6mm, emarginate, ciliate. Seeds ellipsoid, c 3 x 1.6mm, shiny black, white-pilose; aril small, 2 – 3-lobed, yellowish.

Sikkim: locality unknown (73, 80).

These literature records require confirmation as no material from Sikkim or Bhutan has been located.

7. *P. sibirica* L.

Herbaceous suffrutescent perennial 10 – 30cm. Stems slender, unwinged, branched at base, crispate-pubescent. Leaves narrowly elliptic to elliptic-lanceolate, (5 –)15 – 40 x 2 – 7mm, apiculate, green, puberulent to subglabrous, not strongly reticulate-veined above, puberulent or sparsely puberulent on veins beneath and at slightly revolute margins; petioles less than 0.5mm. Racemes 2 – 10cm, elongating in fruit. Bracts and bracteoles caducous. Flowers deep bluish-purple to purplish-

mauve. Outer sepals ovate, boat-shaped, c 3.5mm, subacute, ciliate, green with membranous white or pink margins; wing sepals almost symmetrical, not curved, elliptic-spathulate, 5 – 7mm, glabrous at margins, persistent. Upper petals and staminal sheath villous to pilose at base. Keel petal 5 – 7mm, crest lacinate. Filaments free in upper 1/3 – 1/2. Style curved. Capsule narrowly winged, suborbicular, 5 – 6 x c 6.5mm, emarginate, glabrous at margins. Seeds ovoid, c 2.5 x 2mm, reddish-black, white-pilose; aril small, unequally 3-lobed.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu district; **Sikkim:** Lachung and Chungthang. Open pastures, grassy banks, in scrub, at margins of Pine forest, by streams, roadsides, etc., 1830 – 3660m. March – July.

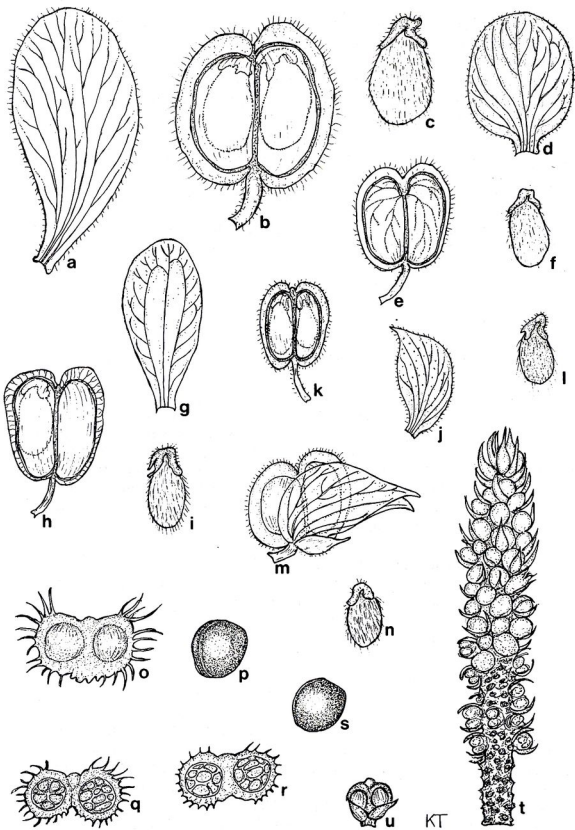
These records refer to subsp. **bhutanica** Kit Tan. Contrary to reports in literature (73, 80), material from Bhutan and Sikkim does not belong to subsp. *elegans* (Royle) Kit Tan (*P. myrsinites* Royle) which can be distinguished from subsp. **bhutanica** by the ciliate wing sepals and capsules. These characters, however, appear to be completely lacking from our material which therefore constitutes a distinct subspecies.

8. *P. persicariifolia* DC.; *P. buchananii* D. Don, *nom. illeg.*, *P. wallichiana* Wight. Fig. 6d – f.

Herbaceous annual 15 – 45cm. Stems erect-ascending, slender, simple or much-branched in upper half, crispate-pilose to pubescent. Leaves subsessile, narrowly elliptic- to linear-lanceolate, 25 – 50 x (1 –)3 – 6mm, subobtuse to mucronate, subglabrous to sparsely scabrid-pubescent, ciliate, greyish-green above. Racemes terminal and axillary, 2.5 – 3cm, elongating to 5cm in fruit, lax-flowered. Bracts and bracteoles linear-lanceolate, c 1mm, persistent. Flowers rose-pink, purple or white tipped pink. Pedicels slender, 3mm, recurved. Sepals obtuse, ciliolate; outer paired ones oblong-ovate, 2.5mm; solitary sepal boat-shaped, 3 – 3.3mm; wing sepals suborbicular to broadly obovate, (5 –)6.5 – 7 x (3.5 –)6mm, strongly 3 – 5-veined, puberulent near base, persistent. Upper petals sparsely pilose in lower 1/3 – 1/2. Keel petal 3.3 – 3.5mm, crested. Filaments free in upper 1/4 – 1/3. Style curved in upper half. Capsule very narrowly winged, broadly elliptic-oblong, 4.2 – 5 x (3 –)4 – 4.2mm, emarginate, ciliate. Seeds oblong-ellipsoid, 3.3 – 3.5 x 1.3 – 1.5mm, shiny reddish-black, densely white-pilose; aril creamy white, unequally 3-lobed, 2 lateral lobes longer than central.

Bhutan: C – Punakha district (Kenchu, Rinchu and Lumichawa), and Tashigang

FIG. 6. **Polygalaceae.** (wing sepals, capsules, seeds). a – c, *Polygala crotalarioides*. d – f, *P. persicariifolia*. g – i, *P. longifolia*. j – l, *P. linearifolia*. m & n, *P. glomerata*. o & p, *Salomonium ciliata*: o, capsule; p, seed. q – s, *S. cantoniensis*: q & r, capsules; s, seed. t & u, *Epirixanthes elongata*: t, part of inflorescence; u, capsule and sepals. Scale: a – c, g – i x 11; d – f, j – n x 6; o – s, u x 16; t x 9. Drawn by K. Tan.



district (Ghunkarah and Kheri, 117); **Sikkim**. Grassy places, along roadsides, often in semi-shade, 1200 – 2500m. August – October.

9. *P. longifolia* Poiret; *P. leptalea* DC., *P. discolor* D. Don. Fig. 6g – i.

Herbaceous annual 15 – 50(–75)cm. Stems erect-ascending, slender, simple or sparingly branched, striate, glabrous, crispate-puberulent at inflorescence only. Leaves \pm sessile or petioles less than 1.5mm, elliptic-linear to linear-lanceolate, 10 – 35 x 1 – 2(–4)mm, apiculate, green, subglabrous. Racemes mostly terminal, dense, (1.5 –)3 – 10cm in fruit. Bracts and bracteoles ovate-lanceolate, ciliate, caducous. Flowers lilac to rose-pink, drying white; pedicels very short. Outer sepals ciliolate in bud, ovate, 1.5 – 2mm, obtuse, white-margined; wing sepals rounded-obovate, \pm symmetrical, 3–4mm, 3-veined, glabrous to sparsely ciliolate, persistent. Upper petals and staminal sheath glabrous. Keel petal with lacinate crest. Filaments free in upper 1/3. Style strongly curved. Capsule narrowly winged, broadly elliptic-oblong, c 2.5 x 3mm, emarginate, green, glabrous. Seeds oblong-ellipsoid, black, sericeous; aril small, unequally 3-lobed.

Darjeeling: Great Rungit Valley. 240m. September – November.

10. *P. linearifolia* Willdenow; *P. chinensis* L. var. *linearifolia* (Willdenow) Chodat. Fig. 6j – l.

Small annual 6 – 12cm. Stems erect, slender, simple or sparingly branched, crispate-pubescent to puberulent. Leaves narrowly elliptic, 10 – 25 x 2 – 6mm, obtuse-apiculate, greyish-green, subglabrous to sparsely hairy at subrevolute margins; petioles short, c 1mm. Racemes less than 1cm, few (5 – 8)-flowered. Bracts and bracteoles minute, caducous. Pedicels less than 1mm, recurved after anthesis. Flowers yellow. Outer sepals \pm equal, ovate-lanceolate, 1 – 1.5mm; wing sepals green, asymmetrical, curved, 3 – 5mm, acute, persistent. Keel petal c 3.5mm, with deeply lacinate crest. Capsule narrowly winged, suborbicular, emarginate. Mature seeds unknown.

West Bengal Duars: Bagdogra; **Sikkim**. Open grassy places, c 200m. June.

P. linearifolia has sometimes been subordinated in the *P. chinensis* complex. The latter bears a formidable synonymy. Only a careful study of type material of all attributed and more commonly, misapplied names can unravel this complicated nomenclatural tangle.

11. *P. glomerata* Loureiro. Fig. 6m&n.

Herbaceous perennial slightly woody at base, 20 – 35(–60)cm. Stems erect or ascending, sparingly or much branched from base or at middle, unwinged, densely crispate-pubescent. Leaves elliptic- to broadly ovate, 10 – 40 x 5 – 20mm, apiculate, greyish-green, spreading to subadpressed pubescent above, subglaucous, sparsely pubescent to glabrescent beneath, ciliate; petioles to 2mm. Racemes 5 – 7mm, few (3 – 5)-flowered. Bracts and bracteoles ovate to lanceolate, subsistent. Flowers shortly pedicellate, white suffused pink. Outer sepals ciliate, ovate-lanceolate, 5mm, acuminate; wing sepals green, slightly curved, ovate, c 5mm, caudate-

acuminate, sparsely ciliate towards base, persistent. Keel petal with filiform crest. Capsule narrowly winged, suborbicular, c 4 x 4.5mm, emarginate, pubescent-pilose, ciliate. Seeds ovoid to ellipsoid, c 2.5 x 1.5mm, shiny black, white sericeous-pilose; aril conspicuous, unequally 3-lobed, creamy yellow.

Darjeeling: Siriong, Rungit and terai. Hot humid valleys, waste places, wet ditches, 300 – 2000m. May – October.

2. SALOMONIA Loureiro

Herbaceous annuals. Stems angular, winged. Leaves alternate. Flowers small, in dense terminal spikes. Sepals 1-veined. Petals adnate to staminal sheath; lower petal keeled, helmet-shaped. Stamens 4 – 5; filaments united in lower half. Disk absent. Capsule flattened, margins denticulate or echinate. Seeds elliptic, flattened, glabrous. Aril thin, inconspicuous.

1. Capsules reticulate-rugose, margins smooth, denticulate or very shortly echinate; leaves broadly ovate, to 2 x 1.5cm; lower sepals equalling or smaller than other sepals **1. S. cantoniensis**
- + Capsules not reticulate-rugose, margins long filiform-echinate; leaves elliptic to lanceolate-ovate, to 1 x 0.6cm at most; lower sepals larger than other sepals
2. S. ciliata

1. S. cantoniensis Loureiro; *S. edentula* DC., *S. petiolata* D. Don, *S. subrotundata* Hasskarl. Fig. 6q – s.

Glabrous annual 5 – 20(–30)cm. Stems erect-ascending, narrowly winged, often highly and divaricately branched. Leaves shortly petiolate, broadly ovate, to 2 x 1.5cm, acuminate, green, often glaucous beneath, glabrous, 3 – 5-veined. Spikes 1 – 3cm. Bracts lanceolate, to 0.7mm, caducous. Sepals subequal, lanceolate, 0.4 – 0.6mm, lower ones equalling or smaller than other sepals. Petals to 2.5mm, creamy-white tipped pink or pale violet; lateral petals shorter than the keel. Keel minutely papillate below. Anthers c 0.5mm, enclosing stigma. Style sigmoid, ± equalling petals, not exerted. Capsule flattened-rectangular, 1 x 1.7 – 2mm, greenish, reticulate-rugose, margins smooth, denticulate or very shortly echinate (spines to 0.5mm). Seeds ovoid, biconvex-lenticular, c 0.7mm, shiny reddish- to blackish-brown.

Bhutan: C – Thimphu district (Thimphu); **Darjeeling:** Tista and Mongpoo. Open and damp places in Blue Pine forest, 2500m. September, October.

2. S. ciliata (L.) DC.; *Polygala ciliata* L., *S. oblongifolia* DC., *S. sessiliflora* D. Don, *S. obovata* Wight, *S. cordata* Wight, *S. rigida* Hasskarl, *S. longiciliata* Kurz. Fig. 6o&p.

Annual 4 – 20cm. Stems simple or sparingly branched, glabrous to denticulate-ciliate in winged portion. Leaves sessile-amplexicaul to subsessile, elliptic to narrowly ovate, 6 – 10 x 2 – 6mm, acute or mucronate at apex, usually 3-veined,

margins glabrous to densely reddish-ciliate. Spikes dense, 1 – 2cm, elongating to 12cm. Sepals unequal, ciliolate, lower ones 1 – 1.5mm, larger than other sepals. Petals pink or white, tipped pink. Keel not papillate. Anthers 4, c 0.15mm. Capsule broadly obovoid, obcordate to subrectangular, 0.7 – 1 x 1.5 – 2mm, smooth, sometimes puberulent; margins reddish, long filiform-echinate. Seeds ellipsoid to ovoid, c 0.7mm, shiny black.

Sikkim: locality unknown (73, 80). Open or slightly shaded places in deciduous forest, 800 – 1250m.

Burmese material with densely ciliate leaves approaches *S. cantoniensis* in fruit characters.

3. EPIRIXANTHES Blume

Small saprophytic herbaceous annuals. Leaves absent or reduced to sessile, brownish scales. Flowers small, in dense terminal spikes. Sepals shorter than petals, persistent. Petals adnate to staminal sheath in lower half; lower petal keeled, helmet-shaped. Stamens 2–4; filaments united in lower half. Anthers not enclosing stigma. Style long and straight or slightly curved; stigma 2-lobed. Capsule indehiscent, thin, membranous, margins entire. Seeds inconspicuously arillate.

1. *E. elongata* Blume; *E. linearis* Blume, *E. tenella* Hook. f., *Salomonina aphylla* Griff., *S. parasitica* Griff. Fig. 6 t&u.

Herbaceous annual. Stems ascending-erect, to 20cm, simple or sparingly branched in upper half, terete, unwinged, reddish to violet, puberulent to glabrous, sometimes papillate. Leaves reduced to a few distant brownish-violet scales, 2 – 3.5mm long, glabrous or ciliate. Spikes terminal, dense, elongate, (0.5 –)2 – 10cm. Bracts ovate, minute (c 1.2mm), cuspidate, early caducous. Bracteoles absent. Flowers 1.5 – 2mm, cream to yellowish-buff, ovoid-globose in bud. Sepals free, subequal, ovate to elliptic-ovate, c 1 x 0.5mm, subacute, glabrous or ciliolate. Stamens 4 – 5. Style c 0.5mm, longer than ovary, slightly curved upwards. Capsule ellipsoid to reniform, enclosed by sepals. Seeds ellipsoid, shiny black, glabrous, dispersing with remains of capsule wall.

Recorded from E India and Burma; so far no material has been seen from Bhutan but it may possibly have been overlooked on account of its small size and habitat; it is a forest litter saprophyte growing in humus-rich soil in deep shade.

Family 92. CORIARIACEAE

by A.J.C. Grierson

Shrubs. Leaves opposite, simple, entire, palmately veined, exstipulate. Flowers actinomorphic, bisexual, in terminal or axillary racemes. Sepals 5, imbricate. Petals

5, distinct, shorter than sepals at first, keeled on inner surface, increasing in size in fruit. Stamens 10, in 2 whorls, those opposite petals adnate to keels of petals; anthers opening by longitudinal slits. Carpels 5, distinct, superior, each with a slender style; carpels 1-celled with a single ovule. Fruit of separate, laterally compressed achenes surrounded and \pm enclosed by fleshy accrescent petals.

1. CORIARIA L.

Description as for Coriariaceae.

1. Racemes in clusters usually from axils of fallen leaves **1. C. napalensis**
 + Racemes solitary borne terminally on leafy shoots **2. C. terminalis**

1. C. napalensis Wall. Dz: *Limphu Shi, Nimbo*. Fig. 4m - p.

Shrub, 1 - 2.5m. Leaves elliptic or ovate, 3.5 - 10 x 2 - 8cm, acute, base rounded or shallowly cordate, glabrous, 3 - 5-veined at base. Flowers in racemes up to 10cm, borne in clusters from the axils of fallen leaves; pedicels up to 7mm; bracts oblanceolate, c 3mm. Sepals ovate, c 1mm, rounded. Petals minute at first, later broadly elliptic, 3 - 5 x 2mm, reddish, turning black in fruit. Filaments c 3mm; anthers c 1.5mm, crimson. Carpels c 0.75mm; styles linear, thickish, c 2mm. Achenes ovoid, 2 - 2.5 x 1.5mm, surrounded by persistent fleshy petals.

Bhutan: S - Chukka district, C - Ha, Thimphu, Tongsa, Bumthang, Mongar and Tashigang districts, N - Upper Mo Chu district; **Sikkim** (80). Steep dry shrub-covered hillsides, 1220 - 3200m. April - May.

Wood used as firewood (48).

2. C. terminalis Hemsley

Similar to *C. napalensis* but racemes up to 25cm, terminal on leafy shoots; pedicels 1 - 1.5cm; flowers at first reddish; fruiting petals up to 8 x 6mm, orange or ?black.

Bhutan: C - Ha, Tongsa and Bumthang districts, N - Upper Mo Chu district; **Sikkim;** **Chumbi.** Streamsides and *Rhododendron* scrub, 1220 - 3650m. April - June.

There is some controversy over the colour of the swollen fruiting petals; according to some reports they are black, to others orange. Sinclair and Long, Bowes Lyon, Ludlow and Sherriff and Cave have all recorded the fruit as orange or yellow in Bhutan and Sikkim. The black fruit may be explained by the petals being in a withered condition. The orange-fruited form has been called var. **xanthocarpa** Rehder & Wilson.

Family 93. ANACARDIACEAE

by A.J.C. Grierson

Trees or shrubs, sometimes scandent, usually with corrosive sap turning black when exposed to air. Leaves alternate, rarely opposite, pinnate or trifoliolate, less often simple, exstipulate. Monoecious or dioecious; flowers small, actinomorphic, bisexual or unisexual, in terminal or axillary panicles. Sepals and petals usually 5, valvate or imbricate; sepals usually connate at base; petals distinct or rarely absent. Stamens 5–10 in bisexual and male flowers (only one fertile in *Mangifera*), anthers opening by longitudinal slits; in female flowers absent or reduced to staminodes. Disc usually present, flat or concave. Ovary free or immersed in disc, rarely inferior. Carpels (1–)3(–5); styles 1–5; ovules solitary within each cell. Fruit drupaceous with resinous or waxy mesocarp, sometimes borne on fleshy pedicel, rarely a dry achene.

Many members of Anacardiaceae produce an irritant juice to which some people are highly allergic.

- | | |
|--|---------------------------------------|
| 1. Leaves simple | 2 |
| + Leaves compound, trifoliolate or pinnate | 5 |
| 2. Leaves opposite | 9. Dobinea |
| + Leaves alternate | 3 |
| 3. Leaves crispate and with a distinct marginal vein | 4. Drimycarpus |
| + Leaves flat and without a marginal vein | 4 |
| 4. Leaves lanceolate or elliptic | 3. Mangifera |
| + Leaves obovate | 7. Semecarpus |
| 5. Leaves trifoliolate | 1. Rhus (<i>R. paniculata</i>) |
| + Leaves pinnate | 6 |
| 6. Scandent shrub | 2. Pegia |
| + Erect shrubs or trees | 7 |
| 7. Plants flowering precociously or with young leaves | 8 |
| + Plants leafy when flowering | 9 |
| 8. Leaflets with a distinct intramarginal vein | 6. Spondias |
| + Leaflets without intramarginal veins | 8. Lannea |
| 9. Male flowers in broad panicles c 15cm; female flowers in panicles 7–40cm; fruit globose, subglobose or reniform, less than 0.7cm diameter | 1. Rhus |

- + Male flowers in narrow axillary panicles 3 – 7cm; female flowers solitary, axillary; fruit oblong-ovoid, c 3.5 x 2.5cm **5. Choerospondias**

1. RHUS L.

Trees or shrubs. Leaves alternate, trifoliolate or odd-pinnate. Flowers usually unisexual, in terminal or axillary panicles. Calyx 5-lobed. Petals 5, imbricate. Stamens 5, inserted at base of disc, sterile in female flowers. Ovary ovoid or globose, 1-celled; styles 3; stigmas capitate or simple, reduced to a pistillode in male flowers. Drupe small, dry; stone compressed.

1. Leaves 3-foliolate **1. R. paniculata**
 + Leaves pinnate with 2 or more pairs of leaflets 2
2. Leaflets regularly crenate-dentate; leaf rachis narrowly winged near apex
2. R. chinensis
 + Leaflets entire; leaf rachis unwinged 3
3. Leaflets up to 13cm, cuneate or sometimes rounded at base, bearing dark spots (small clusters of minute reddish glands, rarely hairs) in axils of veins beneath, otherwise glabrous **3. R. succedanea**
 + Leaflets up to 25cm, rounded at base, pubescent or glabrous beneath 4
4. Leaflets softly pubescent beneath **4. R. hookeri**
 + Leaflets almost glabrous beneath **5. R. griffithii**

1. R. paniculata Hook.f. Dz: *Khyr Khobtang*; Sha: *Khai Roptang Shing, Prekoptang Shing*.

Shrub 1 – 4m. Leaves trifoliolate; leaflets 4 – 13 x 2 – 5.5cm, terminal leaflet longer than lateral ones, acute or rounded, base attenuate, margin entire, usually bearing minute reddish glands on both surfaces; petioles 2 – 5cm. Panicles 15 – 20cm. Calyx c 0.5mm. Petals oblong, c 1 x 0.5mm, whitish. Stamens c 0.5mm, reduced to staminodes in female flowers. Ovary globose, c 1mm, diameter, reduced to a pistillode in male flowers. Drupes globose, 4 – 5mm diameter, 1-seeded.

Bhutan: C – Punakha, Mongar and Tashigang districts. River banks and dry hillsides, 1360 – 1830m. June – August.

2. R. chinensis Miller; *R. javanica* Thunberg non L., *R. semi-alata* Murray. Sha: *Pok Pokpa Shing, Roptang Shing*; Kengpa: *Brampa*; Med: *Datick* (fruit); Nep: *Bhakimlo* (34), *Bakimilo*.

Shrub or small tree up to 10m. Leaves 20 – 50cm; leaflets 3 – 6 pairs, oblong-ovate or elliptic, 5 – 13 x 2.5 – 5.5cm, acute, base rounded, sparsely pubescent above, more densely brownish pubescent beneath, margin regularly crenate-dentate, rachis narrowly winged towards apex. Panicle terminal, c 30cm. Calyx c

0.75mm, lobes rounded. Petals oblong, c 1.5 x 0.75mm. Stamens c 1.5mm, reduced to staminodes in female flowers. Ovary oblong, c 1.5mm, pubescent, reduced to pistillode in male flowers. Drupes subglobose, 4–5mm diameter, reddish, densely covered with minute hairs.

Bhutan: C – Thimphu, Punakha, Tongsa, Mongar and Tashigang districts;

Darjeeling. Forest slopes, 915 – 2745m. July – September.

Fruit edible and used in treatment of dysentery (34).

3. R. succedanea L.; *R. acuminata* DC. Sha: *Say Shing*; Nep: *Rani Bhalayo* (34), *Rani-walai* (34). Fig. 7d – g.

Shrub or tree to 10m. Leaves 15–30cm; leaflets membranous, 2–6 pairs, ovate, oblong or lanceolate, 6–13 x 2–4.5cm, acuminate or caudate-acuminate, base cuneate, margin entire, axils of veins beneath bearing small clusters of minute reddish-brown glands, otherwise glabrous. Panicles axillary, 10–15cm. Calyx c 1mm. Petals 2 x 0.5mm. Stamens c 1.5mm, reduced to staminodes in female flowers. Ovary ovoid, c 1.5mm, reduced to pistillode in male flowers. Drupe subglobose or reniform, c 7mm, dull yellowish when ripe.

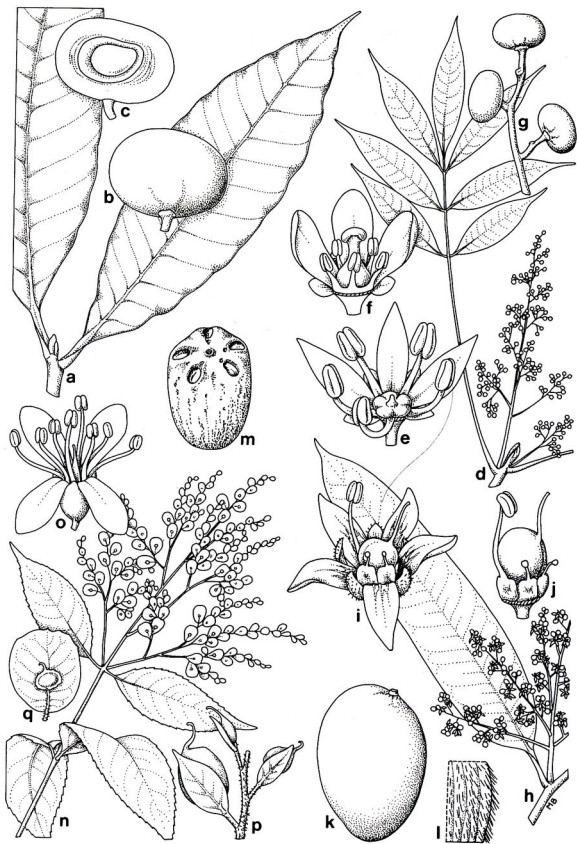
Bhutan: S – Chukka district, C – Punakha and Tashigang districts, N – Upper Mo Chu district; **Darjeeling;** **Sikkim.** South-facing forest slopes, 600 – 2440m. April – June.

Leaves turn bright red in autumn. Sap causes blisters on skin (34). The above is a strict interpretation of this species and many of the specimens that were formerly included are now thought to belong elsewhere. Those that remain are remarkably uniform and probably best correspond to var. *acuminata* (DC.) Hook.f. Those with tufts of hairs instead of glands in vein axils of the lower leaf surface are var. *himalaica* Hook.f.; they are known from Darjeeling (Mongpu) but have yet to be collected from Bhutan.

4. R. hookeri Sahn & Bahadur; *R. insignis* Hook. f. non Oliver. Sha: *Jar Shing*, *Jarsee Shing*; Nep: *Khag Bhalayo* (34), *Bhalaye*.

Tree to 13m. Leaves pinnate, 40–50cm; leaflets 3–7 pairs, thinly coriaceous, ovate-oblong, 9–25 x 3–9cm, acuminate, base rounded, margin entire, pubescent on both surfaces at first, later glabrous above. Panicles lateral, 15–40cm, brownish pubescent. Calyx c 0.7mm. Petals oblong, c 2 x 0.5mm. Stamens c 1.5mm, reduced to staminodes in female flowers. Ovary globose, c 1mm, reduced to pistillode in male flowers. Drupes 5–6mm diameter, pale; seed whitish.

FIG. 7. *Anacardiaceae*. a – c, *Drimycarpus racemosus*: a, leaves; b, fruit; c, l.s. fruit. d – g, *Rhus succedanea*: d, flowering shoot; e, male flower with one sepal and two petals removed; f, female flower with one sepal and two petals removed; g, fruits. h – l, *Mangifera indica*: h, portion of flowering shoot; i, flower; j, ovary, stamen and staminodes; k, fruit; l, surface of stone. m, *Choerospondias axillaris*: stone. n – q, *Dobinea vulgaris*: n, fruiting shoot; o, male flower; p, female flowers; q, fruit. Scale: d, h, k, n x 1/2; a, l x 1/2; b, c x 1/3; m x 1; q x 1 1/2; g x 2; p x 5; i x 6; j x 7; e, f, o x 10. Drawn by M. Bates.



Bhutan: S – Chukka district, C – Thimphu, Punakha and Mongar districts; **Darjeeling; Sikkim.** Forest slopes, 900 – 2500m. July.

Sap causes blisters on skin (34). One specimen from Punakha has the leaves more sparsely pubescent and comes close to *R. griffithii*. Specimens of this species have sometimes been misidentified as *R. wallichii* Hook.f., a West Himalayan species. The record of *R. punjabensis* Stewart from Bhutan (73) is based on a misidentified collection of *R. hookeri*.

5. R. griffithii Hook.f. Nep: *Bhalayo* (34).

Very similar to *R. hookeri*, but leaflets almost glabrous or puberulous on veins beneath; fruit smaller, 4 – 5mm diameter.

Darjeeling: Mongpu, Tista Valley. 600m. May – August.

2. PEGIA Colebrooke

Scrambling shrubs. Leaves alternate, odd-pinnate. Dioecious; flowers in loose axillary panicles. Calyx 5-lobed. Petals 5. Stamens 10, reduced to staminodes in female flowers. Ovary subglobose; styles 5; stigmas capitate; ovary reduced to pistillode in male flowers.

1. P. nitida Colebrooke; *Tapiria hirsuta* Hook. f. Nep: *Lahara Anp* (34).

Leaves 20 – 35cm; leaflets 4 – 7 pairs, ovate or oblong, 4 – 8 x 2 – 4.5cm, acute, base rounded or cordate, margin with a few teeth near apex, pubescent with long white hairs especially on lower surface. Calyx c 1mm. Petals whitish, c 2mm. Stamens c 1.5mm. Ovary subglobose, c 1.5mm. Drupe ellipsoid or obovoid, 9 x 5 – 6mm, crimson or purplish.

Bhutan: S – Sarbhang, Gaylegphug and Deothang districts, C – Tongsa and Mongar districts; **Darjeeling.** Warm broad-leaved forest slopes, 270 – 1475m. February – April.

Fruit edible (34).

3. MANGIFERA L.

Evergreen trees. Leaves coriaceous, alternate, simple, entire. Panicles terminal or axillary; flowers unisexual and bisexual on same plant. Calyx 4 – 5-lobed. Petals 4 – 5, imbricate. Stamens 1, fertile, other 4 reduced to staminodes. Disc bulbous, lobed. Ovary 1-celled (abortive in male flowers); style eccentric. Drupe fleshy and thick in cultivated species; stone woody, fibrous.

1. Commonly cultivated; panicle pubescent **1. M. indica**
 + Normally wild; panicle glabrous **2. M. sylvatica**

1. *M. indica* L. Dz: *Aam Chukuli*; Sha: *Aam, Aumm*; Nep: *Amp, Anp* (34); Eng: *Mango*. Fig. 7h - l.

Tree 10 - 30m. Leaves elliptic or lanceolate, 11 - 22 x 3 - 6 cm, acuminate, base cuneate, glabrous; petioles 1 - 5cm. Panicles usually terminal, pubescent. Calyx c 1.5mm. Petals elliptic, c 3 x 1mm. Fertile stamen c 2mm. Ovary asymmetric, globose; style subterminal, c 1mm. Drupe variable in shape, ovoid-oblong, asymmetric, weakly compressed, 5 - 20 x 3 - 7cm, yellowish or reddish when ripe.

Bhutan: S - Chukka, Sarbhong and Deothang districts; **Darjeeling:** Siliguri, Sivoke, Darjeeling, etc.. Cultivated in terai and foothills, 450 - 915m. March - April.

Cultivated for its sweet edible fruit; timber useful (126).

2. *M. sylvatica* Roxb. Nep: *Chuche Anp* (34).

Very similar to *M. indica* but young leaves drooping, blackish-purple, glossy at first; panicles glabrous, flowers larger; calyx c 2mm; petals 5mm; fertile stamen 6mm; styles 5 - 6mm; fruit obovoid, 7 x 3cm.

Bhutan: S - Chukka and Gaylegphug districts, C - Punakha and Tongsa districts; **Darjeeling; Sikkim.** Warm broad-leaved forests, 915 - 1370m. April - May.

Fruit edible (34).

4. DRIMYCARPUS Hook. f.

Trees. Leaves coriaceous, alternate, simple, with distinct marginal vein. Flowers unisexual, in axillary racemes. Calyx 5-lobed. Petals 5, imbricate. Stamens 5, imperfect or abortive in female flowers. Ovary inferior, 1-celled, ovule solitary; style short; stigmas 3, abortive and rudimentary in male flowers.

1. *D. racemosus* (Roxb.) Hook. f. Nep: *Khak Balaiyo*. Fig. 7a - c.

Tree to 30m. Leaves elliptic or oblanceolate, 12 - 25 x 3 - 9cm, acuminate, base cuneate, entire, margin fluted or crispate and with a marginal vein, glabrous. Racemes up to 6cm, in axillary clusters. Calyx cup c 1mm. Petals greenish, 2 - 2.5 mm. Stamens c 2mm. Female flowers not seen. Fruit subglobose, oblique, c 2.5 x 3.5cm, 1-seeded; embryo purplish; flesh creamy at first, becoming black on exposure to air.

Bhutan: S - Phuntsholing and Sarbhong districts, C - Tongsa district; **Darjeeling:** Kurseong, Pankabari, Tista, etc. Subtropical and warm broad-leaved forest slopes, 410 - 1550m. March - April.

5. CHOEROSPONDIAS Burt & Hill

Evergreen trees. Leaves alternate, odd-pinnate. Dioecious; male flowers in axillary panicles; female flowers solitary, axillary. Calyx 5-lobed. Petals 5. Stamens 10, reduced to staminodes in female flowers. Female flowers with oblong superior

ovary with 5 short styles; stigmas capitate. Drupe ovoid, succulent, with a hard stone.

1. C. axillaris (Roxb.) Burt & Hill; *Spondias axillaris* Roxb. Nep: *Labshi*, *Lapshi*. Fig. 7m.

Tree to 10m or more. Leaves 30–35cm; leaflets 2–5(–6) pairs, ovate, 8–11 x 2.5–3cm, acuminate, base rounded, entire, glabrous; petiolules 0.5–2cm. Male panicles 3–7cm; flowers purplish; calyx c 1.5mm; petals oblong, 3–4mm; stamens c 3mm. Female flowers on peduncles c 1cm; calyx and petals as in male flowers; ovary 2–3mm. Fruit ovoid or oblong, c 3.5 x 2.5cm; stone 2–2.5 x 1.5–2cm, with 5–6 oval shallow depressions at apex.

Bhutan: S—Gayleghphug district (near Tama); **Darjeeling:** Mongpu, Kalimpong and Ronko Chu. Subtropical forests, 300–1540m. April.

Drupes edible.

6. SPONDIAS L.

Deciduous trees. Leaves alternate, odd-pinnate; leaflets entire with a distinct intramarginal vein. Panicles axillary or terminal, precocious or appearing with young leaves; flowers bisexual. Calyx 5-lobed. Petals 5, valvate. Stamens 10. Ovary subglobose; styles 4–5 free. Drupe ellipsoid, 4–5-celled; stone bony and ± fibrous.

1. S. pinnata (L.f.) Kurz; *S. mangifera* Willdenow. Sha: *Ambar Shing*, *Bochong Shing*; Nep: *Amaroo*, *Amaro* (34).

Tree up to 40m. Leaves 10–35cm; leaflets 2–6 pairs, oblong-elliptic, 7–15 x 3–5cm, abruptly acuminate, base rounded or cuneate, glabrous. Flowers ± sessile on inflorescence branches. Calyx lobes c 0.5mm. Petals ovate-oblong, 2.5–3 x 1–1.5mm. Stamens 1–1.75mm. Ovary c 0.75mm; styles c 0.5mm. Fruit ellipsoid, 2.75–5 x 2.5–3.5cm, orange-yellow when mature; stone rather smooth with few connecting fibrous processes.

Bhutan: S—Chukka and Sarbhang districts, C—Punakha and Mongar districts; **Darjeeling:** Rieng and Tista Valley; **Sikkim:** Reinak. Subtropical and warm broad-leaved forest slopes, 285–1150m. March–May.

Yields a gum (Nep: *Chop*); fruit edible but with an unpleasant taste (17).

7. SEMECARPUS L.f.

Deciduous trees. Leaves coriaceous, alternate, simple, entire. Dioecious; flowers small in terminal or axillary panicles. Calyx lobes 5, deciduous. Petals 5, imbricate. Stamens 5, reduced to staminodes in female flowers. Disc intrastaminal. Ovary 1-celled; styles 3, sterile in male flowers. Drupe fleshy, seated on enlarged disc and calyx base.

1. *S. anacardium* L.f. Nep: *Bhalayo* (34), *Kalo Bhalayo* (34); Eng: *Marking Nut Tree* (34).

Tree to 12m. Leaves obovate, 20 – 45 x 11 – 25cm, obtuse, base rounded or cuneate, subglabrous above, pubescent beneath; petioles 1 – 4cm. Panicles stout, ± as long as or shorter than leaves. Flowers 6 – 8mm diameter, subsessile. Petals greenish, oblong, longer than calyx. Drupe ovoid or oblong, c 2.5cm long, black; disc and calyx base red.

Darjeeling: terai at Bamunpokri, Siliguri, etc. Terai forests, 300 – 500m. May – July.

Lower part of fruit edible; upper part yields a gum used as ink and also medicinally as a vermifuge for sheep and goats (34).

8. LANNEA A. Richard

Deciduous trees. Leaves alternate, odd-pinnate, minutely stellate-pubescent. Dioecious; flowers in panicles or in spike-like branches, precocious. Calyx 4-lobed. Petals 4 imbricate. Stamens 8, reduced to staminodes in female flowers. Disc intrastaminal. Ovary oblong, 4-celled (1 or 2 cells fertile); styles 4; ovary reduced to pistillode in male flowers. Drupe with 1 or 2 stony seeds.

1. *L. coromandelica* (Houttuyn) Merrill; *Odina wodier* Roxb. Nep: *Jia, Amaroo, Halonre* (34), *Thulo Dabdabe* (34).

Tree 6 – 10(–20)m; young branchlets, leaves and inflorescences minutely rusty stellate-pubescent at first. Leaves 10 – 25cm; leaflets 3 – 7 pairs, elliptic or ovate, 4 – 11 x 2.5 – 4.5cm, acuminate, base cuneate, entire. Inflorescence branches up to 20cm. Calyx lobes triangular, c 1mm. Petals yellow, elliptic or oblong, 2 – 2.5 x 1 – 1.25mm. Stamens 2 – 2.5mm. Disc c 1mm diameter. Ovary c 0.6mm. Drupe ellipsoid or subreniform, c 1 x 0.6cm, red when mature.

Bhutan: S – Gaylegphug district (near Gaylegphug); **W. Bengal Duars:** Buxa; **Darjeeling:** Tista Valley and Jalpaiguri Duars. Subtropical forest slopes, 280 – 300m. January – May.

A useful timber species (48); wood yields a gum (34).

9. DOBINEA D. Don.

Shrubs. Leaves simple, opposite. Dioecious; panicles terminal, flowers small. Calyx cup 4-toothed, absent in female flowers. Petals 4, lanceolate, slightly longer than calyx, absent in female flowers. Stamens 8, alternately shorter, absent in female flowers. Disc annular in female flowers, absent in males. Ovary lenticular, 1-celled, rudimentary in male flowers; style filiform, curved. Fruit compressed, indehiscent, borne on a membranous bract.

1. *D. vulgaris* D. Don. Sha: *Zumphu Sengkormay Shing*; Nep: *Sangle* (34). Fig. 7n - q.

Shrub 2 - 5m with long slender branches. Leaves elliptic-lanceolate, 12 - 18 x 3.5 - 5cm, acuminate, base rounded or cuneate, margin serrate, sparsely pubescent on veins beneath; petioles 1 - 3cm. Male flowers c 1.5mm, yellowish. Female flowers 1 - 1.5mm. Fruit orbicular, c 3mm diameter, compressed, borne on whitish obovate or rounded bract 1 - 1.5cm diameter.

Bhutan: S - Chukka district, C - Tongsa, Bumthang, Mongar and Tashigang districts; **Darjeeling:** Little Rungit Valley, Rungbe, Lebong. Warm broad-leaved forests, 1525 - 1980m. August - October.

Family 94. ACERACEAE

by A. J. C. Grierson & D. G. Long

Deciduous trees. Leaves opposite, simple, often palmately lobed; stipules absent. Dioecious or monoecious; flowers in axillary or terminal pendulous racemes or panicles, actinomorphic, some or all unisexual. Sepals and petals mostly 5. Stamens (4 -)8(- 12); filaments distinct, inserted around disc. Ovary bilocular, compressed at right angles to septum; styles 2 mostly connate at base. Fruit a double samara; mericarps 1-seeded, separating from persistent carpophore, each with terminal wing.

1. ACER L.

Description as for Aceraceae.

- | | | |
|----|---|--------------------------------|
| 1. | Leaves narrowly oblong-elliptic, always unlobed; base narrowly rounded . | 2 |
| + | Leaves ovate to suborbicular, often 3 - 7-lobed, sometimes unlobed; base truncate or broadly rounded or shallowly to deeply cordate | 3 |
| 2. | Leaves quite entire, usually glaucous and glabrous beneath; petiole 2 - 6cm | |
| | 1. <i>A. oblongum</i> | |
| + | Leaves often serrulate near apex, green and reticulate beneath and sometimes pubescent in vein axils; petiole 1 - 1.5cm | 2. <i>A. laevigatum</i> |
| 3. | Leaves unlobed or all 3-lobed, with usually shallow lobes | 4 |
| + | Leaves 3 - 7-lobed, usually deeply so, never unlobed (if 3-lobed then often with 2 additional very small lobes near base) | 9 |
| 4. | Leaves unlobed (rarely with 2 very small lateral lobes in <i>A. hookeri</i>) | 5 |
| + | Leaves with 2 distinct lateral lobes | 7 |

5. Flowers in short, lax often \pm cymose racemes; leaves coarsely and unequally serrate, softly pubescent beneath or with conspicuous tufts of hair in vein axils beneath **5. A. stachyophyllum**
 + Flowers in long slender spike-like racemes; leaves entire, serrulate or more regularly serrate, glabrous beneath or with inconspicuous tufts of hair in vein axils 6
6. Leaves sharply serrate; bud scales not persistent at flowering time **3. A. hookeri**
 + Leaves entire or obscurely serrulate; bud scales often persistent at flowering time **4. A. sikkimense**
7. Leaves not strongly reticulate, margins doubly serrate **6. A. taronense**
 + Leaves \pm strongly reticulate, margins entire to serrulate 8
8. Leaves elliptic to obovate, 8 – 15 x 4 – 13cm, with a tuft of long pale hairs at petiole insertion on upper surface when young, margins serrulate; mericarps diverging at right angles **7. A. osmastonii**
 + Leaves broadly ovate or suborbicular, 10 – 23 x 7 – 20cm, finely and shortly puberulous at base on upper surface when young, margins entire or obscurely serrate; mericarps ascending, sometimes almost parallel **8. A. thomsonii**
9. Leaf margin quite entire **9. A. cappadocicum**
 + Leaf margin serrate or serrulate, sometimes doubly so 10
10. Leaf margin coarsely doubly serrate **11. A. caudatum**
 + Leaf margin finely serrulate or distantly but regularly serrate (rarely weakly doubly serrate in *A. pectinatum*) 11
11. Mature leaves glabrous beneath, or with a few pale hairs in vein axils beneath, 5 – 7-lobed **10. A. campbellii**
 + Mature leaves usually pubescent beneath at least along veins, 3 – 5-lobed 12
12. Branchlets slender; leaf margin closely serrate; pubescence reddish **12. A. pectinatum**
 + Branchlets stout; leaf margin distantly serrate; pubescence whitish **13. A. sterculiaceum**

1. A. oblongum DC. Dz: *Chhibla Shi*; Nep: *Phirphiri* (34). Fig. 8a – e.

Tree up to 20m. Leaves oblong-elliptic, 8 – 13 x 3 – 5cm, acuminate, base rounded, margin unlobed, entire, glaucous beneath, often pubescent with short crisped hair beneath at first, later glabrous; petiole 2 – 6cm. Flowers in broad panicles 3 – 7cm diameter, pubescent. Sepals c 3mm, rounded. Petals pale greenish-

yellow, oblong, c 5 x 2mm. Stamens c 4mm; anthers crimson. Mericarps with wings 2.5 – 3 x 1cm, somewhat divergent.

Bhutan: S – Sarbhang district, C – Punakha, Tongsa and Mongar districts, N – Upper Kuru Chu district; **Darjeeling:** Kalimpong and Pedong; **Sikkim:** Kulhait. Subtropical, warm broad-leaved and Evergreen oak forests, 300 – 2350m. March – April.

An attractive roadside tree (16).

2. *A. laevigatum* Wall. Nep: *Putli* (34).

Similar to *A. oblongum* but leaves often serrulate towards apex, strongly reticulate, green beneath, often pubescent in vein axils beneath; petioles 1 – 1.5cm; mericarps usually more widely divergent.

Darjeeling: Darjeeling, Birch Hill and Rangirun. 1675 – 2130m. April.

Wood used in house-building and for making agricultural implements (34).

3. *A. hookeri* Miquel. Nep: *Lahara Kapasi* (34), *Lal Kapasi* (34). Fig. 8i – k.

Tree to 10m; branchlets red. Leaves unlobed or rarely with 2 very small lateral lobes, ovate, 7 – 13 x 4.5 – 6cm, finely acuminate, base shallowly cordate, margin sharply serrate, usually glabrous when mature, sometimes with inconspicuous tufts of hair in vein axils beneath; petioles red, 2.5 – 7cm. Monoecious; flowers in elongate racemes. Sepals c 4 x 1mm, oblong. Petals c 3.5 x 1.5mm. Anthers scarcely exerted. Fruit with short wings 1 – 1.5 x 0.5cm.

Bhutan: S – Deothang district, C – Thimphu, Punakha and Tongsa districts, N – Upper Kuru Chu district; **Darjeeling:** common; **Sikkim.** Cool broad-leaved forests, 2200 – 3200m. April – May.

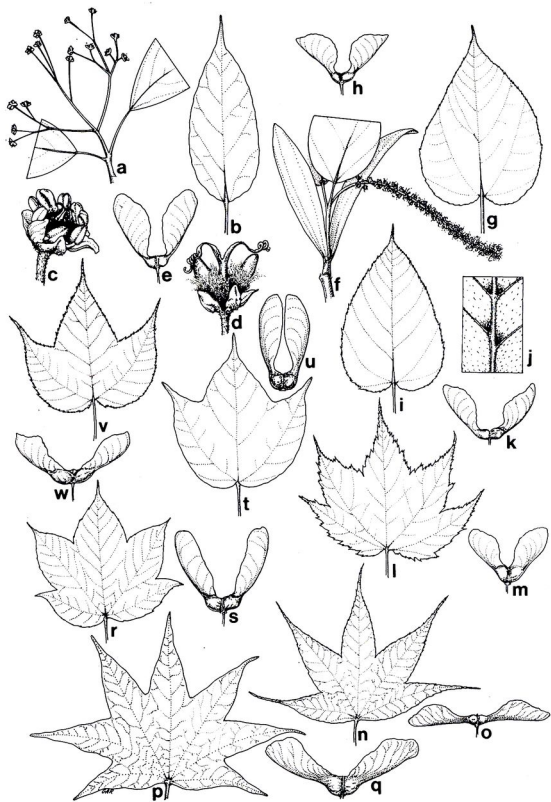
A variable species; some specimens approach *A. taronense* in their tendency to have small lateral leaf lobes.

4. *A. sikkimense* Miquel. Nep: *Lahara Kapasi* (34). Fig. 8f – h.

Similar to *A. hookeri* but leaves subcoriaceous, subtentire or obscurely serrulate, usually with inconspicuous tufts of reddish hair in vein axils at base beneath; petioles 1 – 3cm; bud scales red or green, lanceolate, 3 – 5.5 x 1 – 1.5cm, often persisting at flowering time.

Bhutan: S – Chukka district (near Chimakothi) and Gaylegphug district (near Chabley Khola), C – Thimphu district (near Thimphu, 117); **Darjeeling;** **Sikkim.** Mixed broad-leaved and evergreen oak forests, 1070 – 2140m. March – May.

FIG. 8. *Aceraceae*. a – e, *Acer oblongum*: a, flowering shoot; b, leaf; c, male flower; d, female flower; e, fruit. f – h, *Acer sikkimense*: f, flowering shoot; g, leaf; h, fruit. i – k, *Acer hookeri*: i, leaf; j, vein axils on underside of leaf; k, fruit. l & m, *Acer caudatum*: l, leaf; m, fruit. n & o, *Acer campbellii*: n, leaf; o, fruit. p & q, *Acer cappadocicum*: p, leaf; q, fruit. r & s, *Acer sterculiaceum*: r, leaf; s, fruit. t & u, *Acer thomsonii*: t, leaf; u, fruit. v & w, *Acer pectinatum*: v, leaf; w, fruit. Scale: t x $\frac{1}{6}$; b, g, p, r, u x $\frac{1}{4}$; l x $\frac{1}{3}$; i x $\frac{3}{8}$; a, e, f, m, n, o, q, s, v x $\frac{1}{2}$; h x $\frac{3}{4}$; k, w x 1; j x 2; c, d x 3. Drawn by G. Rodrigues.



5. *A. stachyophyllum* Hiern

Similar to *A. hookeri* and *A. sikkimense* but leaves pale pubescent beneath or with conspicuous whitish tufts of hair in vein axils, coarsely and unequally serrate; petioles 2–6cm; dioecious; racemes short, lax and often \pm cymose; fruit wings c $2.5 \times 0.75 - 1.5$ cm.

Bhutan: C – Ha district (Ha Chu), Thimphu district (Bela La), Tongsa district (near Yuto La) and Bumthang district (Peipe La, Takhung and Gyetsa); **Arunachal Pradesh:** Nyam Jang Chu; **Sikkim:** Thangu, Lachen, Lachung. Hemlock forests, 2700–3350m. April – May.

6. *A. taronense* Handel-Mazzetti; *A. pectinatum* subsp. *taronense* (Handel-Mazzetti) Murray

Similar to *A. hookeri* but leaves more strongly 3-lobed in upper half (rarely weakly 5-lobed with 2 additional lobes near base), 9–15 x 6–10cm, reddish pubescent along veins when young, with tufts persisting in vein axils beneath when older, margins doubly serrate.

Bhutan: C – Tongsa district (near Chendebi) and Mongar district (near Sengor). Wet broad-leaved forests, 2450–2730m. May – June.

7. *A. osmastonii* Gamble. Nep: *Kapasi*.

Tree to 30m. Leaves unlobed or (usually) 3-lobed, elliptic to obovate, 8–15 x 4–13cm, lateral lobes variable in size, acuminate, base rounded, margins serrulate, \pm glabrous but reddish pubescent in vein axils beneath and with longer straight whitish hairs at petiole insertion above; petiole 1.5–3cm. Sepals ovate, c 1.5×1 mm. Petals obovate, c 1.75×1.5 mm, notched above. Outer edges of fruit diverging at right-angles; wings $2.5 - 3 \times 1 - 1.3$ cm.

Darjeeling: Birch Hill, Kurseong, Salombong, Tonglo and Rangirun. 1670–2130m. April.

A very local and poorly known species, endemic to the Darjeeling district. Forms with almost unlobed leaves are similar to *A. oblongum* and *A. laevigatum*; Cowan & Cowan (34) suggest it may be a hybrid between *A. campbellii* and *A. laevigatum*.

8. *A. thomsonii* Miquel; *A. platanifolium* Griff. *nom. illeg.*, *A. villosum* Wall. var. *thomsonii* (Miquel) Hiern. Nep: *Melo Kapasi* (34). Fig. 8t&u.

Tree to 30m. Leaves subcoriaceous, broadly ovate or suborbicular, 3-lobed (rarely almost unlobed), 10–23 x 7–20cm, lobes acuminate, base rounded or cordate, margin entire or remotely serrate, glabrous when mature; petioles 5–20cm. Sepals oblong, c 3×1.5 mm, white pubescent within. Petals \pm as long as sepals. Anthers exerted. Fruit wings c 6.5×2 cm, ascending and parallel, sometimes overlapping.

Bhutan: S – Chukka district (Marichong and near Chukka) and Gaylephug district (Chabley Khola); **Darjeeling:** Kalimpong, Dumsong, Lebong, Merig; **Sikkim:** Gangtok, Lachen. Cool and warm broad-leaved forests, 900–2440m. October – November.

Similar to *A. sterculiaceum* which differs in its leaves mostly 5-lobed and pubescent beneath.

9. *A. cappadocicum* Gleditsch; *A. pictum* sensu F.B.I. non Thunberg. Fig. 8p&q.

Tree c 15 m; young bark and petioles red. Leaves prominently 5–7-lobed, 10–15cm long and broad, lobes acuminate, base cordate, margins entire, white pubescent in axils of veins beneath; petioles 7–10cm, sap milky. Panicles \pm lax 10–15cm. Sepals oblong c 2.5 x 1mm. Petals oblanceolate c 4 x 1.5mm. Fruit with strongly divergent mericarps, almost in line; wing c 3 x 1.5cm.

Bhutan: S—Chukka district (near Chukka), C—Thimphu district (near Chapcha, Thimphu and Dotena); **Sikkim:** locality unknown. Oak and Pine forests, 2300–2700 m. April–May.

The E Himalayan plants belong to var. **indicum** (Pax) Rehder.

10. *A. campbellii* Hiern. Dz: *Chalum*; Sha: *Sermiling Shing*; Nep: *Kapasi* (34). Fig. 8n&o.

Tree up to 20m. Leaves 5–7-lobed, 9–15 x 10–20cm; lobes caudate acuminate, base truncate or cordate, margin finely and regularly serrulate, pubescent beneath at first, later glabrous or sparsely pubescent on veins and in vein axils beneath; petioles 4–8cm. Flowers greenish, in panicles. Sepals ovate, c 3 x 2.5mm, pubescent. Petals \pm as long as sepals. Anthers slightly exerted, reddish. Mericarps very divergent, outer edges forming a straight line; wing 2–2.5 x 0.75cm.

Bhutan: S—Chukka and Gaylephug district, C—Thimphu, Punakha, Tongsa, Bumthang, Mongar and Tashigang districts, N—Upper Kuru Chu district; **Darjeeling** and **Sikkim:** widespread. Evergreen oak and Hemlock forests, 2000–3050m. April–May.

Wood useful (48). Similar to *A. pectinatum* which differs in its leaves mostly 3–5-lobed.

11. *A. caudatum* Wall.; *A. papilio* King; *A. caudatum* sensu F.B.I. p.p. Nep: *Kapasi* (34). Fig. 8 l&m.

Tree to 10m. Leaves 5(–7)-lobed, 10–15cm long and broad; lobes 4–6cm, caudate-acuminate; base cordate, margin coarsely doubly serrate, pale pubescent beneath especially on veins and towards base; petioles 3–10cm. Flowers in dense panicles. Sepals acute, 2–3mm. Petals \pm as long as sepals. Anthers scarcely exerted. Mericarps ascending and narrowly divergent; wing 2–2.5 x 1cm.

Bhutan: C—Thimphu and Bumthang districts, N—Upper Mo Chu district; **Darjeeling;** Tonglu, Sandakphu, etc.; **Sikkim:** Jongri; **Chumbi:** Yatung to Gautsa. In mossy Fir forests, 3350–4880m. May–June.

12. *A. pectinatum* Nicholson; *A. caudatum* sensu F.B.I. p.p. non Wall. Dz: *Wongka*; Nep: *Lekh Kapasi* (34). Fig. 8v&w.

Tree 10–15m; branchlets slender. Leaves 3–5-lobed, basal lobes often smaller, 7–12cm long and broad; lobes (1.5–)4–6cm acuminate, base rounded

or cordate, margin finely and regularly serrulate (rarely weakly doubly serrate), reddish brown pubescent on veins beneath, usually persisting in vein axils; petioles 2 – 7cm. Flowers in loose racemes, reddish green. Sepals lanceolate c 3 x 1mm. Petals somewhat shorter than sepals. Stamens not exerted. Mericarps diverging almost in a straight line; wing 1.5 x 0.7cm.

Bhutan: S – Chukka district, C – Ha, Thimphu, Punakha, Bumthang and Tashigang districts, N – Upper Mo Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Darjeeling:** Tonglu; **Sikkim:** Lachen, Zemu Chu, etc.; **Chumbi:** Yatung. Evergreen oak, cool broad-leaved, Hemlock and Fir forests, 2750 – 3350m. April – May.

A variable species in number and depth of leaf lobing; some forms approach *A. taronense*.

13. *A. sterculiaceum* Wall.; *A. villosum* Wall. non Presl. Fig. 8r&s.

Tree 7 – 15m; branchlets stout. Leaves (3 –)5-lobed, 10 – 20 x 11 – 23cm; lobes acuminate, base cordate, margin distantly serrate, glabrous above, softly pubescent beneath when young, when mature pubescent at least along veins and in vein axils beneath; petioles 10 – 15cm. Sepals oblanceolate, c 3 x 1.5mm. Petals ± as long as calyx lobes but narrower. Anthers shortly exerted. Mericarps ± erect or outer edges diverging at usually less than at right-angles; wings 3.5 – 5 x 1.5 – 2cm.

Bhutan: S – Chukka district, C – Ha, Punakha and Tashigang districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Darjeeling:** Tonglu; **Sikkim:** Dentam. Cool broad-leaved forests, 2360 – 2900m. April – May.

Sometimes cultivated, as at Thimphu.

Family 95. SAPINDACEAE

by D. G. Long

Trees, shrubs or climbing herbs. Leaves alternate, simple, trifoliolate, 1-pinnate or biternate; leaflets opposite or alternate, pinnately veined, exstipulate. Flowers in terminal or often axillary racemes, panicles or cymes. Flowers minute, weakly zygomorphic or actinomorphic, bisexual or frequently functionally unisexual. Sepals 4 – 5, free or united. Petals 4 – 6 or absent, free, often with a nectary-scale at base within. Disc usually present. Stamens 6 – 8, inserted inside or rarely outside disc; anthers 2-celled. Ovary superior, 2 – 4-celled; ovules 1 – 2 (or more) per cell, axile; style 1, simple; stigma often lobed. Fruit indehiscent or capsular, seeds often arillate.

1. Climbing herb with biternate leaves **1. *Cardiospermum***
+ Trees or shrubs, not climbing; leaves simple, 3-foliolate or 1-pinnate 2

2. Leaves simple 3
 + Leaves compound 4
3. Leaves 17 – 42cm, serrate-dentate **6. Allophylus**
 + Leaves 2.5 – 10cm, entire **7. Dodonaea**
4. Leaves trifoliolate; leaflets serrate-dentate **6. Allophylus**
 + Leaves pinnate; leaflets entire 5
5. Calyx broadly cup-shaped, very shallowly 4(–5)-lobed; petals absent; fruit warty, globose **3. Litchi**
 + Calyx narrowly cup-shaped, 5-lobed almost to base; petals present (sometimes absent in *Nephelium*); fruit smooth, or warty and ellipsoid 6
6. Leaflets 3–4 pairs, with axillary tufts of hair beneath; petals c 2mm or absent; fruit warty **4. Nephelium**
 + Leaflets 4–9 pairs, without axillary tufts of hair beneath; petals 4–5mm, always present; fruit smooth 7
7. Leaflets 6–9 pairs; calyx lobes 2–3mm; petals 4; fruit of 1(–3) subglobose segments **2. Sapindus**
 + Leaflets 4–5 pairs; calyx lobes 3–4mm; petals 5; fruit of 1–3 obovoid-ellipsoid lobes **5. Lepisanthes**

1. CARDIOSPERMUM L.

Perennial herbs with extensive climbing annual leafy shoots; stems ribbed. Leaves biternate; leaflets pinnatifid or serrate. Flowers few, in cymes on long slender axillary peduncles, with a pair of tendrils below flowers. Flowers apparently bisexual, weakly zygomorphic. Sepals 4, free, unequal. Petals 4, free, in 2 pairs, each bearing a large nectary scale, two of these with pubescent oblong appendage. Disc one-sided, 2-lobed. Stamens 8, borne on side of ovary opposite disc, ± enclosed by nectary scales. Ovary 3-lobed, 3-celled; style short; stigma shortly 3-lobed. Capsules inflated, papery and veined, 3-valved; valves 1-seeded.

1. *C. halicacabum* L. Fig. 9a–d.

Extensive herb climbing over shrubs, puberulous throughout. Leaves triangular in outline, 3–8 x 3–10cm; leaflets usually 9, ± ovate, acuminate, deeply toothed; petiolules winged; petioles 0.5–8cm, ribbed. Peduncles 3–10cm, borne ± laterally in leaf axils. Cymes usually 3-branched above tendrils, each branch bearing 2 or 3 flowers. Pedicels 2–3mm. Outer sepals c 1mm, inner c 2mm. Petals white, c 3mm. Capsules turbinate, c 2cm broad x 1cm long, puberulous.

Darjeeling: terai (Siliguri and Punkabari). Amongst shrubs, 150 – 370m. January – December.

The above plants belong to var. **microcarpum** (Kunth) Blume.

2. SAPINDUS L.

Trees. Leaves odd- or even-pinnate; leaflets subopposite or alternate, entire, without axillary tufts of hair beneath. Flowers in terminal panicles, functionally unisexual. Sepals 5, free, unequal. Petals 4, concave, each bearing a large nectary-scale. Stamens 8, inserted around base of ovary. Ovary 3-celled; stigma 3-lobed. Fruit of 1 – 3 unequal fleshy indehiscent subglobose segments.

1. S. rarak DC.; *Dittelsma rarak* (DC.) Hiern. Dz, Med: *Nakapani*; Sha: *Kiling Shing*; Nep: *Ritha*. Fig. 9o – w.

Deciduous tree 5 – 15m. Leaves odd- or even-pinnate, 21 – 40cm, rachis pubescent. Leaflets 6 – 9 pairs, elliptic-lanceolate, 6 – 12 x 2.5 – 3.5cm, acuminate, base obliquely cuneate, lateral veins numerous, with fine reticulation, pubescent on midrib beneath; petiolules 3 – 7mm. Panicles axillary and terminal, 12 – 25cm, densely brownish pubescent throughout. Flowers c 3mm diameter. Sepals ovate, unequal, 2 – 3mm. Petals white, c 4mm, nectary-scale villous within. Fruit dirty orange, fleshy, globose, 2 – 2.5cm diameter, usually with 2 aborted carpels at base; seed very hard, black, globose, 1.3 – 1.5cm diameter.

Bhutan: S – Chukka district (Chukka) and Gaylegphug district (Taklai Khola), C – Punakha district (Punakha Dzong, cultivated). Subtropical forest slopes, 350 – 1400m. May.

Apparently native in S Bhutan. Records of *S. detergens* Wall. from Darjeeling (34) may refer to this species, or to the 'Soap Nut', *S. mukorossi* Gaertner (*S. detergens* Roxb.), which differs in its sparsely pubescent shoots and leaf rachises and more membranous lanceolate-acuminate leaflets, smaller flowers c 1.5mm diameter and smaller fruit c 1.8cm diameter.

3. LITCHI Sonnerat

Trees or shrubs. Leaves even-pinnate; leaflets subopposite, entire, without axillary tufts of hair beneath. Monoecious; flowers functionally unisexual, in terminal much-branched panicles. Calyx broadly cup-shaped, shortly 4-toothed.

FIG. 9. Sapindaceae. a – d, *Cardiospermum halicacabum*: a, leaf and fruiting inflorescence; b, flower with petals removed; c, petal with unappendaged nectary scale; d, petal with appendaged nectary scale. e – h, *Litchi chinensis*: e, leaf; f, functionally male flower; g, fruit; h, l.s. fruit. i – l, *Dodonaea angustifolia*: i, flowering shoot; j, male flower; k, female flower; l, fruit. m & n, *Lepisanthes rubiginosa*: m, 3-lobed capsule; n, 1-lobed capsule with two aborted carpels. o – w, *Sapindus rarak*: o, leaf and inflorescence; p, flower; q & r sepals; s, petal; t, stamens; u, ovary; v, 1-lobed fruit with aborted carpel; w, 2-lobed fruit. Scale: e, o x 1/2; i x 1/2; g, h, v, w, x 2/3; a x 1; l x 1 1/2; m, n x 2; f, j, k x 4; p, q, r, s, t, u x 6; b, c, d x 10. Drawn by M. Bates.



Petals absent. Stamens 6–10, inserted within disc, long-exserted from calyx. Ovary 2(–3)-celled; stigma bifid. Fruit warted; seed solitary with fleshy aril.

1. *L. chinensis* Sonnerat; *Nephelium litchi* (Loureiro) Cambessedes. Eng: *Litchi*. Fig. 9e–h.

Tree to 30m. Leaves 14–24cm; leaflets 2–4 pairs, coriaceous, elliptic-lanceolate, 8–13 x 2.5–4.5cm, sharply acuminate, base obliquely cuneate, lateral veins inconspicuous; petiolules 3–6mm. Panicles pubescent, 15–28cm. Calyx greenish-white, c 1.5mm, broadly cup-shaped with very short lobes. Stamens long-exserted at anthesis, 4–5mm. Fruit globose, c 2.5cm; pericarp dry and brittle when ripe, warted; aril whitish, fleshy.

Bhutan: S – Phuntsholing district (Phuntsholing); **Darjeeling:** terai (34). Cultivated in gardens, 200m.

Native of China (80) cultivated for its edible arils.

4. NEPHELIUM L.

Trees. Leaves even-pinnate; leaflets subopposite, entire, with axillary tufts of hair beneath. Dioecious or monoecious; flowers in terminal branched panicles. Sepals 5, free. Petals absent or 4–6. Stamens usually 8, reduced to staminodes in female flowers. Ovary warted, 2-celled; ovules 1 per cell; style with bilobed stigma. Fruit simple, usually warted; seed 1.

1. *N. hypoleucum* Kurz

Tree 8–10(–30)m; branchlets glabrous. Leaves 20–25cm; leaflets 3–4 pairs, coriaceous, lanceolate, 10–16 x 3–4.5cm, acuminate, base oblique, often rounded on inner margin and cuneate on outer, glabrous, lateral veins inconspicuous; petiolules thick, 4–6mm. Panicles densely pubescent, 14–18cm. Sepals c 2.5mm. Petals absent or c 2mm. Fruits ellipsoid 2.5–3cm, densely warted, glabrous.

Bhutan: S – Chukka district (Chukka). Warm broad-leaved forests, 1200m. April.

A rare species discovered in Bhutan by R. E. Cooper and identified by P. W. Leenhouts; elsewhere known from Burma, Thailand and Indo-China.

5. LEPISANTHES Blume

Trees or shrubs, sometimes climbing. Leaves odd or even-pinnate; leaflets opposite or alternate, entire; without axillary tufts of hair beneath. Usually monoecious; flowers unisexual in terminal and axillary panicles. Sepals (4–)5, free, unequal. Petals (4–)5, rarely absent, each with a nectary-scale within. Stamens mostly 8; disc 4-lobed. Ovary 2–3-celled, 2–3-lobed, ovules 1 per cell; stigma bilobed. Fruit 1–3-lobed, indehiscent; lobes 1-seeded.

1. Leaflets glabrous; petals equalling sepals; ovary 2-celled **1. *L. senegalensis***
 + Leaflets pubescent; petals longer than sepals; ovary 3-celled
2. *L. rubiginosa*

1. *L. senegalensis* (Poiret) Leenhouts; *Sapindus attenuatus* Hiern, *Aphania rubra* (Roxb.) Radlkofer. Nep: *Achatta* (34), *Kaphul*.

Shrub, often climbing, or small tree 2 – 4m. Leaves alternate, mostly even-pinnate, 20 – 60cm, rachis terminating in a short point; leaflets 4 – 5 pairs, thinly coriaceous, lanceolate, 13 – 32 x 3.5 – 7.5cm, acuminate, base cuneate, glabrous; petiolules stout, 5 – 10mm. Panicles 20 – 40cm, with slender widely-spreading minutely puberulous branches; male and female flowers intermixed, crimson. Male flowers: sepals ovate, unequal, largest 4mm; petals spreading and reflexed, elliptic, 5mm; nectary-scales small; ovary reduced to a pistillode. Female flowers as males but with bilobed ovary and staminodes. Fruit green ripening scarlet, 1 – 3-lobed, each lobe obovoid-ellipsoid up to 2.3 x 1.4cm, often with aborted carpel remains at base.

Bhutan: S – Samchi, Phuntsholing, Sankosh, Sarbhang, Gaylegphug and Deothang districts; **Darjeeling:** lower valleys and terai. Subtropical and terai forests, 250 – 900m. February – March.

Forms with simple leaves occur in India and Bangladesh but are unknown in Darjeeling and Bhutan.

2. *L. rubiginosa* (Roxb.) Leenhouts; *Erioglossum rubiginosum* (Roxb.) Blume, *E. edule* Blume. Fig. 9m&n.

Similar to *L. senegalensis* but often a large tree, more pubescent throughout, leaflets more variable in shape, ovate, lanceolate or elliptic, 7 – 18 x 2.5 – 6cm, base oblique, brownish pubescent beneath especially on veins; panicles with ascending spike-like branches; flowers slightly smaller; petals obovate, 4mm, each with a large nectary-scale; fruits smaller c 1.5cm.

Darjeeling: Sivoke and Jogighora Terai. Terai forests, 150 – 250m. April – June. A valuable timber tree producing strong and durable brownish wood.

6. ALLOPHYLUS L.

Shrubs or small trees. Leaves mostly trifoliolate, sometimes simple; axillary tufts of hair absent. Flowers in slender axillary simple or branched racemes, weakly zygomorphic, functionally unisexual; pedicels short. Sepals 4, free, unequal, in opposite pairs. Petals 4, conspicuous, each with a villous nectary-scale; sometimes an additional minute petal present. Stamens 8, inserted inside 4-lobed disc. Ovary 2-celled, strongly bilobed; ovules 1 per cell; stigma deeply bifid. Fruit subglobose, indehiscent, fleshy, 1-seeded, rarely bilobed and 2-seeded.

1. A. chartaceus (Kurz) Radlkofer; *A. subfalcatus* Radlkofer, *A. zeylanicus* L. var. *grandifolius* Hiern.

Shrub 1 – 2m. Leaves simple or trifoliolate; simple leaves or terminal leaflets elliptic-obovate, 17 – 42 x 6 – 15cm, acuminate, base cuneate, margin distantly serrate-dentate, often shallowly so; lateral veins and reticulations prominent beneath, glabrous; lateral leaflets when present smaller; petiolules of lateral leaflets 2 – 3mm; petioles 2 – 7cm, jointed below apex. Racemes 10 – 30cm, slender, simple or 1 – 2-branched; pedicels 1 – 2mm. Larger sepals 1.5mm, smaller 1mm. Petals white, c 1mm. Fruit subglobose, 8 – 10mm.

Bhutan: S – Chukka district (Marichong) and Gaylegphug district (Gaylegphug, 117); **Darjeeling:** Tista and Rungit valleys, Rongbe, Riang, etc. Subtropical forests, 300 – 1150m. May – July.

The name *A. chartaceus* was formerly restricted to simple-leaved plants, and the name *A. subfalcatus* Radlkofer applied to trifoliolate ones. However these are now considered to be variants of a single species.

7. DODONAEA Miller

Shrubs or small trees. Leaves simple, sticky, entire. Dioecious or monoecious; flowers in sticky terminal and axillary cymes, usually unisexual, actinomorphic. Sepals 4 – 5, free. Petals absent. Stamens 6 – 8, inserted outside minute disc (stamens absent or sterile in female flowers). Ovary 2 – 4-celled; styles 2(– 4)-lobed. Fruit a 2 – 4-lobed papery winged capsule; seeds 1 – 2 per cell.

1. D. angustifolia L.f.; *D. viscosa* sensu F.B.I. p.p. non Jacquin. Fig. 9i – 1.

Shrub 1 – 2m, rarely a small tree to 6m; branchlets glabrous, sticky. Leaves elliptic-oblongate, 2.5 – 10 x 0.5 – 2cm, subacute, acute or bluntly acuminate, base long attenuate and sessile, glabrous but sticky and shiny, lateral veins numerous. Cymes 2 – 4cm; pedicels slender 3 – 5mm (up to 15mm in fruit). Sepals usually 4, broadly ovate, 3mm, yellow tinged red. Stamens c 3mm. Fruit suborbicular, yellow tinged reddish, 1.5 – 2cm diameter with papery wings 5 – 6mm broad; seeds black, c 3 x 2mm.

Bhutan: S – Sarbhang district (Sarbhang), C – Tongsa district (Shamgong) and Tashigang district (Tashigang Dzong); **Darjeeling:** terai (34). Cultivated as an ornamental shrub and hedge plant, 460 – 2000m. March – June.

Family 96. HIPPOCASTANACEAE

by D.G. Long

Trees. Leaves opposite, palmately compound, exstipulate, venation pinnate. Flowers in erect terminal panicles, bisexual, zygomorphic. Calyx tubular, 5-lobed, somewhat 2-lipped. Petals free, 4 large and clawed, 1 minute or absent. Disc present.

Stamens 5 – 9, exerted, free; anthers 2-celled, dehiscent by slits. Ovary superior, 3-celled; ovules 2 in each cell, axile; style 1, clavate. Fruit a leathery capsule dehiscent by 3 valves; seed solitary, large.

1. AESCULUS L.

Description as for Hippocastanaceae.

1. Petiolule of middle leaflet stout, 6 – 13mm; leaflets 25 – 48cm, obscurely and often bluntly serrulate **1. A. assamica**
 + Petiolule of middle leaflet slender, 15 – 23mm; leaflets 18 – 26cm, sharply serrulate **2. A. indica**

1. A. assamica Griff.; *A. punduana* Hiern, *A. khassiyana* Das & Majumdar *nom. illeg.* Nep: *Satpate* (34). Fig. 10a – c.

Tree 6 – 15m. Leaves orbicular in outline, of 6 – 8 oblanceolate leaflets 25 – 48 x 8 – 13cm, acuminate, base cuneate, margins obscurely, often bluntly, serrulate, glabrous; petiolules stout, 4 – 13mm; petioles 24 – 35cm. Panicles 30 – 45cm, greyish puberulous, branches up to 8cm. Pedicels 5 – 7mm. Calyx tubular, 6 – 7mm including short rounded lobes. Larger 4 petals spatulate, 16 – 20mm, whitish, upper 2 tinged yellow or brownish at base within; small petal linear, 2mm. Stamens usually 7, strongly curved, 3.5 – 4cm. Ovary linear, puberulous. Fruiting racemes pendulous; capsules ovoid-ellipsoid, 8 – 9 x 4 – 5cm, obliquely beaked at apex, scurfy brown puberulous; seed large c 3cm diameter.

Bhutan: S – Sarbhang district (Lam Pati) and Gayleghpug district (Tori Bari and Taklai Khola); **Darjeeling:** Kurseong, Mungpoo and Jalpaiguri. Subtropical and terai forests, often by streams, 300 – 400m. March – April.

2. A. indica (Cambessedes) Hooker. Eng: *Indian Horse Chestnut*.

Similar to *A. assamica* but leaflets more membranous, smaller, 18 – 26cm, margin more sharply and regularly serrulate; petiolules longer and more slender, 15 – 23mm; panicles 20 – 35cm; fruit (80) up to 5cm.

Darjeeling: cultivated in the Lloyd Botanic Garden. May – June.

Native of W Nepal and NW Himalaya; wood useful (48).

Family 97. MELIANTHACEAE

by D.G. Long

Foetid subshrubs. Leaves alternate, 1-pinnate, stipulate; leaflets pinnately veined. Flowers in simple, erect terminal bracteate racemes. Flowers upside-down (resupinate) by twisting of pedicels, bisexual, zygomorphic. Sepals 5, unequal, upper one spurred at base. Petals usually 4, free, clawed, unequal. Disc present,

nectariferous. Stamens 4, antisepalous, inserted inside disk; anthers 2-celled, dehiscent by slits. Ovary superior 4-celled; style 1; ovules 2–5 per cell, axile. Fruit a papery capsule; seeds 1–2 per cell.

1. MELIANTHUS L.

Description as for Melianthaceae.

1. *M. major* L.; *M. himalayanus* Planchon

Erect undershrub 1–2m. Leaves odd-pinnate, 20–40 x 15–25cm; leaflets 2–6 pairs, ovate-elliptic, 9–14 x 4–6cm, acute, base cuneate, decurrent along rachis, margin coarsely serrate, glabrous, pale beneath; stipules large and leafy, 4–9cm, united and adnate to petiole base. Racemes dense, 14–35cm, pubescent; bracts ovate, 1.5–2cm; pedicels 1.5–2.5cm. Flowers reddish-brown. Lower 4 sepals lanceolate, c 2cm; upper sepal folded and spur-like, c 1.3cm. Petals lanceolate, c 1.2cm; claw pubescent. Disc-gland large, contained within sepal spur. Capsule papery, c 3 x 2.5cm, 4-winged, reticulate, glabrous; seeds 2 per cell; calyx persistent.

Bhutan: C – Bumthang district (between Byakar and Gyetsa). Open grassy thickets, 2875m. May.

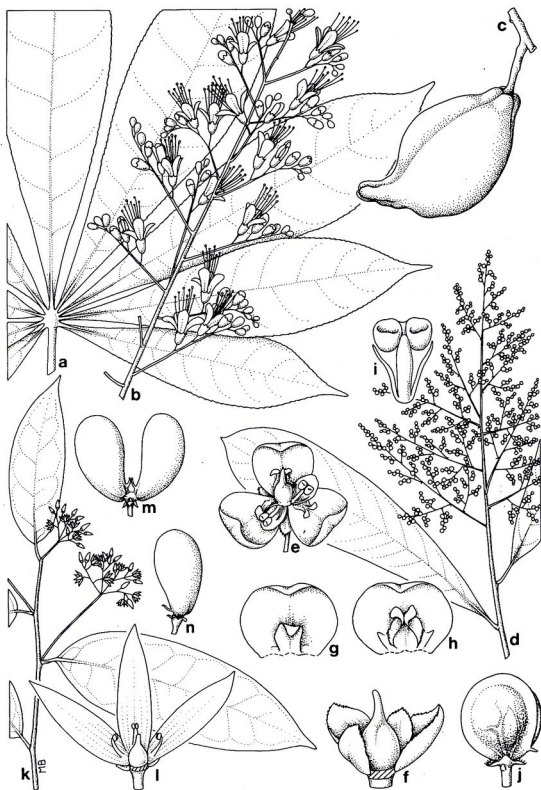
A native of South Africa reported only once from Bhutan by Griffith; no specimen has been located to support this report. The flowers produce abundant nectar and are much visited by bees.

Family 98. SABIACEAE

by A.J.C. Grierson

Evergreen or deciduous trees, shrubs, scramblers or twiners. Leaves alternate, simple or pinnate. Flowers usually small, in terminal or axillary panicles, sometimes in cymes or solitary, actinomorphic, bisexual or sometimes unisexual. Sepals 4–5, imbricate, free or connate at base. Petals 4–5, episepalous, sometimes 2 of them distinctly smaller than the others. Stamens 4–5, opposite petals, sometimes only 2 pollen-bearing. Ovary 2-celled, superior; styles 2, ± connate; ovules usually 2 per cell, axile. Fruit a single or paired indehiscent drupes; styles becoming lateral or basal.

FIG. 10. **Hippocastanaceae** and **Sabiaceae**. **Hippocastanaceae**. a–c, *Aesculus assamica*: a, leaf; b, panicle; c, fruit. **Sabiaceae**. d–j, *Meliosma simplicifolia*: d, flowering shoot; e, open flower; f, flower showing calyx (one sepal removed) and ovary; g, petal with simple staminode; h, petal with bilobed staminode; i, fertile stamen; j, fruit with sub-basal style. k–n, *Sabia lanceolata*: k, flowering shoot; l, flower with sepal and two petals removed; m, paired drupes with sub-basal styles; n, single drupe. Scale: a, b, d x 1/2; c, k x 1/2; m, n x 1 1/2; j x 4; l x 6; e x 8; f x 10; g, h x 12; i x 20. Drawn by M. Bates.



This family is now often subdivided, with *Meliosma* placed in its own family Meliosmaceae and *Sabia* retained in a narrower Sabiaceae or united with Menispermaceae.

1. Petals and stamens all subequal; stamens all pollen-bearing **1. Sabia**
 + Petals 3 large and 2 small; fertile stamens 2, opposite smaller petals; staminodes 3, opposite larger petals **2. Meliosma**

1. SABIA Colebrooke

Woody scramblers or twiners. Leaves simple, ovate or elliptic to lanceolate, entire. Flowers bisexual, solitary or several in axillary cymes, sometimes, (when subtending leaves have fallen), apparently arranged in racemose panicles. Sepals 5, equal or unequal, connate at base, usually rounded. Petals 5, episepalous, rounded. Stamens 5, epipetalous, subequal; filaments flattened. Disc \pm cup shaped, margin often with lobes alternating with stamens. Fruit consisting of solitary or paired, rounded or subglobose, somewhat fleshy, \pm laterally compressed drupes; stones woody, reticulately ribbed.

1. Flowers solitary axillary on pedicels up to 3cm; petals elliptic to obovate, 3.5 – 10 x 2 – 4.5mm; style in flower 3 – 5mm, in fruit \pm as long as adjacent side of drupe(s) **1. S. campanulata**
 + Flowers few to many in cymes, cymes solitary or racemosely arranged; petals elliptic to suborbicular, 1.75 – 2.5 x 1.25 – 2mm, or ovate to lanceolate, 2.25 – 5.5 x 0.75 – 2.25mm; style in flower up to 1.5mm, in fruit much shorter than adjacent side of drupe(s) 2
2. Cymes 2 – 12-flowered, solitary or arranged in lax racemose panicles 3
 + Cymes 4 – 35-flowered, solitary or arranged in dense racemose panicles .. 4
3. Leaves 3 – 12 x 1.5 – 4.5cm, \pm herbaceous; veins 4 – 6 pairs; cymes always solitary; petals ovate to oblong, 2.5 – 4.5 x 1.25 – 2.25mm; drupes obovoid, 5 – 7 x 5.5 – 7.5mm **2. S. purpurea**
 + Leaves 5 – 18 x 1.5 – 6.5cm, \pm coriaceous; veins 5 – 9 pairs; cymes usually arranged in panicles, rarely solitary; petals suborbicular to elliptic, 1.75 – 2.5 x 1 – 2mm; drupes globose to obovoid, 11 – 15 x 10 – 13mm
3. S. limoniacea
4. Leaves oblong-lanceolate; 5 – 18 x 1.5 – 6cm; veins 7 – 12 pairs; petals oblong-ovate, 4 – 5.5 x 1.5 – 2mm; drupes obovoid, 10 – 15 x 7 – 10mm
4. S. lanceolata
 + Leaves oblong, ovate or lanceolate, 5 – 22 x 1.5 – 8cm; veins 5 – 9 pairs; petals oblong to lanceolate, 2.25 – 4 x 0.7 – 1.25mm; drupes globose or obovoid 7 – 11 x 6 – 10mm 5

5. Leaves oblong to lanceolate, 5–9(–12) x 1.5–5cm; veins 6–9 pairs; cymes solitary, axillary, up to 10cm, 7–25-flowered, glabrous or sparsely pubescent; drupes 7–9 x 6–8mm **5. *S. parviflora***
- + Leaves oblong, ovate or lanceolate, 8–22 x 2.5–8cm; veins 5–7 pairs; cymes 15–30-flowered, solitary or more usually in panicles up to 20cm, pubescent; drupes 9–11 x 8–10mm **6. *S. paniculata***

1. *S. campanulata* Wall.; *S. leptandra* Hook. f. & Thomson. Nep: *Kali Lahara* (117).

Diffuse or scrambling shrub c 1.5m, usually deciduous but sometimes with persistent leaves. Leaves ovate-elliptic or lanceolate, 3.5–10 x 2–4.5cm, ± caudate-acuminate, base rounded, veins 4–6 pairs, minutely pubescent on veins and margins beneath. Flowers solitary, usually appearing with the young leaves; pedicels up to 3cm. Sepals elliptic, c 7 x 4mm. Petals green to purple, obovate, 7–10 x 5–7mm. Stamens c 4mm. Style c 4mm. Drupes suborbicular, somewhat compressed, 6–8mm diameter, purplish.

Bhutan: S – Chukka district, C – Ha, Thimphu, Punakha, Tongsa, Bumthang and Mongar districts, N – Upper Mo Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Darjeeling:** Evergreen oak forest, 1670–3050m. April – June.

2. *S. purpurea* Hook. f. & Thomson

Similar to *S. campanulata* but flowers always borne in solitary 3–12-flowered cymes 3–4.5cm; sepals oblong or suborbicular, 0.5–3 x 0.5–1.5mm; petals ovate or oblong, 2.5–4.5 x 1.25–2.25mm; stamens 1–1.75mm; styles 0.5–1mm; drupes obovoid, c 5–7mm.

Bhutan: S – Samchi district (near Gokti); **Darjeeling:** Darjeeling and Kalimpong. Subtropical and warm broad-leaved forest slopes, 500–1800m. February – April.

3. *S. limoniacea* Hook. f. & Thomson

Evergreen twiner up to 10m. Leaves somewhat coriaceous, ovate-elliptic, 5–18 x 1.5–6.5cm, acuminate or obtuse, base cuneate or rounded, glabrous or pubescent on midrib beneath, veins 5–9 pairs. Flowers in 2–3-flowered cymes up to 2cm, or cymes arranged in racemose panicles up to 15cm, subtended at base by ring of minute bracts. Sepals broadly ovate or elliptic, 0.5–1 x 0.5–1mm, acute or rounded. Petals obovate or suborbicular, 1.75–2.5 x 1–2mm, obtuse. Stamens 1.5–2mm. Style 0.2–0.5mm, much shorter than the adjacent sides of the ovary. Fruit subglobose to obovoid, compressed, red or black, 10–15 x 10–13mm; petals and stamens ± persistent at base.

Darjeeling: terai at Jalpaiguri and Dulka Jhar. Terai forests. November.

4. *S. lanceolata* Colebrooke. Nep: *Simali Lahara* (34). Fig. 10k–n.

Evergreen. Leaves elliptic to oblanceolate, 5–18 x (1.5–) 2.5–6cm, shortly acuminate, base rounded or cuneate, glabrous or sparsely pubescent beneath, veins (5–)7–12 pairs. Cymes solitary axillary or arranged in panicles up to 7cm. Sepals

oblong-ovate, 0.75 – 2 x 0.7 – 1.5mm. Petals greenish white, oblong, 4 – 6 x 1.5 – 2.25mm ± acute. Stamens 1.5 – 2.5mm. Styles 0.5 – 1mm. Fruit obovoid, 10 – 15 x 7 – 10mm, ± compressed, yellowish crimson at first, bluish when ripe.

Bhutan: S – Sarbhong district (Singi Khola and near Phipsoo) and Gaylegphug district (Gaylegphug, 117). Subtropical forest, 260 – 280m.

5. *S. parviflora* Roxb. Nep: *Simali Lahara* (34).

Evergreen. Leaves ovate-elliptic, 5 – 9(–12) x 1.5 – 3(–5)cm, acuminate, base cuneate or rounded, ± glabrous, veins 6 – 9 pairs. Cymes solitary, axillary, 1.5 – 8cm, 4 – 25(–35)-flowered, very slender. Sepals ovate-lanceolate, c 3 x 1mm. Petals greenish-yellow or white, lanceolate, 3 – 4.5 x 1mm. Stamens c 2mm. Style conical c 1 – 1.5mm. Fruit obovoid or subglobose, ± compressed, c 8mm long and broad.

Bhutan: S – Gaylegphug district (near Gaylegphug, 117), C – Punakha district (near Punakha); **Darjeeling;** **Sikkim.** Subtropical and warm broad-leaved forests, 270 – 1500m. April – May.

6. *S. paniculata* Hook. f. & Thomson. Nep: *Kali Lahara* (34).

Evergreen. Leaves coriaceous, ovate-elliptic, 8 – 22 x 2.5 – 8cm, acuminate, base rounded, glabrous or sparsely pubescent, veins 5 – 7 pairs. Cymes solitary, axillary, 10 – 30-flowered, up to 5cm but more usually forming paniculate inflorescences 7 – 20cm when subtending leaves have fallen; peduncles and pedicels pubescent. Sepals ovate c 1mm, pubescent. Petals yellowish-green, ovate-oblong, 2.5 – 3.5 x 1mm. Stamens 1.5 – 2.5mm. Style cylindrical or narrowly conical, 0.75 – 1.25mm. Fruit suborbicular, c 8mm diameter, ± compressed.

Bhutan: S – Samchi district (Torsa Valley); **Darjeeling:** Jalpaiguri, Bamunpokri. Subtropical and terai forests, 240 – 450m. December – January.

2. MELIOSMA Blume

Evergreen or deciduous trees or shrubs. Leaves simple or odd-pinnate. Inflorescences terminal or axillary, paniculate; bracts usually caducous; bracteoles absent but bracteole-like sepals sometimes present lower down on pedicel. Flowers numerous, small, bisexual, weakly zygomorphic. Sepals 5 (sometimes 4 rarely 3). Petals 5, outer 3 subequal, suborbicular; 2 inner ones equal, much smaller, opposite fertile stamens and adherent to base of filaments. Disc usually present, shortly 5-toothed. Stamens 5, 2 fertile filaments terminating in a cup bearing 2 anther cells; 3 staminodes opposite larger petals and adherent to their bases. Ovary ovoid or globose; style subulate or minute. Fruit a subglobose drupe with one stone.

1. Leaves pinnate **3. *M. pinnata***
 + Leaves simple 2

2. Evergreen; leaves entire or serrate with rather broad teeth, veins curving towards apex near margin **1. M. simplicifolia**
 + Deciduous; leaves serrate with fine teeth, veins running \pm straight to margin and most excurrent into fine teeth **2. M. dilleniifolia**

1. M. simplicifolia (Roxb.) Walpers; *M. pungens* (Wight & Arnott) Walpers, *M. ferruginea* King nom. illeg. Nep: *Chiuri*, *Chiwari*, *Patpate*. Fig. 10d - j.

Evergreen shrub or tree to 20m. Leaves simple to oblanceolate or obovate, 5 - 35 x 2 - 12cm, acute or acuminate, base cuneate or attenuate, entire or serrate especially in upper half, glabrous or pubescent beneath, veins 5 - 20 pairs, curved towards apex near margin; petiole 0.5 - 3cm. Panicles 10 - 25cm; branches pubescent usually densely so; mature buds 2 - 3mm diameter. Sepals ovate, c 1.25 x 1mm, ciliate. Outer petals suborbicular, c 2 x 2mm glabrous; inner petals c 1.5mm, bifid almost to middle. Stamens and staminodes c 1.5mm. Ovary c 0.75mm; style \pm as long. Drupes subglobose 5(-10)mm diameter; stone with prominent median keel and \pm strongly reticulate sides.

Bhutan: S - Chukka, Gayleghug and Deothang districts, C - Thimphu, Tongsa and Mongar districts; **Darjeeling.** Subtropical and warm broad-leaved forest slopes, 450 - 2133m. October - February.

There are three subspecies in the E Himalaya distinguished as follows:

1. Leaves 8 - 15 x 2 - 5cm, elliptic-oblanceolate, usually with a few teeth in upper half subsp. **yunnanensis**
 + Leaves commonly more than 25 x 7cm, obovate, entire or with numerous teeth **2**
2. Leaves entire, glabrous above or midrib sparsely pubescent subsp. **simplicifolia**
 + Leaves with many teeth, pubescent above, densely so along midrib subsp. **thomsonii**

Subsp. **simplicifolia** is common throughout E Himalaya; subsp. **yunnanensis** (Franchet) Beusekom has been recorded from Thimphu district (Paga) and subsp. **thomsonii** (Brandis) Beusekom from Darjeeling district.

2. M. dilleniifolia (Wight & Arnott) Walpers. Nep: *Lekh Gogun*

Similar to *M. simplicifolia* (especially subsp. *simplicifolia* and subsp. *thomsonii*) but a deciduous shrub or tree to 10m; leaves oblanceolate or obovate, 10 - 18(-24) x 4.5 - 10(-12)cm, acute or shortly acuminate, base attenuate, veins usually 15 - 22 pairs, parallel and running \pm straight to margin, excurrent in fine \pm subulate teeth, glabrous above, finely pubescent especially on veins beneath; mature buds 2 - 3mm diameter; fruit 4 - 5 (-6)mm diameter; stone with median keel \pm prominent.

Bhutan: C – Tongsa district (Changka) and Mongar district (Saleng and near Sengor), N – Upper Mo Chu district (near Gasa); **Darjeeling:** Kalapokri and Garibans; **Sikkim:** Lachen. Cool wet mixed forest, 1800 – 2900m. July – August.

3. M. pinnata (Roxb.) Maximowicz; *M. wallichii* Hook. f. Nep: *Lekh Dabdabe* (34).

Evergreen rarely deciduous tree up to 40m. Leaves with 2 – 10 pairs of leaflets, 5 – 40cm, including petiole c 15cm; leaflets elliptic to obovate, 5 – 18 x 2 – 5.5cm, usually increasing in size towards top of leaf, acuminate, base rounded or cuneate, margin entire or distinctly serrate, glabrous or sometimes pubescent beneath. Panicles terminal, 10 – 55cm; branches ± pubescent. Mature buds c 2mm diameter. Sepals ovate, 1 – 1.5mm, pubescent. Outer petals usually glabrous; inner petals c 0.6mm, deeply bifid. Stamens c 1mm. Ovary 0.6mm, glabrous or densely pubescent. Fruit subglobose to obovoid, 4 – 10mm diameter; stone prominently reticulate, median keel ± distinct.

Bhutan: S – Chukka district (Rydak Valley), C – Mongar district (Unjar); **Darjeeling:** Pul Bazar, Darjeeling, etc. Riverbanks, 120 – 2100m. May – July.

There are two subspecies in the E Himalaya distinguished as follows:

1. Leaves with 6 – 10 pairs of leaflets, glabrous, without tufts of hair in axils of primary veins beneath; ovary glabrous subsp. **pinnata**
- + Leaves with 3 – 7 pairs of leaflets, usually pubescent, often with tufts of hair in axils of primary veins beneath; ovary densely pubescent .. subsp. **barbulata**

Although elsewhere the more restricted of the two, subsp. **pinnata** is recorded from Bhutan and Darjeeling district; subsp. **barbulata** (Cufodontis) Beusekom (subsp. *arnottiana* (Walpers) Beusekom *nom. illeg.*) the more widespread subspecies overall, has not so far been recorded from Bhutan but is known from Darjeeling.

Family 99. BALSAMINACEAE

by C. Grey-Wilson

Annual or perennial herbs, often rather fleshy. Stems erect to procumbent, often rooting at the lower nodes. Leaves spirally arranged, opposite or whorled, toothed, pinnately veined, exstipulate. Inflorescence racemose or flowers epedunculate, solitary or clustered at the leaf axils. Flowers bisexual, turned upside-down (resupinate) through 180°, zygomorphic. Sepals 3 or 5, lowermost one generally modified into a spur sometimes corniculate (i.e. shaped like a bovine horn, somewhat twisted). Petals 5, all free or the lower 4 united in two lateral pairs. Stamens 5, united to enclose the ovary and stigmas. Ovary superior; carpels 5, united, alternating with petals; style solitary very short or obsolete; ovules solitary to many. Fruit a capsule or pseudoberry.

1. IMPATIENS L.

Description as for Balsaminaceae, but lateral petals always united together in pairs and fruit a capsule dehiscing elastically to eject seeds.

In the following accounts, unless otherwise stated, plants are pubescent (either stem or leaves, or both), leaves are spirally arranged and flowers possess 2, (1 pair) lateral sepals. In the descriptions of species all floral parts are described in the resupinate position. The following terms are used to describe floral parts:

bucciniform: trumpet-shaped (Fig. 11 l, 12o).

narrow-bucciniform: narrowly trumpet-shaped (Fig. 12zc).

cucullate: hooded (Fig. 12m, 13p).

navicular: boat-shaped (Fig. 11c, 13m)

saccate: pouch-shaped (Fig. 13b, 13g).

Petal measurements: lateral united petals are measured from insertion to tip of lower lateral petal; upper lateral petal is measured from insertion to tip of upper petal; lower lateral petal is measured from junction of upper and lower lateral petals to tip of lower lateral petal.

The following species are reported in the literature from Bhutan, Darjeeling or Sikkim but the records have not been substantiated and are probably based on misidentified or mislabelled specimens: *I. acuminata* Hook. f. & Thomson; *I. angustiflora* Hook.f., *I. capillipes* Hook.f. & Thomson, *I. chinensis* L., *I. laevigata* Hook. f., *I. paludosa* Hook.f., *I. porrecta* Hook. f. & Thomson, *I. racemulosa* Hook.f. & Thomson and *I. wallichii* Hook.f.

- | | |
|---|-------------------------|
| 1. Flowers sessile or borne on a short peg-like structure up to 0.7cm in length | 2 |
| + Flowers in distinct pedunculate inflorescences, peduncle (0.8-)1.2-16.5cm | 15 |
| 2. Lateral sepals 4 (in 2 pairs, upper pair about one third the size of the lower) | |
| | 12. I. arguta |
| + Lateral sepals 2, in 1 pair | 3 |
| 3. Ovary and fruit densely pubescent | 39. I. balsamina |
| + Ovary and fruit glabrous | 4 |
| 4. Flowers very small; lateral united petals c 3mm; lower sepal without spur (Fig. 13m) | 20. I. occultans |
| + Flowers larger; lateral united petals at least 9mm; lower sepal always distinctly spurred | 5 |
| 5. All, or at least the middle and lower, leaves opposite or subopposite | 6 |
| + All leaves spirally arranged | 7 |

6. Flower pubescent in part; lower sepal sub-saccate, 10 – 17mm (Fig. 11q) **8. I. tripetala**
 + Flowers glabrous; lower sepal narrow-bucciniform, 7 – 8mm (Fig. 11w) **9. I. florigera**
7. Flowers predominantly yellow 8
 + Flowers predominantly pink, lilac or purple 10
8. Upper lateral petals ± obsolete; upper lobe of lower lateral petal sickle-shaped (Fig. 12r), white spotted purple; spur 19 – 32mm **18. I. falcifer**
 + Upper lateral petals 5 – 11mm; lower lateral petals not as above, plain yellow or spotted in basal half; spur 11 – 18mm 9
9. Lateral united petals 18 – 28mm, lower of each pair ± entire (Fig. 12c); capsule 37 – 42mm **11. I. cristata**
 + Lateral united petals 15 – 18mm, lower of each pair deeply notched (Fig. 12v); capsule 22 – 27mm **19. I. lutea**
10. Spur spiralled or strongly incurved at tip 11
 + Spur ± curved but not spiralled at tip 12
11. Bracts ovate; lateral sepals 3 – 7mm, apiculate **13. I. discolor**
 + Bracts linear to linear-lanceolate; lateral sepals 8 – 15mm, acuminate **14. I. spirifer**
12. Flowers small; lateral united petals 9 – 11mm **3. I. exilis**
 + Flowers larger; lateral united petals 15 – 16mm 13
13. Petiole with fimbriate stipule-like processes at base; stems usually glabrous **2. I. infundibularis**
 + Petiole without stipule-like process at base; stems pubescent, at least when young 14
14. Spur 21 – 24mm; petiole usually without stipitate glands **15. I. puberula**
 + Spur 30 – 35mm; petiole with scattered stipitate glands, especially towards the top **16. I. decipiens**
15. Bracts markedly fimbriate, fimbriae 4 – 8mm; inflorescence very dense, terminal **38. I. bracteata**
 + Bracts entire, occasionally very slightly toothed; inflorescence generally lax, lateral 16

16. Ovary and fruit covered in small warts; spur very short or obsolete **33. I. tuberculata**
- + Ovary and fruit smooth; spur at least 4mm 17
17. Spur markedly upcurved 18
- + Spur straight, downcurved or incurved 21
18. Sepals terminating in a gland-tipped appendage 19
- + Sepals acute or subacute, not gland-tipped 20
19. Lower sepal and spur 17 – 29mm; lateral united petals 24 – 26mm; leaf lamina with 5 – 8 pairs of lateral veins **25. I. drepanophora**
- + Lower sepal and spur 12 – 18mm; lateral united petals 16 – 22mm; leaf lamina with 7 – 13 pairs of lateral veins **27. I. stenantha**
20. Peduncle 6 – 9.2cm (excluding rachis); lower sepal and spur 20 – 22mm **26. I. longipes**
- + Peduncle 1.8 – 6.5cm; lower sepal and spur 14 – 18mm **34. I. scitula**
21. Lower sepal navicular, ± abruptly constricted into a filiform spur always greatly exceeding length of lower sepal, very occasionally without spur .. 22
- + Lower sepal bucciniform to saccate, gradually or abruptly constricted into a short spur, shorter than or equal in length to lower sepal 32
22. Flowers predominantly yellow, but often spotted with reddish-brown or purple 23
- + Flowers predominantly pink, lilac, purple or white 26
23. Flowers small; lateral united petals 9 – 11mm; spur 14 – 18mm **23. I. racemosa**
- + Flowers larger; lateral united petals 15 – 33mm; spur 17 – 32mm 24
24. Flowers rather flat; upper lateral petals ± obsolete, lower petal of each pair markedly 2-lobed, upper lobe sickle-shaped, heavily spotted with purple **18. I. falcifer**
- + Flowers cupped; upper lateral petals present, half size of lower lateral petals, unlobed 25
25. Peduncle 20mm or more; bracts at base of pedicels; flowers flushed or veined with red or reddish-purple **6. I. pulchra**
- + Peduncle up to 17mm; bracts midway along pedicels; flowers spotted with reddish-brown **11. I. cristata**

26. Spur 22 – 42mm 27
 + Spur (2 –)4 – 16mm 29
27. Spur markedly curved; upper lateral petals markedly smaller than lower lateral petals; lateral sepals apiculate **1. I. latiflora**
 + Spur straight or slightly curved; upper lateral petals scarcely smaller than lower lateral petals; lateral sepals with a gland-tipped apical appendage 28
28. Spur 22 – 30mm; lateral united petals 7 – 9mm **21. I. radiata**
 + Spur 28 – 38mm; lateral united petals 8 – 12mm **22. I. graciliflora**
29. Upper lateral petals spotted; lower lateral petals 6 – 11mm wide; stems usually sparsely glandular **32. I. laxiflora**
 + Upper lateral petals unspotted; lower lateral petals 1 – 4.5mm wide; stems glabrous, usually eglandular 30
30. Inflorescence 3 – many-flowered; lower flowers of raceme often in pseudowhorls or subopposite; lower sepal 4 – 4.5mm; flowers pale pink or whitish
24. I. gammiei
 + Inflorescence 1 – 7-flowered, racemose; lower sepal 7 – 11mm; flowers purple, reddish or lilac 31
31. Peduncle 0.8 – 2.2cm; lower sepal (excluding spur) 7 – 11mm, spur 10 – 14mm
29. I. prainii
 + Peduncle 2.8 – 7.2cm; lower sepal 12 – 14mm, spur 7 – 11mm, generally curved
35. I. cymbifera
32. Peduncle not exceeding 1.5cm 33
 + Peduncle (excluding rachis) 1.8 – 16.5cm 37
33. Bracts basal on pedicels; petiole with fimbriate stipule-like processes at base
34
 + Bracts apparently midway-along pedicels; petiole without fimbriate stipule-like processes at base 36
34. All leaves spirally arranged; bracts ovate; flowers pale pink or white
13. I. discolor
 + All or at least lower and middle leaves opposite or subopposite; flowers usually purple or reddish-purple 35
35. Flowers pubescent in part; lower sepal sub-saccate, 10 – 17mm (Fig. 11q)
8. I. tripetala
 + Flowers glabrous; lower sepal narrow-bucciniform, 7 – 8mm (Fig. 11w)
9. I. florigera

36. Lateral united petals 18–22mm, upper petal of each pair prolonged in a narrow sickle-shaped appendage (Fig. 11v); spur 8–12mm **10. I. uncipectala**
 + Lateral united petals 12–14mm, upper petal of each pair obtuse (Fig. 13q); spur 3–5mm **17. I. serratifolia**
37. Lateral sepals 4, in 2 pairs 38
 + Lateral sepals 2, in 1 pair 39
38. Flowers cream or pale yellow; lower sepal narrow-conical, gradually tapered into a \pm straight spur; lateral united petals 16–17mm **28. I. leptocarpa**
 + Flowers purple, or occasionally yellow with red veining; lower sepals deeply saccate, abruptly constricted into an incurved spur (Fig. 13e); lateral united petals 32–36mm **31. I. kingii**
39. Lower lateral petals long-tapered, acute, 23–35mm 40
 + Lower lateral petals not long-tapered, obtuse to sub-obtuse, 11–22mm .. 41
40. Lower sepal 19–32 x 9–12mm, shape not as below (Fig. 13za); inflorescence 2–7-flowered; leaf lamina with 4–9 pairs of lateral veins **36. I. urticifolia**
 + Lower sepal 13–16 x 32–37mm, strongly curved so that tip of spur almost reaches tip of sepal (Fig. 13y); inflorescence generally many-flowered; leaf lamina with 8–13 pairs of lateral veins **37. I. pradhanii**
41. Spur straight to slightly curved, but not incurved (Fig. 13u) **35. I. cymbifera**
 + Spur incurved, often markedly so 42
42. Upper lateral petals prolonged into a narrow sickle-shaped acumen (Fig. 13d); inflorescence usually many-flowered; dorsal petal slightly crested above **30. I. sulcata**
 + Upper lateral petals obtuse to emarginate; inflorescence 1–10-flowered; dorsal petal with a prominent crest 43
43. Crest-like appendage on dorsal sepal acute, 7–11mm (Fig. 11i); leaves hairy along veins above **5. I. jurpia**
 + Crest-like appendage on dorsal sepal obtuse, 1–5mm; leaves glabrous above 44
44. Lateral sepals terminating in a large gland; dorsal petal crested near apex (Fig. 11j); plant glabrous **4. I. cathcartii**
 + Lateral sepals not terminating in a gland; dorsal petal crested in middle (Fig. 11o); plant pubescent in part (generally on veins beneath leaves) **7. I. trilobata**

1. *I. latiflora* Hook. f. & Thomson. Fig. 11a – d.

Perennial herb to 40cm. Leaves elliptic to oblanceolate, 5.2 – 16 x 1.5 – 4cm, pubescent between lateral veins above, glabrous or pubescent on veins beneath. Inflorescence a reduced 1 – 2(–3)-flowered raceme; peduncle 2.8 – 7.7cm; flowers pink. Lower sepal navicular, 14 – 16mm, abruptly constricted into a spur; spur 32 – 42mm, curved, filiform. Dorsal petal rather flat, orbiculate, 10 – 20 x 9 – 18mm; lateral united petals 24 – 32mm; upper lateral petal asymmetrically oval, 13 – 15 x 11 – 16mm; lower lateral petal asymmetrically ovate, somewhat attenuate distally, 16 – 22 x 8 – 13mm. Capsule subfusiform, 16 – 22 x 4 – 5mm, glabrous.

Bhutan: S – Deothang district (Yembo La area), C – Tashigang district (Tashigang). Wet rocks by waterfalls, etc., 915 – 1360m. June.

2. *I. infundibularis* Hook. f. Fig. 11g&h.

Annual to 60cm. Leaves rarely subopposite, ovate to lanceolate. Flowers pink, in fascicles of 3 – 8, epedunculate or borne on a 2 – 3mm 'peg'. Lower sepal narrow-bucciniform, 7 – 9 x 8 – 10mm; spur filiform, 18 – 40mm. Dorsal petal semicucullate, c 9 x 10mm, with a keel-like crest above; lateral united petals 16 – 22mm; upper lateral petal oblong-orbicular, 7 – 8 x 6 – 7mm; lower lateral petal asymmetrically obovate-elliptic, 12 – 16 x 8 – 9mm. Capsule fusiform, 14 – 16 x 3 – 4mm.

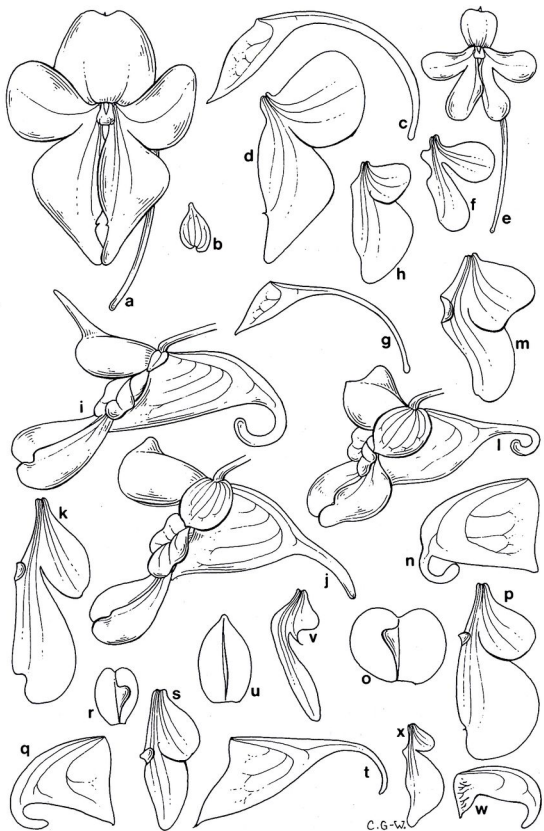
Bhutan: S – Deothang district (N of Deothang); **Darjeeling:** Kurseong, Rishap, Balasun, Punkabari, etc. Subtropical and terai forests, 300 – 1370m. June – September.

3. *I. exilis* Hook. f.; *I. filicornu* Clarke, *I. formicarum* Hook. f., *I. longicornu* Wall. var. *crinata* Hook. f. Fig. 11 e&f.

Annual to 60cm. Leaves lanceolate to ovate-lanceolate, 3.6 – 10 x 1.2 – 4.5cm. Flowers in fascicles of 2 – 3 or solitary, epedunculate or with a short peduncle to 4mm, pink. Lower sepal navicular, 3.5 – 6mm, abruptly constricted into a filiform spur 20 – 28mm. Dorsal petal ovate when flattened, 5 – 7 x 4 – 6mm; lateral united petals 9 – 11mm; upper lateral petal ± oval, 5 – 7 x 3.5 – 4mm; lower lateral petal ± elliptic, 5 – 8 x 4 – 5mm. Capsule fusiform, 9 – 11 x 2.5 – 3mm.

Bhutan: S – Deothang district (Deothang and Demri Chu); **Darjeeling:** Mamrim, Mongpu, Rongbe, Kalimpong; **Sikkim:** Gangtok. Moist rocks along streams, by waterfalls, 460 – 1220m. July – October.

FIG. 11. **Balsaminaceae.** a – d, *Impatiens latiflora*: a, flower; b, lateral sepal; c, lower sepal and spur; d, lateral united petals. e & f, *I. exilis*: e, flower; f, lateral united petals. g & h, *I. infundibularis*: g, lower sepal and spur; h, lateral united petals. i, *I. jurpia*: flower. j & k, *I. cathcartii*: j, flower; k, lateral united petals. l & m, *I. pulchra*: l, flower; m, lateral united petals. n – p, *I. trilobata*: n, lower sepal and spur; o, dorsal petal; p, lateral united petals; q – s, *I. tripetala*: q, lower sepal and spur; r, dorsal petal; s, lateral united petals. t – v, *I. uncipectala*: t, lower sepal and spur; u, dorsal petal.; v, lateral united petals. w & x, *I. florigera*: w, lower sepal and spur; x, lateral united petals. Scale: all x 1/3. Drawn by C. Grey-Wilson.



C.G.-W.

4. *I. cathcartii* Hook. f. Fig. 11j&k.

Perennial herb to 60cm, often less. Leaves glabrous, oval to \pm ovate, 8.5 – 24 x 3.2 – 12cm. Inflorescence a 3 – 10-flowered raceme; flowers pale to mid-yellow, spur often reddish; peduncle 3.2 – 11cm (to 19cm including rachis). Lower sepal obliquely saccate, 19 – 23mm, 17 – 20mm deep, abruptly constricted into a curved spur 11 – 18mm. Dorsal petal cucullate, 16 – 18 x 20 – 22mm when flattened, with a keel-like crest, 1 – 5mm, in upper part above; lateral united petals 32 – 37mm; upper lateral petal broadly oval, 15 – 18 x 11 – 14mm, emarginate; lower lateral petal asymmetrically obovate, 22 – 24 x 10 – 12mm. Capsule cylindrical, c 25 x 4mm.

Darjeeling: Kalimpong, Kurseong, Darjeeling, Mamrim, Tista, Rishap, etc.. Subtropical and submontane forest, in moist heavily shaded places, 600 – 1500m. May – October.

Records from Bhutan (117) have not been substantiated.

5. *I. jurpia* Hamilton. Fig. 11i.

Similar to *I. cathcartii*, but stem often pubescent and leaves elliptic to elliptic-lanceolate, 5.5 – 23 x 3 – 7.8cm, often hairy above and beneath, occasionally glabrous beneath. Flowers whitish with a pale yellow throat, to cream with deep red in throat and a red spur. Lower sepal saccate, 15 – 20mm, 12 – 16mm deep, abruptly constricted into a \pm incurved spur 10 – 17mm. Dorsal petal cucullate, 12 – 13 x 13 – 17mm when flattened, obliquely appendaged near apex; appendage 7 – 11mm, acute; lateral united petals 24 – 30mm.

Bhutan: S – Chukka district (Sinchu La) and Sarbhang district (above Sarbhang); **Darjeeling:** Great Rungit, Darjeeling, Sureil, Balasun, etc. Subtropical and warm broad-leaved forest, in dense shade, 915 – 1830m. June – October.

6. *I. pulchra* Hook. f. & Thomson. Fig. 11l&m.

Perennial herb to 40cm. Leaves elliptic-oblancoelate, 5 – 17.5 x 2.5 – 5.7cm, \pm pubescent between lateral veins above, glabrous beneath. Inflorescence a (1 –)2 – 5-flowered raceme; flowers pale yellow with bright red or purplish-red veins and markings on lip and in throat; peduncle 2 – 6cm. Lower sepal bucciniform, 15 – 24mm, 13 – 19mm deep, \pm gradually constricted into a spur; spur 17 – 28mm, incurved, sometimes spiralled at tip. Dorsal petal cucullate, 13 – 16 x 14 – 20mm when flattened, crested in centre; lateral united petals 24 – 33mm; upper lateral petal oval to subovate, 10 – 13 x 9 – 12mm; lower lateral petal asymmetrically oval-elliptic, 13 – 21 x 8 – 14mm, auricled at point of fusion with upper lateral petal. Capsule \pm fusiform, 16 – 21 x 3 – 4mm glabrous.

Bhutan: S – Chukka district (Marichong); **Darjeeling:** Darjeeling, Dumsong, Nimbong, Sureil. Subtropical forest, stream beds, 760 – 1670m. July – November.

7. *I. trilobata* Colebrooke; *I. flavida* Hook.f. & Thomson. Fig. 11n – p.

Perennial herb to 70cm, usually glabrous. Leaves lanceolate to ovate-elliptic, often rather narrow, 2.4 – 12.5 x 1.4 – 3cm, glabrous but finely pitted above, \pm pubescent on veins beneath. Inflorescence a (1 –)2 – 5-flowered raceme; flowers

purple with a whitish or yellowish lower sepal, or reddish with a yellowish throat, more rarely yellowish with red streaks; peduncle 1.8 – 6cm (to 9.5cm including rachis). Lower sepal deeply saccate, 11 – 17mm, 14 – 20mm deep, abruptly constricted into an incurved spur 8 – 12mm. Dorsal petal cucullate, 9 – 13 x 12 – 16mm when flattened, with a prominent keel-like crest in centre; lateral united petals 24 – 30mm; upper lateral petal suborbicular, 7 – 10 x 6 – 8mm; lower lateral petal asymmetrically ovate-oval, 15 – 17 x 9 – 13mm. Capsule fusiform, 13 – 15mm, glabrous.

Darjeeling: Jalpaiguri, Siliguri, Pankabari, Dulkajhar. Subtropical and terai forests, 200 – 1250m. October – November.

8. *I. tripetala* DC.; *I. multiflora* Hook.f. & Thomson. Sha: *Doorgonang*. Fig. 11q – s.

Annual herb, 15 – 50cm tall. Leaves opposite to subopposite, occasionally in threes, but uppermost often spirally arranged, lanceolate to ovate or elliptic, 2.5 – 19 x 1.2 – 7.8cm, ± pubescent between lateral veins above and on veins beneath, often glabrescent on ageing; petiole 1.5 – 9.5cm, pubescent, with fimbriate, stipule-like processes at base. Flowers ± epedunculate, in fascicles of (1 –) 2 – 5, occasionally borne on a short peg-like peduncle to 15mm, reddish-purple to bluish-purple, yellowish in throat and with a whitish lower sepal. Lower sepal saccate, 10 – 17mm, 13 – 18mm deep, abruptly constricted into an incurved spur 5 – 8mm. Dorsal petal cucullate, 8 – 10 x 5 – 6mm, with a pronounced keel-like crest above; lateral united petals 18 – 23mm; upper lateral petal suborbicular, 6 – 8 x 5 – 9mm; lower lateral petal asymmetrically oval, 10 – 14 x 6 – 10mm. Capsule linear-fusiform, 12 – 19 x 2 – 4.5mm, glabrous.

Bhutan: S – Phuntsholing district (Torsa River), Gaylegphug district (Thewar Khola) and Deothang district (Nersula and above Samdrup Jongkhar); **Darjeeling:** Jalpaiguri, Rishap, Mongpo, Kurseong. Subtropical forest, 300 – 600m. May – August.

9. *I. florigera* Hook. f. Fig. 11w&x.

Annual herb to 50cm tall. Leaves spirally arranged, lowermost often opposite or subopposite, elliptic-lanceolate to ovate-lanceolate, 3.5 – 13.5 x 1.5 – 3.5cm, glabrous, or sparsely pubescent above; petiole 0.8 – 4.2cm, with fimbriate, stipule-like processes at base. Inflorescence 2 – 5-flowered, racemose to subumbellate, sometimes epedunculate; flowers purple with a whitish spur with purplish veins; peduncle 0 – 15mm. Lower sepal sub-bucciniform, 7 – 9mm long, 14 – 17mm deep overall, including incurved spur 3.5 – 5mm. Dorsal petal cucullate, 6 – 7 x 7 – 8mm, crested above in upper half; lateral united petals 14 – 20mm; upper lateral petal ± oval, 3.5 – 5 x 3 – 4mm; lower lateral petal asymmetrically ± elliptic, 10 – 13 x 6 – 7mm. Capsule fusiform, 10 – 12 x 2 – 3.5mm, glabrous.

Bhutan: S – Chukka district (Marichong, Raidak valley) and Deothang district (between Samdrup Jongkhar and Deothang); **Darjeeling:** Sivok, Kurseong, Selim, Nimbong. Montane forests, rocky stream beds, 600 – 1220m. June – November.

10. *I. uncipetala* Hook. f. Fig. 11t - v.

Perennial to 60cm. Leaves elliptic-lanceolate, 2.8 - 10.2 x 1.7 - 5.4cm. Inflorescence 1 - 2-flowered; bracts not basal on pedicels; flowers white or pale pink, yellowish in throat; peduncle 0.7 - 1cm. Lower sepal sub-bucciniform, 14 - 17 x 12 - 16mm; spur downcurved 8 - 12mm. Dorsal petal cucullate, ovate when flattened, 13 - 15 x 9 - 11mm; lateral united petals 18 - 22mm; upper lateral petal suborbicular, 6 - 7 x 5 - 6mm, with an asymmetrical acute, reniform apiculus; lower lateral petal narrow-obovate, 16 - 17 x 6 - 7mm. Capsule linear-cylindric, 37 - 47mm, pendent.

Darjeeling: Rangirun, Rungbe, Senchal and Darjeeling. Moist humus-rich woodland soils, stream margins, 1980 - 2700m. July - October.

11. *I. cristata* Wall.; *I. scabrida* sensu Hara, non DC. Fig. 12a - c.

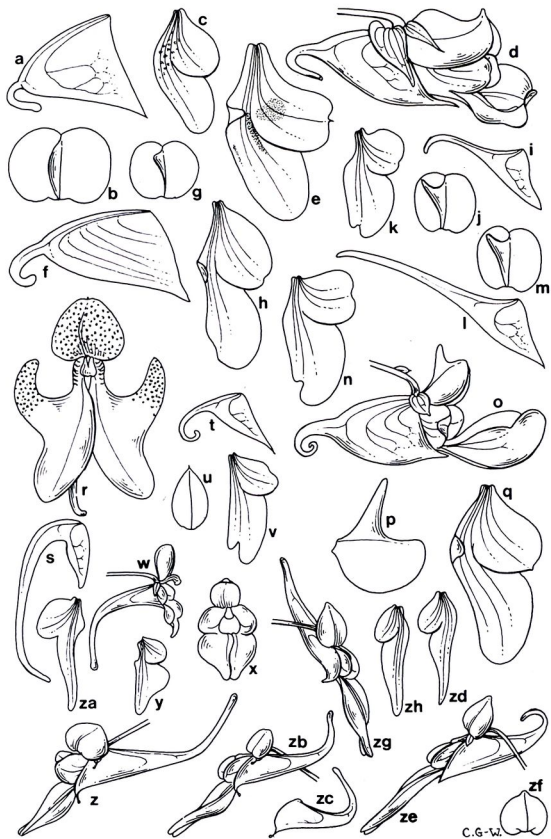
Annual herb to 70cm, but often only 20 - 30cm, pubescent; stems usually branched. Leaves ovate to elliptic or elliptic-oblancheolate, 3.8 - 15 x 1.4 - 5.5cm. Inflorescence a 1 - 3(-4)-flowered raceme; flower pale creamy white to yellow, generally spotted in throat with reddish-brown. Bracts midway along pedicels. Lower sepal deeply navicular to navicular-saccate, 9 - 13 x 6 - 12mm, abruptly constricted into a ± curved, filiform spur 8 - 18mm. Dorsal petal semi-cucullate, broadly ovate-cordate when flattened, 14 - 18 x 18 - 24mm, with a prominent keel-like crest above; lateral united petals 18 - 28mm; upper lateral petal ovate to ovate-triangular, 7 - 11 x 6 - 9mm, entire; lower lateral petal asymmetrically elliptic to elliptic-ovate, 11 - 17 x 5 - 8mm. Capsule cylindrical, 37 - 42mm.

Bhutan:S - Chukka district, C - Thimphu and Bumthang districts, N - Upper Mande Chu and Upper Kulong Chu districts; **Chumbi.** Sunny or semi-shaded moist habitats, particularly in open forest, along pathways or close to habitation, 1500 - 2500m. June - October.

12. *I. arguta* Hook. f. & Thomson; *I. gagei* Hook. f. Fig. 12d&e.

Perennial herb to 80cm. Leaves elliptic to ovate-elliptic or lanceolate, 3 - 17 x 1.2 - 6.2cm, glabrous; petiole 4 - 18cm, with a pair of sessile or subsessile glands towards top. Flowers epedunculate, solitary or in clusters of 2 - 3(-5), rose-purple to violet. Lateral sepals 4, in 2 pairs. Lower sepal saccate, 19 - 23mm, 19 - 22mm deep, more or less gradually constricted into a incurved spur 16 - 19mm. Dorsal

FIG. 12. **Balsaminaceae.** a - c, *Impatiens cristata*: a, lower sepal and spur; b, dorsal petal; c, lateral united petals. d & e, *I. arguta*: d, flower; e, lateral united petals. f - h, *I. discolor*: f, lower sepal and spur; g, dorsal petal; h, lateral united petals. i - k, *I. puberula*: i, lower sepal and spur; j, dorsal petal; k, lateral united petals. l - n, *I. decipiens*: l, lower sepal and spur; m, dorsal petal; n, lateral united petals. o - q, *I. spirifer*: o, flower; p, dorsal petal; q, lateral united petals. r & s, *I. falcifer*: r, flower; s, lower sepal and spur. t - v, *I. lutea*: t, lower sepal and spur; u, dorsal petal; v, lateral united petals. w - y, *I. racemosa*: w, flower; x, flower, front view; y, lateral united petals. z & za, *I. drepanophora*: z, flower; za, lateral united petals. zb - zd, *I. stenantha*: zb, flower; zc, lower sepal and spur; zd, lateral united petals. ze & zf, *I. longipes*: ze, flower; zf, dorsal petal. zg & zh, *I. prainii*: zg, flower; zh, lateral united petals. Scale: all x 1/3. Drawn by C. Grey-Wilson



C.G.-W.

petal cucullate, 14 – 16 x 18 – 19mm when flattened, crested in lower two-thirds; lateral united petals 25 – 32mm; upper lateral petal oval to oblong, 10 – 15 x 6 – 11mm, entire to emarginate; lower lateral petal asymmetrically oval, 16 – 20 x 8 – 12mm, emarginate. Capsule clavate, 23 – 30 x 4 – 5mm, glabrous.

Bhutan: S – Deothang district, C – Punakha and Tongsa districts, N – Upper Kulong Chu district; **Darjeeling:** Broad-leaved forests, on moist humus-rich soils, 2000 – 2590m. May – October.

13. *I. discolor* DC. Fig. 12f – h.

Perennial to 25cm tall; stems decumbent, rooting at lower nodes. Leaves elliptic-lanceolate, 3.8 – 12.5 x 1.4 – 4.8cm. Inflorescence a 1 – 3(–4)-flowered raceme; flowers pale pink or white, generally with some deeper spotting in throat; peduncle 4 – 13mm, often bracteate. Lower sepal bucciniform, 14 – 17mm, 17 – 19mm deep, obliquely veined, abruptly constricted into a spur; spur 7 – 11mm, incurved, spiralled. Dorsal petal cucullate, 10 – 11 x 10 – 11mm when flattened, with a prominent keel-like crest above; lateral united petals 25 – 27mm; upper lateral petal oblong to suborbicular, 10 – 12 x 7 – 9mm, slightly emarginate; lower lateral petal asymmetrically elliptic-obovate, 16 – 18 x 8 – 10mm. Capsule narrowly clavate, 19 – 21mm.

Bhutan: C – Thimphu district (Pyemithangkha), Punakha district (Wangdu Phodrang) and Mongar district (Kori La); **Darjeeling:** Kurseong, Dumsong, Tonglo, Darjeeling. Montane forest, moist shaded or semi-shaded places, 1500 – 3000m. July – October.

14. *I. spirifer* Hook. f. & Thomson; *I. acmanthera* Hook. f. Fig. 12o – q.

Annual herb to 60cm. Leaves elliptic to ovate-lanceolate, 2 – 11.5 x 1 – 6cm, sparsely pubescent above, glabrous, or somewhat pubescent along veins beneath. Flowers solitary or paired, epedunculate, pale pink with a yellowish-orange spur. Lower sepal bucciniform, 15 – 24mm long, 12 – 19mm deep, ± gradually constricted into an incurved, spiralled spur 11 – 14mm. Dorsal petal cucullate, 12 – 17 x 14 – 19mm when flattened, with a prominent keel-like crest above; lateral united petals 26 – 36mm; upper lateral petal suborbicular, generally slightly emarginate, 9 – 15 x 9 – 11mm; lower lateral petal asymmetrically elliptic, 20 – 27 x 7 – 11mm. Capsule subfusiform 21 – 23 x 3.5 – 4.5mm, glabrous.

Bhutan: C – Thimphu, Punakha and Tongsa districts; **Darjeeling:** Dumsong, Lopchu; **Sikkim:** Lachung, Choongtam, Kanglasa. Montane forest on humus-rich soils, along pathways, 1520 – 3000m. July – October.

15. *I. puberula* DC.; *I. mollis* Wall., *I. hispidula* Benth. Fig. 12i – k.

Perennial herb to 60cm; stem finely pubescent. Leaves lanceolate-elliptic to oblong-lanceolate, 3.5 – 15.5 x 1 – 6cm, pubescent above and beneath, sometimes subglabrous beneath. Flowers solitary, epedunculate or on a short peg up to 6mm, bluish-purple, mauve to mauve-blue. Lower sepal obliquely navicular, 11 – 13mm, usually pubescent, constricted into a ± S - shaped spur 21 – 24mm. Dorsal petal

semi-cucullate, broadly ovate, 11–15 x 12–18mm when flattened, with a keel-like crest above, often pubescent along crest; lateral united petals 19–26mm; upper lateral petal oblong to suborbicular, \pm emarginate, 7–10 x 5–9mm; lower lateral petal asymmetrically \pm elliptical, 13–21 x 7–12mm. Capsule cylindrical-fusiform, 19–27 x 3–5mm, glabrous.

Bhutan: C – Tongsa district (Tongsa), Mongar district (near Namning) and Tashigang district (Tashi Yangtisi), N – Upper Kuru Chu district (Denchung); **Darjeeling:** Rangirun, Senchal. Montane forest and stream beds, on humus-rich soils, 1520–2550m. June – October.

16. *I. decipiens* Hook. f. Fig. 12 l – n.

Perennial herb to 50cm. Leaves ovate to ovate-elliptic, 2.6–12.5 x 1.3–5.4cm, glabrous, or somewhat pubescent between lateral veins above. Flowers in fascicles of 2–4, occasionally solitary, epedunculate, pink to purple. Lower sepal narrowly funnel-shaped, 8–12mm, tapering into a spur; spur 30–35mm, slightly S-shaped, filiform, sparsely pubescent. Dorsal petal cucullate, 10–12 x 12–15mm when flattened, with a low crest above terminating in a short point; lateral united petals 15–21mm; upper lateral petal of each pair broadly oval, slightly emarginate, 8–11 x 7–9mm; lower lateral petal asymmetrically oval, 10–14 x 8–12mm. Capsule \pm cylindrical, c 19 x 3mm, glabrous.

Darjeeling: Dumsong, Tista, Rishap; **Sikkim:** Chakung, Gangtok. Montane forests, 915–1520m. May – October.

17. *I. serratifolia* Hook. f.; *I. serrata* auct. p.p. non Hook. f. & Thomson. Fig. 13 o – q.

Annual 15–40cm. Leaves lanceolate to elliptic-lanceolate, 1–6.5 x 0.8–2.3cm. Inflorescence 1–3-flowered, bracts not basal on pedicels; flowers white with a yellow throat. Lower sepal deeply navicular, 5–9 x 5–6mm; spur downcurved, 3–5mm. Dorsal petal cucullate, 4–5mm, crested; lateral united petals 12–14mm; upper lateral petal suborbicular, c 3 x 3.5mm; lower lateral petal \pm oval, c 8 x 5mm. Capsule \pm pendent, linear-cylindrical, 24–32 x 2mm.

Sikkim: Lachung, Yeumthang, Lamtong. Moist rocks, stream margins, 2750m. August – October.

18. *I. falcifer* Hook. f.; *I. serrata* sensu F.B.I. p.p. non Hook. f. & Thomson. Fig. 12 r&s.

Annual herb 15–50cm tall, glabrous. Leaves elliptic to elliptic-lanceolate or elliptic-oblancheolate, 2–12.5 x 0.8–3.6cm, apex acuminate. Inflorescence a reduced 1–2-flowered raceme; flowers with a white, purple spotted, dorsal petal and yellow wings, upper lobes purple or purple-brown spotted; peduncle 5–13mm. Lower sepal shallowly navicular, 9–12mm, abruptly constricted into a curved filiform spur 19–32mm. Dorsal petal broadly ovate-cordate, 8–11 x 10–16mm; lateral united petals 15–26mm; upper lateral petal \pm obsolete; lower lateral petal 2-lobed, upper lobe sickle-shaped, obtuse, 7–13 x 3–5mm, lower lobe ovate-oval,

obtuse, 6 – 14 x 6 – 9mm. Capsule descending, curved, linear-cylindric, 34 – 43 x 1 – 1.5mm, glabrous.

Darjeeling: Kalapokri, Tonglu; **Sikkim:** Chowbhanjan, Karponang, Jongri, Changu, Lachung, Dikchu Valley. Montane forest and stream beds, 2440 – 3810m. July – November.

19. *I. lutea* Hook. f. Fig. 12t – v.

Annual herb to 30cm; stems simple or few-branched. Leaves pubescent between veins above, ± glabrous beneath, elliptic to elliptic-ovate, 4 – 12.5 x 1.8 – 5.6cm. Inflorescence a 1 – 2-flowered raceme; with greenish sepals, otherwise unmarked. Lateral sepals lanceolate, 4 – 6mm, acute to apiculate, but without a gland-tipped appendage; lower sepal 19 – 22mm overall, tapered into a strongly upcurved spur. Lateral united petals 21 – 24mm; upper lateral petal ± oval, 5 – 6 x 4 – 5mm; lower lateral petal linear-lanceolate, 14 – 15 x 2mm.

Darjeeling: Dumsong. Broad-leaved forest, generally amongst rocks or along stream margins, 1520m. July.

20. *I. occultans* Hook. f. Fig. 13m&n.

Annual herb 4 – 24cm; stems erect simple or branched. Leaves ovate to lanceolate, 0.9 – 3.4 x 0.6 – 7.7cm. Flowers solitary, pedunculate, whitish; peduncle 4 – 7mm. Lower sepal navicular, 2.5 – 3mm, without spur. Dorsal petal cucullate, 1 – 1.5mm; lateral united petals c 3mm; upper lateral petal ± oval, 0.5 – 1 x 0.5mm; lower lateral petal asymmetrically pyriform, c 2 x 1 – 1.5mm. Capsule narrowly fusiform, 4 – 7mm, semi-pendent.

Sikkim: Tankra Mountain and Lachen. Moist alpine rocks and low scrub, 3960 – 4110m. July – September.

21. *I. radiata* Hook. f.; *I. racemosa* DC. var. *radiata* (Hook. f.) T. Shimizu, *I. racemosa* auct. non DC.

Annual herb to 1m, glabrous. Leaves elliptic to lanceolate-elliptic, 3.4 – 18 x 1 – 3.6cm. Inflorescence racemose, 6 – many-flowered; lower flowers in pseudovercils, interrupted above; flowers pink with a whitish spur; peduncle 3.4 – 6cm (to 15.5cm including rachis). Lower sepal narrow funnel-shaped, 5 – 8mm, tapering into a slender straight spur 22 – 30mm. Dorsal petal cucullate, 6 – 7 x 4 – 5mm when flattened; lateral united petals 7 – 9mm; upper lateral petal suborbicular to squarish, c 3 x 3mm; lower lateral petal asymmetrically ovate, 7 – 8 x 2.5 – 3.5mm, somewhat drawn out distally. Capsule narrowly cylindrical-clavate, 17 – 19 x 2mm.

Bhutan: S – Chukka district, C – Thimphu, Punakha and Bumthang districts, N – Upper Kulong Chu district; **Darjeeling; Sikkim.** Broad-leaved and montane forests, pathways, rocky places and stream beds, 1250 – 3150m. May – October.

22. *I. graciliflora* Hook. f.

Annual to 60cm. Leaves elliptic to lanceolate-elliptic, 8 – 12.5 x 3.2 – 4cm. Inflorescence a many-flowered raceme, lower flowers in pseudovercils, flowers

pink; peduncle 3.3 – 7.4cm (to 20.5cm including rachis). Lower sepal shallowly navicular, 5 – 7 x 2 – 3mm; spur slightly curved or S-shaped, filiform, 28 – 38mm. Dorsal petal cucullate 3 – 4mm; lateral united petals 8 – 12mm; upper lateral petal auricle-like, 1.5 – 2 x 2mm; lower lateral petal asymmetrically bilobed, 8 – 10 x 5 – 5.5mm. Capsule linear-cylindric, 15 – 8 x 2mm.

Darjeeling: Senchal, Batase, Kurseong, Darjeeling, etc.. Warm broad-leaved forests and scrub, 600 – 2100m. June – October.

23. *I. racemosa* DC.; *I. micrantha* D. Don, *I. laxiflora* auct. non Edgeworth, *I. microsciadia* Hook. f., *I. tingens* auct. non Edgeworth. Fig. 12w – y.

Annual herb 20 – 120cm, glabrous. Leaves ovate to elliptic-lanceolate, 3.5 – 12 x 1.8 – 5cm. Inflorescence a 5 – many-flowered raceme, occasionally reduced to 2 – 3 flowers on lateral branches; flowers bright yellow, often with reddish-brown markings on lip; peduncle 4.4 – 6.5cm (to 12cm including rachis). Lower sepal shallowly navicular 5 – 8mm, constricted into a slightly curved tapering spur 14 – 18mm, rarely without spur. Dorsal petal cucullate, 3.5 – 5 x 3.5 – 5mm when flattened; lateral united petals 9 – 12mm; upper lateral petal ± oval, 2.5 – 3 x 2mm; lower lateral petal asymmetrically oval, 7 – 8 x 3 – 4mm. Capsule cylindric-clavate 14 – 17 x 2 – 3mm.

Bhutan: C – Thimphu district (Pajoding and Dochong La); **Darjeeling:** Tonglo, Darjeeling, Dentam, Little Rungit; **Sikkim:** Yak La, Lachung; **Chumbi:** Broad-leaved and montane forest, rocky places, pathsides, stream margins, 915 – 3000m. May – November.

Forms lacking a spur are sometimes assigned to var. *ecalcarata* Hook. f.

24. *I. gammiei* Hook. f. & Thomson; *I. minimiflora* Hook. f.

Annual 8 – 40cm. Leaves elliptic, 1.8 – 9 x 0.9 – 3.5cm. Inflorescence racemose, 3 – many-flowered, lowermost flowers often opposite or subverticillate; flowers white to pale pink; peduncle 1.6 – 4.5cm (to 16cm including rachis). Lower sepal navicular, 4 – 4.5 x 1.5 – 2mm; spur to 5mm or absent. Dorsal petal cucullate, 2 – 5 – 3mm; lateral united petals 4 – 6mm; upper lateral petal oval, 1 – 1.5 x 0.75 – 1mm; lower lateral petal elliptic, 4 – 5 x 1mm. Capsule linear 13 – 16 x 1mm.

Darjeeling: between Sandakphu and Phallut, Tonglu; **Sikkim:** Yak La, Lamteng. Moist rocks, stream margins and ravines in Fir forests, 3000 – 3600m. June – October.

25. *I. drepanophora* Hook. f. Fig. 12z&za.

Perennial herb to 50cm, glabrous; stems erect to decumbent, with scattered sessile glands. Leaves lanceolate-elliptic to ovate-elliptic, 2.2 – 12.5 x 1.3 – 5.8cm. Inflorescence a spreading, 7 – many-flowered raceme; flowers yellow, lateral petals speckled with purple towards base, asymmetrically distorted, viewed from front; peduncle 2 – 8cm (to 15.5cm including rachis). Lower sepal 26 – 30mm in length overall, narrow-bucciniform, terminating in a slender gland-tipped appendage, 8 – 12mm, gradually tapering into an upcurved spur. Dorsal petal ovate-oval, erect to

deflexed, 5 – 9 x 4 – 7mm; lateral united petals 24 – 26mm; upper lateral petal triangular-ovate, 8 – 10 x 3.5 – 5mm; lower lateral petal narrowly elliptic-lanceolate, 15 – 20 x 4 – 5mm. Capsule cylindrical-clavate, 10 – 16 x 2.5 – 4mm.

Bhutan: C – Mongar district (near Zimgang); **Darjeeling:** Rongbe, Tista. Broad-leaved forests, especially on riversides, rocks and shingle, 1475 – 2150m. June – October.

26. *I. longipes* Hook. f. & Thomson; *I. bivittata* Hook. f. Fig. 12ze&zf.

Similar to *I. drepanophora*, but often taller. Leaves up to 15 x 5cm. Bracts lanceolate-subulate, not gland-tipped, 3 – 5mm, caducous. Flowers yellow or pale yellow, usually spotted purple in throat; peduncle 3 – 5.3cm (to 14.8cm including rachis). Lower sepal funnel-shaped, 10 – 13mm in length overall, gradually tapering into \pm straight spur. Dorsal petal cucullate, \pm ovate when flattened, c 5 x 5mm; lateral united petals 15 – 18mm; upper lateral petal suborbicular, 4 – 5 x 4 – 5mm, often slightly emarginate; lower lateral petal narrow triangular-lanceolate, tapering, 10 – 11 x 3.5 – 4mm. Capsule cylindrical, 16 – 18mm.

Bhutan: C – Tongsa district (Tongsa); **Darjeeling:** Gumpahar, Senchal, Richi La; **Sikkim:** Lachen. Moist shaded or semi-shaded places, woodland and close to habitations, 3150 – 3400m. July – October.

27. *I. stenantha* Hook. f.; *I. asymmetrica* Burkill, *nom. nud.* Fig. 12zb – zd.

Similar to *I. drepanophora*, but plants to 80cm tall. Leaves elliptic to elliptic-oblongate, to 18 x 4.8cm. Inflorescence (2 –) 4 – many-flowered; flowers yellow with rust-red or red-crimson spots merging into blotches along spur. Lower sepal shorter, 12 – 18mm overall, more abruptly upcurved into spur. Lateral united petals 16 – 22mm; upper lateral petal oval-reniform, 6 – 9 x 2.5 – 3.5mm; lower lateral petal linear-lanceolate, 10 – 15 x 1.5 – 2mm.

Bhutan: C – Punakha district (Wangdu Phodrang) and Mongar/ Tashigang district (Donga La), N – Upper Kulong Chu district (Tobrang); **Darjeeling:** Senchal, Tonglu, Kurseong, etc. Montane forest, amongst rocks and along stream margin, sometimes on humus-rich soils, 2550 – 3500m. June – October.

The above description and records refer to the typical yellow-flowered var. *stenantha*.

FIG. 13. Balsaminaceae. a – d, *Impatiens sulcata*: a, flower; b, lower sepal and spur; c, dorsal petal; d, lateral united petals. e – i, *I. kingii*: e, flower; f & g, lower sepal and spur; h & i, lateral united petals. j – l, *I. laxiflora*: j, flower; k, lower sepal and spur; l, lateral united petals. m & n, *I. occultans*: m, lower sepal; n, lateral united petals. o – q, *I. serratifolia*: o, lower sepal and spur; p, dorsal petal; q, lateral united petals. r – t, *I. scitula*: r, flower; s, lower sepal and spur; t, lateral united petals. u – w, *I. cymbifera*: u, flower; v, dorsal petal; w, lateral united petals. x – z, *I. pradhanii*: x, flower; y, lower sepal and spur; z, lateral united petals. za & zb, *I. urticifolia*: za, flower; zb, lateral united petals. zc – ze, *I. balsamina*: zc, lower sepal and spur; zd, dorsal petal; ze, lateral united petals. Scale: all x 1/3. Drawn by C. Grey-Wilson.



C. G.-W.

var. **porphyrea** (Toppin) Hook. f.; *I. porphyrea* Toppin.

Similar in all respects to typical plant, but flowers deep reddish-purple.

Bhutan: C – Tongsa district (Changkha). Boulders along stream margins, c 2400m. May – July.

28. *I. leptocarpa* Hook. f.

Annual herb to 70cm tall; stem simple or branched. Leaves elliptic to elliptic-lanceolate, 8 – 12.5 x 2.8 – 5.2cm, pubescent between veins above. Inflorescence an 8 – many-flowered raceme; flowers cream; peduncle 4 – 11mm. Lower sepal navicular, abruptly constricted into a curved, filiform spur 11 – 13mm. Dorsal petal ovate, 8 – 10 x 8 – 9mm; lateral united petals 15 – 18mm; upper lateral petal ± oval-obovate, 5 – 6 x 4 – 5mm, slightly emarginate; lower lateral petal obliquely rhombic-ovate, 10 – 14 x 5 – 6mm; deeply notched. Capsule cylindrical, 22 – 27mm, somewhat beaded.

Darjeeling: Phallut, Neora. 3050 – 3660m. October.

29. *I. prainii* Hook. f. Fig. 12zg&zh.

Perennial herb to 25cm tall. Leaves crowded towards stem tops, glabrous, linear-elliptic, 1 – 11 x 0.9 – 1.5cm; petiole 2 – 3mm, or leaves ± sessile, with a pair of stipule-like processes at base. Inflorescence a reduced 1 – 3-flowered raceme; flowers bluish- or reddish-purple; spur whitish tinged with purple; peduncle 0.8 – 2.2cm. Lower sepal 12 – 16mm overall, narrowly funnel-shaped, drawn out into a straight, somewhat tapering spur. Dorsal petal cucullate, 6 – 8 x 5 – 8mm when flattened, shallowly crested above; lateral united petals 16 – 25mm; upper lateral petal ± ovate, obtuse, 6 – 8 x 4 – 5mm; lower lateral petal linear-oblong, somewhat tapered distally, 16 – 18 x 4 – 4.5mm. Capsule linear-cylindrical, 14 – 19mm.

Bhutan: Thimphu district (between Hinglai La and Tsalimaphe), and Mongar district (above Namning); **Sikkim:** Lachung. Montane forest, on humus-rich soils, wet rocks, 2450 – 3650m. July – October.

30. *I. sulcata* Wall.; *I. gigantea* Edgeworth. Fig. 13a – d.

Annual herb to 1.5m tall, glabrous. Leaves opposite or subopposite, ovate to ovate-elliptic or lanceolate, 4.5 – 18.5 x 1.8 – 7cm. Inflorescence a 4 – many-flowered raceme, sometimes subumbellate; lowermost flowers generally in a pseudovertilcil; flowers mauve, pink or reddish, spotted with yellow-brown in throat; peduncle 2.8 – 16.5cm. Lower sepal saccate, 14 – 25mm, 10 – 17mm deep, abruptly constricted into an incurved spur 5 – 10mm. Dorsal petal cucullate, 10 – 18 x 13 – 22mm when flattened, slightly crested above; lateral united petals 17 – 33mm; upper lateral petal oval, with a short recurved acute apex, 10 – 12 x 6 – 9mm; lower lateral petal elliptic-triangular, 12 – 22 x 7 – 14mm, subobtuse. Capsule cylindrical-clavate, 20 – 34 x 3 – 4mm.

Bhutan: Ha, Thimphu, Punakha and Bumthang districts, N – Upper Mo Chu and Upper Mangde Chu districts; **Sikkim:** Lachung, Lachen, Tongu; **Chumbi.** Stream margins and pathsides in forests, 2850 – 3850m. June – September.

31. *I. kingii* Hook. f.; *I. gamblei* Hook. f., *I. hobsonii* Hook. f. Fig. 13e - i.

Perennial herb to 60cm tall; stems erect, usually glabrous. Leaves lanceolate, 3.5 - 12.5 x 1.7 - 6.2cm, scabrid along veins above and beneath, often more or less pubescent beneath. Inflorescence a (1 -)2 - 8-flowered, semi-secund raceme; flowers yellow with reddish veining, or all purple; peduncle 2.7 - 10cm (to 14.5cm including rachis). Lateral sepals 4, 2 pairs; upper (inner) pair linear-lanceolate, 2.5 - 4mm; lower (outer) pair ovate, 4 - 7mm, usually toothed, at least along one edge. Lower sepal deeply saccate, 17 - 21mm, 13 - 15mm deep, abruptly constricted into an incurved spur 6 - 7mm. Dorsal petal cucullate, ovate, 9 - 12 x 15 - 20mm when flattened, not crested; lateral united petals 32 - 36mm; upper lateral petal suborbicular, 9 - 11 x 7 - 9mm; lower lateral petal asymmetrically \pm triangular, 21 - 24 x 7 - 9mm, drawn out distally to a \pm acute tip. Capsule cylindrical-clavate, 22 - 25mm.

Bhutan: C - Thimphu district (near Saka La) and Mongar district (Ghijamchu); **Darjeeling:** Sandakphu, Tonglu; **Sikkim:** Jongri; **Chumbi:** near Yatung. Moist coniferous forests, on wet rocks and river margins, 2850 - 3960m. July - October.

32. *I. laxiflora* Edgeworth; *I. micranthemum* Edgeworth, *I. laxiflora* var. *sikkimensis* Hook. f., *I. thomsonii* Hook. f. Fig. 13j - l.

Annual herb to 60cm. Leaves spirally arranged, lowermost sometimes \pm opposite, elliptic to lanceolate-elliptic, 4 - 17.5 x 1.2 - 6cm, glabrous or slightly hairy on veins beneath. Inflorescence a (1 -)2 - many-flowered raceme; flowers pink with a paler or whitish dorsal petal, throat yellowish, often brown spotted, as well as upper lateral petals; peduncle 2 - 6.5cm (to 15cm including rachis). Lateral sepals with a darkish round gland on dorsal edge at base. Lower sepal navicular, 8 - 10mm, 2 - 3mm deep, abruptly constricted into a \pm curved filiform spur 12 - 15mm. Dorsal petal semi-cucullate, 5 - 10 x 7 - 11mm; lateral united petals 13 - 22mm; upper lateral petal suborbicular, 5 - 8 x 4 - 7mm; lower lateral petal asymmetrically semi-elliptic-obovate, 8 - 15 x 7 - 11mm. Capsule cylindrical-clavate, 22 - 34 x 2.5 - 4mm, glabrous.

Bhutan: S - Chukka district (Bunakha), C - Tongsa district (S of Tongsa); **Sikkim:** Lachen, Lachung, Thangu. Middle and upper montane rocks, rocky places and stream margins, 2100 - 3350m. July - November.

33. *I. tuberculata* Hook. f. & Thomson; *I. aganantha* Hook. f.

Annual to 40cm. Leaves lanceolate-elliptic, 2.3 - 8 x 1.2 - 2.6cm. Inflorescence racemose, 3 - many-flowered; flowers white with pink or reddish markings; peduncle 0.9 - 3.3cm (to 6.5cm including rachis). Lower sepal navicular, 5 - 6 x 1.5mm; spur obsolete to 1mm. Dorsal petal cucullate; lateral united petals c 11mm; upper lateral petal \pm orbicular, c 3 x 3.5mm; lower lateral petal asymmetrically pyriform, c 9 x 4mm. Capsule clavate, warted, 10 - 11 x 2 - 3mm.

Bhutan: C - Bumthang district (near Bumthang), N - Upper Mo Chu, Upper Pho Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Champithang,

Yeumthang; **Chumbi**: Lingmuthang. Moist rocks, scrub, open woodland, 3200 – 4250m. June – September.

34. *I. scitula* Hook. f.; *I. barbata* Hook. f., *I. nummulariifolia* Hook. f., *I. pantlingii* Hook. f., *I. tubifer* Hook. f. Fig. 13r – t.

?Annual herb 10 – 50cm. Leaves ovate to lanceolate-elliptic, 1.6 – 11.2 x 1 – 5.5cm, glabrous above and beneath or somewhat papillose on veins beneath. Inflorescence a 2 – 6-flowered raceme; flowers yellow, dorsal petal and upper lateral petals speckled with brown; peduncle 1.8 – 6.5cm (to 13.5cm including rachis). Lateral sepals 2 pairs; lower sepal bucciniform, 14 – 18mm overall, acute, gradually tapering into an upcurved spur. Dorsal petal cucullate, broadly ovate, 6 – 9 x 8 – 12mm when flattened, scarcely crested above; lateral united petals 16 – 22mm; upper lateral petal oval to suborbicular, 4 – 8 x 3.5 – 6mm; lower lateral petal linear-lanceolate, 11 – 14 x 1.5 – 2mm. Capsule unknown.

Bhutan: C – Bumthang district (E side of Yuto La); **Darjeeling**: Tonglu, Rishi La; **Sikkim**: Syrugong. Montane forest, rocky stream beds, 2050 – 3375m. July – October.

35. *I. cymbifera* Hook. f.; *I. amphorata* auct. non Edgeworth. Fig. 13u – w.

Annual herb to 1.5m tall, often less, glabrous. Leaves elliptic to ovate-elliptic or lanceolate-elliptic, 8 – 20.5 x 2.8 – 7.7cm. Inflorescence a 2 – 7-flowered raceme, occasionally reduced to 1 flower on lateral shoots; flowers lilac-purple or reddish-purple, asymmetrically distorted viewed from front; peduncle 2.8 – 7.2cm. Lower sepal deeply navicular, 12 – 14mm, 7 – 10mm deep, abruptly constricted into a slightly curved filiform spur 7 – 11mm. Dorsal petal subcucullate, ovate-cordate, 9 – 10 x 10 – 12mm when flattened, slightly crested above; lateral united petals 18 – 22mm; upper lateral petal suborbicular, 8 – 9 x 7 – 8mm; lower lateral petal narrow-lanceolate-oblong, obtuse, 11 – 12 x 4 – 4.5mm. Capsule ± cylindrical, 18 – 26 x 2 – 2.5mm.

Sikkim: Lachung, Choongtam, Gangtok, Karponang. Montane forest, on moist humus-rich soils, 1850 – 3250m. July – November.

36. *I. urticifolia* Wall. Fig. 13za&zb.

A stout perennial herb to 1m. Leaves elliptic, lanceolate-elliptic to oblanceolate, 4 – 26 x 1.8 – 6.8cm, glabrous or minutely scabrid on veins above and beneath. Inflorescence a horizontal to drooping, 2 – 7-flowered raceme; flowers cream or pale yellow, lined with purple or reddish-purple in throat and on lower sepal, or more or less purplish throughout; peduncle 4.7 – 11.5cm (to 13.5cm including rachis). Lateral sepals often ± toothed along edge. Lower sepal deeply navicular, pointed, 19 – 32mm, 9 – 12mm deep, abruptly constricted into an incurved spur 13 – 15mm. Dorsal petal cucullate, 12 – 14 x 13 – 17mm when flattened, shallowly crested above; lateral united petals 37 – 42mm; upper lateral petal ± triangular, obtuse, 8 – 10 x 7 – 8mm; lower lateral petal narrow triangular-lanceolate, 28 – 36 x 6 – 8mm, drawn out distally to an acute tip. Capsule linear-cylindrical, c 33 x 3mm.

Bhutan: C – Tashigang district (Tashi Yangtshi); **Sikkim** (80). Upper montane rain forest, on moist humus-rich soil, especially in forest clearings and ravines, 2550 – 3150m. July – October.

Note: Other Bhutanese specimens with a \pm straight spur may be more appropriately regarded as a distinct variety or subspecies, but this requires further investigation.

37. *I. pradhanii* Hara; *I. bicornuta* sensu F.B.I. p.p. non Wall. Fig. 13x – z.

Annual herb 30 – 100cm. Leaves elliptic to lanceolate-elliptic, (3.5 –)7 – 22.5 x (1.7 –)2.9 – 7.6cm, glabrous or with a sparse pubescence above. Inflorescence a 2 – many-flowered raceme, lower flowers in a pseudoverticil; flowers yellowish with violet, purplish-black or reddish veining; peduncle (2 –)5 – 10.5cm (to 28cm including rachis). Lower sepal bucciniform-saccate, 13 – 17mm, 15 – 20mm deep, constricted into an incurved, S-shaped spur 3 – 5mm. Dorsal petal cucullate, 7 – 10 x 12 – 14mm when flattened, terminating in a short acute point; lateral united petals 31 – 36mm; upper lateral petal suborbicular-triangular, 5 – 7 x 6 – 7mm; lower lateral petal linear, somewhat tapered to tip, with a rounded lobe at base, 25 – 27 x 3 – 6mm overall. Capsule linear-clavate, 32 – 38 x 2 – 2.5mm.

Darjeeling: Tonglu; **Sikkim:** Laghep. Montane forest, on humus-rich soil, river margins, 2200 – 3250m. July – November.

38. *I. bracteata* Wall.; *I. fimbriata* Hook.

Annual herb to 40cm tall, sometimes as low as 6cm, glabrous; stem simple or few-branched. Leaves mostly opposite, occasionally sub-opposite or alternate, elliptic to elliptic-lanceolate, 2.5 – 12 x 1 – 3.4cm. Inflorescence a dense many-flowered raceme; flowers pink with a yellowish throat; peduncle 1.9 – 7cm (– 18cm including rachis). Bracts closely overlapping, markedly fimbriate, fimbriae 4 – 8mm. Lower sepal navicular, abruptly constricted into a curved filiform spur 17 – 23mm. Dorsal petal cucullate, ovate when flattened, c 4 x 3mm; lateral united petals 10 – 12mm; upper lateral petal suborbicular, 1.5 – 2 x 1.5 – 2mm; lower lateral petal asymmetrically obovate, 6 – 9 x 4 – 6mm, emarginate along inner margin. Capsule fusiform, 5 – 8mm.

Darjeeling: Mungpoo. Naturalized. Introduced from Assam, Khasia Hills, with orchids, 650 – 1300m. June – October.

39. *I. balsamina* L.; *I. coccinea* Sims. Fig. 13zc – ze.

Annual herb to 60cm tall; stem simple, more rarely branched. Leaves elliptic to narrow-obovate, 6 – 10.5 x 1.2 – 2cm, usually glabrous. Flowers epedunculate, solitary or in axillary fascicles of 2 – 3, pink, mauve or white. Lower sepal navicular, 10 – 17mm, abruptly constricted into a curved filiform spur 16 – 21mm. Dorsal petal cucullate, ovate-cordate when flattened, 9 – 10 x 10 – 12mm, with a shallow crest above, terminating in an acute point; lateral united petals 23 – 30mm; upper lateral petal suborbicular to \pm obovate, 8 – 10 x 6 – 9mm, slightly apiculate; lower lateral petal broadly obovate in outline, unevenly 2 – lobed, 18 – 21 x 18 – 20mm.

Bhutan:C – Mongar district (Mongar); **Darjeeling:** Sukna and Jalpaiguri. Cultivated, 200 – 1800m. November – June.

Native of India and Burma but widely naturalized and cultivated in Himalayan foothills.

Family 100. AQUIFOLIACEAE

by S. Andrews

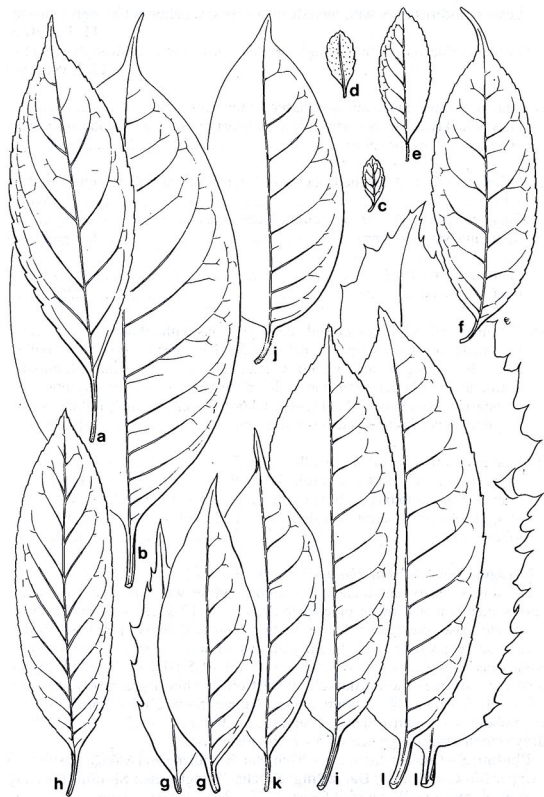
Evergreen or deciduous trees or shrubs. Leaves alternate, simple, pinnately veined; stipules minute. Dioecious; flowers solitary or in axillary fascicles, cymes, pseudoumbels or pseudocymes, actinomorphic, unisexual. Calyx 4 – 8-lobed, imbricate. Corolla lobes 4 – 9, imbricate, united at the base. Male flowers: stamens 4 – 8, epipetalous; pistillode rudimentary. Female flowers: ovary 2 – 9-celled, placentation axile; stigma sessile. Fruit a berry; stones (pyrenes) 2 – 9, each 1-seeded.

1. ILEX L.

Description as for Aquifoliaceae.

- | | |
|--|---|
| 1. Deciduous trees; branches brittle with conspicuous lenticels; leaves <i>Prunus</i> -like; corolla lobes 5 – 9 | 1. <i>I. fragilis</i> |
| + Evergreen trees or shrubs | 2 |
| 2. Leaves less than 5cm | 3 |
| + Leaves more than 5cm | 5 |
| 3. Leaves gland-dotted beneath; fruit black | 4. <i>I. crenata</i> var. <i>thomsonii</i> |
| + Leaves not gland-dotted beneath; fruit red | 4 |
| 4. Prostrate shrub to 1m; leaves 0.8 – 1.5cm long; petals crimson to pale chocolate | 9. <i>I. intricata</i> forma <i>intricata</i> |
| + Erect shrub to 4m; leaves 2.9 – 4.2cm long; petals purple to purplish-red | 10. <i>I. sp. A</i> |
| 5. Apex of leaf caudate, sometimes curved | 6 |
| + Apex of leaf acuminate or acute, never caudate | 7 |

FIG. 14. *Aquifoliaceae*. Leaves. a, *Ilex fragilis*; b, *I. venulosa*; c, *I. intricata* forma *intricata*; d, *I. crenata* var. *thomsonii*, underside of leaf to show punctate dots; e, *I. sp. A*; f, *I. cyrtura*; g, *I. dipyrrena*, showing juvenile foliage behind; h, *I. hookeri*; i, *I. sikkimensis*; j, *I. godajam*; k, *I. excelsa*; l, *I. kingiana*, showing juvenile foliage behind. Scale: all $\times \frac{2}{3}$. Drawn by E. Catherine.



6. Leaves subcoriaceous, with curved caudate apex; venation not strongly reticulate **11. I. cyrtura**
 + Leaves coriaceous, with \pm straight caudate apex; venation strongly reticulate **12. I. venulosa**
7. Leaves chartaceous to thinly coriaceous; margins entire 8
 + Leaves thickly coriaceous, sometimes rigid; margins serrate to spinose (especially on young leaves) or entire 9
8. Calyx glabrous with notched lobes; basal margin of leaf eciliate; flowering May - June **2. I. excelsa**
 + Calyx pubescent with strongly ciliate lobes; basal margin of leaf usually ciliate; flowering March - April **3. I. godajam**
9. Leaf margins serrate 10
 + Leaf margins not serrate 11
10. Terminal buds small; outer bud-scales glabrous with ciliate margins; leaves lanceolate to narrowly oblong, 6.4 - 14.3 x 1.9 - 3.6cm; flowers in axillary fascicles; fruiting pedicels glabrous **7. I. hookeri**
 + Terminal buds large; outer bud-scales pubescent; leaves broadly oblong to oblong-lanceolate, (6.7-)11-14(-16) x 3.6-5.7(-6.2)cm; male inflorescence a pseudopanicule; fruiting pedicels pubescent **8. I. sikkimensis**
11. Leaves elliptic to ovate or broadly ovate, 5.8 - 11.2 x 2 - 3(-4)cm; margins entire to spinose; calyx and corolla lobes ciliate **5. I. dipyrena**
 + Leaves elliptic-oblong to broadly oblong, 11.5 - 18.5(-22) x 4 - 7.2cm; margins obscurely serrate but sharply toothed when young; calyx and corolla lobes eciliate **6. I. kingiana**

1. I. fragilis Hook. f. Nep: *Phalamkath* (34). Fig. 14a.

Deciduous tree to 10m; branchlets glabrous, brittle, with conspicuous lenticels. Leaves membranous, ovate or elliptic-ovate, 8 - 12 x 2.5 - 5.7cm, acute to acuminate, base rounded or obtuse, midrib depressed above, prominent below, margins serrate; petioles 1.1 - 1.7cm, glabrous. Flowers glabrescent, both sexes in axillary fascicles. Calyx glabrous, lobes 5 - 8, c 1 - 1.5 x 0.8 - 1.7mm (but varying greatly on the same flowers), densely ciliate. Corolla white or greenish-white, lobes 5 - 7(-9), 2 - 2.3 x 1.4 - 1.6mm, ciliate. Stamens 5 - 8, c 1.3 - 2mm long. Fruit red, globose, 4 - 4.5mm in diameter; stigma turgid; stones 5 - 9, 2.5 - 3 x 1.5 - 2mm, fairly smooth; fruiting pedicels 3.5 - 6mm, glabrous.

Bhutan: S - Chukka district, C - Thimphu, Bumthang and Mongar districts; N - Upper Mo Chu district; **Darjeeling:** Senchal, Tonglu, etc.; **Sikkim:** Lachung, Lachen, Karponang. Wet mixed forest, 1524 - 3353m. May - June.

The above description and records refer to the typical forma **fragilis**.

forma **kingii** Loesener

Differs from forma *fragilis* in its scattered appressed pubescence on the upper leaf surface.

Bhutan: C – Tongsa district (near Tongsa). Oak forest, 2250m. May.

As a living or dried specimen *Ilex fragilis* is often mistaken at first glance for a *Prunus* (Rosaceae).

2. I. excelsa Hook. f.; *Cassine excelsa* Wall., *Ilex exsulca* Wall., *I. doniana* DC. Fig. 14k.

Evergreen tree to 13m; branchlets glabrous or pubescent, new growth somewhat ridged. Leaves chartaceous or subcoriaceous, elliptic to oblong-elliptic, (6 –)7 – 10.3 x 3 – 5cm, acuminate, base cuneate or obtuse, midrib deeply impressed above, prominent below, margin entire, glabrous or pubescent; petioles 0.8 – 2cm, glabrous or pubescent, channelled above. Flowers in pseudoumbels. Calyx glabrous, rarely pubescent, lobes 4 – 5, 0.5 – 0.7 x 1mm, notched. Corolla white, lobes 4 – 5, 2 – 2.3 x 1 – 1.5mm, minutely papillate, deflexed at maturity. Stamens c 2.25mm long. Ovary c 1.5mm in diameter; stigma discoid; pistillode with 5-lobed apex. Fruit scarlet, globose to ellipsoid, 3.5 – 4.5mm in diameter; stones 4 – 5, 3.3 – 4 x 1.8 – 2mm, smooth; fruiting pedicels 2 – 5mm, pubescent.

Two varieties occur in Bhutan but appear to be absent from Darjeeling and Sikkim:

var. **excelsa**

Branchlets, leaves and petioles all glabrous.

Bhutan: C – Tashigang district (Shali). Warm broad-leaved forest, 1829m.

var. **hypotricha** (Loesener) Hu; *I. hypotricha* Loesener, *I. excelsa* forma *hypotricha* (Loesener) Hara.

Branchlets pubescent, rarely scarcely so; leaves glabrous above, pubescent mainly on the midrib and veins below; petioles pubescent.

Bhutan: C – Punakha district (Punakha), N – Upper Mo Chu district (Gasa). Warm broad-leaved forests, 1372 – 2134m. May – June.

3. I. godajam (Colebrooke) Hook. f. Fig. 14j.

Evergreen tree to 8m; branchlets pubescent. Leaves thinly coriaceous or chartaceous, ovate or oblong, 6.5 – 13 x 2.5 – 6cm, acuminate, base rounded, rarely pubescent on lower surface, midrib depressed above, often puberulent, pubescent below, margins entire often ciliate around base; petioles 1 – 1.5cm, pubescent, channelled above. Flowers in many-flowered pseudoumbels. Calyx pubescent, lobes 4 – 6, 0.8 – 1.2 x 1 – 1.2mm, strongly ciliate. Corolla creamy white, lobes 4 – 5, 2 – 2.2 x 1.5 – 1.8mm, ciliate. Stamens 2.5mm long. Pistillode globose with 3 – 5-lobed apex. Female flowers not seen. Fruit red, ellipsoid to globose, c 3.5mm

in diameter; stigma capitate; stones 5–7, 3.8–4 x 1.5–1.7mm, ridged on dorsal surface; fruiting pedicels 0.5mm, pubescent.

Bhutan: S – Sankosh district (Balu Khola) and Sarbhang district (Sarbhang to Chirang road); **Darjeeling:** Tista Valley (34). Subtropical forest slopes, 200–590m. March–April.

4. *I. crenata* Thunberg; *I. thomsonii* Hook. f. Fig. 14d.

Shrub to small evergreen tree to 7m; branchlets pubescent. Leaves elliptic to ovate, 1.5–3 x 1–1.7cm, acute, base attenuate, margins crenate, glossy above, gland-dotted with occasional hairs on midrib beneath; petioles 2–3mm, pubescent. Flowers solitary or in 1–3-flowered axillary cymes, pubescent. Calyx glabrous, lobes 4, 1 x 1.2mm. Corolla white, lobes 4, 2–2.3 x 1.5–2.3mm. Stamens 4, 2–2.3mm long. Fruit c 5mm in diameter, black; stones 4, 3.3 x 1.7mm, striate; fruiting pedicels 0.8–1cm, pubescent.

Bhutan: C – Tongsa district (Chendebi, Tashiling and Changkha), N – Upper Mo Chu district (Gasa Dzong); **Darjeeling:** Tonglu. Wet forest, small wooded valleys and among rocks on open hillsides, 2286–2743m. May–June.

The E Himalayan plants all belong to var. *thomsonii* (Hook. f.) Loesener.

5. *I. dipyrena* Wall. Sha: *Ra-tsa Shing*; Hindi: *Kanderu*; Nep: *Lise* (34), *Liso*, *Caulah*; Eng: *Himalayan Holly*. Fig. 14g.

Evergreen tree to 12m; branchlets glabrescent; terminal buds small, pubescent. Leaves coriaceous, elliptic to ovate or broadly ovate, 5.8–11.2 x 2–3(–4)cm, acute to shortly acuminate, base rounded, midrib depressed above, prominent below, margins entire to spinose; petioles 2–9mm, glabrescent. Flowers glabrescent, both sexes in axillary fascicles. Calyx glabrous, lobes 4, c 0.5 x 1.3mm, ciliate. Corolla greenish-white or tinged with purple on outside, lobes 4, 3–4 x 1.8–2.5mm, ciliate. Stamens 4, c 2.8–3mm long. Ovary 3 x 2mm; stigma discoid. Fruit globose to elliptic, c 6–7.5mm in diameter, red; stones 2(–3), 6 x 4–5(–5.5)mm, deeply sulcate; fruiting pedicels 2–3mm, glabrous.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa and Tashigang districts, N – Upper Mo Chu, Upper Pho Chu and Upper Kulong Chu districts; **Darjeeling:** Tonglu, Senchal; **Sikkim:** Bakkim to Jongri. Dense mixed forest, evergreen oak forests, open mountainsides and edges of cultivated fields, 2000–3120(–4000)m. April–May.

This species varies considerably in shape and spininess of its leaves and taxa based on the differences of leaf margin are not worthy of recognition.

6. *I. kingiana* Cockerell; *I. insignis* Hook. f. non Heer. Nep: *Lasceni*, *Lise* (34), *Hare* (34). Fig. 14l.

Evergreen tree to 10m; branchlets glabrous, stout, grooved, silvery-grey. Leaves thick and rigid, elliptic-oblong to broadly oblong, 11.5–18.5(–22) x 4–7.2cm, long acuminate, base shortly attenuate, midrib depressed above, prominent below,

margin obscurely serrate but sharply toothed when young; petioles (0.9–)1.3–2.5(–3)cm, glabrous, purplish. Flowers glabrous, both sexes in scarcely stalked subglobose clusters. Calyx glabrous, lobes 4, 1.5–2 x 1.5–2.2mm, eciliate. Corolla lobes 4, 4.3–5.2 x 2.2–2.5mm, eciliate. Stamens 4, 3.5–4.5mm long. Ovary and stigma not seen. Fruit red, globose, c 1cm in diameter; stones 3–4, 7–8 x 4.5–5mm, deeply sulcate; fruiting pedicels very short.

Bhutan: S—Chukka district (between Jumudag and Tala); **Darjeeling:** Darjeeling, Lopchu and Gumpahar. Warm broad-leaved forest, 1372–2438m. April–May.

It is unfortunate that the epithet *insignis* given to this species by J. D. Hooker is illegitimate, being a latter homonym of *I. insignis* Heer, a fossil species.

7. *I. hookeri* King. Nep: *Lise* (34). Fig. 14h.

Evergreen shrub or small tree up to 10m high, glabrous; terminal bud-scales glabrous but margins ciliate. Leaves thickly coriaceous, lanceolate to narrowly oblong, 6.4–14.3 x 1.9–3.6 cm, acuminate, base attenuate, midrib depressed above, prominent below, margins serrate; petioles 1–2.3cm, glabrous. Flowers glabrous; males in axillary fascicles of 1–3-flowered branches; females in axillary fascicles of solitary flowers. Calyx glabrous, lobes 4, 1–1.2 x 0.8–1.5mm, eciliate. Corolla reddish-pink, lobes 4, 2.3–2.8 x 1.5–2mm, eciliate. Stamens 4, c 2mm long. Ovary 2 x 1.5mm; stigma discoid. Fruit c 4mm in diameter, red; stones 4, 3.5 x 2mm; fruiting pedicels 2.5mm, glabrous.

Bhutan: C—Thimphu district (Chankaphug and Pajoding), Punakha district (Dochong La) and Mongar district (Lhuntse Dzong), N—Upper Kulong Chu district (Lao and Tobrang); **Darjeeling:** **Sikkim:** **Chumbi.** Edges of wet broad-leaved and coniferous forests, 2743–3300m. April–May.

8. *I. sikkimensis* Kurz. Nep: *Lise* (34). Fig. 14i.

Evergreen tree to 15m; branchlets glabrous, stout; terminal buds covered by large pubescent scales. Leaves coriaceous, broadly oblong to oblong-lanceolate, (6.7–)11–14(–16) x 3.6–5.7(–6.2)cm, acute to shortly acuminate, base attenuate to broadly attenuate, midrib depressed above, prominent below, margins serrate; petioles 1.8–3.2cm, glabrous. Flowers fragrant, glabrous, males in a pseudopanicle (female inflorescence not seen). Calyx glabrous, lobes 4, 1–1.4 x 1mm, ciliate. Corolla green, lobes 4, 2.8–3 x 2–2.5mm, ciliate. Stamens 4, c 1.2mm long. Fruit c 4–5mm in diameter, red or yellow; stones 4; fruiting pedicels 0.5–0.7mm, pubescent.

Bhutan: C—Punakha district (between Dochong La and Menchunang); **Darjeeling:** Tonglu, Phallut, Sandakphu; **Sikkim:** Chiabanshan, Bakkim to Yoksum. Dense evergreen oak forests, 2134–3048m. April.

9. *I. intricata* Hook. f. Fig. 14c.

Evergreen shrub, prostrate or to 1m. Branchlets extremely verruculose, glabrous. Leaves obovate-elliptic, 0.8–1.5 x 0.4–0.7(–0.9)cm, obtuse or acute, base cuneate,

midrib depressed above, prominent below, margins serrate; petioles 1 – 3mm, glabrous. Flowers glabrous, both sexes in axillary fascicles. Calyx glabrous, lobes 4, 0.6 x 0.6mm, eciliate. Corolla crimson to pale chocolate, lobes 4, 1.4 – 1.8 x 1.2mm, eciliate. Stamens 4, 1.2mm long. Ovary 0.5 x 0.5mm; stigma discoid. Fruit red, globose, 3 – 5mm in diameter; stones 4, 0.3 x 0.2mm, sulcate; fruiting pedicels 1.5 – 3mm, glabrous.

Bhutan: C – Bumthang district (Yuto La) and Mongar district (above Sengor), N – Upper Mo Chu district (Gasa Dzong); **Darjeeling; Sikkim.** Mossy *Abies/Rhododendron* forest, 2743 – 3700m. May – June.

The E Himalayan plants belong to the typical forma **intricata**.

10. *I. sp.* A. Fig. 14e.

Evergreen shrub to 4m, glabrous in all parts; stems verruculose. Leaves elliptic, 2.9 – 4.2 x 1.4 – 1.6cm, acute, base cuneate or rounded, midrib depressed above, prominent below, margins serrate; petioles 5 – 7mm, glabrous. Male flowers glabrous. Calyx lobes 4, 1 x 1 – 1.3mm, eciliate. Corolla purple to purplish red, lobes 4, 1.5 – 2 x 1.3 – 1.8mm, ciliate. Stamens 4, 1.5 – 2mm long. Female flowers not seen. Fruit c 5mm in diameter, red; stones 4, 4 x 1.8mm; fruiting pedicels 0.4mm, glabrous.

Bhutan: N – Upper Mo Chu district (S side of Pari La); **Sikkim:** Rimbi Chu. Mossy *Abies* forest, 3048 – 3390m. April.

This possibly undescribed species appears to be closest to *I. delavayi* Franchet (W China, SE Tibet) and *I. intricata* Hook. f. forma *macrophylla* Comber (Tibet, Assam). It differs from the former in its shorter petioles, smaller leaves and height and from the latter in its flower colour and larger leaves.

11. *I. cyrтура* Merrill. Fig. 14f.

Evergreen shrub to 4m; branchlets glabrous. Leaves subcoriaceous, elliptic to oblong-lanceolate, 10.5 – 11.3 x 3 – 3.5 cm, with curved caudate tip 1 – 2cm long, base cuneate, midrib strongly depressed above, prominent below, margin serrate throughout; petioles c 1cm, glabrous. Flowers fasciculate, sessile. Calyx glabrous, lobes 4, 0.8 x 0.6mm, ciliate. Corolla greenish-white, lobes 4, 2.2 – 3 x 1.2 – 2mm. Stamens c 3.7mm long. Ovary c 1.8 mm long, stigma 4-lobed. Fruit 4 – 5mm in diameter, scarlet, globose; stones 4, 3 – 4 x 2.8mm, striate and sulcate.

Bhutan: S – Gaylephug district (W bank of Chabley Khola). Mixed evergreen broad-leaved forest, 1829 – 1910m. March – April.

12. *I. venulosa* Hook. f. Fig. 14b.

Evergreen tree to 8m; branchlets glabrous with conspicuous lenticels. Leaves coriaceous, oblong or ovate-oblong, 9.5 – 19 x 3.5 – 7.5cm, caudate tip straight, to 3cm, base rounded or obtuse, midrib deeply impressed above, pubescent, prominent below, parallel lateral nerves prominent on both surfaces, margin entire; petioles 1.7 – 2.7cm, glabrous. Flowers pubescent, both sexes in compound cymes. Calyx glabrous, rarely pubescent, lobes 5 – 6, 0.5 x 0.5 – 1.2mm, ciliate. Corolla white,

lobes (4 -)5 - 7, 1.4 - 1.6 x 1 - 1.3mm, ciliate. Stamens c 1.8mm long. Ovary 1.2 x 1mm; stigma discoid. Fruit c 1.5 - 3mm in diameter, red, globose; stones 5 - 6, 2 x 1mm, smooth; fruiting pedicels 2 - 3mm, pubescent.

Bhutan: S - Gaylephug district (W bank of Chabley Khola), C - Tongsa district (between Shamgong and Pertimi). Warm broad-leaved forest, 1660 - 1829m. March - April.

Family 101. CELASTRACEAE

by D. G. Long

Trees, shrubs or woody climbers. Leaves opposite or alternate, simple, pinnately veined; stipules usually minute. Flowers in axillary or terminal cymes, racemes or panicles, rarely solitary, mostly bisexual, actinomorphic. Calyx united at base, 4 - 5-lobed. Petals 4 - 5, free. Disc usually conspicuous, often lobed. Stamens 4 - 5 free or rarely filaments connate at base, borne on disc, antisepalous; anthers (1 -)2-celled. Ovary superior, sometimes partly or totally immersed in disc, 2 - 5-celled; style short, 2 - 3-lobed; ovules 1 - 2(- 18) per cell, axile. Fruit a 2 - 5-valved capsule, rarely indehiscent; seeds 1-many, often arillate, rarely winged.

- | | |
|--|------------------------|
| 1. Leaves opposite | 2 |
| + Leaves alternate | 5 |
| 2. Leaves serrate or crenate, sometimes obscurely so (rarely entire in <i>Euonymus</i>); petals thin, flat, smooth; fruit indehiscent or a 4 - 5-valved capsule | 3 |
| + Leaves entire; petals thick and keeled within, or crested on inner surface; fruit 2-valved and 1-seeded or deeply 3-angled and 3-valved | 4 |
| 3. Ovary completely immersed in disc, 4 - 5-celled; fruit a 4 or 5-valved capsule, seeds 4 or more | 1. Euonymus |
| + Ovary partly immersed in disc, 2-celled; fruit indehiscent, 1 - 2-seeded | 2. Cassine |
| 4. Shrub or small tree; leaves obovate-elliptic; petals thick, concave and keeled within; capsules c 1.5cm, terete, 2-valved | 3. Microtropis |
| + Large tree; leaves ovate-oblong; petals densely crested on inner surface; capsules 10 - 15cm, deeply 3-angled | 4. Lophopetalum |
| 5. Leaves entire and with very fine parallel secondary veins; flowers in long slender racemes | 8. Bhesa |
| + Leaves serrate or crenate, sometimes obscurely so, without fine, parallel secondary veins; flowers in cymes or panicles, rarely solitary | 6 |

6. Flowers 3 in short cymes, or solitary; fruit a many-seeded indehiscent drupe
7. **Siphonodon**
- + Flowers many in cymes or panicles; fruit a 1 – 6-seeded, 2 – 3-valved capsule
7
7. Climbing shrubs, never spiny; ovary free from disc; seeds completely covered by fleshy aril 5. **Celastrus**
- + Erect shrubs or small trees, sometimes spiny; ovary partly immersed in disc; seeds with basal aril 6. **Maytenus**

1. EUONYMUS L.

Erect or climbing, evergreen or deciduous trees or shrubs, usually glabrous. Leaves opposite; stipules slender, minute, caducous. Flowers in axillary, usually lax cymes, 4- or 5-merous. Calyx of short rounded entire or dentate lobes. Disc flat, entire to distinctly 4 or 5-lobed. Stamens borne on disc; anthers (1 –)2-celled, sometimes sessile. Ovary immersed in disc, 4- or 5-celled, style usually short; each cell with 2 ovules. Capsules pendulous 4- or 5-lobed, sometimes angled or winged, dehiscing to reveal seeds covered by fleshy aril.

Specimens of *E. fimbriatus* Wall., recorded from Sikkim (80) have not been located; those published as *E. bullatus* Loddiges (34) belong to *Maytenus sikkimensis*.

1. Evergreen; flowers mostly 5-merous; some or most capsules 5-valved and subtended by 5 persistent calyx lobes (in *E. lucidus* flowers 4 and 5-merous and capsules often 4-lobed, but leaves with subulate-pointed marginal teeth) ... 2
- + Evergreen or deciduous; flowers all 4-merous; capsules 4-valved, subtended by 4 persistent calyx lobes; leaf serrations without subulate points 5
2. Leaves entire or with a few teeth near apex; anthers subsessile
1. **E. attenuatus**
- + Leaves distinctly toothed almost to base; anthers borne on distinct filaments
3
3. Leaves smooth above, marginal teeth with sharp subulate points; cymes 7 – 15-flowered; petals c 3.5mm 2. **E. lucidus**
- + Leaves rugose and reticulate above, marginal teeth shallow, bluntly to sharply serrate but without subulate points; cymes mostly 3-flowered; petals c 5mm
4
4. Small tree; leaves ovate-elliptic, 3 – 6cm; capsules c 1.5cm diameter, up to 2cm after dehiscence 3. **E. tingens**
- + Climbing shrub; leaves elliptic-lanceolate 6 – 9cm; capsules c 2cm diameter, up to 4cm after dehiscence 4. **E. macrocarpos**

5. Plants in flower 6
 + Plants in fruit 14
6. Petals 4 – 8mm; filaments 2 – 2.5mm 7
 + Petals 2 – 3mm; filaments absent or up to 1.2mm 8
7. Leaves acute or rounded; cymes mostly 3-flowered; petals suborbicular c 8 x 8mm **5. E. grandiflorus**
 + Leaves acuminate; cymes mostly 7 – 15-flowered; petals oblong 4 – 4.5 x 2 – 3mm **6. E. hamiltonianus**
8. Petals white, creamy or greenish; anthers on filaments 0.5 – 1.2mm 9
 + Petals crimson, anthers sessile on disc 12
9. Erect deciduous shrub; leaves 1.5 – 3 x 0.3 – 0.8cm; cymes mostly 3-flowered **7. E. tibeticus**
 + Evergreen climbing or creeping shrubs; leaves 4 – 10 x 1.5 – 6cm; cymes mostly 7 – 30-flowered 10
10. Branchlets ribbed and distinctly tuberculate **8. E. theifolius**
 + Branchlets smooth or weakly ribbed, never tuberculate 11
11. Lateral veins of leaves widely spreading and arching; petals 2.5 – 3mm; ovary warty **9. E. echinatus**
 + Lateral veins ascending; petals 2 – 2.5mm; ovary smooth **10. E. vagans**
12. Anthers clearly 2-celled (with median constriction); winter buds small 2 – 3mm 13
 + Anthers apparently 1-celled (without median constriction); winter buds large 5 – 10mm 16
13. Small epiphytic shrub, often pendulous, or climber; leaf base rounded or broadly cuneate, margins serrulate **11. E. viburnoides**
 + Small erect tree or shrub; leaf base attenuate, margins coarsely serrate **12. E. lawsoni**
14. Capsules armed with numerous short thick spines c 2mm **9. E. echinatus**
 + Capsules smooth, angled, winged or spurred, not spiny 15
15. Winter buds large, conical 5 – 10mm; capsules with fleshy spur-like wings near base, becoming ± flat after dehiscence 16
 + Winter buds small, 2 – 3mm; capsule smooth, angled or if winged then wings ± rigid and inserted throughout length of capsule; capsule ± cup-shaped after dehiscence 18

16. Evergreen; leaves \pm distant, coriaceous **13. *E. frigidus***
 + Deciduous; leaves \pm clustered towards shoot tips 17
17. Lateral veins prominent and minutely papillate beneath . **14. *E. porphyreus***
 + Lateral veins not prominent, smooth beneath **15. *E. amygdalifolius***
18. Capsules smooth, with 2 - 4 shallow rounded lobes, not angled, winged or spurred 19
 + Capsules with lobes angled, winged or spurred 20
19. Branchlets 4-angled and tuberculate **8. *E. theifolius***
 + Branchlets 4-ribbed, smooth **10. *E. vagans***
20. Capsules shallowly lobed, angled but not winged 21
 + Capsules deeply lobed or appearing winged 23
21. Shrub with small leaves 1.5 - 3 x 0.3 - 0.8cm **7. *E. tibeticus***
 + Shrub, climber, or tree with leaves 4 - 11 x 2 - 4cm 22
22. Deciduous tree; leaves obovate or elliptic, acute to rounded; cymes 3-flowered
5. *E. grandiflorus*
 + Evergreen shrub or climber, usually epiphytic; leaves ovate or ovate lanceolate, acuminate; cymes many-flowered **11. *E. viburnoides***
23. Deciduous; leaves shallowly serrulate; lobes of capsule \pm terete
6. *E. hamiltonianus*
 + Evergreen; leaves coarsely serrate; lobes of capsule \pm flattened
12. *E. lawsonii*

1. *E. attenuatus* Lawson; *E. glaber* Roxb. 'var.' sensu F.B.I.

Evergreen shrub 3m; winter buds not produced; branchlets smooth, weakly ridged. Leaves thinly coriaceous, elliptic-lanceolate, 8 - 14 x 3 - 5cm, acuminate, base cuneate, entire or with a few teeth near apex, midrib and lateral veins weakly prominent above; petioles 8 - 12mm. Flowers 7 - 15 in spreading dichotomous cymes 5 - 6cm long, 5-merous. Calyx lobes rounded, unequal, 0.8 - 1.5mm. Petals pale yellow, suborbicular, 3 - 3.5mm. Disc 5-lobed. Anthers with 2 spreading cells, subsessile on disc. Capsule obovoid, c 12 x 15mm, sharply 5-angled.

Bhutan: S - Sarbhang district (Sarbhang to Chirang road). Subtropical jungle, 950m. May.

Records of *E. glaber* Roxb. 'var.' (80) belong here but Griffith's locality is unknown; Cowan and Cowan's (34) record is from W. Bengal Duars (Buxa) but specimens have been seen only from Bhutan, Khasia and Silhet.

2. E. lucidus D. Don; *E. pendulus* Wall. *nom. illeg.*

Similar to *E. attenuatus* but a small evergreen tree 6 – 12m; leaves thickly coriaceous, oblong-elliptic, 9 – 13 x 2 – 4cm, margins sharply serrate throughout with sharp, subulate teeth; flowers mostly 5-merous, but sometimes some 4-merous; petals ovate-oblong, c 3.5 x 2.5mm; stamens with anther cells parallel; filaments 3mm; capsules c 1.5cm diameter, deeply divided into 3 – 5 oblong spreading rounded lobes c 7 x 5mm.

Bhutan: N – Upper Kuru Chu district (Shambling); **Darjeeling:** between Ramam and Phalut (71). 2130 – 3000m. May.

3. E. tingens Wall. Fig. 15d&e.

Small evergreen tree 3 – 10m; branchlets weakly roughened and with 4 low ribs. Leaves rigidly coriaceous, ovate-elliptic, 3 – 6 x 1.5 – 3cm, acute, base rounded or cuneate, finely bluntly to sharply serrate, rugose and reticulate above; petioles 3 – 6mm. Cymes 3 – 6cm, mostly 3-flowered. Flowers 5-merous, scented. Calyx lobes short, ciliate. Petals large, c 5 x 5mm, clawed, white or cream with conspicuous purple veins. Disc conspicuous, 5-angled. Filaments c 3.5mm, anthers with 2 parallel cells. Capsules turbinate, c 1 x 1.5cm, 5-angled but scarcely lobed, retuse at apex, c 2cm diameter after dehiscence; valves rounded.

Bhutan: C – Ha, Thimphu, Punakha and Bumthang districts, N – Upper Bumthang district; **Darjeeling:** Ramam, Phalut; **Chumbi;** **Arunachal Pradesh:** Nyam Jang Chu. Blue Pine and Hemlock forests, 2440 – 3200m. May – September. In Bhutan sometimes cultivated around monasteries.

4. E. macrocarpos Gamble

Similar to *E. tingens* but a large evergreen climber; leaves elliptic-lanceolate, 7 – 10 x 2.5 – 4cm, acuminate; cymes 2 – 3cm; petals without purple veins; filaments c 1mm; capsules ellipsoid, c 4 x 2cm, not angled, tapering at apex into fine point, c 4cm diameter after dehiscence.

Darjeeling: Khumpung. Broad-leaved forest, 2300m. November. Endemic to Darjeeling district.

5. E. grandiflorus Wall. Fig. 15a – c.

Deciduous shrub 3 – 5m, or tree to 10m; branchlets smooth, not ribbed. Leaves coriaceous, obovate or elliptic, 4 – 9 x 2 – 4cm, acute to rounded, base cuneate, margins serrulate to almost entire, midrib and veins smooth beneath; petioles 5 – 8mm. Cymes axillary, 4 – 6cm, 3(–6)-flowered. Flowers large, c 2cm diameter, 4-merous. Calyx lobes very short, borne on margin of flattened disc c 8mm diameter. Petals creamy yellow, suborbicular, c 8mm long. Anthers 2-celled, on stout filaments c 2mm. Capsules yellow or pink, pendulous, squarish, strongly 4-angled, 10 – 12 x 11 – 13mm; seeds black, half-covered by bright red aril.

Bhutan: C – Thimphu district (common in Thimphu, Paro and Kyapcha valleys) and Tongsa district (near Chendebi); **Darjeeling:** (69).

A valuable ornamental shrub, occasionally cultivated in Bhutan; the report from Darjeeling requires confirmation.

6. *E. hamiltonianus* Wall.

Similar to *E. grandiflorus* but leaves elliptic to lanceolate, 8–17 x 2.5–4.5cm, acuminate, margins more regularly and sharply serrate, midrib and veins minutely roughened beneath; cymes 7–15-flowered; petals white, oblong, 4–4.5 x 2–3mm with revolute margins; filaments c 2.5mm; capsules smaller, c 8 x 10mm, shallowly to deeply 4-lobed with rounded \pm ascending lobes, not sharply angled.

Darjeeling: foothills, Tista Valley, Kurseong; **Sikkim:** Gangtok, Lingtham; **Arunachal Pradesh:** Nyam Jang Chu valley.

Riverside scrub, 1500–2100m. May–June.

7. *E. tibeticus* W. W. Smith

Erect deciduous shrub 2–3m, growing in dense rounded masses; branchlets 4-angled. Leaves lanceolate, 1.5–3 x 0.3–0.8cm, bluntly acute, base cuneate, margins obscurely crenulate; petioles 2–3mm. Cymes 1–2cm, mostly 3-flowered. Flowers 4-merous. Calyx lobes c 1mm, rounded. Petals yellowish-green, suborbicular, 2–2.5mm. Filaments 0.6–0.8mm. Ovary 4-angled. Immature fruit squarish, 4-angled, similar to that of *E. grandiflorus*.

Tibet: Lhakhang, N of Bhutan.

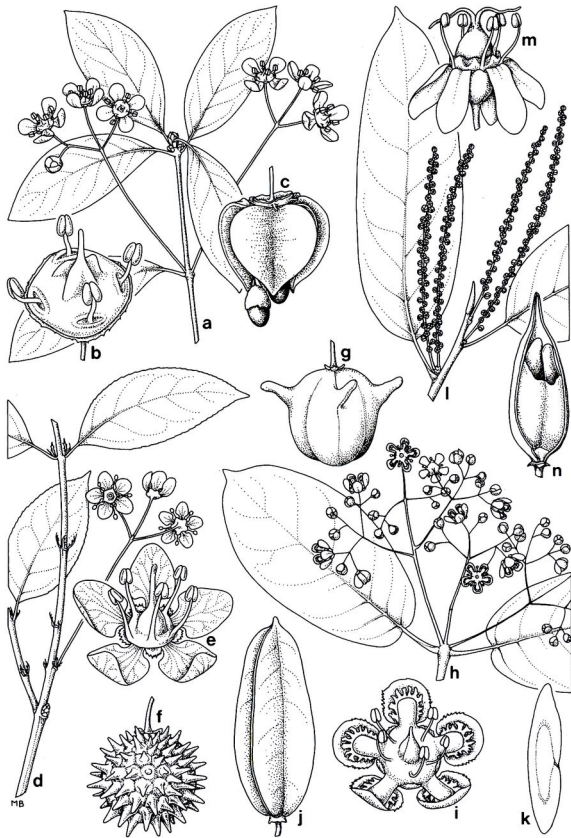
Open hillsides, 3500m. May–June.

8. *E. theifolius* Lawson

Evergreen shrub 1–2m or a large woody climber; branchlets 4-ribbed, conspicuously tuberculate with dense lenticels. Leaves coriaceous, ovate to elliptic-lanceolate, 6–10 x 1.5–3.5cm, acuminate, base rounded or cuneate, margins serrate, midrib, veins and reticulations prominent on both surfaces; petioles 3–5mm. Cymes dense, rounded, 3–5cm, 7–30-flowered. Flowers 4-merous, 7–9mm diameter. Calyx lobes c 1mm, concave. Petals whitish or creamy, suborbicular, 2.5–3mm. Filaments 0.8–1.2mm. Capsules subglobose, 6–7 x 7–10mm, almost unlobed, 1–2-seeded.

Bhutan: C – Punakha district (below Mendegang and between Rinchu and Mishichen) and Tongsa district (near Shamgong); **Darjeeling:** localities unknown (34). Warm broad-leaved forest, 1580–2000m. June (34).

FIG. 15. *Celastraceae*. a–c, *Euonymus grandiflorus*: a, flowering shoot; b, flower with petals removed; c, dehisced fruit with pendulous arillate seeds. d & e, *Euonymus tingens*: d, flowering shoot; e, flower. f, *Euonymus echinatus*: undehisced fruit. g, *Euonymus frigidus*: undehisced fruit. h–k, *Lophopetalum wightianum*: h, flowering shoot; i, flower; j, fruit; k, seed. l–n, *Bhesa robusta*: l, flowering shoot; m, flower; n, fruit with one valve partly removed. Scale: j, k x 1/3; a, l x 1/2; h x 2/3; d, n x 1; c, f, g x 2; i x 2 2/3; b, e x 3; m x 8. Drawn by M. Bates.



9. *E. echinatus* Wall. Fig. 15f.

Evergreen climbing shrub rooting like *Hedera* by adventitious roots; branchlets 4-ribbed, smooth. Leaves ovate-lanceolate, 4–9 x 1.5–3cm, acute or shortly acuminate with blunt tip, base rounded, margins crenate-serrate, lateral veins usually widely spreading, prominent above, less so below; petioles 2–4mm. Cymes 1.5–4cm, 3–15-flowered (commonly 7-flowered). Flowers 4-merous, 7–8mm diameter. Calyx lobes 1–1.2mm. Petals white, greenish or yellowish, suborbicular, 2.5–3mm. Filaments 0.6–0.8mm. Capsules subglobose, c 8mm diameter, unlobed, armed with short thick spines c 2mm.

Bhutan: N – Upper Mo Chu district (Gasa); **Darjeeling:** Ghoom, Goompahar and Garibans. Cool broad-leaved forests, often growing on rocks and trees, 1500–2700m. May – June.

10. *E. vagans* Wall.; ?*E. scandens* Graham

Very similar to *E. echinatus* in flower, but leaves more variable in shape and size, up to 14 x 6cm, with more ascending lateral veins; cymes 7–30-flowered; flowers smaller, 5–6mm diameter; petals 2–2.5mm; capsules subglobose, c 6 x 10mm, with 2–4 shallow rounded lobes, smooth.

Bhutan: C – Punakha, Tongsa and Mongar districts, N – Upper Kulong Chu district; **Darjeeling:** common; **Sikkim:** Gangtok, Choongtam. Epiphytic and on rocks in cool broad-leaved forests, 1800–2100m. May – June.

Difficult to distinguish from *E. echinatus* in flower; *E. theifolius* differs in its distinctly warted branchlets.

11. *E. viburnoides* Prain; *E. frigidus* sensu F.B.I. p.p. non Wall. Nep: *Hare Lahara*.

Small evergreen epiphytic shrub, often pendulous, sometimes climbing; branchlets weakly quadrangular. Leaves thinly coriaceous, ovate or ovate-lanceolate, 5–11 x 2–4cm, acuminate, base rounded or broadly cuneate, margins serrulate; petioles 6–13mm. Cymes lax, 4–9cm, with widely spreading branches, many-flowered. Flowers 4-merous, 6–7mm diameter. Calyx lobes c 1.5mm, concave. Petals crimson, orbicular, 2.5–3mm. Anthers almost sessile on disc, with 2 spreading horizontal cells with median constriction. Capsule turbinate, c 10 x 12mm, weakly 4-angled.

Bhutan: S – Chukka district (near Jumudag); **Darjeeling:** Goompahar, Palmajua to Rimbik road, Darjeeling, Sureil etc. Evergreen oak forests, 1830–2130m. February – April.

12. *E. lawsonii* Prain

Similar to *E. viburnoides* but a shrub c 2m or small tree; leaves narrowly elliptic-lanceolate, 7–11 x 1.5–3cm, tapering at both ends, coarsely serrate in upper 2/3; (mature flowers not seen but stamens as in *E. viburnoides*); capsules woody, deeply 4-lobed, c 10 x 16mm; lobes flattened, spreading, inserted along full length of capsule.

Bhutan: C – Thimphu district (Woolookha). Habitat unknown, 3000m.

A poorly-known species collected only once in Bhutan, by Griffith; similar to *E. frigidus* which differs in its serrulate leaves, 1-celled anthers and soft fleshy capsules spurred from lower half.

13. *E. frigidus* Wall. var. *frigidus*. Nep: *Chure Lahara* (34). Fig. 15g.

Evergreen shrub 1 – 2m or small tree to 4m; terminal buds becoming large in autumn and winter; branchlets smooth. Leaves \pm distant, coriaceous, oblong-elliptic to oblanceolate, 4 – 13 x 1.5 – 3.5cm, acuminate, base cuneate, margins serrulate, often irregularly, lateral veins smooth beneath; petioles 5 – 11mm. Cymes axillary, slender, 4 – 9cm, commonly 7-flowered. Flowers 4-merous, 5 – 6mm diameter. Calyx lobes 0.8mm. Petals brownish-crimson, broadly ovate or suborbicular, 2.5 – 3mm. Anthers sessile, minute, 1-celled, without median constriction, suborbicular when dehiscent. Capsules subglobose, fleshy, 1 – 1.5cm before dehiscence, weakly 4-lobed, produced at base between lobes into 4 short spreading or deflexed rounded spur-like wings which become shorter as capsule ripens; after dehiscence capsule \pm flat, red, 4-lobed, 2 – 2.5cm diameter, with spurs remaining as folds in the angles; seeds 4.

Bhutan: C – Thimphu district (Sharno Sampa), Punakha district (Punakha) and Tongsa district (E side of Pele La and W side of Yuto La); **Darjeeling:** Darjeeling, Tonglo, Garibans; **Sikkim:** Yakla and Zemu. Mossy broad-leaved and Hemlock/*Rhododendron* forests, 2100 – 3100m. May – June.

var. ***elongatus*** Cowan and Cowan; *E. frigidus* forma *elongatus* (Cowan & Cowan) Hara.

Differs from var. *frigidus* in its long very narrow willow-like leaves, 7 – 16 x 0.6 – 2cm, long-acuminate, more distantly serrulate.

Bhutan: C – Thimphu district (Barshong), Punakha district (W side of Pele La), Tongsa district (Chendebi and Pele La) and Bumthang district (Kuktang and above Lami Gompa), N – Upper Mo Chu district (Gasa Dzong); **Darjeeling:** Rechi La, Palmajua, Tonglo; **Sikkim:** Jongri, Lachung, Cho La etc. In scrub and mossy coniferous forests, 2200 – 3960m. May – June.

Some collections are intermediate in leaf characters; in general leaves are narrower at higher altitudes.

14. *E. porphyreus* Loesener

Similar to *E. frigidus* var. *frigidus* but deciduous; flowers borne amongst young leaves; leaves \pm clustered towards shoot tips, membranous throughout year, margins finely serrulate, lateral veins prominent and minutely roughened beneath; petals usually ovate-elliptic, 2.5 – 3mm; capsule often with long spurs.

Bhutan: C – Ha district (Ha), Thimphu district (Barshong) and Tongsa district (Sephu Chu); **Sikkim:** Lachen. In scrub, 3050m. May – June.

15. *E. amygdalifolius* Franchet

Similar to *E. frigidus* and *E. porphyreus* but deciduous; leaves \pm clustered towards shoot tips, margins finely serrulate, lateral veins not prominent, smooth beneath; petals suborbicular, c 2.5mm; capsules with short rounded spurs.

Bhutan: C – Ha district (Damthang), N – Upper Mo Chu district (Laya). In *Berberis*/*Rhododendron* scrub and *Abies*/*Picea* forest, 2980 – 3350m. May.

Possibly a deciduous form of *E. frigidus*, but the whole group awaits critical revision in the Himalaya and China.

2. CASSINE L.

Evergreen shrubs or trees, glabrous. Leaves opposite, crenate-serrate; stipules minute, caducous. Flowers in diffuse axillary peduncled cymes, 5-merous, bisexual. Calyx unequally and deeply lobed. Disc fleshy, shallowly 5-lobed. Stamens with short filaments. Ovary partly immersed in disc, 2-celled with short style; ovules 2 per cell. Fruit indehiscent, woody, 1 – 2-seeded.

1. *C. glauca* (Rottboell) Kuntze; *Elaeodendron glaucum* (Rottboell) Persoon, *E. roxburghii* Wight & Arnott. Nep: *Chikyeng-Kung* (34).

Small tree; bark grey, smooth. Leaves thinly coriaceous, ovate, 6 – 15 x 3 – 8cm, acuminate, base rounded, margins crenate-serrate, sometimes shallowly so; petioles 0.5 – 1.5cm. Cymes lax, spreading, few-flowered, 3 – 10cm long and broad; peduncle slender. Calyx lobes 0.7mm, rounded. Petals green, oblong, 3 – 3.5mm. Fruit broadly ellipsoid, c 2 x 1.4cm.

Darjeeling: foothills, rare. Subtropical forest. July.

Timber valued for carpentry (34); bark used medicinally.

3. MICROTROPIS Meisner

Shrubs or small trees (? evergreen), glabrous; branchlets bearing 2 filiform scales at apex (these caducous to leave a small interpetiolar scar). Leaves opposite, entire; stipules minute or absent. Flowers in axillary pedunculate cymes, 4- or 5-merous, bisexual. Calyx deeply lobed. Petals oblong, thick, concave or hooded at apex, keeled within. Disc absent. Stamens with short filaments. Ovary ovoid, free, 2-celled; style absent; each cell with 2 ovules. Capsules 1-celled, 1-seeded, 2-valved; calyx persistent.

1. *M. discolor* (Wall.) Wall. Nep: *Chilekath* (34).

Shrub or small tree to 10m. Leaves obovate-elliptic, 9 – 16 x 3.5 – 7.5cm, acuminate, base attenuate, pale beneath; petioles 5 – 10mm. Cymes short, 1 – 2cm. Calyx lobes almost free, suborbicular, c 2mm diameter. Petals thick, oblong, 3 – 3.5mm, white or yellowish. Ovary 1.8mm. Capsules ellipsoid, 1.5 x 0.8cm, finely roughened. Seed red, persistent on pedicel after capsule valves have fallen.

Bhutan: S – Samchi district (Dorokha, 117) and Gayleghphug district (Surey and

Sham Khara); **Darjeeling**: foothills and terai. Subtropical and warm broad-leaved forests, 1200 – 1500m. November – January.

4. LOPHOPETALUM Arnott

Large glabrous evergreen trees; trunk sometimes buttressed. Leaves opposite, entire; stipules minute, subulate, caducous. Flowers in broad axillary panicles, 5-merous, bisexual. Calyx disc-shaped, shortly lobed. Petals free, inner surface crested and fimbriate. Disc flat, fleshy, with 5 oblong lobes. Stamens borne on upper surface of disc. Ovary partly immersed in disc, 3-celled, tapering into short style; each cell with 4 – 18 ovules. Capsules large, oblong, deeply 3-angled; seeds few, flat, broadly winged.

1. *L. wightianum* Arnott; *L. fimbriatum* Wight. Fig. 15h – k.

Tall tree to 50m; branchlets smooth. Leaves coriaceous, ovate-oblong, 10 – 19 x 5 – 9cm, acute or shortly and bluntly apiculate, base rounded; petioles 1 – 2.5cm. Panicles 6 – 15cm. Calyx lobes very short, minutely ciliate, borne on margin of broad flat calyx-disc 6 – 7mm diameter, reddish. Petals yellow, suborbicular, 4 – 5mm, inner surface densely crested. Filaments 1.5 – 2mm. Ovary 3-angled. Capsules 10 – 15cm, sharply 3-angled; seeds (including wing) 7 – 8 x 2 – 2.5cm.

Darjeeling: Sukna. Terai forests. March – April.

5. CELASTRUS L.

Large deciduous or evergreen climbing shrubs, usually glabrous. Leaves alternate, serrate, secondary venation reticulate; stipules minute, linear or deeply lacinate. Dioecious; flowers 5-merous in unisexual axillary or terminal cymes or panicles. Calyx cup-shaped, deeply lobed, persistent. Disc cup-shaped or flat, entire or 5-lobed. Filaments glabrous or hairy, borne on or beneath margin of disc. Ovary ± free from disc, 3-celled, each cell with 2 ovules. Fruit a 3-celled, 1 – 6-seeded capsule dehiscent by 3 valves; valves bearing part of projecting style; seeds completely covered by red fleshy aril.

- | | |
|---|--------------------------|
| 1. Flowers and fruits in terminal leafless panicles | 3. C. paniculatus |
| + Flowers and fruits in cymes or panicles, these borne laterally and/or terminally but then usually also bearing leaves | 2 |
| 2. Evergreen; leaves commonly 8 – 18cm long; branches of inflorescence densely umbellate, many-flowered; fruits 1-seeded, valves 12 – 17mm long | |
| | 4. C. monospermus |
| + Deciduous; leaves mostly 7 – 13cm long; branches of inflorescence few-flowered, cymose; fruits 3 – 6-seeded, valves 7 – 10mm long | 3 |

3. Cymes puberulous; flowers numerous, borne amongst and below leaves and from older wood; filaments minutely puberulous; valves of capsule thick; seeds lunate (curved)..... **1. *C. stylosus***
 + Cymes glabrous; flowers few, borne terminally and amongst leaves at ends of leafy shoots; filaments glabrous; valves of capsule thin; seeds ovoid-ellipsoid, not curved..... **2. *C. hookeri***

1. *C. stylosus* Wall., *C. stylosus* sensu F.B.I. p.p., *Gymnosporia neglecta* Lawson

Large deciduous climbing shrub; branchlets thinly lenticellate. Leaves elliptic-obovate, 7 – 13 x 3.5 – 6cm, acuminate, often abruptly so, base cuneate, margins shallowly serrate; petioles 1 – 2cm. Flowers usually very numerous, borne in few-flowered cymes on lateral shoots from old wood, or amongst and below leaves on new leafy shoots. Cymes puberulous; pedicels 3 – 6mm. Male flowers: calyx cup 2.5mm diameter, lobes c 1.2mm rounded; petals greenish-white, oblong, c 3mm; filaments minutely puberulous; pistillode present. Female flowers as males but with staminodes and ovary. Fruits numerous, globose when young, 3-valved, orange-red; valves broadly elliptic, thick and woody, 7 – 10 x 6 – 8mm with shallow median groove; seeds 3 – 4(–6) ellipsoid, distinctly lunate, covered by fleshy yellow aril.

Bhutan: S – Chukka district (Chukka) and Gaylegphug district (above Sher Camp), C – Punakha district (Ritang); **Darjeeling:** Mongpu, Sureil, Pankabari; **Sikkim:** Gangtok, Dentam, Pemiongchi, Singalila, Lachen. Subtropical and warm broad-leaved forests, 860 – 2440m.

2. *C. hookeri* Prain; *C. stylosus* sensu F.B.I. p.p. non Wall.

Similar to *C. stylosus* but leaves more broadly elliptic to suborbicular, 8 – 13 x 5 – 9.5cm, abruptly mucronate, base rounded or broadly cuneate, margins often more coarsely crenate-serrate; flowers few, in axillary and terminal glabrous cymes at ends of new leafy shoots; petals shallowly toothed; filaments glabrous; fruits few, valves thinly coriaceous; seeds ovoid-ellipsoid, not curved.

Bhutan: C – Tongsa district (Chendebi and Rukubji), Bumthang district (Pamprang) and Tashigang district (Chorten Kora), N – Upper Mo Chu district (Gasa Dzong); **Darjeeling:** Jalapahar, Lebong; **Sikkim:** Lachen, Lachung; **Arunachal Pradesh:** Nyam Jang Chu. Amongst shrubs at margins of cool broad-leaved, Blue-Pine and Oak/*Rhododendron* forests, 2100 – 3050m. April – June.

3. *C. paniculatus* Willdenow; *C. multiflorus* Roxb. Nep: *Bhaisa Lahara*

Similar to *C. stylosus* but shoots usually densely lenticellate; leaves oblong-elliptic to suborbicular, 8 – 12 x 3 – 7cm, abruptly acuminate; margins crenate-serrate; flowers in terminal pubescent panicles 6 – 12cm; calyx lobes c 0.5mm; petals white, c 3mm; fruits with valves 8 – 10mm with conspicuous median groove; seeds ellipsoid.

Bhutan: S – Samchi district (Samchi, 117); **Darjeeling:** Rungit and Tista Valleys, Darjeeling, Kurseong, Jalpaiguri etc. Subtropical forests, 200 – 900m. June – July.

Seeds yield an oil used medicinally (126). The common plant in Darjeeling district is subsp. **multiflorus** (Roxb.) Ding Hou with oblong-elliptic leaves. Subsp. **paniculatus**, with suborbicular leaves, has been recorded from Rayang.

4. **C. monospermus** Roxb.; *C. championii* Bentham

Evergreen climbing shrub; branchlets with few lenticels. Leaves elliptic, 8 – 18 x 4 – 9cm, acuminate, base cuneate, margins serrate; petioles 7 – 13mm. Flowers in axillary peduncled umbellate cymes or often cymes aggregated into panicles, many-flowered, glabrous. Pedicels 1 – 2mm. Flowers white or greenish-white, c 3mm diameter. Male flowers: calyx lobes 0.8mm, rounded; petals 1.5mm; filaments glabrous. Female flowers as males but with conspicuous ovary and minute staminodes. Fruits cylindrical, c 2 x 1cm, 1-seeded; valves becoming strongly reflexed.

Bhutan: S – Phuntsholing district (Kamji, 117); **Darjeeling:** Rungit Valley, Sureil, Darjeeling etc. Subtropical and warm broad-leaved forests, 600 – 2000m. April – August.

Records of *C. venulosus* Prain from Darjeeling (34) probably refer to this species.

6. MAYTENUS Molina

Erect shrubs or small trees, sometimes spiny, glabrous. Leaves alternate, serrate; stipules subulate, minute. Flowers in axillary cymes, 5-merous, bisexual, sometimes unisexual. Calyx deeply lobed. Disc usually \pm flat, entire or shallowly lobed. Stamens borne on margin of disc. Ovary partly immersed in disc, 2 – 3-celled, each cell with 2 ovules. Fruit a 2 – 3-celled capsule dehiscing by 2 – 3 valves, 2 – 6-seeded; seeds with basal aril.

1. Branchlets not lenticellate; cymes elongate 2 – 8cm; with long slender peduncles and pedicels; capsules 3-valved 2
- + Branchlets often conspicuously lenticellate; cymes short and compact 1 – 2cm; capsules 2(–3)-valved 3

2. Leaves mostly narrowly elliptic, sharply acuminate; cymes short, 2 – 4cm
 1. **M. rufa**
- + Leaves mostly broadly elliptic, bluntly pointed; cymes long 6 – 8cm
 2. **M. sikkimensis**

3. Shoots often armed; leaves membranous, dark brown when dry, 5 – 13 x 2 – 5cm; petioles 3 – 5mm; flowers c 3mm diameter 3. **M. kurzii**
- + Shoots unarmed; leaves thinly coriaceous, greenish when dry, 10 – 17 x 4 – 6cm; petioles 6 – 10mm; flowers c 6mm diameter 4. **M. hookeri**

1. *M. rufa* (Wall.) Hara; *Gymnosporia rufa* (Wall.) Lawson

Shrub 1 – 3m or small tree to 7m; branches smooth, not lenticellate, often with slender axillary spines 8 – 13mm. Leaves thinly coriaceous, elliptic-lanceolate, 5 – 15 x 1.5 – 4.5cm, acuminate, base cuneate, margins serrate; petioles 3 – 10mm; stipules subulate, 1 – 2mm, early caducous. Cymes clustered on short scaly axillary shoots, clusters 2 – 4cm diameter; peduncles filiform 1 – 2cm, reddish; pedicels 3 – 4mm; flowers numerous 4 – 4.5mm diameter. Petals white or cream, 1.5 – 2mm. Capsules reddish, turbinate, 6 – 9mm diameter, (2 –)3-valved; seeds black.

Bhutan: S – Chukka district (Marichong), C – Punakha district (Menchunang, Samtengang etc.) and Tongsa district (Dakpai, Kinga Rapden and Jirgang Chu); **Darjeeling:** In broad-leaved forests, in scrub and on cliff ledges, 910 – 2280m. April – June.

2. *M. sikkimensis* (Prain) Raju & Babu; *Gymnosporia sikkimensis* Prain

Similar to *M. rufa* but leaves broadly elliptic, 8 – 10 x 3 – 6cm, obtuse or bluntly pointed, obscurely serrate; cymes very lax, 5 – 8cm diameter; capsules 3-celled.

Darjeeling: Sivoke (34), Tista Valley and Ambioikh. November.

A poorly-known species endemic to Darjeeling district.

3. *M. kurzii* Bennet & Sahni; *M. thomsonii* (Kurz) Raju & Babu, *Gymnosporia thomsonii* Kurz. Nep: *Maidal Kanra* (34).

Spiny shrub or small tree 3 – 6m; branches usually with numerous conspicuous lenticels. Leaves membranous, dark brown when dry, elliptic, 5 – 13 x 2 – 5cm, acuminate, base cuneate, margins serrate; petioles 3 – 5mm. Cymes short, dense, 0.5 – 1.5cm diameter, with short peduncles 3 – 6mm; pedicels 1 – 2mm. Flowers greenish or white, c 3mm diameter. Petals c 1mm. Capsules 2-lobed, compressed, c 10 x 12mm, 2-valved, 2-seeded.

Bhutan: S – Chukka district (Marichong and Sinchu La) and Deothang district (Dewangiri Hills); **Darjeeling:** Darjeeling, Rongbe, Rishap, Lebong, Merek; **Sikkim:** Yoksam. Warm broad-leaved forests, 900 – 1800m. April – May.

4. *M. hookeri* Loesener; *M. oxyphylla* Grierson & Long, *Gymnosporia acuminata* Lawson

Similar to *M. thomsonii* but unarmed; leaves more coriaceous, larger, 10 – 17 x 4 – 6cm, green when dry; petioles 6 – 10mm; cymes slightly larger, 1.5 – 2cm diameter; flowers larger, c 6mm diameter; petals c 2.5mm, capsules 10 – 12mm, 2(– 3)-seeded.

Bhutan: S – Chukka district (Marichong) and Gaylegphug district (Mon La and near Katley), C – Tongsa district (between Pertimi and Tintibi Bridge); **Darjeeling:** Yankeung, Darjeeling. Warm broad-leaved forests, 1030 – 1090m. March – April.

7. SIPHONODON Griff.

Evergreen trees, glabrous. Leaves alternate, crenate-serrate (sometimes obscurely); stipules minute. Flowers solitary or 3 in short axillary cymes, 5-merous, bisexual. Calyx unequally lobed. Filaments short and broad, united at base; anther cells separated by broad connective. Ovary partly immersed in disc, many-celled, upper part hollow and containing a style-like column; ovules 1 per cell. Fruit a hard drupe enclosing many 1-seeded stones.

1. *S. celastrineus* Griff.

Tree up to 15m. Leaves coriaceous, oblong-elliptic, 10 – 19 x 5 – 8cm, acute or shortly acuminate, base cuneate to rounded; margins crenate-serrate but sometimes obscurely so; petioles 8 – 15mm. Flowers mostly 3 in short cymes 10 – 15mm, sometimes solitary on pedicel 5 – 6mm. Calyx lobes rounded, 1.5 – 2mm. Petals creamy-white, ovate, 2.5 – 3.5mm. Filaments c 1mm. Drupe broadly ellipsoid to globose or obovoid, up to 6 x 4cm.

Darjeeling: Tista Valley, not common (34). Subtropical forests. May.

8. BHESA Arnott

Buttressed evergreen trees, glabrous throughout. Leaves alternate, with very fine parallel secondary veins between laterals, entire; stipules early caducous but sheathing conical terminal buds (as in *Ficus*) and leaving conspicuous scars. Flowers in slender spike-like axillary racemes, 5-merous. Calyx deeply lobed. Disc cup-shaped, fleshy. Ovary free from disc, 2-celled, bearing 2 slender simple styles; ovules 2 per cell. Capsules simple or deeply 2-lobed, 1 – 2-seeded, lobes dehiscing by 2 valves; seeds arillate.

1. *B. robusta* (Roxb.) Ding Hou; *Kurrimia pulcherrima* Lawson. Fig. 151 – n.

Tree 15 – 30(–40)m. Leaves ovate to oblong-lanceolate, 10 – 23 x 4 – 10cm, acuminate, base rounded, secondary veins inconspicuous; petioles 1 – 3.5cm, swollen at apex; stipules lanceolate 5 – 7mm. Racemes 1 – 2 per axil, 6 – 8cm. Flowers white, on short pedicels c 1mm. Calyx lobes c 1mm. Petals oblong, c 2.5mm, becoming strongly reflexed. Disc and apex of ovary pubescent. Capsules simple, narrowly ovoid, c 3.5 x 1.5cm, tapering into beak.

Darjeeling: Birik and Kurseong. Subtropical and terai forests, 300 – 1500m. August.

Records for Bhutan (73) have not been substantiated.

Family 102. HIPPOCRATEACEAE

by D. G. Long

Shrubs, often climbing. Leaves opposite, simple, pinnately veined; stipules minute. Flowers in axillary fascicles or cymes, bisexual, actinomorphic. Sepals 5, united at base. Petals 5, free. Stamens 3, free; anthers 2-celled. Disc present, sometimes enclosing ovary. Ovary superior, 3-celled; style simple, 3-fid; ovules 2 – 10 per cell, axile. Fruit a capsule or berry; seeds winged or not.

1. Branchlets smooth; flowers in large axillary cymes; fruit capsular; seeds winged **1. Reissantia**
 + Branchlets often lenticellate; flowers in axillary fascicles; fruit a berry; seeds not winged **2. Salacia**

1. REISSANTIA Halle

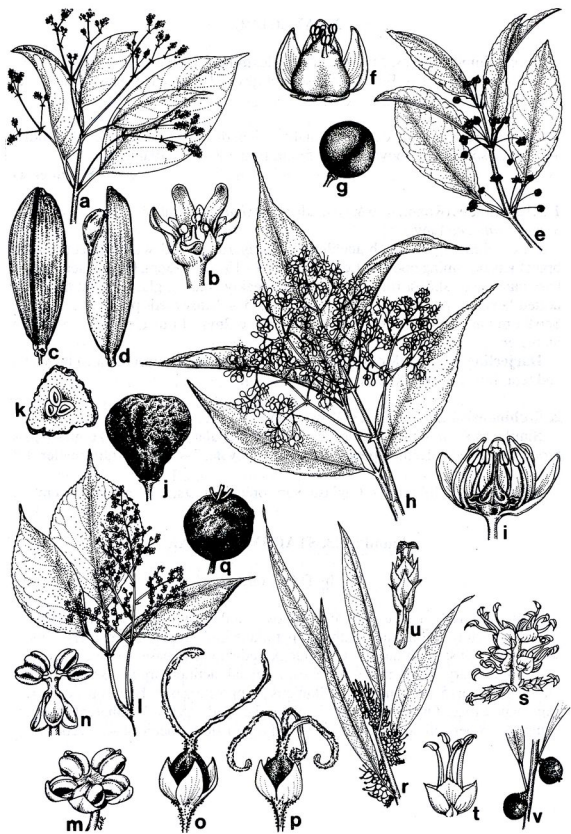
Large deciduous climbing shrubs. Stipules minute. Flowers in broad axillary cymes. Disc surrounding base of ovary. Fruit of (1 –)3 pendulous pod-like capsules shortly united at base; seeds compressed, winged.

1. R. arborea (Roxb.) Hara; *Hippocratea arborea* Roxb. Nep: *Thakauley Thulo*, *Takaule Lahara*. Fig. 16a – d.

Climber with some branches forming stout tendrils. Leaves ovate-elliptic, 7 – 13 x 3 – 6.5cm, shortly acuminate, base cuneate, margins shallowly serrulate, glabrous; petioles slender 12 – 17mm; stipules subulate, c 1mm. Cymes 5 – 10cm long and broad; flowers numerous, yellowish-green. Sepals ovate, c 1mm. Petals oblong, c 1.5mm. Pods mostly borne in 3's, compressed, 8 – 9 x 3cm, striate, each splitting into 2 boat-shaped valves; seeds 2, c 2 x 1cm, with large wing c 6 x 2cm.

Bhutan: S – Phuntsholing district (Torsa Valley), Sarbhang district (Phipsoo Khola and Noonpani) and Gayleghphug district (Birti and near Tori Bari); **Darjeeling.** Subtropical and terai forests, often on river banks, 200 – 820 m. May – June.

FIG. 16. Hippocrateaceae, Staphyleaceae, Bischofiaceae and Buxaceae. Hippocrateaceae. a – d, *Reissantia arborea*: a, flowering shoot; b, flower; c, undehisced capsule; d, dehisced capsule showing winged seed. e – g, *Salacia chinensis*: e, flowering shoot; f, flower with two petals removed; g, fruit. Staphyleaceae. h – k, *Turpinia pomifera*: h, flowering shoot; i, flower with one sepal, two petals and one stamen removed; j, fruit; k, t.s. fruit. Bischofiaceae. l – q, *Bischofia javanica*: l, flowering shoot (male); m, male flower before anthesis; n, male flower at anthesis; o, p, female flowers; q, fruit. Buxaceae. r – v, *Sarcococca hookeriana*: r, flowering shoot; s, part of raceme showing four male and two female flowers; t, male flower; u, female flower; v, fruits. Scale: a, h, l, x ¼; c, d x ¼; e, r, v x ½; g, j, k x 1; q x 1½; s x 2; i, t, u x 3½; n x 4; f, m, o, p x 5; b x 7½. Drawn by G. Rodrigues.



2. SALACIA L.

Large climbing shrubs, ? evergreen. Stipules minute. Flowers in axillary fascicles. Ovary immersed in disc. Fruit a globose or ellipsoid 2–3-seeded berry; seeds large, angular.

1. Petals erect, oblong, c 2mm; fruit 4.5–5cm diameter **1. *S. salacioides***
 + Petals spreading, obovate, 3–3.5mm; fruit 1.3–2cm diameter **2. *S. chinensis***

1. *S. salacioides* (Roxb.) Rao & Hemadri; *S. roxburghii* Wight & Arnott *nom. illeg.*, *S. membranacea* Lawson.

Large climbing shrub; branchlets minutely roughened with lenticels, some branchlets becoming hooked. Leaves ovate, 6–15 x 2.5–5cm, bluntly acuminate, base cuneate or almost rounded, entire or weakly sinuate, glabrous but minutely dotted beneath; petioles 5–7mm. Fascicles 5–8-flowered; pedicels 2–4mm. Sepals minute, 0.8mm. Petals erect, oblong, c 2mm. Fruit globose, 4.5–5cm diameter.

Darjeeling: Rongbe, Mongpu, Tingleng, Khumani and Lower Fagu. Subtropical and terai forests, 300–1200m. February–June.

2. *S. chinensis* L.; *S. prinoides* (Willdenow) DC. Fig. 16e–g.

Similar to *S. salacioides* but leaves entire or crenulate; pedicels 5–6mm; sepals broadly rounded, c 1.2mm; petals spreading, obovate, 3–3.5mm; fruit smaller, 1.3–2cm.

Darjeeling: Kalijhora and Jinglasa. Subtropical forests, 300–600m. December.

Family 103. STAPHYLEACEAE

by D.G. Long

Evergreen trees or shrubs. Leaves opposite and decussate, unevenly 1-pinnate (rarely pinnately trifoliolate), with interpetiolar stipules; leaflets pinnately veined, serrate, glabrous; petiolules with minute paired stipels at base and apex. Flowers small, in axillary and terminal panicles, bisexual, actinomorphic. Sepals 5, free, imbricate. Petals 5, free, imbricate. Stamens 5, opposite sepals, borne outside lobed, cup-shaped disc. Ovary superior, 3-lobed, 3-celled; styles 3, coherent at apex; ovules 4–8 per cell, axile. Fruit a 3-celled dry or fleshy berry, 4–8-seeded.

1. TURPINIA Ventenat

Description as for Staphyleaceae.

1. Leaves oblong-ovate, crenate-serrate; sepals 2.4–2.7mm; petals 2.9–3.5mm; fruits 2–2.5cm diameter, with thick fleshy pericarp, rugose when dry

1. *T. pomifera*

- + Leaves elliptic or lanceolate, sharply serrate; sepals and petals subequal, 1.5–1.7mm; fruits 1–1.5cm diameter, with thin hard pericarp, smooth when dry

2. *T. nepalensis*1. *T. pomifera* (Roxb.) DC. Nep: *Thali*, *Nagpat* (34). Fig. 16h–k.

Tree 10–20cm. Leaf rachis swollen at nodes when fresh, constricted when dry; stipules ovate-triangular, 5–6mm; leaflets 3–4 pairs, thinly coriaceous, oblong-ovate, 13–22 x 5–8.5cm, acuminate, base oblique, broadly cuneate or rounded, margins crenate-serrate, lateral veins 6–8 pairs, prominent beneath, minor veins finely reticulate beneath; lateral petiolules 3–10mm, bearing a pair of minute stipels c 1mm at base and apex. Panicles broad, 15–35cm, branches puberulous, green or tinged with red; bracts lanceolate c 2mm, caducous. Flowers creamy. Sepals ovate, 2.4–2.7mm, margins ciliate. Petals oblong, distinctly longer than sepals, 2.9–3.5mm, scarcely ciliate. Ovules 6–8 per cell. Fruit globose, 2–2.5cm diameter, 3-grooved at apex, rugose when dry, with fleshy pericarp c 5mm thick.

Bhutan: S – Sankosh district (Balu Khola), Sarbhag district (near Phipsoo) and Gaylephug district (Aie Bridge); **Darjeeling:** foothills and terai, Jalpaiguri, Kalimpong, Tista and Rungit Valleys. Subtropical and terai forests, 200–600 (–1000)m. March–April.

Fruit gives an oil used in medicine and for burning (34).

2. *T. nepalensis* Wight & Arnott; *T. cochinchinensis* auct. non (Loureiro) Merrill, *T. pomifera* sensu F.B.I. p.p. non (Roxb.) DC. Nep: *Thali*.

Similar to *T. pomifera* but petioles and panicles often crimson; leaflets elliptic or lanceolate, 8–16 x 3–6cm, base cuneate, margins more sharply serrate; flowers smaller; sepals and petals smaller, subequal, 1.5–1.7mm; ovules c 4 per cell; fruit small, dry, becoming smooth and hard when dry, 1–1.5cm diameter, with thin pericarp 1–1.5mm thick, not grooved but with 3 weak ridges at apex.

Bhutan: S – Chukka and Gaylephug districts; C – Punakha, Tongsa and Mongar districts, N – Upper Mo Chu district; **Darjeeling:** Rissum, Darjeeling, Labha; **Sikkim:** Yoksam to Bakkim. Warm and cool broad-leaved and Evergreen oak forests, 1500–2130m. May–June.

Foliage used as cattle-fodder (34) and timber for firewood.

Family 104. BISCHOFIACEAE

by D.G. Long

Deciduous trees. Leaves alternate, pinnately trifoliolate, stipulate; leaflets pinnately veined, serrate; petioles and petiolules with minute stipels at apex. Dioecious; flowers small in axillary panicles, unisexual, actinomorphic. Perianth segments 5, free, imbricate, concave; disc absent. Male flowers: stamens 5, opposite and at first contained by perianth segments, later raised on a short androphore; pistillode peltate. Female flowers: staminodes minute or absent; ovary (2 -)3-celled; styles (2 -)3, linear, spreading; ovules 2 per cell. Fruit a berry, 3 - 6-seeded.

1. BISCHOFIA Blume

Description as for Bischofiaceae.

1. B. javanica Blume. Dz: *Goile Shing*; Nep: *Kainjal*. Fig. 16 l - q.

Tree 8 - 20(-30)m. Petioles 9 - 12cm, with a pair of minute lanceolate stipels 1 - 1.2mm at apex; stipules membranous, lanceolate, 6 - 10mm, caducous; leaflets thinly coriaceous, ovate-elliptic, 10 - 19 x 6 - 11cm, apiculate or shortly acuminate, base cuneate, margins crenate-serrate, glabrous; lateral petiolules 0.5 - 2cm, terminal 1.5 - 6.5cm, with 2 minute stipels at apex. Male panicles 12 - 20cm, densely flowered; flowers greenish-white, 2mm across. Female panicles 15 - 20cm, with fewer flowers; perianth segments c 2mm, soon reflexing and caducous; ovary ellipsoid, 4 - 5mm; styles reflexed, 5 - 6mm. Fruiting panicles up to 30cm; fruits globose, 1cm diameter when dry, fleshy and blue-black when ripe.

Bhutan: S - Chukka and Gaylegphug districts, C - Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** foothills. Subtropical and warm broad-leaved forests, 270 - 2000m. April - June.

Wood dark red with a very strong odour of vinegar (34); timber valuable (34).

Family 105. BUXACEAE

by A. J. C. Grierson & D. G. Long

Evergreen shrubs or small trees. Leaves alternate or opposite, simple, entire, pinnately veined or 3-veined at base, exstipulate. Monoecious or rarely dioecious; flowers small, in short axillary bracteate racemes or clusters, unisexual, actinomorphic. Perianth of 4(-6) free segments. Male flowers: stamens 4, opposite perianth segments; pistillode sometimes present. Female flowers fewer than males; ovary superior, 3-celled; styles 3, free; ovules 2 per cell, axile. Fruit a capsule or indehiscent and berry-like; seeds compressed.

1. Leaves alternate; flowers in axillary racemes; fruit a 3-seeded berry
1. Sarcococca
 + Leaves opposite; flowers in axillary clusters; fruit a 6-seeded capsule
2. Buxus

1. SARCOCOCCA Lindley

Shrubs. Leaves alternate, coriaceous, pinnately veined or 3-veined at base. Flowers in short axillary racemes; upper flowers male, lower few female or sometimes all female. Perianth segments oblong, obtuse, concave. Styles short, becoming recurved. Fruit a 3-seeded berry with persistent styles.

1. Shoots puberulous; leaves narrowly elliptic-lanceolate, 5 – 9 x 1 – 2cm, pinnately veined to base **1. S. hookeriana**
 + Shoots glabrous; leaves ovate-lanceolate, 8 – 12 x 2.5 – 4cm, 3-veined at base
2. S. wallichii

1. S. hookeriana Baillon; *S. pruniformis* Lindley var. *hookeriana* (Baillon) Hook. f. Tongsa: *Hue Shing*; Nep: *Chilekath* (34). Fig. 16r – v.

Shrub 0.3 – 2m; shoots puberulous. Leaves narrowly elliptic-lanceolate, 5 – 9 x 1 – 2cm, acuminate or acute, base cuneate, pinnately veined but veins obscure, glabrous except on midrib above; petioles 5 – 7mm. Flowers strongly fragrant; racemes short, 3 – 10-flowered; bracts ovate c 2.5cm. Perianth segments greenish or pink, c 2mm. Stamens white, long-exserted, c 6mm. Ovary ovoid, c 2.5mm. Berries subglobose, c 8mm, black.

Bhutan: S – Chukka district, C – Ha, Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu district; **Darjeeling; Sikkim; Arunachal Pradesh:** Nyam Jang Chu. Shaded streamsides and ravines in cool broad-leaved and Blue Pine forests, 2130 – 2900m. April – June.

Wood hard, sometimes used to make walking sticks (34). Valued horticulturally as a ground-cover plant and for its fragrant flowers.

2. S. wallichii Stapf; *S. pruniformis* sensu F.B.I. p.p. non Lindley

Similar to *S. hookeriana* but shoots glabrous; leaves ovate-lanceolate, 8 – 12 x 2.5 – 4cm, long-acuminate, strongly 3-veined above base; petioles 1 – 1.5cm; fruits c 1cm diameter.

Bhutan: S – Samchi district (Sangura, 114), C – Tongsa district (Chendebi) and Mongar district (Mongar); **Darjeeling:** Batasi, Rimbik; **Sikkim:** Singalela; **Arunachal Pradesh:** Nyam Jang Chu. Warm and cool broad-leaved forests, 1500 – 2300m. November – April.

2. BUXUS L.

Shrubs or small trees. Leaves opposite, coriaceous, pinnately veined. Flowers in globose axillary clusters; outer flowers male (opening first); innermost one female. Male flowers: perianth segments 4, obovate, obtuse, concave. Female flowers: perianth segments 6, obovate; styles short, thick, erect, becoming weakly recurved. Fruit a 3-valved loculicidal capsule with persistent styles, dehiscent along mid-line of styles.

1. *B. wallichiana* Baillon; *B. sempervirens* sensu F.B.I. p.p. non L.

Shrub or small tree, 3–10(–15)m; shoots puberulous. Leaves yellowish, elliptic, 3.5–6 x 0.7–1.8cm, obtuse, base cuneate, glabrous except on midrib above; lateral veins numerous, obscure; petioles 1–2mm. Flower clusters 5–7mm diameter. Perianth segments c 3mm. Ovary ellipsoid, 2–3mm. Capsules ellipsoid, c 10 x 5mm. Seeds compressed-ovoid, c 5mm, black, glossy.

Bhutan: locality unknown (80). 1800–2400m. December–March.

Recorded from Bhutan on the basis of a single unlocalised collection by Griffith in 1838.

Family 106. ICACINACEAE

by D.G. Long

Trees, shrubs or woody twiners; indumentum of simple hairs or stellate scales. Leaves alternate, simple, pinnately or palmately veined, exstipulate. Flowers racemously arranged in axillary panicles or forming heads, unisexual or bisexual, actinomorphic. Calyx small, united at base, 4–5-lobed. Corolla of 4–5 free or shortly united petals. Stamens 4–5 free, or united with corolla tube, antisepalous; anthers 2-celled. Disc absent or present. Ovary superior, 1-celled; style simple; stigma lobed or not; ovules 2, pendulous. Fruit a 1-seeded drupe.

1. Trees or large shrubs, not twining 2
+ Woody twiners 3

FIG. 17. *ICACINACEAE* and *CARDIOPTERIDACEAE*. *ICACINACEAE*. a–f, *Platea latifolia*: a, portion of flowering shoot (male); b, portion of flowering shoot (female); c, d, male flower; e, female flower; f, fruit. g–i, *Nothapodytes foetida*: g, flowering shoot; h, flower with one petal and one stamen removed; i, fruit. j–n, *Natsiatium herpeticum*: j, flowering shoot; k, male flower; l, stamen with glands on filament; m, female flower; n, fruits. o–q, *Miquelia assamica*: o, portion of flowering shoot (male); p, male flower bud; q, male flower. *CARDIOPTERIDACEAE*. r–w, *Peripterygium quinquelobum*: r, portion of flowering shoot; s, flower bud; t & u, partly and fully developed flowers showing unequal development of styles; v, dissected corolla with stamens; w, fruits. Scale: a, g, j, o, r x ¼; f, w x ½; b, i, n x 1; e, m x 2½; s, u, v x 3; h x 3½; p, q, t x 4; c, k x 5; d x 6; l x 10. Drawn by G. Rodrigues.



2. Young shoots and inflorescences stellate-scaly; flowers unisexual, males in spicately-branched axillary panicles, females in axillary cymes **1. Platea**
 + Young shoots and inflorescences with simple hairs, not scaly; flowers bisexual, in terminal corymbose cymes **2. Nothapodytes**
3. Leaves palmately 7 – 9-veined at base; margins crenate-dentate; flowers 5-merous in slender pendulous racemes **3. Natsiatum**
 + Leaves pinnately veined, margins subentire; flowers 4-merous in pedunculate clusters **4. Miquelia**

1. PLATEA Blume

Trees; young growth stellate scaly. Leaves entire, pinnately veined. Inflorescences stellate scaly; flowers unisexual, males in spicately-branched axillary panicles, females in axillary cymes. Male flowers: calyx lobes 5; petals 5, shortly connate at base; stamens 5, attached to base of corolla; pistillode absent. Female flowers: calyx lobes 5; petals absent; ovary obconical; stigma sessile, discoid. Drupe fleshy with woody endocarp, stigma persistent.

1. P. latifolia Blume; *Sideroxylon gamblei* Clarke, *Planchonella gamblei* (Clarke) Lam, *Gomphandra gamblei* (Clarke) van Royen. Fig. 17a – f.

Large tree to 20m or more. Young shoots densely reddish stellate-scaly. Leaves thinly coriaceous, ovate-elliptic, 8 – 21 x 3.5 – 10cm, shortly acuminate, base rounded or broadly cuneate; pale beneath, stellate-scaly beneath becoming subglabrous; petioles 1.5 – 2.5cm. Male panicles 3 – 9cm, flowers densely clustered; sepals ovate, c 0.8mm, pubescent, petals green, 1.5mm, glabrous. Female cymes short, 2 – 5-flowered, stellate-tomentose; sepals 2mm. Drupes ovoid-ellipsoid, 2.5 – 4.5 x 2 – 2.5cm, black when ripe.

Darjeeling: Rungbee. Warm broad-leaved forests, 1500m.

2. NOTHAPODYTES Blume

Trees; hairs simple. Leaves entire, pinnately veined. Flowers bisexual, in spreading terminal corymbose cymes. Calyx 5-lobed. Petals 5, almost free. Stamens 5, free. Disc present, cup-shaped. Ovary with erect style; stigma subcapitate. Drupe with thinly woody endocarp.

1. N. foetida (Wight) Sleumer; *Mappia foetida* (Wight) Miers, *M. tomentosa* Miers, *M. ovata* Miers, *M. oblonga* Miers. Fig. 17g – i.

Shrub or small tree, 5 – 10 m; branchlets ribbed, appressed puberulous. Leaves ovate-elliptic, 8 – 18 x 4.5 – 9cm, sharply mucronate or shortly acuminate, base rounded, puberulous beneath, at least on veins; petioles 2.5 – 3cm. Cymes pubescent, 4 – 12cm broad, on peduncles 3 – 6cm; flowers strongly foetid. Calyx shallowly

cup-shaped, c 2.5mm diameter, shortly lobed. Petals white, oblong 4–5mm. Drupes ellipsoid, black, 1.5–2 x 1cm, thinly hairy.

Darjeeling: Lopchu and Rungbi (34). Warm broad-leaved forests, 1830m. July–August.

These records require confirmation as no E Himalayan material has been located.

3. NATSIATUM Arnott

Twining shrubs; hairs simple. Leaves dentate, palmately 7–9-veined at base. Dioecious: flowers in pendulous racemes. Male flowers: calyx deeply 5-lobed; petals 5, free; stamens 5, opposite calyx lobes, each filament bearing 2 glands; pistillode small. Female flowers: as male flowers but stamens reduced to staminodes; glands 5; ovary ovoid with 2–3-lobed style. Fruit an oblique drupe.

The genus is endemic to the East Himalaya and Assam.

1. *N. herpeticum* Arnott. Fig. 17j–n.

Extensive woody climber; shoots strigose-hairy. Leaves broadly ovate 6–19 x 5–15cm, shortly acuminate, base cordate, margins coarsely dentate-serrate, palmately 7–9-veined at base, scabrid especially beneath with stiff hairs; petioles 4–12cm. Racemes slender, 6–15cm, hispid; pedicels 2–3mm. Flowers pale green. Calyx lobes narrowly lanceolate, c 2mm. Petals lanceolate, c 2.5mm. Drupes ovoid, blackish green, c 12 x 10mm.

Bhutan: S–Samchi, Phuntsholing, Chukka, Sankosh, Sarbhang and Gaylegphug districts, C–Tashigang district (117); **Darjeeling:** Tista and Rungit Valleys and terai. Subtropical and terai forests, 150–1220m. November–January.

4. MIQUELIA Meisner

Twining shrubs; hairs simple. Leaves pinnately veined, borne on short side-shoots; petioles often acting as tendrils. Dioecious; flowers minute, in peduncled clusters borne on short leafy or leafless supra-axillary shoots. Male flowers sessile: calyx deeply 4-lobed; corolla elongate, tubular at base, deeply 4-lobed; stamens 4, filaments very short. Female flowers as in males, ovary with sessile discoid stigma. Drupes ovoid, thinly fleshy; seed rugose.

1. *M. assamica* (Griff.) Long; *Jenkinsia assamica* Griff., *M. kleinii* sensu F.B.I. non Meisner. Fig. 17o–q.

Branchlets finely strigose-hairy, becoming glabrous. Leaves membranous, elliptic, 11–18 x 4–6cm, acuminate, base cuneate or narrowly rounded, margins very shallowly sinuate-dentate or almost entire; petioles 1.5–3cm. Male flowers c 3mm diameter, on elongate filiform tube 3–5mm, forming globose umbels 12–16mm diameter; umbels borne on slender simple or racemosely branched peduncles 10–40mm, these aggregated on short thick supra-axillary shoots c 5mm. Female flowers and fruit unknown.

Bhutan: S – Gayleghug district (Karai Khola above Aie Bridge). Subtropical forest in steep valley, 510m. March.

Family 107. CARDIOPTERIDACEAE

by D. G. Long

Glabrous twining herbs with milky sap. Leaves alternate, simple, palmately lobed, palmately veined, exstipulate. Flowers subsessile in dichotomous axillary cymes, bisexual, actinomorphic. Sepals 5, shortly united at base, persistent. Corolla funnel-shaped below, 5-lobed, caducous. Stamens 5, inserted in upper part of corolla tube, alternating with lobes; filaments short; anthers 2-celled. Disc absent. Ovary superior, 1-celled; styles 2, unequal, one erect, persistent, the other curved, deciduous; ovules 2, pendulous. Fruit compressed, indehiscent, broadly 2-winged, at first with persistent fleshy style, 1-seeded.

1. PERIPTERYGIUM Hasskarl

Description as for Cardiopteridaceae.

1. P. quinquelobum Hasskarl; *Cardiopteris lobata* Bennett & Brown, *C. javanica* Blume. Nep: *Chiuri Lahara* (117). Fig. 17r – w.

Deciduous twining shrub. Leaves ovate-triangular, 6 – 12 x 5 – 11 cm, sharply acuminate, base broadly cordate, shallowly to quite deeply dentate-lobed in lower part, otherwise entire, palmately 5 or 7-veined at base. Cymes spreading, 2 – 8 cm broad (up to 20 cm in fruit). Flowers subsessile. Sepals c 2 mm. Petals white c 2.5 mm. Fruits usually numerous, brownish, elliptic-obovate, 2 – 2.5 x 1.5 – 1.8 cm including broad wings, with median rib on each side, apex emarginate with sub-persistent fleshy style 5 – 11 mm.

Bhutan: S – Gayleghug district (Gayleghug, 117). Subtropical forests, 270m. October.

No E Himalayan material of this genus has been seen.

Family 108. RHAMNACEAE

by D.G. Long & S.J. Rae

Trees or shrubs, sometimes climbing, armed or unarmed, sometimes tendrillar. Leaves simple, alternate or opposite, pinnately veined or 3 – 5-veined at base, stipulate. Flowers in fascicles or cymes, often arranged in panicles or racemes, actinomorphic, bisexual, sometimes unisexual. Calyx 4- or 5-lobed, lobes ribbed within. Petals 4 or 5, free, rarely absent, shortly clawed at base, usually hooded and

enclosing anthers. Stamens 4 or 5, antipetalous; filaments adnate to base of petals; anthers 2-celled. Disc thin or thick and fleshy. Ovary free or immersed in disc, 2 – 4-celled; style short, simple or 2 – 4-lobed; ovules 1 per cell, basal. Fruit a capsule or a fleshy or dry drupe, sometimes winged.

1. Leaves strongly 3-veined at base (basal lateral veins much stouter than others); flowers in cymes, these sometimes aggregated into panicles 2
- + Leaves pinnately veined throughout (basal lateral veins not stouter than others); flowers in fascicles or racemes, these often forming terminal panicles 3
2. Leaves 3-veined almost to apex, serrulate with minute teeth; style 2-lobed; fruits fleshy, borne on slender peduncles **1. Zizyphus**
- + Leaves 3-veined \pm to mid leaf; serrate with sharp spreading teeth; style 3-lobed; fruits leathery, borne on swollen fleshy peduncles **5. Hovenia**
3. Leaves opposite or subopposite; spines (when present) axillary.. **6. Sageretia**
- + Leaves alternate; spines usually absent, when present (*Rhamnus*) then terminal
4
4. Leaves entire and with close parallel veins **2. Berchemia**
- + Leaves serrate or crenate, sometimes obscurely so; veins usually widely spaced
5
5. Tendrillar climber; flowers in long slender compound racemes; fruit a 3-winged capsule dividing into 3 mericarps **7. Gouania**
- + Erect or climbing shrubs without tendrils; flowers in axillary fascicles, short racemes or densely clustered in panicles; fruit a fleshy drupe or winged nut
6
6. Flowers densely clustered in panicles, bisexual; fruit a winged nut
3. Ventilago
- + Flowers in fascicles or loose compound racemes, unisexual; fruit a fleshy drupe
4. Rhamnus

1. ZIZYPHUS Miller

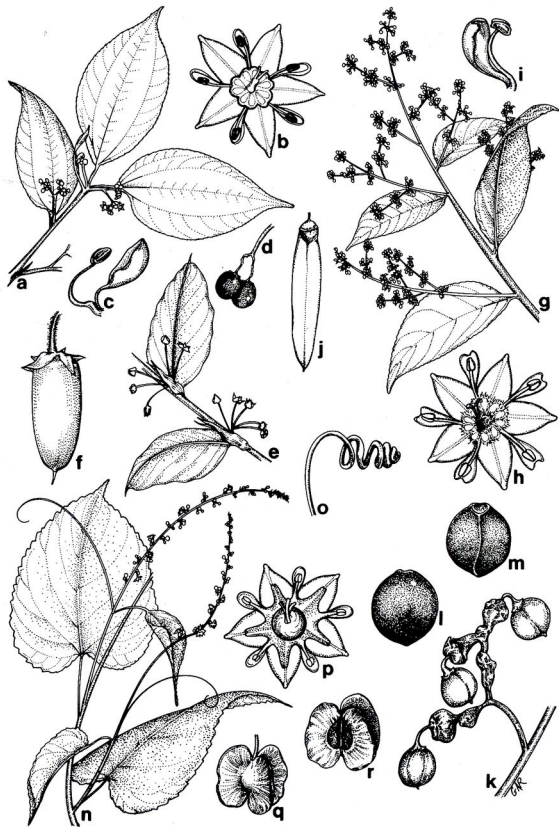
Trees or shrubs, often climbing; stems often with single or paired spines. Leaves alternate, borne in one plane, strongly 3(- 5)-veined from base almost to apex. Flowers bisexual, 5-merous, in axillary (sometimes also terminal) cymes, these sometimes forming \pm leafless panicles. Calyx lobes spreading. Petals hooded, sometimes absent. Disc 5- or 10-lobed. Ovary immersed in disc, 2-celled; style bilobed. Fruit fleshy with a hard 1 – 2-celled 1 – 2-seeded stone.

1. Leaf apex obtuse (sometimes very shortly apiculate in *Z. rugosa* but then leaves tomentose beneath) 2
 + Leaf apex acute, acuminate or caudate; leaves glabrous beneath or pubescent only on veins 4
2. Climbing shrub; spines single; leaves 6–15 x 3.5–9 cm; cymes aggregated into a leafless panicle **3. *Z. rugosa***
 + Shrub or tree; spines paired; leaves 2–7 x 1.5–5 cm; cymes borne in leaf axil 3
3. Leaves tomentose beneath **1. *Z. mauritiana***
 + Leaves glabrous or pubescent only on veins **2. *Z. sp.***
4. Cymes aggregated into a ± leafless panicle 5
 + Cymes borne in leaf axils 6
5. Leaves narrowly ovate, 9–15 x 4–7 cm; petals absent **4. *Z. rubiginosa***
 + Leaves ovate 5–10 x 2.5–5 cm; petals present **6. *Z. funiculosa***
6. Shrub; branchlets red-brown tomentose; petals absent **7. *Z. apetala***
 + Tree or climbing shrub; branchlets pubescent when young, becoming glabrous; petals present 7
7. Tree, usually unarmed; leaves ovate, tapering into shortly acuminate or acute apex **5. *Z. incurva***
 + Climbing shrub usually with numerous hooked spines; leaves ovate-elliptic, ± abruptly narrowed into caudate apex **6. *Z. funiculosa***

1. *Z. mauritiana* Lamarck; *Z. jujuba* (L.) Gaertner non Miller. Sha: *Khangkhari Shing*; Nep: *Baer* (34).

Shrub or tree 0.5–10m, branches densely woolly tomentose; spines usually paired, one straight, ascending, 4–8mm, one recurved 3–6mm. Leaves broadly ovate-elliptic to suborbicular, 2–7 x 1.5–5cm, obtuse, base cuneate or rounded, margin serrulate, glabrous above, densely pale woolly beneath; petiole 2–4mm, woolly. Flowers in short woolly axillary cymes, 1–2cm diameter. Pedicels 3–7mm, tomentose, elongating in fruit. Calyx lobes triangular, 1.5mm, woolly

FIG. 18. **Rhamnaceae.** a–d, *Zizyphus incurva*: a, flowering shoot; b, flower; c, petal and stamen; d, fruits. e & f, *Berchemia edgeworthii*: e, portion of flowering shoot; f, fruit. g–j, *Ventilago denticulata*: g, flowering shoot; h, flower; i, petal and stamen; j, winged nut. k–m, *Hovenia acerba*: k, fruiting inflorescence; l & m, fruit. n–r, *Gouania leptostachya*: n, flowering shoot; o, apex of tendril; p, flower; q & r, fruit. Scale: g x ¼; a, d, n x ½; j, k, o, q, r x 1; e x 1¼; f x 2¼; l, m x 3½; h x 5; b x 5½; p x 6; c, i x 12. Drawn By G. Rodrigues.



outside. Petals spatulate, equalling calyx. Disc 10-grooved and lobed. Style 2-lobed divided nearly to middle. Fruit a fleshy drupe, c 1.5 x 1 cm, red, 2-seeded.

Bhutan: S – Samchi district (Khana Bharti Khola) and Phuntsholing district (Phuntsholing), C – Tashigang district (Ghunkarah); **Darjeeling:** Tista, Siliguri, Sivoke Terai. Roadsides and dry hot river banks, 200 – 760m. May – August.

Fruit edible. A good firewood crop for the arid tropics (130); wood useful (48).

2. *Z. sp.*

Similar to *Z. mauritiana* but a shrub to 40cm; straight spines longer, 1.2 – 2cm; leaves 3.5 x 1.8cm, apex rounded, margin sharply and irregularly serrate near apex, sparsely pubescent on veins beneath.

Bhutan: S – Phuntsholing district (Torsa River). On river shingle, 200m.

Only known from a single sterile specimen which cannot be matched vegetatively with other Indian species.

3. *Z. rugosa* Lamarck. Nep: *Kanta Baer* (34), *Rukh Baer* (34).

Prickly climber, branches pubescent; spines single, stout, hooked, reflexed up to 7mm on older specimens. Leaves thinly coriaceous, broadly elliptic, 6 – 15 x 3.5 – 9cm; acute or bluntly apiculate, base rounded or shallowly cordate, often asymmetric, margin serrulate, glabrous above, softly tomentose beneath; petiole 6 – 12mm. Cymes pale brown or fawn tomentose, aggregated into panicles on leafless branches, 7 – 20cm. Flowers pale green; pedicels 3 – 4mm. Calyx lobes triangular, 2.5mm, tomentose outside. Petals absent. Disc glabrous. Ovary immersed in disc, hairy; style 2-lobed, divided to middle. Drupes fleshy, obovoid-globose, c 12 x 10mm, 1-celled, 2-seeded.

Darjeeling: Tista and Sivoke Terai. Subtropical and terai forests, 200 – 300m. April – May.

4. *Z. rubiginosa* Long & Rae

Similar to *Z. rugosa* but differing in leaves narrowly ovate; apex acuminate; sparsely hairy on veins beneath; panicles red-brown tomentose; flowers creamy; calyx lobes ovate 2.5 – 3mm.

Bhutan: S – Sarbhang district (above Noonpani); **Darjeeling:** Jalpaiguri Duars. Warm broad-leaved forest, 890m. March.

5. *Z. incurva* Roxb. Dz: *Tsangshing Karmo*. Fig. 18a – d.

Tree 4 – 20m, usually unarmed (when spiny, spines paired, 3 – 5mm); branches pubescent becoming glabrous. Leaves ovate, 5 – 14 x 2 – 6cm, bluntly acuminate, base oblique, rounded, margin serrulate, sparsely pubescent on veins beneath; petioles pubescent. Flowers in short axillary cymes 1.5 – 2.5cm across; peduncle 5 – 17mm, pubescent. Flowers yellow. Calyx lobes ovate, 1.8 – 2mm, spreading, pubescent externally. Petals spatulate, spreading, equalling calyx. Disc shortly 10-lobed, fleshy, glabrous. Ovary immersed; style 2-lobed, short, stout. Drupes subglobose, c 13mm diameter, 2-celled, 2-seeded.

Bhutan: S – Chukka district, C – Punakha, Mongar and Tashigang districts; **W Bengal Duars:** Buxa. River banks in hot (often dry) valleys, 1220 – 1675m. April – May.

Often cultivated as a host plant for the lac insect. The record of the S Indian *Z. glabrata* Heyne from Bhutan (80) is based on a poor specimen of this species.

6. *Z. funiculosa* Lawson

Similar to *Z. incurva* but a climbing shrub, usually spiny; spines single, short, stout, recurved, 2 – 3mm; leaves 5 – 10 x 2.5 – 5cm, apex caudate-acuminate; 3-veined but with 1 or 2 additional minor veins from base; peduncle 3 – 6mm; style divided nearly to base.

Darjeeling: Tista Valley (34). Subtropical forests. February – March.

7. *Z. apetala* Lawson

Similar to *Z. incurva* but a small shrub with red-brown tomentose stems; leaves obliquely ovate, 6 – 10 x 2.4 – 4cm, shortly acuminate; cymes tomentose; calyx lobes tomentose outside, pubescent within; petals absent; disc 5-lobed, hairy.

Darjeeling: Mal Forest and Glen Cathcart. Subtropical and terai forests, 600m. March.

2. BERCHEMIA A.DC.

Shrubs, scrambling, climbing or twining, unarmed. Leaves alternate, entire, pinnately veined with close parallel veins. Flowers in axillary fascicles or arranged in racemes or panicles, bisexual, 5(–6)-merous. Ovary surrounded by but not united to disc, 2-celled; style simple; stigma shallowly 2-lobed. Fruit a drupe with hard 2-celled, 2-seeded stone.

Note: branchlets in *Berchemia* species often bear a black bristle-like fungal infection; these bristles have sometimes been mistaken for stem hairs.

1. Leaves 0.8 – 2 x 0.5 – 1.5cm; stipules subpersistent; flowers in axillary fascicles

1. *B. edgeworthii*

+ Leaves 3.5 – 9 x 2.5 – 5cm; stipules early caducous; flowers in panicles ... 2

2. Leaves obtuse or subacute, minutely mucronate, often yellow beneath when dry; panicles little-branched, 2 – 7cm; peduncle glabrous ... 2. *B. flavescens*

+ Leaves acute or shortly acuminate, green beneath when dry; panicles wide-branched, 7 – 14(–17)cm; peduncle often pubescent 3. *B. floribunda*

1. *B. edgeworthii* Lawson; *B. axilliflora* Cheng, *B. lineata* sensu F.B.I. non (L.) DC. Fig. 18e&f.

Shrub 1 – 3m, often scrambling, sometimes prostrate; branchlets glabrous. Leaves ovate, 0.8 – 2 x 0.5 – 1.5cm, obtuse and with minute apiculus, base rounded,

margins entire, lateral veins 5–6 pairs, glabrous and pale beneath; petioles 2–8mm; stipules lanceolate, 3–5mm, glabrous, subsistent. Flowers 2–5 in axillary fascicles, 5(–6)-merous, pedicels 3–5mm. Calyx lobes ovate-triangular, 1.5–2mm, erect. Petals spatulate, 1.5–2mm. Fruit cylindrical, 5–7mm, red becoming black, bearing persistent floral parts at base.

Bhutan: C – Thimphu district (Thimphu Chu valley), Tongsa district (Chendebi) and Bumthang district (Byakar); **Sikkim:** Lachen. Amongst scrub in dry valleys, often with Blue Pine, 2130–2750m. July – August.

Himalayan specimens seen labelled *B. lineata* appear to belong here; *B. lineata* (L.) DC. is a Chinese species distinguished by its pubescent branchlets, more elliptical leaves, and lanceolate calyx lobes and petals.

2. *B. flavescens* (Wall.) Brongniart

Straggling, climbing or twining shrub; branchlets glabrous. Leaves ovate, 3.5–47 x 2.5–4cm, obtuse or subacute and with minute mucro, base rounded, margins entire, lateral veins 9–13 pairs, glabrous, often becoming yellow beneath when dry; petioles 0.5–2cm; stipules lanceolate, 6.5–7mm, early caducous. Flowers in terminal little-branched panicles 2–7cm long, peduncles glabrous. Calyx lobes triangular, c 3mm, reflexed. Petals pale yellow-green, spatulate, c 1.5mm. Fruit cylindrical, c 10mm, surrounded at base by persistent floral parts.

Bhutan: C – Thimphu, Punakha, Tongsa, Bumthang and Mongar districts, N – Upper Mo Chu district; **Darjeeling:** Phallut to Ramam. Amongst scrub on river banks and at margins of cool broad-leaved forests, 2400–3000m. June – August.

3. *B. floribunda* (Wall.) Brongniart. Nep: *Bange* (34).

Similar to *B. flavescens* but leaves 5–9 x 3.5–5cm, acute or shortly acuminate, pale green beneath when dry; flowers in large compound wide-branched panicles 7–17cm long; peduncles often pubescent; fruiting panicles up to 23cm.

Bhutan: S – Gaylephug district (Sham Khara, 117), C – Punakha district (Ratsoo); **Darjeeling:** Takdah, Pedong, Darjeeling and Kalimpong. Amongst shrubs in warm broad-leaved forests, 1200–2100m. April – July.

Young leaves poisonous to cattle (34).

3. VENTILAGO Gaertner

Climbing shrubs, unarmed; stems sometimes twining. Leaves alternate, pinnately veined. Flowers 5-merous, bisexual, in axillary and terminal panicles. Calyx lobes spreading, keeled within. Stamens attached to base of petals. Disc weakly lobed. Ovary superior, partly immersed in disc, 2-celled; style short, deeply 2-fid. Fruit a 1-celled, 1-seeded nut, bearing persistent calyx tube around base, produced at apex into an oblong wing.

1. *V. denticulata* Willdenow; *V. calyculata* Tulasne. Fig. 18g–j.

Extensive climber; branches finely pubescent. Leaves ovate-elliptic, 4–13 x 2.5

– 6cm, acute or shortly acuminate, base rounded or cuneate, oblique, margin obscurely crenate-serrate, pubescent on both surfaces at least when young, reticulations prominent, parallel; petioles 3–8mm; stipules 1.5mm, early caducous. Panicles spreading, up to 20cm, branches pubescent. Flowers clustered, on short pedicels c 1mm. Calyx lobes triangular, 1–1.5mm, pubescent externally. Petals spatulate, 1–1.5mm. Disc and base of style pubescent. Nut subglobose 5–6mm diameter, lower half enclosed by cup-shaped, entire calyx tube; wing oblong 3–4.5 x 0.8–1cm, pubescent.

Bhutan: S – Phuntsholing district (Phuntsholing, 117), C – Tashigang district (Manas River); **Darjeeling:** Tista, Sivoke, Mungpoo etc. Subtropical forests, 300–600m. September–December.

Some authors describe plants as tendrillar, but tendrils have not been observed on the numerous specimens studied.

4. RHAMNUS L.

Shrubs, sometimes prostrate or climbing, rarely trees, unarmed or with terminal spines on short branches. Leaves alternate or subopposite, sometimes \pm clustered on short lateral shoots, pinnately veined. Dioecious; flowers in axillary fascicles or terminal and axillary compound racemes, 4 or 5-merous, unisexual, males with pistillode, females with staminodes. Petals 4 or 5 or absent. Disc thin, inconspicuous. Ovary free from disc, 2–4-celled; style 2–4-lobed. Fruit a fleshy 2–4-celled, 2–4-seeded drupe.

1. Leaves large, (5–)7–15cm long; trees or large climbing shrubs, unarmed..2
+ Leaves small, 1.2–5(–8)cm; dwarf shrubs or if large usually with branches ending as spines 3
2. Flowers numerous in simple or compound (\pm paniculate) racemes; petals 5, small; large often climbing or scrambling shrub **1. R. napalensis**
+ Flowers 3–6 in axillary fascicles; petals absent; tree or erect shrub
2. R. purpureus
3. Leaves and flowers densely clustered on short lateral shoots; sepals and petals usually 4; spiny erect shrub **3. R. virgatus**
+ Leaves \pm distant; flowers 1 or 2 per axil; sepals 5; petals absent; low or prostrate unarmed shrub **4. R. procumbens**

1. R. napalensis (Wall.) Lawson. Nep: *Archal* (34).

Large scrambling or climbing shrub 3–6m; branchlets puberulous when young. Leaves thinly coriaceous, alternate or subopposite, oblong-elliptic, 8–16 x 4–7cm, shortly apiculate, base rounded, margin serrulate, with tufts of hair in vein axils beneath, otherwise glabrous; petioles 1–1.5cm; stipules minute, early caducous. Flowers greenish, numerous in branched terminal and axillary racemes (forming a

sparsely leafy panicle), 3–7cm; peduncles puberulous; pedicels 1–2mm. Calyx lobes 5, triangular, c 1.5mm. Petals 5, spatulate, 0.4–0.8mm, inconspicuous. Ovary rounded; style columnar, deeply 3-fid. Drupes subglobose, c 5mm diameter, red, ripening black, 2–3-lobed, with sublateral styler remains and subtended by persistent calyx cup, 2- or 3-seeded.

Bhutan: S – Samchi district (117) and Phuntsholing district, C – Punakha and Mongar districts, N – Upper Mo Chu district; **Darjeeling:** Kalimpong and Darjeeling. In scrub and secondary subtropical and Warm broad-leaved forest, 660–1800m. July – September.

2. *R. purpureus* Edgeworth

Similar to *R. napalensis* but an erect shrub or small tree; leaves membranous, elliptic-obovate, cuneate at base; flowers 3–6 in axillary fascicles; petals absent; drupes c 7mm, 3(-4)-lobed.

Darjeeling: Ramam to Phallut (69). 2400–3500m. May – July.

This record requires confirmation; otherwise known from NW Himalaya to central Nepal.

3. *R. virgatus* Roxb.; *R. dahuricus* sensu F.B.I. non Pallas

Erect shrub 1–4m; branchlets pubescent when young, ending in terminal spine. Leaves \pm clustered on short lateral shoots (later in year some subopposite on elongated shoots), ovate or elliptic, 1–5(-8) x 0.5–3cm, shortly acuminate, base cuneate, margin serrulate, pubescent on both surfaces, especially on veins beneath; petioles 2–10mm; stipules linear, 3–6mm, bases persistent. Flowers numerous, in axillary fascicles condensed on short leafy lateral shoots, pale yellow-green. Calyx lobes ovate, c 2.5mm. Petals spatulate, 1mm. Style deeply 2(-3)-fid. Drupes obovoid, c 8mm diameter, black when ripe, 2(-3)-seeded.

Bhutan: C – Thimphu district (Thimphu Chu valley) and Mongar district (Lhuntsi Dzong), N – Upper Mo Chu district (Gasa); **Darjeeling:** (34); **Sikkim:** Lachen. Amongst scrub in dry Blue Pine and Oak/Spruce forests, 1800–2700m. April – May.

Used for firewood; fruit used medicinally (48).

4. *R. procumbens* Edgeworth

Similar to *R. virgatus* but a low or prostrate unarmed shrub; leaves rigid, coriaceous, glossy, 1.5–4.5(-6) x 0.7–1.5(-2)cm, usually glabrous; stipules usually persistent; flowers 1 or 2 per axil, \pm distant; petals absent; style deeply 3(-4)-fid; drupes subglobose, 3-seeded.

Bhutan: S – Deothang district (near Deothang), C – Punakha district (Samtengang to Chusom, 71). 1500–2100m. May – July.

The Griffith collection from Deothang is doubtfully referred to this species; it appears to be a larger shrub with longer, less glossy leaves.

5. HOVENIA Thunberg

Deciduous trees, unarmed. Leaves alternate, borne in one plane, 3-veined at base. Flowers in axillary and terminal dichotomous cymes, bisexual, 5-merous. Ovary immersed in flat hairy disc, 3-celled; style deeply 3-lobed. Fruit indehiscent, leathery, 3-celled, 3-seeded, borne on thickened fleshy branched peduncles.

I. *H. acerba* Lindley; *H. dulcis* auct. non Thunberg, *H. dulcis* Thunberg var. *acerba* (Lindley) Sengupta & Safui. Dz: *Ruto Shing*, *Pumolota*; Nep: *Bangikath* (34), *Bunge Kat*. Fig. 18k - m.

Small to large deciduous tree 10 - 25m; branchlets pubescent, becoming glabrous. Leaves ovate or broadly ovate, 9-15 x 4-10cm, acuminate, base rounded or truncate often obliquely, margin sharply serrate, 3-veined at base, pubescent on veins beneath or glabrous; petiole 1.2 - 2cm; stipules minute, early caducous. Cymes terminal and in many upper leaf axils, 2 - 4cm diameter; peduncles pubescent, 1 - 4cm. Calyx lobes reflexed, triangular, c 1.5mm. Petals equalling sepals, concave, spatulate, spreading and enclosing stamens. Style c 1.5mm, 3-lobed to middle. Fruit globose, 5 - 6mm, borne on swollen fleshy branched peduncles.

Bhutan: S - Samchi district (Chamarchi valley) and Deothang district (Deothang), N - Upper Mo Chu district (Kenchu); **Darjeeling:** foothills, Rungit and Tista valleys, Mongpu, etc. Subtropical and Warm broad-leaved forests, 240 - 1830m. May - June.

Apparently native; formerly confused with the Chinese and Japanese *H. dulcis* Thunberg, which is widely cultivated for its edible peduncles. No specimens of the latter have been located from the E Himalaya, nor has evidence been seen that *H. acerba* is eaten or cultivated.

6. SAGERETIA Brongniart

Shrub, sometimes spiny, often climbing, with long slender spreading branches. Leaves opposite or subopposite, pinnately veined. Flowers minute, in sessile clusters in terminal spicately-branched panicles, bisexual, 5-merous. Disc cup-shaped, 5-lobed. Ovary immersed in disc but free from it, 3-celled; style short, stout, with 3 capitate stigmas. Fruit indehiscent, leathery, 3-celled, 3-seeded.

I. *S. filiformis* (Roth) G. Don; *S. parviflora* (Willdenow) G. Don, *S. oppositifolia* (Wall.) Brongniart

Climbing shrub with long arching slender shoots and axillary spines on main stems; branchlets softly pubescent. Leaves rigid, ovate or ovate-lanceolate, 5 - 10 x 2.3 - 5.5cm, acuminate, base rounded or weakly cordate, margin serrulate, villous when young becoming almost glabrous, glossy above, lateral veins 5 - 7 pairs, prominent beneath; petioles 5 - 13mm; stipules linear, 1 - 2mm, subpersistent. Flowers in small sessile clusters, in terminal spreading leafy panicles 15 - 50cm

long, spicately branched; peduncle and branches villous. Calyx lobes triangular, c 1.3mm, villous outside. Petals spatulate, c 0.8mm. Style short, stout, shallowly 3-lobed. Fruit globose, 7mm, green becoming crimson.

Bhutan: C – Punakha district (Chuzomsa, Tang Chu valley). Warm broad-leaved forest, on river bank, 1400 – 1700m. September – November.

Fruit edible (17).

7. GOUANIA Jacquin

Climbing shrubs, unarmed, tendrillar. Leaves alternate, pinnately veined. Flowers in slender axillary racemes often aggregated into terminal panicles, bisexual, 5-merous. Disc large, on outer margin bearing 5 stamens and 5 staminode-like lobes. Ovary inferior, immersed in disc, 3-celled; style 3-fid. Fruit a 3-winged capsule, dehiscing into 1-seeded mericarps, each bearing part of calyx remains at apex.

1. Leaves coarsely crenate; calyx with a few hairs externally; disc lobes triangular; capsules with glabrous remains of calyx **1. G. leptostachya**
- + Leaves finely serrate or crenate-serrate; calyx densely appressed pubescent externally; disc lobes linear; capsules with pubescent remains of calyx

2. G. napalensis

1. G. leptostachya DC. Nep: *Bainshi Khanra*, *Pat Pate*. Fig. 18n – r.

Extensive climber with stout tendrils borne at base of racemes; stems glabrous. Leaves membranous, ovate, 7 – 12 x 3 – 8cm, acuminate, base cordate to almost truncate, margins coarsely crenate, sparsely pubescent on veins beneath; petioles 1.5 – 3.5cm, glandular at apex; stipules lanceolate, 6 – 7mm, caducous. Racemes slender, 15 – 45cm, often forming terminal panicles, pubescent. Flowers whitish, borne in clusters on short pedicels c 1mm. Calyx lobes ovate, c 1.5mm, with only a few hairs on outside. Petals spatulate, 1.5mm. Disc-lobes triangular. Style divided 1/4 – 1/3. Capsules glabrous, 1.5 x 2cm, bearing glabrous remains of calyx.

Bhutan: S – Phuntsholing, Sarbhag, Gaylegphug and Deothang districts; **Darjeeling:** terai and Tista valley. In scrub and secondary subtropical forests, 150 – 1000m. June – July.

Leaves used to make poultices for sores (34).

2. G. napalensis Wall.

Similar to *G. leptostachya* but leaves often larger, 8 – 15 x 4 – 12cm, margins finely serrate or crenate-serrate, more pubescent beneath; stipules 7 – 10mm; calyx lobes densely pale appressed pubescent outside; lobes of disc linear; style divided to 1/2; mericarps often pubescent at apex and bearing pubescent remains of calyx.

Bhutan: S – Deothang district (N of Samdrup Jongkhar), C – Punakha district (Tinlegang to Gon Chungnang), Tongsa district (Mangde Chu valley) and Tashigang district (Dangme Chu); **Darjeeling:** Kurseong, Lopchu, Sureil, Pedong, Dumsong etc. Margins of warm broad-leaved forests, 1200 – 2100m. June – July.

Family 109. VITACEAE

by D.G. Long & S.J. Rae

Climbing shrubs with tendrils, or rarely an erect herb without tendrils; tendrils leaf-opposed, sometimes also borne on peduncles, simple or dichotomously (rarely radiately) branched. Leaves alternate, simple or compound; when simple, palmately veined and often palmately lobed; when compound, trifoliolate, or digitately or pedately 4–7-foliolate; stipules present, often small. Flowers bisexual or unisexual, actinomorphic, in leaf-opposed or pseudo-axillary cymes, these umbellately, racemously or paniculately branched. Calyx cup-shaped, 4- or 5-lobed or almost entire. Petals 4 or 5, free or united at tips, caducous, sometimes shed together as a cap. Stamens 4 or 5, opposite petals; anthers free or connate. Disc lobed or entire, free or variously connate with other floral parts. Ovary superior, 2–6-celled, each cell with 2 ovules; style short; stigma discoid or 4-lobed. Fruit a berry.

1. Leaves simple (but often lobed) 2
+ Leaves compound 5
2. Tendrils usually twice bifid, never borne on peduncles; flowers 4-merous; style elongate **5. Cissus**
+ Tendrils once-bifid, or with one branch again bifid, often borne on peduncles; flowers 5-merous; style very short or absent 3
3. Flowers in rounded cymes; petals free and spreading at anthesis
2. Ampelocissus
+ Flowers in panicles; petals free and spreading or united and shed as a cap at anthesis 4
4. Stems, petioles and peduncles never softly glandular-bristly; petals united at apex and shed as a cap at anthesis **1. Vitis**
+ Stems, petioles and peduncles softly glandular-bristly; petals free at apex and spreading at anthesis **2. Ampelocissus (A. barbata)**
5. Leaves trifoliolate 6
+ Leaves palmately or pedately 4–7-foliolate 9
6. Young stems whitish woolly; lateral leaflets often lobed; peduncles usually bearing a tendril; flowers 5-merous **2. Ampelocissus (A. divaricatus)**
+ Stems glabrous or pubescent but never whitish woolly; lateral leaflets unlobed; peduncles without tendril; flowers 4- or 5-merous 7

7. Tendrils 2–3 x bifid, branches ending in disc-like pads; flowers in terminal and leaf-opposed cymes, 5-merous; style stout, shortly columnar
3. Parthenocissus
- + Tendrils simple or 1 – 2 x bifid, but branches not ending in disc-like pads; flowers in axillary or pseudo-axillary cymes, 4-merous; style absent or elongate and slender 8
8. Tendrils simple; leaves glabrous beneath; stigma conspicuously 4-lobed or disc-like, sessile on ovary **4. Tetrastigma**
- + Tendrils 1 – 2 x bifid; leaves softly villous beneath; stigma minute on slender elongate style **7. Cayratia (C. geniculata)**
9. Leaves palmately compound; berry 1 – 2-seeded 10
- + Leaves pedately compound; berry 2 – 4-seeded 12
10. Tendrils simple or radiately branched; style absent or very short
4. Tetrastigma
- + Tendrils 1 – 2 x bifid; style elongate 11
11. Young stems, petioles, inflorescences and leaves glabrous or almost so; leaflet margins sharply serrulate; cymes leaf-opposed; berry 2 – 2.5cm; seed c 16 x 10mm **5. Cissus (C. elongata)**
- + Young stems, petioles, inflorescences and leaves (beneath) softly pubescent; leaflet margins crenate; cymes pseudo-axillary or terminal; berry c 1.5cm diameter; seed c 8 x 6mm **6. Cyphostemma**
12. Tendrils simple or bifid; flowers functionally unisexual; stigma broadly 4-lobed on short thick style or subsessile **4. Tetrastigma**
- + Tendrils 1 – 2 x bifid; flowers bisexual; stigma minute on slender elongate style
7. Cayratia (C. japonica)

1. VITIS L.

Climbers, tendrils bifid, borne opposite leaves and often also on peduncles. Leaves simple, usually lobed; stipules minute. Flowers in condensed, leaf-opposed panicles, unisexual or bisexual, 5-merous. Calyx minute, cup-shaped, not or

FIG. 19. Vitaceae and Leeaceae. Vitaceae. a – d, *Vitis heyneana*: a, part of flowering shoot; b, bud; c, petals; d, male flower after anthesis. e & f, *Ampelocissus divaricata*: e, part of flowering shoot; f, flower with two petals removed. g, *Tetrastigma obtectum*: tendril. h & i, *Tetrastigma rumicispermum*: h, part of flowering shoot; i, female flower with one petal and one staminode removed. j & k, *Cissus repanda*: j, portion of shoot and inflorescence; k, fruit. Leeaceae. l – o, *Leea aequata*: l, shoot and inflorescence; m, peltate glands on leaf underside; n, flower; o, stamens removed from staminodal tube. Scale: l x $\frac{1}{3}$; h x $\frac{1}{3}$; j x $\frac{1}{2}$; a, e x $\frac{2}{3}$; g x $1\frac{1}{3}$; k x 2; m x 6; b, c, d, n x 8; f, i x 12; o x 14. Drawn by M. Bates.



minutely lobed. Petals united at apex, at anthesis shed as a cap. Disc 5-lobed, united to base of ovary. Ovary 2-celled; style very short or absent; stigma discoid. Berry 2 – 4-seeded.

1. Leaves broadly ovate, unlobed or with 2 shallow lateral lobes; margins shallowly serrate; berry 6 – 8mm; native **1. V. heyneana**
- + Leaves suborbicular, shallowly to deeply 3 or 5-lobed; margins coarsely and irregularly dentate; berry 15 – 25mm; cultivated **2. V. vinifera**

1. V. heyneana Roemer & Schultes; *V. lanata* Roxb. Fig. 19a – d.

Stems woolly red-brown tomentose when young, rarely becoming glabrous; tendrils commonly borne on stems and peduncles. Leaves broadly ovate, 6 – 20 x 5 – 17cm, unlobed or with 2 shallow lateral lobes, apex shortly acuminate, base shallowly to deeply cordate; thinly brownish tomentose above, becoming glabrous, densely to thinly tomentose beneath; petioles 3 – 8cm; stipules membranous, ovate, 5 – 6mm, not persistent. Flowers functionally unisexual, in short dense panicles 3 – 8 x 2 – 3cm, borne on short peduncle 0.5 – 3cm. Calyx minute, c 0.3mm. Petals c 1.5mm. Berry globose, blackish, 6 – 8mm diameter, 2 – 4-seeded.

Bhutan: C – Thimphu district (Taba, Dotena etc) and Punakha district (Tamji and between Mishichen and Khosa); **Sikkim:** Tista Valley, Chumbati and Terai. On shrubs in dry valleys with Blue Pine, 200 – 2400m. May – June.

Stems and leaves variable in hairiness; those almost glabrous have been distinguished as *V. lanata* Roxb. var. *glabra* Lawson. Formerly confused with *Ampelocissus rugosa* which is found at lower altitudes, has larger leaves and bears flowers in corymbose cymes.

2. V. vinifera L. Eng: *Grape Vine*.

Similar to *V. heyneana* but stems and leaves whitish tomentose when young; tendrils rarely borne on peduncles; leaves suborbicular, shallowly to deeply 3- or 5-lobed, 6 – 14 x 6 – 13cm, base deeply cordate, margins coarsely and irregularly dentate; panicles up to 15 x 6cm in flower; berries up to 2.5 x 2cm, green or blackish purple.

Darjeeling: occasionally cultivated in terai and foothills (34).

An important crop plant; berries used in fermentation of wine, eaten as a fresh fruit and dried to produce raisins.

2. AMPELOCISSUS Planchon

Climbers, tendrils bifid or with one branch again bifid, borne opposite leaves and on peduncles. Leaves simple, often shallowly lobed, or 3-foliolate; stipules minute. Flowers in rounded corymbose cymes or conical panicles borne opposite leaves, usually 5-merous, bisexual. Calyx cup-shaped, shortly lobed. Petals spreading and free at apex at anthesis. Disc annular, united with lower part of ovary. Ovary 2-celled; style short, conical, stigma minute. Berry 2 – 3-seeded.

1. Leaves mostly 3-foliolate 1. **A. divaricata**
 + Leaves simple but often shallowly lobed 2
2. Stems, petioles and peduncles softly glandular-bristly; flowers in panicles 2. **A. barbata**
 + Stems, petioles and peduncles glabrous to tomentose but never glandular-bristly; flowers in rounded cymes 3
3. Leaves often shallowly 5 – 7-lobed, softly red-brown tomentose beneath, becoming pubescent or almost glabrous, rugose above 3. **A. rugosa**
 + Leaves unlobed, glabrous, smooth above 4. **A. sikkimensis**

1. **A. divaricata** (Lawson) Planchon; *Vitis divaricata* Lawson. Sha: *Chungru*, *Phrogpa Laga*. Fig. 19e&f.

Stems red, covered in white woolly tomentum when young. Leaves trifoliolate, sometimes simple and lobed; petioles red, 3 – 12cm, woolly tomentose. Terminal leaflet lanceolate to ovate, 9 – 25 x 3.5 – 12cm, acuminate, base rounded (cordate on simple leaves), margin serrate and often shallowly lobed, sparsely to densely whitish woolly tomentose beneath; lateral leaflets asymmetric at base. Flowers in reddish rounded branched cymes 5 – 8cm diameter. Calyx shortly lobed. Petals red, c 1mm. Berry globose, c 1cm diameter.

Bhutan: C – Punakha district (Wangdu Phodrang), Mongar district (Kuru Chu valley) and Tashigang district (Tashigang). Climbing on shrubs and rocks in dry valleys and Chir Pine forest, 1300 – 1740m. May – July.

2. **A. barbata** (Wall.) Planchon; *Vitis barbata* Wall. Nep: *Jarila Lahara* (34).

Stems stout, conspicuously softly glandular-bristly; tendrils glandular-bristly. Leaves simple, unlobed or shallowly 3 – 5-lobed, broadly ovate, 15 – 27 x 12 – 22cm, acuminate, base deeply cordate, margin irregularly shallowly dentate, 7-veined at base, glabrous above, softly tomentose beneath at least on veins; petioles 5 – 16cm, glandular-bristly. Flowers whitish or yellowish green in panicles 9 – 12cm diameter on bristly peduncle. Calyx cup-shaped, shallowly lobed. Petals 1.5 – 2mm. Berry black, globose, c 1cm diameter.

Bhutan: S – Phuntsholing district (Phuntsholing); **Darjeeling:** foothills and terai, e.g. Siliguri, Rungit Valley. Subtropical and terai forests, 600 – 900m. May – June.

3. **A. rugosa** (Wall.) Planchon; *A. nervosa* (Lawson) Planchon, *Vitis nervosa* Lawson, *V. rugosa* Wall.

Similar to *A. barbata* but stems red-brown tomentose and without bristles, becoming glabrous; leaves larger 13 – 35 x 10 – 30cm, apex subacute or acute, rugose above, softly red-brown tomentose beneath becoming pubescent or almost glabrous; petioles without bristles; flowers in corymbose cymes 3 – 10cm diameter; peduncle not bristly.

Bhutan: S – Chukka district (Raidak Valley), C – Mongar district (Lhuntse); **Darjeeling:** Tista Valley. Warm broad-leaved forests, 1200 – 1500m. April – July.

4. A. sikkimensis (Lawson) Planchon; *Vitis sikkimensis* Lawson

Similar to *A. barbata* and *A. rugosa* but whole plant glabrous; leaves shortly and abruptly acuminate, margin shallowly denticulate; flowers in dense subumbellate cymes 3 – 5cm diameter.

Darjeeling: Rangbe, Kalimpong, Darjeeling. Subtropical forests, 600 – 1500m. July – October.

Used by Lepchas as a treatment for foot and mouth disease in cattle.

3. PARTHENOCISSUS Planchon

Climber; tendrils borne opposite leaves, never on peduncles, 2 – 3 x bifid, branch tips swollen into a cup. Leaves 3-foliolate, deciduous; stipules membranous, early deciduous. Flowers in terminal and leaf-opposed cymes, bisexual or functionally unisexual, (4 –)5-merous. Calyx cup-shaped, unlobed. Petals spreading at anthesis. Disc united to base of ovary, but distinct from it in colour and texture. Ovary 2-celled; style simple, short, stout, with small discoid stigma. Berry usually 2-seeded.

1. P. semicordata (Roxb.) Planchon; *Vitis semicordata* Roxb., *Vitis himalayana* (Royle) Brandis var. *semicordata* (Roxb.) Lawson. Sha: *Kho-soo-ba-roo*; Tongsa: *Lasum*; Nep: *Charchare* (34).

Large deciduous climbing shrub; stems pubescent or glabrous. Leaves 3-foliolate; petioles 2.5 – 12cm, pubescent or glabrous; stipules ovate-lanceolate, 7 – 10mm. Terminal leaflets elliptic-obovate, 5 – 14 x 3.5 – 8cm, acuminate, base cuneate, margins serrulate, serrate or crenate, pubescent beneath or glabrous; lateral leaflets similar but strongly asymmetrically cordate at base. Flowers (4 –)5-merous in terminal cymes on lateral branches, 3 – 7cm diameter; peduncle 1 – 3cm, pubescent. Calyx 0.5mm, cup-shaped, glabrous. Petals 2.2mm, glabrous. Style stout, columnar. Berry purplish c 7mm, obovoid, globose, 2-seeded.

Bhutan: S – Chukka district, C – Thimphu, Punakha and Tongsa districts, N – Upper Mo Chu district; **Darjeeling:** **Chumbi.** Climbing on rocks and shrubs on river banks in Blue Pine and *Quercus semecarpifolia* forests, 1370 – 2560m. May – July.

The above description and records apply to the common var. *semicordata*. Two collections from Punakha district (Wangdu Phodrang) and others from Darjeeling, refer to var. *roylei* (Parker) Raizada & Saxena (*Parthenocissus himalayana* (Royle) Planchon, *Vitis himalayana* (Royle) Brandis) which differs from var. *semicordata* in its glabrous stems, petioles and cymes.

Leaves turn bright red in autumn before being shed.

4. TETRASTIGMA (Miquel) Planchon

Climbers; stems and branches usually borne in one plane; tendrils simple, bifid or radiately branched and then bearing swollen pads, borne opposite leaves, never borne on peduncle. Leaves 3-foliolate or pedately or digitately 5 – 7-foliolate. Flowers in pseudo-axillary cymes, often umbellately branched, unisexual or bisexual, 4-merous. Calyx minute, cup-shaped. Petals tapering to a thickened or subulate point, free and spreading at anthesis. Disc united to base of ovary. Ovary 2-celled; style short or absent, stigma swollen into 4 lobes, rarely disc-like. Berry 1 – 4-seeded, bearing \pm conspicuous remains of disc.

- | | |
|--|----------------------------|
| 1. Leaves all 3-foliolate | 2 |
| + At least some leaves 4 – 7-foliolate | 4 |
| 2. Leaflets coriaceous, subentire or with minute teeth at vein ends; petals blunt at apex; berry ellipsoid | 8. T. campylocarpum |
| + Leaflets membranous, serrate or serrulate; petals produced into subulate point; berry globose | 3 |
| 3. Stems often pubescent; leaflets ovate or elliptic, 3.5 – 9cm broad; cymes lax, 3 – 7cm diameter | 1. T. bracteolatum |
| + Stems glabrous; leaflets lanceolate, 2.5 – 5cm broad; cymes compact 2 – 4.5cm broad | 2. T. dubium |
| 4. Leaves pedately divided | 5 |
| + Leaves digitately divided | 10 |
| 5. Slender climber with bifid tendrils; leaflets small, 2 – 10 x 1 – 3cm | 4. T. serrulatum |
| + Robust climbers with simple or bifid tendrils; leaflets large, 6 – 20 x 2 – 8.5cm | 6 |
| 6. Leaflets obovate or broadly oblanceolate; leaflet serration reduced to subulate vein tips; cymes rounded, 4 – 10cm diameter | 5. T. rumicispermum |
| + Leaflets lanceolate, elliptic or sometimes oblanceolate, distinctly serrate; cymes rounded, 2 – 7cm, or corymbose to paniculate, 8 – 15cm diameter . | 7 |
| 7. Cymes lax, corymbose or paniculate, 8 – 15cm diameter | 8 |
| + Cymes compact, rounded, 2 – 7cm diameter | 9 |
| 8. Cymes corymbose, glabrous; leaves thinly coriaceous, marginal serrations numerous | 6. T. corymbosum |
| + Cymes \pm paniculately arranged, puberulous; leaves thickly coriaceous, serrations few, distant | 7. T. aplinianum |

9. Leaflets lanceolate, 6 – 14 x 2.5 – 5cm; petals with subulate point
 2. **T. dubium**
- + Leaflets elliptic or narrowly ovate, 10 – 20 x 4 – 8.5cm; petals with short blunt point 3. **T. leucostaphylum**
10. Stems and petioles pubescent; tendrils radiately branched; leaflets small, 5.5 – 10 x 2.5 – 4cm 10. **T. obtectum**
- + Stems and petioles glabrous; tendrils simple; leaflets large, 8 – 20 x 2.5 – 8cm
11. Leaflets subentire or remotely denticulate, coriaceous; stigma disc-like; berry ellipsoid, 1-seeded 8. **T. campylocarpum**
- + Leaflets serrate, membranous or subcoriaceous; stigma 4-lobed; berry globose, 2-seeded 9. **T. planicaule**

11

1. T. bracteolatum (Wall.) Planchon; *Vitis bracteolata* Wall. Nep: *Lahara Bilauney*.

Large climber; stems smooth, puberulous becoming glabrous; tendrils simple. Leaves trifoliolate; petioles 4 – 12cm; stipules caducous. Leaflets membranous, ovate or elliptic, 7 – 17 x 3.5 – 9cm, acuminate, base rounded, margins distantly and shallowly serrate, glabrous or puberulous on veins beneath. Flowers in lax minutely puberulous cymes 3 – 7cm diameter; peduncle 3.5cm, puberulous. Sepals 0.3mm, ovate. Petals c 1mm, produced into slender subulate point. Style 0; stigma 4-lobed. Berry 1cm diameter, subglobose, (1 –)2-seeded.

Bhutan: S – Deothang district (Diu Ri valley), C – Tongsa district (Wangde Khola below Shamgong); **Darjeeling:** common in foothills and terai; **Assam Duars:** Hazareegong S of Deothang. Subtropical, warm broad leaved and terai forests, 300 – 1700m. August – October, rarely spring.

Distinct in its puberulous stems, trifoliolate leaves and subulate-pointed petals.

2. T. dubium (Lawson) Planchon; *Vitis dubia* Lawson

Closely allied to *T. bracteolatum* but stems glabrous; leaves pedately 5-foliolate or 3-foliolate; leaflets lanceolate 2.5 – 5cm broad; cymes compact, glabrous or sparsely pubescent, 2 – 4.5cm diameter.

Bhutan: S – Samchi district (Khagra Valley near Gokti); **Darjeeling:** Tista Valley, Rongbe and terai. Subtropical and terai forests, 250 – 900m. February – April.

Plants commonly bear both 3-foliolate and 5-foliolate leaves which are variable in depth of leaf serration. Some plants are difficult to distinguish from *T. bracteolatum*.

3. T. leucostaphylum (Dennstedt) Mabblerley; *T. lanceolarium* (Roxb.) Planchon, *T. hookeri* (Lawson) Planchon, *Cissus leucostaphyla* Dennstedt, *C. lanceolaria* Roxb., *Vitis hookeri* Lawson. Nep: *Bherseri* (34), *Tsar Tsare Lahara*.

Large climbing shrub with very stout stems; branches smooth or with few, scattered lenticels, glabrous, flattened when older; tendrils simple. Leaves thinly

coriaceous, pedately 5-foliolate; petiole stout, 4 – 11cm, swollen at base; stipules caducous. Leaflets elliptic or narrowly ovate, 10 – 20 x 4 – 8.5cm, acuminate, base cuneate, margins distantly serrate, glabrous on both surfaces. Dioecious; flowers creamy or pale green in rounded, umbellately-branched, puberulous cymes 2.5 – 7cm diameter; peduncle 1 – 4cm. Calyx minute. Corolla flask-shaped in bud; petals 1.5 – 2mm, puberulous, with short blunt thickened point. Berries globose, 1 – 2cm diameter, 1 – 4-seeded.

Bhutan: S – Chukka, Sarbhag and Gaylegphug districts, C – Tongsa district; **Darjeeling:** Tista Valley, Tonda, Chunbati, Rieng, etc. Subtropical forests and on river banks in terai forests, 260 – 1400m. March – May.

Differs from *T. bracteolatum* in its consistently 5-foliolate more leathery leaves, its spring flowering and bluntly pointed petals; from *T. dubium* it differs in its much more robust habit, larger more leathery leaflets and petals shortly and bluntly pointed.

4. T. serrulatum (Roxb.) Planchon; *T. affine* (Osmaston) Raizada & Saxena, *T. indicum* Maulik, *Cissus serrulata* Roxb., *Vitis capreolata* D. Don. Dz: *Om Robji*; Nep: *Charchare*.

Evergreen climbing shrub; stems red, glabrous, smooth, sometimes rooting at nodes; tendrils bifid. Leaves pedately 5-foliolate; petioles 2 – 5.5cm; stipules triangular, 3 – 4mm, subpersistent. Leaflets lanceolate, elliptic or obovate, 2 – 10 x 1 – 3cm, subacute to acuminate, base cuneate, margin shallowly crenate but with lateral veins produced as short sharp teeth between crenations, glabrous on both surfaces. Flowers pale green in rounded, glabrous or pubescent, lax, umbellately-branched cymes 3 – 7cm diameter; peduncle red, 3 – 7cm. Calyx minute. Petals c 1.5mm with short blunt point. Style very short. Berry globose, c 8mm diameter, red, ripening black or purple, 1 – 2-seeded.

Bhutan: S – Samchi, Phuntsholing, Chukka, Sarbhag and Gaylegphug districts, C – Punakha and Tongsa districts; **Darjeeling.** Subtropical forests (rarely), warm broad-leaved, cool broad-leaved and (most commonly) evergreen oak forests, 550 – 2420m. May – October.

A variable species sometimes subdivided into narrower species largely on the basis of leaf shape, but intermediates appear to be frequent. In fact, plants occur which bear a range of leaflet shapes from narrowly lanceolate and acuminate to obovate and subacute. Larger forms resemble *T. rumicispermum* but lack warted stems.

5. T. rumicispermum (Lawson) Planchon; *Vitis rumicisperma* Lawson. Fig. 19h&i.

Large climber; stems glabrous, older stems coarsely warted; tendrils bifid. Leaves pedately 5 – 7-foliolate; petioles 4 – 10cm; stipules caducous. Leaflets membranous, broadly oblanceolate to obovate, 7 – 14 x 3 – 6cm, acuminate, base attenuate, margin serrulate with vein tips projecting as small spreading teeth, glabrous on both surfaces. Flowers greenish white in lax compound, puberulous

cymes 4 – 10cm diameter; peduncle 2 – 6cm. Calyx minute. Petals 1 – 2mm, tapering to thickened blunt point. Berry obovoid c 1cm diameter, angled when dry, 1 – 4-seeded.

Bhutan: S – Phuntsholing, Chukka and Gaylegphug districts, C – Punakha, Tongsa and Mongar districts; **Darjeeling:** Kurseong, Darjeeling, Kalimpong, etc.; **Sikkim:** Yoksam. Warm broad-leaved forests, 900 – 2100m. April – June.

Fruit edible (17). A variable species distinguished by its warty stems, obovate or broadly oblanceolate leaflets with small spreading teeth, and large compound puberulous cymes.

6. *T. corymbosum* Long

Similar to *T. rumicispermum* but plants glabrous throughout; leaflets thinly coriaceous, elliptic – oblanceolate, margins sharply serrate; cymes large, 6 – 12cm diameter, corymbose, borne on somewhat fleshy peduncle 3 – 9cm; style short, thick.

Bhutan: C – Mongar district (Zimgang); **Darjeeling:** Dumsong and Chumbati. Warm broad-leaved forest, 910 – 1830m. June – July.

7. *T. aplinianum* (Collett & Hemsley) Momiyama; *Vitis apliniana* Collett & Hemsley

Similar to *T. rumicispermum* and *T. corymbosum* but leaflets thickly coriaceous, elliptic, 7 – 15 x 3 – 7cm, abruptly acuminate, margins coarsely but distantly serrate; cymes puberulous, ± paniculately arranged in a compound inflorescence up to 15 x 15cm.

Bhutan: S – Chukka district (Marichong); **Sikkim/Darjeeling:** locality unknown. 1060m. July.

8. *T. campylocarpum* (Kurz) Planchon; *T. alcornae* Haines, *Vitis campylocarpa* Kurz

Large climber; stems smooth, glabrous; tendrils simple. Leaves coriaceous, trifoliolate or digitately 5-foliolate; petioles 5 – 7cm; stipules caducous. Leaflets elliptic-obovate, 8 – 15 x 2.5 – 8cm, abruptly acuminate, base cuneate, margins subentire or remotely denticulate with short teeth at vein ends, glabrous. Flowers in diffuse widely branching puberulous cymes 3 – 10cm diameter; peduncle 1 – 5cm. Calyx cup-shaped, 0.4mm, subentire. Petals oblong, 1mm, apex blunt. Style absent; stigma disc-like. Berry ellipsoid, 14 x 9mm, 1-seeded.

Bhutan: S – Sankosh district (Balu Khola west of Phipsoo); **Darjeeling:** Mal Nadi and Great Rungit and Tista Valleys. Subtropical forests, 150 – 240m. November – December.

9. *T. planicaule* (Hook.f.) Gagnepain; *Vitis planicaulis* Hook.f., *V. neurosa* Kurz

Large climber, stems smooth, glabrous, flattened when old; tendrils simple. Leaves digitately 5-foliolate, subcoriaceous; petioles 6 – 15cm; stipules caducous. Leaflets elliptic to elliptic-lanceolate, 10 – 20 x 3 – 9cm, acuminate to apiculate,

base cuneate, margins serrate, glabrous. Flowers in puberulous cymes 4–7 (– 15)cm diameter; peduncle 1 – 7cm. Calyx cup-shaped, 0.5mm, entire. Petals 1.5mm, puberulous, apex blunt. Style absent; stigma 4-lobed. Berry globose, c 2.5cm, 2-seeded.

Darjeeling: Phedong and Darjeeling. Subtropical forests, 915 – 1200m. April – May.

A poorly-known species based on a cultivated plant grown from seed from 'Sikkim'. Some specimens from Darjeeling district have broadly elliptic, apiculate leaflets and are doubtfully referred here; they have sometimes been (wrongly) identified as *T. obovatum* (Lawson) Gagnepain from Khasia and W China which differs however in its softly tomentose stems and petioles and obovate leaflets.

10. T. obtectum (Lawson) Franchet; *Vitis obsecta* Lawson. Fig. 19g.

Creeping shrub; stems pubescent, becoming rough and warty when old; tendrils radiately branched into 7 – 10 slender branches each ending in a swollen pad. Leaves digitately 3 – 5-foliolate, membranous; stipules simple; petioles 5 – 13cm, pubescent. Leaflets obovate, 5.5 – 10 x 2.5 – 4cm, acute, base cuneate, margins serrate with small, sharp teeth at vein ends, glabrous above, pubescent beneath at least on veins. Flowers in compound, umbel-like, pubescent cymes 2 – 4cm diameter; peduncle 2cm. Calyx minute. Petals c 3mm, pinkish-white, apex blunt. Style short, stout; stigma conspicuously 4-lobed. Berry obovoid, 10 – 12mm long, 1-seeded.

Bhutan: C – Punakha district (Ratsoo, 71, 101). 2000m. April.

5. CISSUS L.

Climbers; tendrils usually twice bifid, borne opposite leaves, never borne on peduncles, rarely erect herbs without tendrils. Leaves simple or palmately 5-foliolate; stipules often conspicuous. Flowers in leaf-opposed umbellate cymes, 4-merous, bisexual or functionally unisexual. Calyx cup-shaped, shortly lobed. Corolla not constricted in bud; petals spreading at anthesis. Disc 4-lobed. Ovary 2-celled; style elongate; stigma discoid, minute. Berry 1 (– 2)-seeded.

- | | |
|--|--------------------------|
| 1. Leaves palmately 5-foliolate | 7. C. elongata |
| + Leaves simple | 2 |
| 2. Small erect perennial herb to 60cm; tendrils absent; leaves 14 – 30cm broad | 6. C. spectabilis |
| + Large climbing shrubs usually over 1m; tendrils present; leaves rarely over 15cm broad | 3 |
| 3. Leaves ovate-lanceolate, 3 – 6cm broad, blotched white on upper surface | 1. C. javana |
| + Leaves broadly ovate, 4 – 18cm broad, without blotches | 4 |

4. Young stems, leaves beneath and inflorescences densely pubescent or tomentose; calyx and petals (at least tips) hairy 5
 + Young stems and leaves glabrous, or sparsely pilose and becoming subglabrous; calyx and petals glabrous 6
5. Leaves beneath, stems, petals and cymes reddish pubescent but not tomentose; leaves broadly ovate often suborbicular **2. C. repanda**
 + Leaves beneath, stems, petioles and cymes softly red-brown tomentose; leaves ovate, often ovate-triangular **3. C. simplex**
6. Stems glabrous, glaucous; leaves glabrous beneath **4. C. repens**
 + Stems pilose when young, when older pilose only at nodes, not glaucous; leaves sparsely pilose on veins beneath **5. C. assamica**

1. C. javana DC.; *C. discolor* (Blume) Dalzell, *Vitis discolor* Blume. Nep: *Sanu Pureni* (34). Fig. 19j&k.

Branches red, long and slender, angular, glabrous or with tufts of hair at nodes. Leaves simple, lanceolate to ovate, 9 – 15 x 3 – 6cm, acuminate, base cordate or truncate, sometimes asymmetric, margins sharply serrulate, purple and glabrous beneath, above often blotched with white between veins; petioles 0.5 – 3cm; stipules broadly ovate, 2.5 – 4.5mm. Flowers yellow, in short, umbellate, leaf-opposed cymes 1.5 – 2.5cm diameter; peduncle red. Calyx almost unlobed. Petals 1.6 – 1.8mm. Style conspicuous. Berry red-purple, obovoid-globose, c 5mm diameter, 1 – 2-seeded, often with styler remains.

Darjeeling: Tista Valley, Darjeeling and foothills. Subtropical forests, 300 – 900m. June – August.

Forms with variegated leaves make very attractive plants in cultivation.

2. C. repanda Vahl; *Vitis repanda* (Vahl) Wight & Arnott, *V. rosea* Royle. Nep: *Pani Lahara* (34).

Large climber; young stems reddish pubescent, becoming glabrous when older. Leaves simple, broadly ovate, often suborbicular, 5 – 20 x 5 – 18cm, acuminate, base deeply cordate, margins serrate or serrulate, pubescent beneath when young becoming ± glabrous, glabrous above; petioles 2 – 10cm, pubescent; stipules oblong, membranous, 6mm. Flowers red, in leaf-opposed pubescent cymes 3 – 7cm diameter; peduncle pubescent, 3 – 6cm. Calyx shortly lobed, appressed-pubescent. Petals 1.5mm, pubescent at tips. Style slender, unlobed. Berry obovoid, c 10 x 6mm.

Bhutan: S – Gaylegphug district (Tatapani), C – Tongsa district (Mangde Chu valley) and Tashigang district (Gamri Chu); **Darjeeling:** Darjeeling, Tondu and Chunbati. Forest margins and scrub, dry valleys and subtropical forest, 150 – 1325m. May – June.

Water can be obtained from the stems (34).

3. *C. simplex* Blanco; *C. adnata* sensu F.B.I. p.p. non Roxb. Nep: *Charchare* (34).

Similar to *C. repanda* but whole plant softly red-brown tomentose; leaves often ovate-triangular, 6–15 x 5–13cm, base often shallowly cordate or truncate; cymes smaller, 2–3cm diameter; petals pubescent throughout; berry c 6 x 4mm.

Darjeeling: Siliguri and Jalpaiguri terai. December.

4. *C. repens* Lamarck; *C. cordata* Roxb., *Vitis repens* (Lamarck) Wight & Arnott

Similar to *C. repanda* but a weak trailing glabrous climber; stems fleshy, glaucous; leaves ovate 7–15 x 4–10cm; margins distantly serrulate; stipules rounded, thick, c 3mm; flowers greenish-white; calyx entire, glabrous; petals glabrous.

Bhutan: S – Samchi district (117) and Phuntsholing district (Phuntsholing), C – Tashigang district (117); **Darjeeling:** Tista Valley, Kalimpong, Ryang, Mongpo. On shrubs in subtropical forest, 300–1060m. July – August.

5. *C. assamica* (Lawson) Craib; *Vitis assamica* Lawson

Similar to *C. repanda* and *C. repens* but stems pilose throughout when young, becoming glabrous except at nodes, not glaucous; leaves sparsely pilose on midrib and veins beneath or glabrous; stipules ovate, 4–5mm; calyx glabrous; petals 2mm, glabrous.

Bhutan: S – Phuntsholing district (Phuntsholing); **Darjeeling:** Rongbe, Farseng, Rieng, Rishap, Siliguri. Subtropical forests, 450–1200m. June – August.

6. *C. spectabilis* (Kurz) Planchon; *Vitis spectabilis* Kurz

Perennial herb to 60cm; stems erect, thick, red-brown hirsute, without tendrils. Leaves when young erect and sheathing stem, simple, broadly ovate, 10–24 x 14–30cm, obtuse or subacute, base cordate, margins unlobed or obscurely 3–5-lobed, denticulate, red-brown hirsute beneath; petioles thick, fleshy, hirsute, on young leaves c 1cm, on older leaves 2–6cm; stipules ovate 6–8mm, membranous. Flowers in leaf opposed cymes 3–6cm diameter; peduncle 1–3cm, sparsely red-brown hirsute. Calyx green, 1mm, truncate. Petals 2mm, greenish-white, puberulous. Style slender, truncate.

Darjeeling: Kurseong, Siliguri and Dulkajhar. Terai and warm broad-leaved forests, 150–1500m. May – September.

7. *C. elongata* Roxb.; *Cayratia elongata* (Roxb.) Sussenguth, *Vitis elongata* (Roxb.) Wall. Nep: *Charchare* (34).

Large climber with succulent glabrous stems; tendrils borne opposite leaves. Leaves palmately 5-foliolate; petioles 3–16cm; stipules rounded, c 2.5mm, persistent. Leaflets membranous, elliptic or obovate-elliptic, 6–20 x 2–9cm, acuminate, base cuneate or attenuate, margin serrulate, glabrous or with a few hairs on midrib beneath. Flowers in small cymes 2–3cm diameter; peduncle 1–2cm, glabrous. Calyx cup-shaped, unlobed. Petals 1.5–2.5mm. Disc conspicuously 4-lobed. Style slender, elongate. Berry fleshy, obovoid, 2–2.5cm long; seed ellipsoid c 16x10mm.

Bhutan: S – Samchi district (117) and Phuntsholing district (71); C – Punakha district (Neptengkha) and Tashigang district (Tashi Yangtshi Chu); **Darjeeling:** Darjeeling and Dulka Jhar. Warm broad-leaved forests, 900 – 1800m. June.

6. CYPHOSTEMMA (Planchon) Alston

Climber; tendrils usually twice bifid, borne opposite leaves, never on peduncles. Leaves palmately 5-foliolate; stipules persistent. Flowers in pseudo-axillary or terminal cymes, bisexual, 4-merous. Calyx cup-shaped, subtire. Corolla cylindrical, constricted above swollen base; petals free, spreading. Disc of 4 large glands. Ovary 2-celled; style subulate, stigma minute, bifid. Berry 1-seeded; seed usually rounded at base.

1. C. auriculatum (Roxb.) Singh & Shetty; *Cayratia auriculata* (Roxb.) Gamble, *Cissus auriculata* Roxb., *Vitis auriculata* (Roxb.) Wall.

Large climber with succulent stems, pubescent when young; tendrils leaf-opposed. Leaves palmately 5-foliolate; petioles 9 – 13cm, pubescent. Leaflets ovate-elliptic, 8 – 14 x 4.5 – 8cm, acuminate, base rounded, margin crenate, pubescent beneath but only on veins above. Flowers in pseudo-axillary or terminal cymes 7 – 10cm across; peduncle pubescent. Corolla constricted in bud, pubescent, 1.5mm. Berry globose, c 1.5cm diameter, seed ellipsoid c 8 x 6mm.

Sikkim/Darjeeling: locality unknown (80). 900 – 1500m.

No E Himalayan material of this species has been seen. Superficially *C. auriculatum* seems to be closely allied to *Cissus elongata*, but differs in its crenate leaflets.

7. CAYRATIA Jussieu

Climbers; tendrils usually twice bifid, borne opposite leaves, never borne on peduncles. Leaves pedately 5-foliolate or trifoliolate; stipules thick, persistent. Flowers in pseudo-axillary cymes, 4-merous, bisexual or functionally unisexual. Calyx minute, subtire. Corolla constricted above swollen base; petals spreading at anthesis. Disc 4-lobed. Ovary 2-celled; style subulate; stigma discoid. Berry 2 – 4-seeded.

Three additional species of *Cayratia* have been recorded (34, 80) from Darjeeling district: *C. pedata* (Lamarck) Gagnepain (*Vitis pedata* (Lamarck) Wall.), *C. tenuifolia* (Wight & Arnott) Gagnepain (*Vitis tenuifolia* Wight & Arnott) and *C. trifolia* (L.) Domin (*Vitis carnosus* (Lamarck) Wall.). Most E Himalayan specimens thus identified belong to *C. japonica*.

1. Leaves pedately 5-foliolate **1. C. japonica**
+ Leaves 3-foliolate **2. C. geniculata**

1. *C. japonica* (Thunberg) Gagnepain; *Vitis mollis* Lawson, *V. japonica* Thunberg; *Vitis tenuifolia* sensu F.B.I. p.p. non Wight & Arnott

Climber with fleshy stems, pubescent when young becoming glabrous; tendrils leaf-opposed. Leaves pedately 5-foliolate; petioles 3 – 6cm, pubescent; stipules 2 – 3mm, rounded, persistent. Leaflets elliptic-ovate or obovate, 3 – 10 x 1.5 – 6cm, acute, base cuneate, margin serrate, glabrous or pubescent above, softly pubescent beneath, or pubescent only on veins beneath. Flowers white in cymose panicles 2 – 4cm diameter; peduncle 10 – 24cm, pubescent. Calyx 0.5mm, cup-shaped, subentire. Petals 1.8mm, constricted above swollen base, puberulous. Style elongate. Disc conspicuous. Berry 2 – 4-seeded.

Bhutan: S – Chukka district (Marichong) and Sarbhang district (hills above Sarbhang), C – Punakha district (Bhotokha to Rinchu); **Darjeeling:** Tista Valley, Mongpu, Siliguri, etc. Dense hot subtropical forest slopes, 200 – 1150m. March – May.

Two varieties are found in the area: var. **japonica** which is a sparsely pubescent plant, with leaves glabrous beneath except for midrib and main veins; and var. **mollis** (Lawson) Momiyama (*Vitis mollis* Lawson), a softly pubescent plant with leaves softly hairy beneath. Var. *mollis* is the more common, but both are recorded from Darjeeling and Bhutan.

2. *C. geniculata* (Blume) Gagnepain

Similar to *C. japonica* but stems distinctly striate; leaves trifoliolate; petioles 7 – 15cm; leaflets ovate-elliptic, 12 – 20 x 5 – 11cm, shortly acuminate, margin denticulate, villous beneath; berry 2-seeded.

Darjeeling: Rangpo Ghora, Singtam, Rungit Valley, Birick, etc. 300 – 1200m. May.

These collections have mostly been identified as this species by B. V. Shetty; it is a Malesian species in which the leaflets were described as oblong-lanceolate by Blume; it is possible that the Darjeeling collections represent a new distinct species, but further material is desirable.

Family 110. LEEACEAE

by D.G. Long & S.J. Rae

Large herbs, shrubs or small trees, often with herbaceous branches, neither tendrillar nor climbing. Leaves alternate, distichous, unifoliolate (simple), 3-foliolate or 1 – 2(–3)-pinnate, sometimes peltate-glandular; petiole expanded and sheathing at base; stipules large, persistent or caducous. Flowers bisexual, actinomorphic, 5-merous, in leaf-opposed corymbose cymes. Calyx campanulate, lobed. Petals free, reflexed (but cohering at apex in bud). Stamens inserted on 5-lobed staminodal tube which is adnate to corolla; filaments alternating with staminodal lobes; anthers coherent, pendent within tube at first. Ovary superior,

inserted on disc, 4 – 6-celled; ovules 1 per cell; style short, unlobed. Fruit a depressed-globose berry, usually 6-seeded.

1. LEEA L.

Description as for Leeaceae.

The Nepali name *Galení* applies to all species (34).

- | | |
|---|----------------------------|
| 1. Leaves and inflorescence glandular-scaly | 1. L. aequata |
| + Leaves and inflorescence never glandular-scaly | 2 |
| 2. Flowers red or orange-yellow | 3 |
| + Flowers green or greenish-white | 4 |
| 3. Stems and petioles terete or weakly ribbed, never winged; leaflets ovate-lanceolate, caudate-acuminate | 2. L. guineensis |
| + Stems and petioles strongly ribbed, often winged; leaflets oblong, acute | 3. L. alata |
| 4. Corymbs with persistent ovate bracts 6 – 12mm | 4. L. compactiflora |
| + Corymbs ebracteate or bracts lanceolate, up to 2mm, often caducous | 5 |
| 5. Leaves simple, broadly ovate | 7. L. macrophylla |
| + Leaves trifoliolate or 1 – 2(– 3)-pinnate | 6 |
| 6. Petioles 1.5 – 4cm; larger leaflets often cordate at base | 5. L. asiatica |
| + Petioles mostly 7 – 15cm; leaflets rounded at base | 7 |
| 7. Leaflets oblong, coarsely and bluntly crenate-serrate, glabrous... | 6. L. indica |
| + Leaflets lanceolate, shallowly and acutely serrulate, often pubescent or puberulous beneath | 7. L. macrophylla |

1. L. aequata L.; *L. hirta* Hornemann. Fig. 191 – o.

Shrub 1 – 2m, stems hairy and peltate-glandular. Leaves mostly bipinnate, 30 – 55cm; petiole 5 – 14cm; stipules conspicuous, obovate, 2 – 3cm, caducous. Leaflets elliptic-lanceolate, 10 – 18 x 3 – 6cm, acuminate, base rounded, margin irregularly and \pm coarsely serrate, (3 –)5-veined at base, peltate-glandular on both surfaces, scabrid-bristly above, hairy beneath, especially on veins. Flowers green, in compact, glandular-scaly corymbose cymes 5 – 7cm diameter; bracts triangular or ovate, 1.5 – 2.5mm, \pm persistent. Calyx cup-shaped, glabrous or with a few scales; lobes short. Fruit depressed-globose, 5 – 8mm diameter when dry, black.

Bhutan: S – Phuntsholing district (Phuntsholing, 117) and Gaylegphug district (Thewar Khola); **Darjeeling:** Sivoke, Tista and Darogadara. Subtropical forest, 300 – 600m. May – June.

2. *L. guineensis* G. Don; *L. acuminata* Clarke. Nep: *Dewani Gali*.

Shrub 1.5 – 2.5m, stems glabrous. Leaves bipinnate, up to 65cm; petioles 9 – 22cm; stipules usually broadly ovate, 2.5–3cm, caducous. Leaflets ovate-lanceolate, 9 – 22 x 3 – 9cm, caudate-acuminate, base rounded, margin coarsely serrate with \pm acute teeth, 3(5)-veined at base, upper surface with a few bristles, glabrous beneath. Flowers red or orange-yellow, in rusty-red pubescent corymbs 7 – 12cm across; bracts and bracteoles absent. Calyx cup-shaped, lobes triangular 0.5 – 0.8mm. Fruit subglobose, 1cm in diameter when dry.

Bhutan: S – Gaylegphug district (Thewar Khola); **Darjeeling:** Darjeeling, Tista Valley and Terai. Subtropical and Terai forests, 300-1300m. May – July.

3. *L. alata* Edgeworth

Similar to *L. guineensis* but stems ribbed and narrowly winged; leaves 1-pinnate, (rarely 3-foliolate); petioles 5 – 7cm, ribbed and winged; stipules oblong, 2.5 – 3.5cm; leaflets oblong, acute, margin sharply serrate, 5-veined at base; corymbs puberulous.

Darjeeling: Jalpaiguri, Dulka Jhar, Siliguri and Sukna terai. Terai forests, 150 – 200m. May – July.

Literature records from Bhutan have not been substantiated.

4. *L. compactiflora* Kurz; *L. bracteata* Clarke, *L. trifoliata* Lawson.

Small shrub with ribbed stems. Leaves 1 – 2-pinnate (rarely 3-foliolate), 40 – 50cm; petioles 9 – 15cm; stipules narrow wings 5 – 9cm long. Leaflets elliptic-lanceolate, 8 – 33 x 4 – 14cm, caudate-acuminate, base rounded, margin shallowly serrate, 3-veined at base, glabrous above, pubescent on veins beneath. Flowers greenish-white, in reddish-brown tomentose corymbs 4 – 5cm diameter; bracts ovate, 6 – 12mm, persistent. Calyx lobes c 1.2mm. Fruit orange-yellow, 7 – 10mm diameter when dry.

Bhutan: S – Chukka district (Giengo); **Darjeeling:** Tista valley, Rishap, Pomong, Terai, etc. Subtropical forest, 200 – 1050m. April – July.

5. *L. asiatica* (L.) Ridsdale; *L. crispa* L., *L. aspera* Edgeworth non G. Don, *L. edgeworthii* Santapau, *L. herbacea* Hamilton. Sha: *Boram Shing*.

Shrub 1.5 – 2m; stems ribbed and often narrowly winged. Leaves 1(–2)-pinnate, up to 40cm; petioles 1.5 – 4cm, ribbed and often winged; stipules oblong, 3 – 5 x 0.5 – 1cm. Leaflets ovate or ovate-oblong, 6 – 23 x 3 – 9cm, caudate-acuminate, base rounded or often shallowly cordate, margin coarsely serrate, 5 – 7-nerved at base, with a few bristles above, pubescent beneath at least on veins. Flowers greenish-white, in \pm puberulous corymbs 5 – 17cm diameter; bracts narrowly triangular to linear, c 2mm. Calyx cup-shaped, glabrous or puberulous, with shallow lobes c 0.2mm. Fruit purple-black when ripe, 1 – 1.2cm diameter when dry.

Bhutan: S – Phuntsholing, Gaylegphug and Deothang districts, C – Punakha and Mongar districts; **Darjeeling:** foothills and Terai. Subtropical (including Terai) and warm broad-leaved forests, 150 – 1500m. May – August.

A valuable fodder-plant.

6. *L. indica* (Burman) Merrill; *L. sambucina* Willdenow, *L. umbraculifera* Clarke

Similar to *L. asiatica* but stems unwinged (sometimes ribbed); leaves c 50 – 100cm; petioles 7 – 15cm; stipules usually broadly obovate, 2 – 2.5cm; leaflets oblong to elliptic-lanceolate, 7 – 30 x 3 – 9cm, acuminate, base rounded but never cordate, margin coarsely and bluntly crenate-serrate, 3-nerved at base, glabrous on both surfaces; flowers greenish-yellow; bracts absent; calyx campanulate, lobes triangular c 0.5 – 1mm.

Bhutan: S – Samchi district (Chepuwa Khola) and Phuntsholing district (71); **Darjeeling:** Darjeeling, Kurseong, Tista Valley and Terai. Subtropical and terai forests, 300 – 900m. June – July.

7. *L. macrophylla* Hornemann agg.; *L. aspera* G. Don non Edgeworth, *L. diffusa* Lawson, *L. robusta* Roxb. Nep: *Bulyettra* (34).

Large shrub 1 – 2m; stems ribbed, whitish mealy and often pubescent. Leaves simple, trifoliolate or 1 – 2-pinnate; petioles 5 – 22cm; stipules 2 – 6cm. Simple leaves broadly ovate, 25 – 65 x 15 – 60cm, acuminate, base rounded or cordate, margin irregularly serrate and often shallowly lobed, 5-veined at base, glabrous above, white puberulous beneath. Trifoliolate leaves: terminal leaflet ovate-elliptic, 24 – 30 x 12 – 14cm, lateral leaflets smaller, 10 – 18 x 6 – 9cm, oblique at base. Pinnate leaves: leaflets ovate-lanceolate, 10 – 17 x 3 – 8cm. Flowers greenish-white, mealy puberulous, in corymbs up to 22cm diameter; bracts lanceolate, c 2mm, cauducous. Calyx mealy puberulous, lobes 0.4mm. Fruit 10 – 15mm diameter.

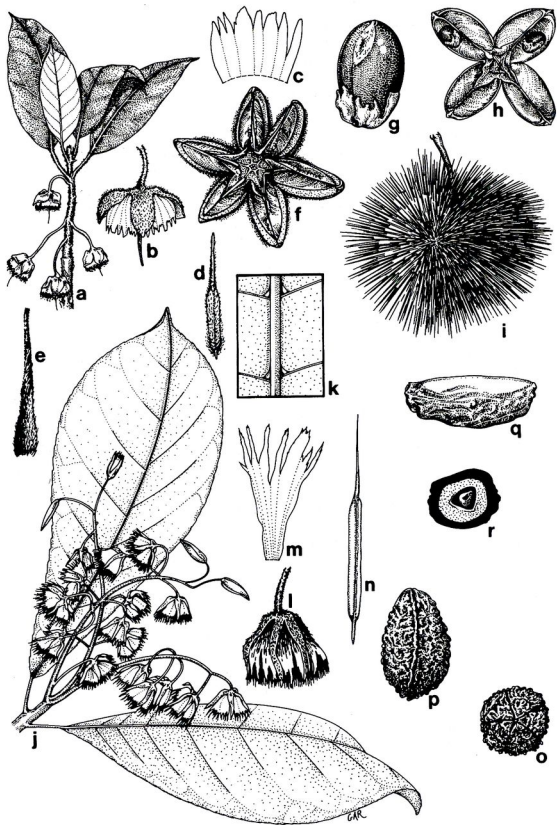
Darjeeling: Sukna and Kynanooka (simple, trifoliolate and pinnate forms). Subtropical and Sal forests, 150m. April, May, August, December.

Family 111. ELAEOCARPACEAE

by A.G. Miller

Trees. Leaves alternate, simple, pinnately veined, stipulate. Flowers axillary, in racemes, fascicles or solitary, bisexual, actinomorphic. Sepals 4 – 5, free or connate at base. Petals 4 – 5, rarely united at base, toothed or fimbriate at apex. Disc flat or rounded and lobed. Stamens 20 – many, free; anthers opening at apex by lateral or transverse slits. Ovary superior, 2 – 5-celled; 2 – 20 ovules per cell, placentation axile; style 1; stigma not distinct. Fruit a capsule or drupe; seeds arillate or not.

FIG. 20. **Elaeocarpaceae**: a – f, *Sloanea tomentosa*: a, flowering shoot; b, flower; c, dissected corolla; d, anther; e, ovary; f, dehisced capsule. g & h, *Sloanea dasycarpa*: g, undehisced capsule; h, dehisced capsule. i, *Sloanea sterculiacea*: capsule. j – n, *Elaeocarpus aristatus*: j, flowering shoot; k, glands in vein axils; l, flower; m, petal; n, stamen. o, *Elaeocarpus sphaericus*: stone. p, *Elaeocarpus lanceifolius*: stone. q & r, *Elaeocarpus sikkimensis*: q, fruit; r, t.s. fruit. Scale: a, f, j x 1/2; h, i, q, r x 3/5; o, p x 3/4; b, c, l x 1 1/2; k, m, n x 2 1/2; g x 3; d, e x 4; n x 4 1/2. Drawn by G. Rodrigues.



1. Flowers axillary, solitary or in fascicles; fruit a 3 – 5-valved, woody capsule; seeds arillate **1. Sloanea**
 + Flowers in racemes; fruit a drupe; seeds exarillate **2. Elaecarpus**

1. SLOANEA L.

Trees. Leaves weakly serrate to ± entire, frequently with tufts of hairs in axils of veins beneath; petioles swollen at apex; stipules small, linear, deciduous. Flowers axillary, solitary or in fascicles. Sepals 4(– 5), free or connate at base. Petals 4(– 5), free or rarely united at base, toothed at apex. Disc flat. Stamens numerous; anthers acute or awned, dehiscing by 2 vertical slits at apex. Ovary tomentose, (3 –)4 – 5-celled, with numerous ovules in each cell. Fruit a woody, loculicidally dehiscing capsule, (3 –)4 – 5-valved, coated with spines or bristles; seeds arillate 1 – 4 per loculus.

1. Leaves ± glabrous 2
 + Leaves tomentose beneath 3
2. Fruit densely spiny, spines 2 – 2.5cm long...**1. S. sterculiacea** var. **assamica**
 + Fruit densely covered with bristles, bristles c 2mm long **3. S. dasycarpa**
3. Fruit densely spiny, spines 2 – 2.5cm long; petioles glabrescent to minutely felted, up to 1.5mm diameter **1. S. sterculiacea** var. **sterculiacea**
 + Fruit densely covered with bristles, bristles c 2mm long; petioles densely tomentose, 1.5 – 3mm diameter **2. S. tomentosa**

1. S. sterculiacea (Bentham) Rehder & Wilson; *Echinocarpus sterculiaceous* Bentham. Nep: *Gobre* (34). Fig. 20i.

Tree to 20m. Leaves elliptic, ovate or obovate, 12–35 x 5–12cm, acute to shortly acuminate, base cuneate to rounded, glabrous or tomentose beneath; petioles 1.5 – 4cm, glabrous or minutely felted. Flowers in few-flowered fascicles; pedicels 3 – 4cm. Sepals 4, oblong-ovate, 7–9 x 4–5mm. Petals 4, creamy white, equalling or slightly exceeding sepals, shallowly toothed at apex. Anthers acute or with short awns to 1mm. Fruit ovoid, c 5.5 x 2.5cm, excluding the dense stiff spines, c 2–2.5cm long; (4 –)5-valved, with up to 4 seeds per valve.

Bhutan: S – Sarbhang district (Burborte Khola near Phipsoo); **Darjeeling:** foothills and terai. Subtropical and terai forests, 290 – 610m. February – March.

All the material from Darjeeling and one Griffith collection (without locality) from Bhutan belong to var. **sterculiacea**. Var. **assamica** (Bentham) Coode is known from Sarbhang district in Bhutan.

2. *S. tomentosa* (Benth) Rehder & Wilson; *Echinocarpus tomentosus* Benth. Dz: *Thothrum*; Nep: *Runche* (34). Fig. 20a - f.

Semi-evergreen tree 20 - 25m; young shoots brown tomentose. Leaves elliptic to obovate-elliptic, 13 - 40 x 8 - 20cm, acute to shortly acuminate, base rounded or \pm cuneate, densely tomentose beneath; petioles 2 - 4cm, densely tomentose. Flowers solitary; pedicels 2 - 3cm. Sepals 4(-5), broadly ovate, 8 - 12 x 5 - 8mm. Petals creamy-white, free or fused, 10 - 14mm, shallowly toothed or divided at apex. Anthers awned; awns 2 - 2.5mm. Fruit globose-ovoid, (4 - 5)-valved, 2.75 - 3.5cm long, densely covered with short (c 2mm) plumose, deciduous bristles.

Bhutan: C - Punakha district (Tang Chu and Rinchu) and Tongsa district (Shamgong); **Darjeeling:** Pankabari, rare. Subtropical and warm broad-leaved forests, 590 - 1680m. March - April.

3. *S. dasycarpa* (Benth) Hemsley; *Echinocarpus dasycarpus* Benth. Nep: *Gobre* (34). Fig. 20g&h.

Evergreen tree 12 - 25m. Leaves oblanceolate or obovate, 8 - 21 x 4 - 6(-9)cm, acute to acuminate, base cuneate, glabrous or with tufts of hairs in the axils of veins along midrib beneath; petioles 1 - 3cm, glabrous. Flowers solitary; pedicel 2.5 - 3cm lengthening to 8cm in fruit. Sepals 4(-5), broadly ovate, 5 - 6(-8) x 4 - 5(-7)mm. Petals cream or pale yellow, c 5(-13)mm, toothed at apex. Anthers acute, not awned. Fruit globose-ovoid, 2.5 - 3cm long, densely covered with short (c 2mm) plumose, deciduous bristles, (3 - 4)(-5)-valved, 1 seed per valve.

Bhutan: S - Gaylegphug district (Chabley Khola), C - Tongsa district (S of Shamgong); **Darjeeling:** common, Kurseong, Lopchu, Cheungthang, Rungbi, etc. Evergreen oak and warm evergreen, broad-leaved forests, 1525 - 2140m. September - November.

Wood used for house-building, tea-boxes and to make charcoal (34, 48).

2. ELAEOCARPUS L.

Trees. Leaves weakly crenate-serrate to \pm entire, often with small glands at axils of veins beneath, turning red on withering; petioles often swollen at apex. Flowers in racemes borne amongst or below the leaves. Sepals 5, free. Petals 5, fimbriate or toothed with 10 - 60 \pm linear divisions. Disc rounded, 5 or 10-lobed. Stamens 20 - many; anthers dehiscing by transverse slits at apex, prolonged or not into an awn and sometimes bearing short (c 0.5mm) bristles. Ovary 3 - 5-celled; 2 - 5 ovules per cell. Fruit a drupe; stone smooth or rugose with 1 - 5 cells; seeds without arils, 1 - 2 per cell.

1. Mature leaves obovate; sepals more than 13mm long **2. *E. aristatus***
 + Mature leaves elliptic to oblong-obovate; sepals 5 - 10mm long 2
2. Anthers awned 3
 + Anthers not awned 5

3. Petals glabrous within, not thickened or pouched at base; fruit globose, (4-)-5-celled **1. E. sphaericus**
 + Petals sericeous within, thickened or pouched at base; fruit ovoid, 1-2-celled 4
4. Leaves 12-20cm; sepals 8-10mm; anthers with awns 1-1.5mm **3. E. varunua**
 + Leaves 6-12cm; sepals 7-8mm; anthers with awns 0.3-0.5(-1)mm **4. E. prunifolius**
5. Mature leaves oblong-ovate, base rounded to cuneate, never minutely blistered; stamens 45 or more **5. E. tectorius**
 + Mature leaves elliptic to ovate, base acute, if rounded leaves minutely blistered; stamens 25-35 6
6. Petals divided in upper third only, sericeous on back, at least near base; style exerted from flower; leaves rarely minutely blistered; never glandular-punctate beneath **8. E. sikkimensis**
 + Petals divided to middle, ± glabrous on back; style included in flower; leaves minutely blistered and glandular punctate beneath 7
7. Leaves ovate to elliptic, 8-15 x 3-7cm; petiole (2.5-)-3-5cm; petals with hairs on margins only; fruit with smooth stone **6. E. floribundus**
 + Leaves narrowly elliptic, 10-18 x 2.5-5cm; petiole 1-2cm; petals hairy within; fruit with strongly rugose stone **7. E. lanceifolius**

1. E. sphaericus (Gaertner) Schumann; *E. ganitrus* Roxb. Fig. 20o.

Tree to 20m, often buttressed at base. Leaves elliptic to oblong-obovate, 10-17 x 3-5cm, acute to acuminate, base cuneate, thinly sericeous becoming glabrous, often with glands at branches of lateral veins beneath; petioles 1-1.5cm. Racemes 5-7cm, 15-20-flowered; pedicels 5-8mm. Sepals lanceolate, thinly sericeous, 6-7 x 1-1.75mm. Petals white, oblong to obtriangular, 5-8 x 2-3.5mm, pubescent on margins and at base only, divided to middle into c 12 segments. Stamens 28-35, 4-4.5mm; awn 0.5mm, with short bristles at apex. Ovary (4-)-5-celled. Fruit blue when ripe, globose, 2 x 2cm; stone (4-)-5-grooved, strongly rugose, (4-)-5-celled; cells 1-seeded.

Darjeeling: Palmajua and Darjeeling. Occasionally cultivated on plains, 2000-2200m. May-August.

Cultivated for its tubercled stones which are used to make rosary beads (34).

2. E. aristatus Roxb. Nep: *Dalchiwari* (34). Fig. 20j-n.

Tree 5-12m. Leaves crowded at ends of branches, obovate, elliptic when immature, 14-30cm, rounded or acuminate, base cuneate, glabrous, with small

glands in axils of lateral veins along midribs beneath; petioles 23cm. Racemes crowded, 5 – 12cm, c 10-flowered; pedicels 1.5 – 2cm. Sepals narrowly triangular, 13 – 15 x c 2mm, tomentose. Petals white, obtriangular, c 15 x 10mm, irregularly divided in upper third into 25 – 35 segments. Stamens c 60, c 10mm; awns c 3mm. Ovary 2-celled. Fruit ellipsoid c 3.5 x 2cm; stone rugose, somewhat compressed, 1-seeded.

Bhutan: S – Sankosh district (2km W of Pinkhua); **Darjeeling:** Tista, Sitong and the Terai. Subtropical forests, 300 – 914m. April – May.

The Darjeeling record of the doubtfully distinct *E. rugosus* Roxb. (34) is probably based on this species.

3. *E. varunua* Masters. Nep: *Bhadrase* (34).

Tree 10 – 20m. Leaves oblong-elliptic, 12 – 20 x 5 – 8cm, acuminate, base rounded or cuneate, glabrous above, thinly pubescent on veins beneath, and often with glands at branches of lateral veins towards the margin; petioles (2 –)4 – 6cm. Racemes 8 – 10cm, 10 – 15-flowered; pedicels 8 – 12mm. Sepals narrowly triangular, 8 – 10 x c 2mm, tomentose. Petals white, oblong, 8 – 10 x 3 – 3.5mm, thickened at base, densely sericeous outside, divided in upper third into c 15 segments. Stamens c 28, 5 – 7mm; awns 1 – 1.5mm. Ovary 3-celled. Fruit oblong-ovoid, 1.5 – 1.8 x 1cm; stone 3-grooved, finely rugose, 1-celled, 2-seeded.

Bhutan: S – Sarbhang district (near Phipsoo) and Gaylegphug district (NE of Surey); **Darjeeling:** Rongbi, Birick, Darjeeling, Kalimpong. Subtropical and warm broad-leaved forests, 300 – 1070m. March – May.

Leaves turn red when old.

4. *E. prunifolius* Masters

Similar to *E. varunua* but leaves smaller, 6 – 12 x 3 • 6cm, glands rarely present beneath; flowers smaller; sepals 7 – 8 x 1.5mm; petals 7 – 8 x c 2mm, distinctly pouched internally at base; anthers with shorter awns, 0.3 – 1mm long.

Darjeeling: Lal. Subtropical forests, 900 – 1220m. February.

5. *E. tectorius* (Loureiro) Poiret; *E. robustus* Roxb.

Tree to 20m. Leaves ovate-oblong, 10 – 24 x 4 – 10cm, acute to acuminate, base rounded to cuneate, ± glabrous; petioles 1 – 3cm. Racemes 6 – 16cm, 10 – 25-flowered; pedicels 6 – 8mm. Sepals lanceolate, 5 – 6 x 1.5 – 1.75mm, tomentose. Petals white, obtriangular, 5 – 6 x 4 – 5mm, hairy on margins and at base, divided to middle into 40 – 50 segments. Stamens 40 – 50, 2.5 – 3.5mm, with short bristles at apex. Ovary 3-celled. Fruit ovoid 2 – 2.5 x 1.5cm; stone 3-grooved, rugose, 2 – 3-celled, cells 1-seeded.

Bhutan: S – Gaylegphug district (Gaylegphug, 117); **Darjeeling:** Tista Valley, terai and duars. Subtropical forests, 270 – 920m. April – June.

Leaves becoming bright red when old.

6. *E. floribundus* Blume

Tree to 20m. Leaves ovate to elliptic-ovate, 8–15 x 3–7cm, acute to acuminate, base cuneate or ± rounded, glabrous, glandular-punctate beneath, minutely blistered when dry; petioles (2.5–)3–5cm. Racemes 7–8cm, 20–25-flowered; pedicels 7–8mm. Sepals lanceolate, 5–6 x 1.5–2mm, glabrescent or thinly appressed hairy. Petals white, obtriangular, 5–7 x 4–6mm, hairy on margins only, divided almost to middle into 25–35 segments. Stamens 25–30, 2.5–3.5mm, with or without short bristles at apex. Ovary 3-celled. Fruit ellipsoid to obovoid, 2–3(–3.5) x 1–1.5cm; stone smooth, 1–2(–3)-celled; cells 1-seeded.

Darjeeling: foothills. Warm broad-leaved forest, 1520m. May–July.

Records (73, 80) of the south Indian species *E. serratus* L. (*E. cuneatus* Wight) probably refer to this species. It is distinguished by the long (1–2mm) bristles at the apex of the anthers, and is widely cultivated for its edible fruit in S India, but no correctly-named material from the E Himalaya has been seen.

7. *E. lanceifolius* Roxb. Sha: *Gashe Thung Shing*; Nep: *Bhadrase* (34), *Badrassi*. Fig. 20p.

Tree, 12–20m. Leaves elliptic to narrowly elliptic, 10–18 x 2.5–5cm, acute to acuminate, base attenuate, glabrous or thinly pubescent beneath, often minutely blistered when dry, with small glands in axils of lateral veins along midribs beneath; petioles 1–2cm. Racemes 5–7cm, c 10-flowered; pedicels c 0.5cm. Sepals lanceolate, 5–7 x 1.5–2mm, glabrescent or tomentose. Petals white, obtriangular, 6–8 x 3–4mm, thinly pubescent on back at base, divided to middle into 12–25 segments. Stamens 26–32, 2.5–3.5mm, with short bristles at apex. Ovary 3-celled. Fruit ovoid to ellipsoid, 3–4 x 2–2.5cm (5 x 3.5cm when fresh); stone 3-grooved, strongly rugose, 1-celled, 1-seeded.

Bhutan: S – Chukka district (N of Jumudag) and Deothang district (S of Riserboo), C – Punakha and Tongsa districts; **Darjeeling:** Darjeeling, Goompahar. Warm broad-leaved and evergreen oak forests, 1500–2200m. August–September.

Wood used for house-building, to make tea-boxes and for charcoal (34, 48); fruit edible (48).

8. *E. sikkimensis* Masters. Nep: *Bhadrase* (34). Fig. 20q&r.

Tree 7–13m. Leaves elliptic, 13–23 x 5–7cm, acute or acuminate, base cuneate, ± glabrous, often with small glands in axils of lateral veins along midrib beneath; petioles 1.5–3cm. Racemes 4–6cm, 10–15-flowered; pedicels c 1cm. Sepals lanceolate, 7–8 x c 1.5mm, appressed pubescent. Petals white, obtriangular, c 7 x 2–3mm, appressed hairy on back, divided in upper third into 25–35 segments. Stamens 25–28, 4–4.5mm, with short bristles at apex. Ovary 3-celled. Fruit ellipsoid, c 4.5 x 2mm; stone ± smooth, 1-celled, 1-seeded.

Bhutan: S – Chukka district (Sinchu La), C – Tongsa district (S of Shamgong); **Darjeeling:** Lebong, Rongbi, Badamtam; **Sikkim:** Gangtok. Subtropical and warm broad-leaved forests, 650–1950m. April–May.

Fruit edible (34); leaves becoming orange-red when old.

Family 112. TILIACEAE

by D.G. Long and S. J. Rae

Trees, shrubs or herbs; indumentum often stellate. Leaves in 2 ranks, simple, unlobed or lobed, alternate, palmately veined at base, stipulate. Flowers in axillary (or leaf-opposed) and terminal cymes or panicles or 1 – 3 per axil, bisexual, actinomorphic. Sepals 4 – 5, free or connate at base. Petals 4 – 5, free or rarely absent. Stamens 10 – many, free or connate at base into bundles. Ovary superior, 2 – 10-celled; ovules 1 – many per cell, axile; style simple; stigma capitate or 2 – 10-lobed. Fruit a capsule or drupe.

- 1. Herbs or small shrubs; fruit a capsule 2
- + Shrubs or trees; fruit a drupe 3

- 2. Flowers 1 – 4, leaf-opposed; capsule sometimes warty but not spiny
1. Corchorus
- + Flowers usually more than 3, axillary; capsule spiny **2. Triumfetta**

- 3. Flowers few in cymes, mostly axillary, sometimes also terminal, rarely leaf-opposed **3. Grewia**
- + Flowers numerous in panicles, mostly terminal, sometimes also in upper axils
4. Microcos

1. CORCHORUS L.

Herbs, sometimes woody at base. Leaves often with lowest teeth prolonged into subulate deflexed tails. Flowers small, 1 – several on short leaf-opposed peduncles. Sepals 4 – 5, free. Petals 4 – 5. Stamens many. Ovary 2 – 5-celled; ovules numerous; style short. Fruit a 2 – 5-valved capsule.

- 1. Tall cultivated herb to 5m; leaves long acuminate; capsule obovoid-globose
3. C. capsularis
- + Small native herbs to 60cm; leaves obtuse, acute or shortly acuminate; capsules linear or cylindrical 2

- 2. Leaves mostly ovate to elliptic, acute or shortly acuminate, sharply serrate; capsules cylindrical, winged and with 3 spreading bifid beaks . **1. C. aestuans**
- + Leaves mostly lanceolate, sometimes oblong or ovate, obtuse or subacute; capsules linear, unwinged, with single erect undivided beak
2. C. trilocularis

1. *C. aestuans* L.; *C. acutangulus* Lamarck. Fig. 21a - c.

Annual herb 20 - 60cm; stems sparsely pubescent or glabrous. Leaves ovate or elliptic, 3 - 7 x 2 - 4.5cm, acute or shortly acuminate, base rounded, margins sharply serrate with lowermost teeth sometimes produced into subulate deflexed tails, 3 - 5-veined at base, both surfaces sparsely appressed pilose; petioles 0.5 - 3cm; stipules linear-subulate 7 - 10mm. Cymes 1 - 3-flowered, borne on short leaf-opposed peduncles c 1mm. Sepals linear, 3 - 3.5mm. Petals yellow, spatulate c 4mm. Capsule cylindric, 1.7 - 3 x 0.5cm, 3-valved, each valve winged dorsally and tapering at apex into a short spreading bifid beak.

Bhutan: C - Punakha district (Punakha, 117); **Darjeeling:** Ramam (178). Damp ditches and disturbed soil. August - October.

2. *C. trilocularis* L.

Similar to *C. aestuans* but often more woody at base; leaves more variable in shape, often lanceolate, sometimes oblong or ovate, 2 - 12 x 0.7 - 4.5cm, obtuse or subacute, margins bluntly crenate-serrate; stipules 5 - 8mm; sepals c 5mm; petals 5 - 6mm; capsules linear, 3 - 7 x 0.3cm, 3 - 4-valved, unwinged, with single erect undivided beak.

Bhutan: locality unknown; **Darjeeling/Sikkim:** locality unknown. Weed of roadsides, fields and disturbed ground. June - September.

Both records (178) are based on Griffith specimens which have not been traced.

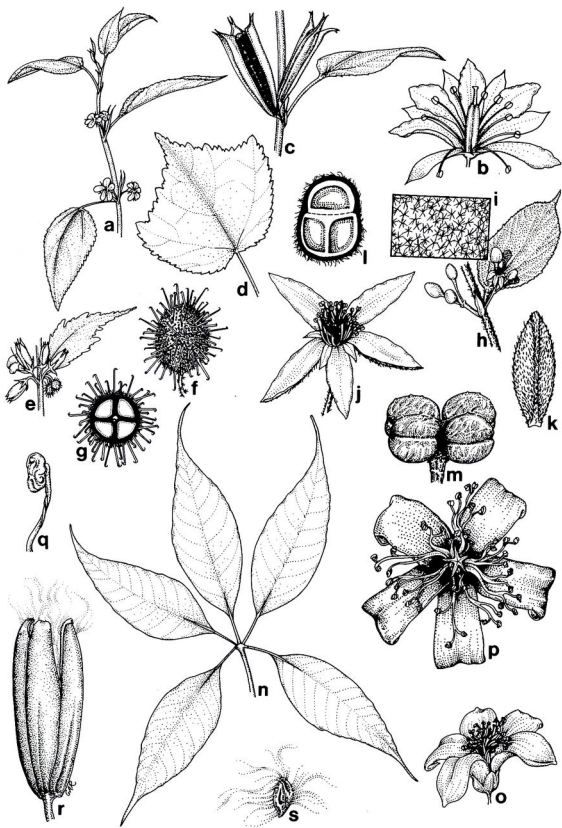
3. *C. capsularis* L. Eng: *Jute*

Tall erect herb with simple, glabrous stems to 5m. Leaves lanceolate, 8 - 13 x 2.5 - 5.5cm, long acuminate, base rounded, margins serrate with lowermost pair of teeth produced into deflexed filiform tails, glabrous; petiole 1 - 2.5cm, pubescent on upper surface; stipules subulate 7 - 15mm. Cymes compact on short leaf-opposed peduncle 1 - 2mm; flowers 2 - 4, ± sessile. Sepals oblong c 3.5mm. Petals yellow, spatulate 4 - 5mm. Capsule obovoid-globose, 10 - 13mm diameter, warted, 5-celled.

Darjeeling: terai as at Jalpaiguri. Cultivated on flood-plains in terai. June - September.

An important fibre crop used to produce hessian. *C. capsularis* is the main Jute plant; *C. olitorius* L. is less widely grown and has not been recorded from the area.

FIG. 21. **Tiliaceae** and **Bombacaceae**. **Tiliaceae**. a - c, *Corchorus aestuans*: a, flowering shoot; b, dissected flower; c, part of fruiting stem with dehiscent and undehiscent capsules. d - g, *Triumfetta rhomboidea*: d, leaf; e, part of flowering stem; f, fruit; g, t.s. fruit. h - l, *Grewia eriocarpa*: h, part of flowering stem; i, leaf indumentum; j, flower; k, sepal; l, t.s. fruit. m, *Grewia optiva*: fruit. **Bombacaceae**. n - s, *Bombax ceiba*: n, leaf; o, flower in side view; p, flower from above; q, stamen; r, capsule; s, seed. Scale: n, o x 1/4; r x 1/10; a x 1/3; d, h x 1/2; c, s x 1 1/4; e, m x 1 1/2, f, g, j, x 3; l x 4; b, k, q x 5; i x 15. Drawn by G. Rodrigues.



2. TRIUMFETTA L.

Shrubs or herbs. Leaves unlobed or 3–7-lobed. Flowers in axillary few to many-flowered cymes or fascicles. Sepals 5, free, often hooded. Petals 5, glandular or pitted at base. Stamens many, inserted above glandular receptacle. Ovary 2–5-celled, ovules 2 per cell; style slender. Fruit indehiscent or splitting into segments, with straight or hooked spines.

A genus of many widespread tropical species; further research is needed and is likely to result in further name-changes for some species.

1. Leaves suborbicular, conspicuously 3-lobed; fruit (including spines) 4–6mm diameter **1. T. rhomboidea**
- + Leaves ovate to lanceolate, unlobed or with 2 shallow lateral lobes; fruit (including spines) 11–20mm diameter 2
2. Leaves sparsely pilose beneath with mostly simple hairs; spines of fruit glabrous **2. T. annua**
- + Leaves stellate-tomentose beneath; spines of fruit spreading pilose 3
3. Leaves lanceolate or ovate-lanceolate; fruit (including spines) 18–20mm diameter, spines strongly hooked at apex **3. T. pilosa**
- + Leaves ovate; fruit (including spines) 11–13mm diameter, spines straight or oblique, not hooked **4. T. tomentosa**

1. T. rhomboidea Jacquin; *T. bartramia* L. *nom. illeg.* Fig. 21d – g.

Erect herb 15–80cm, woody at base; stems villous and thinly stellate-pilose. Leaves suborbicular or broadly ovate, 4–8 x 4–8cm, acuminate, base rounded, 3–5-veined, margin irregularly serrate and deeply 3-lobed, pilose with a mixture of simple and stellate hairs; upper leaves ovate, unlobed; petioles 1–6cm; stipules lanceolate, 3–4mm. Cymes compact, c 1cm diameter, few-flowered. Sepals oblong, 5–5.5mm, apiculate, glabrous or stellate-pubescent. Petals yellow, spatulate, c 5mm. Capsule 4–6mm, white pilose, with numerous hooked glabrous spines.

Bhutan: S–Samchi, Phuntsholing and Gayleghug districts; **Darjeeling:** Tista, Birik, Kurseong, Darjeeling, etc. On roadsides, river banks and in scrub, 200–900m. August–December.

2. T. annua L.

Similar to *T. rhomboidea* but leaves ovate, 3–11 x 2–7cm, unlobed or with 2 shallow blunt lateral lobes, sparsely pilose with mostly simple hairs; cymes 1–1.5cm diameter; sepals 4–5mm; capsules 13–15mm diameter, glabrous with hooked usually glabrous spines.

Bhutan: C–Punakha district (N of Punakha Dzong); **Darjeeling:** Tista Valley and Rishap. Open slopes and field margins, 300–1500m. August–October.

3. T. pilosa Roth; *T. cana* Blume, non F.B.I., ?*T. tomentosa* Noronha *nom. nud.*, ?*T. oblonga* D. Don

Subshrub 1–2m; stems densely spreading stellate-pilose. Leaves lanceolate or ovate-lanceolate, 6–13 x 2–5cm, acuminate, base rounded or shallowly cordate, margins irregularly serrate, unlobed or with 2 shallow lateral lobes, stellate-tomentose beneath, more thinly so above, 5-veined at base; petioles 1–3cm; stipules subulate 8–10mm. Cymes dense, c 1.5cm diameter. Sepals linear, c 10mm, apiculate, stellate-pubescent. Petals yellow, c 10mm. Capsule 18–20mm diameter, pilose, with spreading-bristly hooked spines.

Bhutan: S—Samchi and Gaylegphug districts, C—Punakha district; **Darjeeling:** Kalimpong, Rishap, Little Rungit, Badamtam, Sureil. Open slopes, scrub and field margins, 900–1500m. July–February.

This species has often been confused with *T. tomentosa* and the name *T. tomentosa* Noronha wrongly applied to the aggregate.

4. T. tomentosa Bojer; *T. pseudocana* Sprague & Craib, *T. cana* sensu F.B.I. non Blume, non *T. tomentosa* Noronha

Similar to *T. pilosa* but leaves ovate, 3–8 x 2–4cm, acute or shortly acuminate; cymes dense, compact, 1.5–3cm diameter; sepals 6–7mm, stellate-tomentose; capsule 11–13mm diameter, glabrous, with straight (sometimes oblique but never hooked), spreading-bristly spines.

Bhutan: locality unknown (Griffith); **Darjeeling:** Little Rungit, Dulka Jhar, Pashok. 150–760m. October.

Has often been wrongly united with *T. pilosa* but differs in its \pm straight, unhooked capsular spines.

3. GREWIA L.

Trees or shrubs. Leaves unlobed or shallowly lobed, palmately 3–7-veined from base. Flowers in axillary or leaf-opposed pedunculate, often umbellate cymes. Sepals 5, free. Petals 5, pitted or glandular at base. Stamens many, inserted on glandular receptacle. Ovary 2–4-celled; style subulate, lobed. Fruit a 2–4-lobed drupe.

1. Leaves \pm coriaceous, ovate, suborbicular or broadly elliptic, with broadly rounded base, stellate-tomentose beneath 2
- + Leaves membranous, elliptic to lanceolate, with cuneate or narrowly rounded base, stellate-pilose or pubescent to almost glabrous beneath 6
2. Peduncles leaf-opposed **1. G. optiva**
- + Peduncles axillary 3
3. Cultivated shrub; leaves cordate at base **4. G. asiatica**
- + Native shrubs, subshrubs or small trees; leaves rounded or cuneate at base...4

4. Leaf apex acuminate, base oblique 5. *G. eriocarpa*
 + Leaf apex rounded or subacute, base not or weakly oblique 5
5. Subshrub 20 – 40cm; leaves not reticulate beneath; peduncles slender 1.5 – 3cm; sepals 7 – 8mm; fruit 8 – 10mm 2. *G. sapida*
 + Shrub to 1m; leaves strongly reticulate beneath; peduncles stout 0.5 – 1.5cm; sepals 15 – 18mm; fruit c 20mm 3. *G. sclerophylla*
6. Leaves elliptic, narrowly rounded at base; peduncles 2 – 3-flowered; pedicels 5 – 10mm; sepals 7 – 10mm 6. *G. sepiaria*
 + Leaves ovate-lanceolate, cuneate at base; peduncles 3 – 5-flowered; pedicels 10 – 20mm; sepals 12 – 16mm 7. *G. serrulata*

1. *G. optiva* Burret; *G. oppositifolia* D. Don non DC. Fig. 21m.

Shrub or tree to 12m; branchlets densely stellate-pubescent. Leaves ovate, 6 – 14 x 3 – 10cm, acuminate, base rounded, margins crenate-serrate, 3-veined at base, veins prominent beneath, densely stellate-pubescent beneath, scabrous-pubescent above; petioles 3 – 13mm; stipules narrowly lanceolate, 4 – 7mm, early caducous. Cymes leaf-opposed, umbellate; peduncle stout, 1 – 4cm; pedicels 0.8 – 1.7cm. Sepals oblong-lanceolate, 12 – 16mm, thick, white on upper surface, green below. Petals lanceolate, slightly connate at base, 6 – 7mm, creamy white. Drupes deeply 4-lobed, 7 – 13mm.

Darjeeling: Pankabari, Kodabari and Tindharia. Subtropical and terai forests, 600 – 900m. April – July.

Wood useful; bark yields a fibre and foliage lopped for fodder (48).

2. *G. sapida* DC. Dz: *Dopta*; Sha: *Tsu Tsu Shing*; Nep: *Kuail* (34).

Low subshrub with stout woody rootstock and base, bearing erect annual leafy shoots 20 – 40cm, branches softly hairy. Leaves broadly obovate elliptic, 3 – 10 x 2.5 – 7cm, subacute or obtuse, base rounded or broadly cuneate, 5 – veined, margin irregularly crenate-serrate, pilose and slightly rough to touch above, stellate-pubescent beneath; petioles 3 – 5mm, villous; stipules lanceolate 5 – 7mm. Flowers yellow or orange, in 3 – 5-flowered umbellate cymes; peduncles 2 – 4 per axil, slender 1.5 – 3cm, villous; pedicels 5 – 10mm, villous. Sepals oblong, 7 – 8mm, densely stellate-hairy outside. Petals elliptic, 4 – 5mm. Drupes rounded 2-lobed c 8 x 10mm, hairy.

Bhutan: C – Punakha district (near Wangdu Phodrang); **Darjeeling:** terai at Siliguri, Champasari and Sukna. Dry scrub, 300 – 1500m. March – May.

Some records of *G. subinaequalis* DC. from E. Himalaya (73) refer to this species. Regenerates freely after fires (34).

3. *G. sclerophylla* G. Don

Shrub to c 1m, with stout main stems and erect leafy shoots; branches stellate-tomentose. Leaves coriaceous, broadly ovate or suborbicular, 10 – 20 x 7 – 17cm,

obtuse or subacute, base broadly rounded, margins irregularly serrate, 3-veined at base, rugose and rough to the touch above with stellate scabrous hairs, stellate-tomentose and reticulate beneath; petioles stout, 6-12mm, glandular at apex; stipules caducous. Cymes 2-3-flowered, axillary; peduncles short, unequal, 5-15mm, tomentose; pedicels 2-6mm. Sepals linear, 1.5-1.8cm, white within, tomentose on outside. Petals white, c 5mm. Drupe subglobose, c 2cm diameter, obscurely lobed, 4-seeded.

Darjeeling: terai at Lataguri and Siliguri. Dry scrub and grassland. May-June.

Regenerates after burning (16). The record from Bhutan (73) has not been confirmed.

4. *G. asiatica* L. Nep: *Siyal Phusra* (34).

Similar to *G. sclerophylla* but differing in its non-rugose leaves with apex acute, base cordate, margins unequally serrate, 5-veined at base, minutely pubescent above, finely greyish tomentose beneath; peduncles slender, 1-4cm; pedicels slender, 1-1.5cm; sepals oblong, 8-10mm; drupes 12mm, weakly 2-lobed.

Darjeeling: terai at Jalpaiguri. Cultivated. May-June.

Commonly confused with *G. subinaequalis* DC. which differs in its leaves cuneate not cordate at the base, and pubescent not greyish tomentose beneath.

5. *G. eriocarpa* Jussieu; *G. asiatica* L. var. *vestita* Masters, *G. elastica* Royle, *G. vestita* (Masters) Cowan & Cowan. Nep: *Phalsa* (34), *Siyal Phusra* (34). Fig. 21h-1.

Shrub or small tree 3-4m; branches softly tomentose. Leaves membranous, reddish when young, ovate, 7-16 x 4-9cm, acuminate, base obliquely rounded, margins serrate, 5-veined at base; stellate-pubescent above, softly tomentose beneath; petioles 6-10mm; stipules lanceolate, 6-8mm. Peduncles 2-3 per axil, 5-20mm; pedicels ± equalling peduncles. Sepals linear, c 3mm, greenish, orange-yellow within. Petals linear, 3mm, pale green. Drupes subglobose, obscurely lobed, c 6mm.

Bhutan: S - Sarbhang district (near Sarbhang) and Deothang district (above Samdrup Jongkhar); C - Tongsa district (Banjormani), Mongar district (Kuru Chu valley) and Tashigang district (Ghunkara); **Darjeeling:** foothills and terai, common; **West Bengal Duars:** Buxa. Amongst scrub in dry valleys and at margins of subtropical and Chir Pine forests, 600-1325m. March-June.

Wood useful; foliage lopped for fodder (48).

6. *G. sepiaria* G. Don; *G. disperma* auct. non Sprengel, *G. glabra* auct. non Blume, *G. multiflora* sensu F.B.I. p.p. non Jussieu, *G. serrulata* auct. non DC.

Shrub or small tree 4-6m; branches subglabrous or thinly stellate-pubescent. Leaves thinly coriaceous, rigid, elliptic, 3-14 x 1.5-5cm, acuminate, base narrowly rounded, margins serrulate, often bluntly, prominently 3-veined at base, with tufts of hair in vein axils, sparsely appressed stellate-pubescent beneath; petioles 5-10mm; stipules subulate 6-9mm. Cymes umbellate, 2-3-flowered;

peduncles 1(-2) per axil, 1-2.5cm; pedicels 5-10mm. Sepals thick, linear, 7-10mm, green outside, white inside. Petals whitish, minute, 2.5mm. Drupes 6-8mm, deeply 2-lobed, each lobe shallowly bifid.

Bhutan: S - Samchi district (Chepuwa Khola), C - Mongar district (near Zimgang); **Darjeeling:** Tista valley, terai etc. Subtropical and terai forests, 300-1500m. July - September.

This species has been much confused in the literature; most records of *G. multiflora* from Bhutan and Darjeeling probably belong here. Records of the S. Indian *G. laevigata* Vahl (*G. disperma* Sprengel) from Darjeeling (73) refer either to this species or to *G. serrulata*.

7. *G. serrulata* DC.; *G. glabra* Blume, *G. laevigata* auct. non Vahl. Nep: *Chiple, Kua'il* (34).

Similar to *G. sepiaria* but differing in its stellate-pilose branches; leaves membranous, ovate-lanceolate, base cuneate, stellate-pilose beneath, sometimes densely so; peduncles 1-2 per axil, each 3-5-flowered; pedicels 1-2cm; sepals 12-16mm; drupes c 10mm.

Darjeeling: foothills and terai, e.g. at Pankabari, Badamtam, Mamrim, Ryang. Waste ground and scrub, 300-900m. July - September.

4. MICROCOS L.

Similar to *Grewia* but leaves unlobed, 3-veined at base; flowers in terminal (sometimes also axillary) panicles; fruit a fleshy unlobed drupe.

1. *M. paniculata* L.; *Grewia microcos* L.

Shrub or small tree; branchlets glabrous. Leaves thinly coriaceous, elliptic-lanceolate, 9-26 x 4-8cm, acuminate, base rounded, rarely subcordate, margins crenulate or obscurely sinuate, strongly 3-veined at base, glabrous or stellate-pubescent on veins beneath; petioles 7-12mm, stellate-pubescent; stipules subulate, 6-11mm. Panicles up to 15 x 12cm, stellate-pubescent; bracts lanceolate, often bifid. Sepals spatulate, c 7mm, stellate-tomentose. Petals short, c 2mm, pubescent externally. Drupes obovoid up to 1cm long, unlobed.

Darjeeling: not common (34). Subtropical forests. March - June

Family 113. MALVACEAE

by A. G. Miller and D. G. Long

Herbs, shrubs, trees or climbers; indumentum usually stellate; stems often fibrous. Leaves alternate, simple or lobed, usually palmately 3-7-veined from base, sometimes pinnately veined; stipulate. Monoecious, rarely dioecious; flowers axillary, solitary, or in 2-many-flowered, terminal or axillary racemes or panicles,

bisexual, rarely unisexual, actinomorphic; usually subtended by an epicalyx of 3 – many, free or connate, segments. Calyx of 4(–5) ± connate sepals; epicalyx present or absent. Petals 5, free, adnate to base of staminal column. Stamens with filaments united around style into staminal column, bearing pollen throughout or divided at apex into numerous filaments or 5 – many branches. Ovary superior, 2 – many-celled; style simple or 2 – many-branched. Fruit a loculicidally dehiscent, rarely indehiscent capsule, or schizocarpic, consisting of 5 – many mericarps around a central columella.

1. Epicalyx absent 2
- + Epicalyx present 4
2. Fruit a capsule; staminal column pollen-bearing throughout **1. Hibiscus**
- + Fruit a schizocarp of 5 – many mericarps; staminal column divided at apex into numerous filaments 3
3. Fruit of 15 – 20, 2 – 3-seeded mericarps **9. Abutilon**
- + Fruit of 5 – 12, 1-seeded mericarps **10. Sida**
4. Fruit a schizocarp of 5 – many mericarps 5
- + Fruit a capsule 8
5. Shrubs, sometimes scrambling; corolla 2 – 7cm long **12. Malvaviscus**
- + Herbs with corolla 0.4 – 4.5cm, or if shrubby then never scrambling and with corolla 1 – 2cm 6
6. Epicalyx of 6 or 7 segments; corolla 4 – 4.5cm **8. Alcea**
- + Epicalyx of 3 or 5 segments; corolla 0.4 – 2.5cm 7
7. Epicalyx of 3 segments **7. Malva**
- + Epicalyx of 5 segments **11. Urena**
8. Epicalyx segments 4(–6), ovate to lanceolate, widely spreading in fruit; petals gland-fringed 9
- + Epicalyx segments 3 – 15, variously shaped, if spreading in fruit segments more than 6; petals not gland-fringed 10
9. Trees or shrubs, bisexual; style bifid; staminal column divided into many branches each bearing 2 anthers **5. Nayariophyton**
- + Dioecious trees; style 3-branched; staminal column divided above into 5 branches each bearing 3 – 4 anthers **6. Kydia**

10. Calyx 5-toothed, splitting along one side, adnate to and deciduous with the corolla **2. Abelmoschus**
 + Calyx 5-lobed or undulate, not splitting along one side, not adnate to or deciduous with the corolla 11
11. Style 5-branched; calyx 5-lobed with ovate or triangular lobes....**1. Hibiscus**
 + Style simple; calyx truncate, undulate or with 5-linear lobes 12
12. Epicalyx of 5 filiform segments **3. Thespesia**
 + Epicalyx of 3 broad, leafy segments **4. Gossypium**

1. HIBISCUS L.

Herbs, shrubs or trees. Leaves palmately or pinnately veined. Stipules deciduous or not. Flowers bisexual, axillary, solitary or in terminal or axillary racemes or panicles, pedicels jointed. Epicalyx segments 5 – 15, rarely absent, linear to ovate, free or connate below. Sepals 5, connate below middle. Staminal column pollen-bearing throughout or above middle only. Ovary 5-celled; style 5-branched above; stigma capitate. Fruit 5-valved, loculicidally dehiscent; seeds glabrous or woolly, 3 – many per valve.

A specimen of the coastal species *H. tiliaceus* L. collected by Griffith labelled "Bootan" is surely a label error.

1. Epicalyx absent or minute, c 1mm, deciduous **3. H. lobatus**
 + Epicalyx present 2
2. Stems and pedicels with recurved prickles; epicalyx with erect linear appendages or margins with bulbous-based bristles 3
 + Stems and pedicels unarmed; epicalyx neither appendaged nor with bulbous-based bristles 4
3. Epicalyx segments spatulate, obtuse; stipules leafy, ovate, base auriculate
4. H. surattensis
 + Epicalyx segments linear, acute; stipules linear to lanceolate...**5. H. radiatus**
4. Annual; calyx fleshy **6. H. sabdariffa**
 + Perennial shrub or tree; calyx never fleshy 5
5. Tree or woody climber; epicalyx segments 5, ovate 6
 + Shrub; epicalyx segments (5 –)6 – 10, linear or lanceolate 7

6. Leaves unlobed; flowers 2 – 3 in axils of leaves and sometimes also few-flowered terminal panicles; calyx with stellate and glandular hairs
 1. **H. fragrans**
- + Leaves 3 – 5-lobed; flowers in terminal panicles; calyx with stellate hairs but without glandular hairs 2. **H. scandens**
7. Petals 1.3 – 1.8cm, pink 9. **H. hirtus**
- + Petals 4cm or more, lilac or scarlet 8
8. Leaves ovate, unlobed, margin regularly serrate; corolla usually scarlet
 7. **H. rosa-sinensis**
- + Leaves ovate-rhombic, sometimes deeply 3-lobed, margin irregularly serrate; corolla usually lilac 8. **H. syriacus**

1. **H. fragrans** Roxb.

Large climbing shrub, stellate-tomentose throughout. Leaves unlobed, broadly ovate, (4 –)6 – 12 x 3 – 9cm, acute or acuminate, base cordate, margin obscurely serrate, tomentose becoming glabrescent; petiole 3 – 5cm; stipules linear, deciduous. Flowers in 2 – 3-flowered axillary fascicles and often also few-flowered terminal panicles; pedicels 3 – 5cm. Epicalyx segments 5, ovate, c 1.5cm, connate at base. Flowers fragrant. Calyx as long as epicalyx; lobes ovate, stellate-tomentose and with glandular hairs. Petals white or pale pink, yellow at base, 2.5 – 3cm. Staminal column c 1.5cm. Fruit ovoid, c 2.5cm; seeds with long hairs.

Darjeeling: Kalimpong, Tista Valley, Sureil, Mungpoo and Rongbe. Subtropical forest, 300 – 1220m. September – December.

2. **H. scandens** Roxb.

Similar to *H. fragrans* but leaves 3 – 5-lobed; flowers in many-flowered terminal panicles; epicalyx segments and calyx smaller, 7 – 10mm, calyx without glandular hairs; petals white or with dark purple or crimson base.

Darjeeling: Tista valley (34). Subtropical forests, 300 – 1200m. October.

A doubtful record as all old specimens from the E Himalaya labelled *H. scandens* have proved to be *H. fragrans*

3. **H. lobatus** (Murray) Kuntze; *H. solandra* L'Héritier

Erect annual herb, 0.3 – 1m, pubescent with mainly simple hairs throughout. Lower leaves broadly ovate to orbicular, upper leaves becoming deeply 3-lobed, 1.5 – 6 x 1.5 – 6cm, acute, base cordate or rounded, margin crenate to serrate, pubescent; petioles 1.5 – 6cm; stipules filiform, 3 – 6mm. Flowers axillary, solitary, forming racemes above, pedicels 1 – 1.5cm, lengthening to 3 – 4cm in fruit. Epicalyx segments absent or minute, c 1mm, deciduous. Calyx 6 – 8mm; lobes narrowly triangular, connate below middle. Petals white, 1 – 1.2cm. Fruit ovoid, 8 – 10mm; seeds verrucose, glabrous or minutely hairy.

Bhutan: S – Chukka district, C – Punakha, Mongar and Tashigang districts; **Darjeeling:** Waste places, dry hillsides etc., 600 – 1525m. July – October.

4. *H. surattensis* L. Sha: *Borangmangan*; Nep?: *Kauscho* (117). Fig. 22e.

Scrambling or prostrate herb to 2m; shoots hirsute or glabrous; stems, petioles and pedicels with scattered, recurved prickles. Leaves broadly ovate to orbicular, 2 – 6 x 2 – 6cm, base shallowly cordate or truncate, entire or 3 – 5-lobed, lobes ovate to lanceolate, acute, margins serrate; petiole 1 – 6cm; stipules leafy, 1 – 1.5 x 0.4 – 0.5cm, bases oblique, auriculate. Flowers axillary, solitary, pedicels 3 – 9cm. Epicalyx segments 9 – 15, spatulate, 10 – 17 x 3 – 5mm, with erect linear appendage 7 – 10mm near apex. Calyx c 2cm; lobes ovate, acuminate, connate below middle, accrescent in fruit. Petals yellow or with purple base, 2.5 – 3(–5)cm. Staminal column shorter than petals. Fruit ovoid, acute, 1 – 1.5cm; seeds glabrous, or with minute, stellate hairs.

Bhutan: S – Samchi, Sarbhang, Gaylephug and Deothang districts; **Darjeeling:** Dense subtropical jungle, 260 – 300m. September – October.

5. *H. radiatus* Cavanilles

Similar to *H. surattensis* but an erect herb or shrub, with scattered prickles or unarmed; stipules linear to lanceolate, 0.5 – 1.5cm; epicalyx segments linear, acute, with or without appendage; flowers larger, petals 5 – 7cm.

Darjeeling: terai. Weed of waste ground. September.

6. *H. sabbdariffa* L.

Similar to *H. surattensis* but an erect, unarmed annual; leaves with a gland at base of midrib beneath; epicalyx segments unappendaged, adnate to the base of calyx; calyx becoming swollen and fleshy.

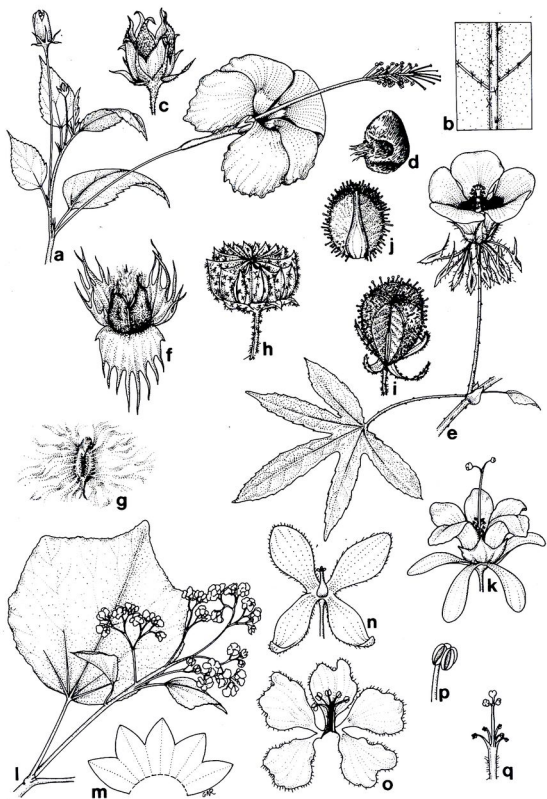
Darjeeling: Jaldaka valley.

Widely cultivated in the tropics for its swollen edible calyx. Stems yield a useful fibre (126).

7. *H. rosa-sinensis* L. Fig. 22a – d.

Erect glabrescent shrub to 2m. Leaves unlobed, ovate, 3 – 12 x 2 – 8cm, acute, base rounded, margin regularly serrate. Epicalyx segments 6 – 10, lanceolate, ± free, half as long as calyx. Flowers large, showy; petals usually scarlet, 4 – 6cm. Staminal column long-exserted, pollen-bearing in upper half only.

FIG. 22. **Malvaceae.** a – d, *Hibiscus rosa-sinensis*: a, flowering shoot; b, leaf indumentum; c, dehiscent capsule; d, seed. e, *Hibiscus surattensis*: part of flowering shoot. f & g, *Gossypium hirsutum*: f, fruit and persistent epicalyx; g, seed. h, *Abutilon indicum*: fruit. i & j, *Urena lobata*: i, fruit with one mericarp removed; j, mericarp. k, *Nayariophyton zizyphifolium*: flower. l – q, *Kydia calycina*: l, part of flowering shoot; m, calyx; n, epicalyx and pistillode (male flower); o, petals and stamens (male flower); p, fertile anther; q, style and staminodes (female flower). Scale: l x ¼; a, c, e, f x ½; k x 2/3; g x 1; h, m x 1/4; i, o x 2; b, j x 2/4; d x 2½, n, q x 3; p x 5. Drawn by G. Rodrigues.



Bhutan: S – Gayleghphug district (Gayleghphug); **Darjeeling:** Badamtam. Cultivated in gardens, 300m. May – December.

Widely grown as an ornamental plant for its showy flowers.

8. *H. syriacus* L.

Similar to *H. rosa-sinensis* but leaves often 3-lobed, ovate-rhombic, 5 – 8 x 2 – 4cm, base cuneate, margin irregularly serrate; petals lilac, 4 – 7cm; staminal column included, pollen-bearing throughout.

Bhutan: S – Gayleghphug district (Gayleghphug), C – Thimphu district (Thimphu). Cultivated in gardens, 300 – 2300m. April – May.

Cultivated as an ornamental plant.

9. *H. hirtus* L.

Erect stellate-hairy shrub. Leaves shallowly 3-lobed, ovate, 3 – 5 x 2 – 4cm, acuminate, base rounded or cordate, margin serrate. Epicalyx segments 6 – 7, linear, free, shorter than the calyx. Petals pink, 1.3 – 1.8cm. Staminal column pollen-bearing throughout.

Darjeeling: Darjeeling.

Cultivated as an ornamental.

2. ABELMOSCHUS Medikus

Similar to *Hibiscus* but calyx 5-toothed at apex, splitting along one side at anthesis, adnate to base of corolla and deciduous with it; style 5-branched at tip.

- | | |
|---|-------------------------|
| 1. Epicalyx segments 4 – 6, ovate to lanceolate | 3. A. manihot |
| + Epicalyx segments 7 – 12(– 16), linear | 2 |
| 2. Fruit ovoid, 3.5 – 4cm; flowers in terminal racemes | 1. A. crinitus |
| + Fruit cylindrical, 8 – 10(– 25)cm; flowers axillary, solitary..... | 2. A. esculentus |

1. *A. crinitus* Wall.; *Hibiscus crinitus* (Wall.) G. Don

Erect herb, 0.5 – 1m, hirsute to strigose with long simple hairs and scattered 2 – 3-branched hairs throughout; root tuberous. Leaves broadly ovate to rhombic, lower ones obscurely 3 – 5-angled, upper more deeply lobed to hastate, 3 – 9 x 3 – 8cm, acute, base cordate to sagittate, margin dentate; petiole 1 – 6cm; stipules linear, 0.5 – 1.5cm. Flowers in terminal 2 – 7-flowered racemes, pedicels 2 – 3cm. Epicalyx segments 9 – 10(– 16), free, linear, (1.5 –)2 – 2.5cm. Calyx c 2cm. Petals yellow, sometimes with red base, 4.5 – 5(– 8)cm. Staminal tube c 2cm, pollen-bearing throughout. Fruit ovoid, 3.5 – 4 x 2 – 2.5cm, hispid with long yellowish hairs.

Bhutan: C – Punakha district (Wangdu Phodrang) and Mongar district (Lhuntse). Dry, grassy hillsides, 1370 – 1525m. July – September.

2. *A. esculentus* (L.) Moench; *Hibiscus esculentus* L. Eng: *Okra, Ladies Fingers*; Hindi: *Bhindi*.

Similar to *A. crinitus* but leaves orbicular, 5 – 7-lobed, lobes ovate to oblong, obtuse or acute, base cordate, margin crenate to coarsely serrate; flowers solitary, axillary; epicalyx segments 7 – 12, 1 – 1.5(– 2)cm; fruit cylindrical, 8 – 10(– 25) x 1.5 – 3cm, glabrescent or shortly hirsute.

Bhutan: S – Deothang district (cultivated at Samdrup Jongkhar). 500m. June. Cultivated for its edible fruits and fibrous stems.

3. *A. manihot* (L.) Medikus; *Hibiscus pungens* Roxb. Sha: *Seyr Metog*.

Similar to *A. crinitus* but a perennial herb or undershrub 1 – 2m; epicalyx segments 4 – 6, ovate to lanceolate, c 2.5cm; fruit narrower, oblong-ovoid, 4.5 – 5.5 x 1.2 – 2cm.

Bhutan: C – Punakha district (Rinchu) and Tashigang district (Tashi Yangtshi); **Darjeeling:** Kalimpong, Jalpaiguri, Ryang, Great Rungit, Rongsong. Warm broad-leaved forests, 600 – 1800m. August – December.

The Bhutan plants belong to subsp. **tetraphyllus** (Hornemann) Borssum-Waalke var. **pungens** (Roxb.) Hochreutiner.

3. THESPESIA Correa

Shrubs or trees. Stipules deciduous. Flowers bisexual in 1 – several-flowered pedunculate axillary cymes. Epicalyx segments free, filiform. Calyx cup-shaped, entire or with 5-linear lobes. Staminal column 5-toothed at apex, pollen-bearing throughout. Ovary 5-celled, style simple, stigma clavate. Fruit a ± woody capsule, loculicidally dehiscent.

1. *T. lampas* (Cavanilles) Dalziel & Gibson

Shrub 1 – 3m, stellate-hairy throughout. Leaves broadly ovate or deltoid, sometimes 3-lobed, 9 – 16 x 5 – 12cm, acute or acuminate, base round to cordate, glabrescent above, tomentose beneath, midrib with a linear gland 1 – 3mm near base. Cymes 1(– 3)-flowered. Epicalyx segments 3 – 6, filiform, 3.5 – 7mm. Calyx truncate usually with narrow linear lobes 4 – 12mm, rarely entire. Petals yellow with crimson base, obovate, 6 – 9 x 5 – 6cm. Staminal column c 2.5cm. Style c 3cm. Fruit obovoid, 5-angled, 2 – 2.5 x 1.5 – 1.8cm, 5-valved, c 10 seeds per valve.

Darjeeling: foothills and terai, e.g. Ryang, Pankabari, Balasun, Sukna. Subtropical forest, on roadsides and waste ground, 150m. October – February.

Sometimes cultivated for its showy flowers.

4. GOSSYPIUM L.

Shrubs or subshrubs, pitted with black glands throughout. Stipules deciduous. Flowers bisexual, large, solitary, axillary. Epicalyx segments 3, large, enveloping flower, entire or variously incised, free or connate at base. Calyx truncate, cup-

shaped, margin undulate to 5-lobed. Staminal column pollen-bearing throughout. Ovary 3 – 5-celled; style simple, stigma clavate, 5-grooved. Fruit a 3 – 5-valved, loculicidally dehiscent capsule, 5 – 17 seeds per valve; seeds woolly.

1. Epicalyx segments entire or 3 – 4-toothed; teeth serrate, less than 3 x as long as broad **3. G. arboreum**
- + Epicalyx segments deeply incised; teeth long, acuminate, more than 3 x as long as broad 2
2. Corolla 3.5 – 5cm long; capsule ovoid, apex abruptly acute...**1. G. hirsutum**
- + Corolla 5 – 7cm long; capsule ovoid, apex acuminate **2. G. barbadense**

1. G. hirsutum L. Sha: *Mowan*; Nep: *Kapkash*; Eng: *Cotton*. Fig. 22f&g.

Annual herb or perennial shrub to 2m; shoots pubescent or glabrescent with stellate and simple hairs. Leaves broadly ovate to orbicular, 3 – 12 x 4 – 12cm, base cordate, 3(–5)-lobed, lobes broadly triangular to ovate, acute, glabrescent; petiole 3–8cm. Pedicels 0.5–2cm, lengthening to 6cm in fruit. Epicalyx segments broadly ovate, 3–4 x 2–3cm, slightly increasing in size in fruit, apex deeply incised with long acuminate teeth, more than 3 x as long as broad, base cordate. Calyx c 6mm. Petals pale yellow to white or with red centre, 3.5–5cm. Staminal column 1–2cm, the upper filaments longest. Fruit ovoid, c 3cm, abruptly acute at apex, densely gland-pitted.

Bhutan: C – Tashigang district (Tashigang); **Darjeeling:** Kalimpong. Cultivated and sometimes naturalised in hot dry valleys, 600 – 1340m. April – June.

The woolly hairs of the seeds are harvested as cotton and used to manufacture cloth; a very important crop plant.

2. G. barbadense L.

Similar to *G. hirsutum* but leaves 3–5(–7)-lobed, lobes ovate to oblong; corolla larger, 5 – 7cm; stamens with filaments of equal length; capsule ovoid, tip acuminate.

Darjeeling: Singtam (109). April.

Probably cultivated.

3. G. arboreum L.

Similar to *G. hirsutum* but leaves smaller, 2–8 x 2–8cm, (3–)5(–7)-lobed, lobes ovate, distinctly narrower at base than middle; epicalyx segments entire or serrate with 3–4 teeth at apex, teeth less than 3 x as long as broad.

Bhutan: C – Tashigang district (Dangme Chu, cultivated); **Sikkim:** Rangpo forest and Rungit Valley. Cultivated and naturalised, on dry open hillsides, 300 – 1220m. September – November.

5. NAYARIOPHYTON Paul

Shrubs or trees, stellate-hairy throughout. Leaves entire or 3-lobed, with obscure linear gland on midrib beneath; stipules deciduous. Flowers bisexual, solitary, axillary. Epicalyx segments 4(-6), oblanceolate, connate at base, spreading in fruit. Sepals 5, connate to middle, lobes broadly-triangular. Petals 5, gland fringed. Staminal column divided above into many branches each bearing 2 anthers. Ovary 2-celled; style bifid near apex; stigmas peltate. Fruit an indehiscent capsule, 1-2-seeded.

1. N. zizyphifolium (Griff.) Long & Miller; *N. jujubifolium* (Griff.) Paul, *Dicellostyles jujubifolium* (Griff.) Bentham, *Kydia zizyphifolia* Griff., *K. jujubifolia* Griff. *nom. illeg.* Nep: *Kubinde* (34). Fig. 22k.

Shrub or tree to 7(-15)m. Leaves broadly ovate to elliptic, sometimes obscurely 3-lobed, 8-13 x 4-10cm, acute or acuminate, base rounded or truncate, densely tomentose beneath, glabrescent above; petiole 1.5-4.5cm. Epicalyx segments 1.8-2.5cm. Calyx lobes 4-7mm. Petals white, obovate, 2.5-3 x 1.3-1.7cm. Staminal column c 8mm, branches c 5mm. Style c 3cm. Fruit globose, c 8mm diameter, enveloped by accrescent calyx.

Bhutan: S-Sarbhag district (above Sarbhag) and Deothang district (Deothang), C-Tongsa district (Wangdegong near Shamgong); **Darjeeling:** common in foothills; **Sikkim:** Yoksam to Bakkim, Lachen. Subtropical and warm broad-leaved forests, 300-1700m. March-July.

6. KYDIA Roxb.

Trees; stellate-hairy throughout. Leaves obscurely 3-5-lobed, midrib beneath with a linear gland 1-2mm; stipules deciduous. Dioecious; flowers functionally unisexual (sometimes appearing bisexual), in axillary and terminal panicles. Epicalyx of 4(-6) ovate segments, connate at base, spreading and accrescent in fruit. Sepals 5, connate to middle, lobes broadly triangular. Petals 5, suborbicular to elliptic, clawed, gland-fringed. Male flowers with staminal column divided above into 5 branches each bearing 3-4 anthers; ovary and styles reduced to a pistillode hidden within staminal column. Female flowers with 3-celled ovary; style 3-branched; stigmas peltate; stamens without pollen. Capsule 3-valved, loculicidally dehiscent, valves 1-seeded.

1. Leaves densely tomentose beneath; epicalyx segments tomentose, ashy grey
1. K. calycina
 + Leaves glabrous or glabrescent beneath; epicalyx segments glabrous or glabrescent, reddish brown **2. K. glabrescens**

1. **K. calycina** Roxb. Sha: *Chhambagtang Shing, Tso Shing*; Nep: *Kubinde* (34), *Pichala*. Fig. 22 1–q.

Small tree to 12m. Leaves suborbicular to broadly ovate, 6–14 x 6–16cm, acute or obtuse, rounded to subcordate at base, margin irregularly denticulate, with scattered hairs above, densely tomentose beneath; petiole (1–)3–7cm. Epicalyx segments 4.5–5.5mm, accrescent in fruit to 7–12(–15)mm, greyish tomentose. Calyx lobes 2.3–3mm. Petals 7–8mm, white or pink sometimes with reddish base. Male flowers with staminal column 3–4mm, branches 2.5–3mm. Female flowers with style c 4mm; stamens sterile. Fruit subglobose 4–4.5mm.

Bhutan: C – Tashigang district (Tashigang and Ghunkarah); **Darjeeling:** Kurseong, Darjeeling and the Terai. Subtropical and warm broad-leaved forests, 150–1220m. September–October.

Bark fibre used in rope-making; wood useful.

2. **K. glabrescens** Masters

Similar to *K. calycina* but less hairy; leaves glabrous or glabrescent, suborbicular, 8–15 x 8–15cm; epicalyx segments 1–1.5(–2.5)cm, glabrous or glabrescent, reddish brown.

Bhutan: C – Tongsa district (near Shamgong). Warm broad-leaved forest, 1760m. October.

7. MALVA L.

Annual, biennial or perennial herbs. Leaves unlobed or lobed; stipules persistent. Flowers bisexual, axillary, solitary or fascicled. Epicalyx of 3 free segments. Sepals 5, connate to middle, lobes triangular. Petals 5, cuneate to obovate. Staminal column included, divided at apex into numerous filaments. Ovary 8–15-celled; style branches as numerous as cells; stigmas decurrent. Fruit of 8–15, 1-seeded indehiscent mericarps.

1. Usually perennial; petals 20–25mm, 3–4 x as long as sepals
4. M. sylvestris
- + Annual or biennial; petals 4–15mm, 1–2 x as long as sepals 2
2. Petals 10–15mm; mericarps 13–15, dorsally smooth, pubescent
2. M. neglecta
- + Petals 4–9mm; mericarps 10–12, reticulate at least at margins 3
3. Calyx not enveloping fruit; mericarps strongly reticulate dorsally; petals c 4mm, shorter than or just exceeding sepals **1. M. parviflora**
- + Calyx conspicuously accrescent, enveloping fruit; mericarps reticulate only on margins; petals 5–9mm, 1.5–2 x as long as sepals **3. M. verticillata**

1. *M. parviflora* L.; *M. microcarpa* Persoon

Annual herb, stems prostrate to ascending, to 40cm; shoots sparsely pubescent to glabrescent with short, stellate and long, simple hairs. Leaves unlobed or obtusely 3-5-lobed, 0.5-3 x 1-5cm, base cordate, margin crenate, pubescent; petiole 1-10cm; stipules lanceolate, c 2mm. Flowers axillary, in 1-3-flowered fascicles, pedicels 3-5mm, lengthening to 2cm in fruit. Epicalyx segments linear, c 7mm. Calyx 3-4mm, accrescent in fruit. Petals white or pink, c 4mm, shorter than or just exceeding calyx. Staminal column c 1mm. Fruit 6-7mm across; mericarps 8-10, c 2mm, dorsally reticulate, sides with fine radiating striations, glabrous.

Bhutan: C - Ha district (Ha) and Thimphu district (Tashi Cho Dzong); **Sikkim:** Dry hillsides and weed of cultivation, 2440-2800m. March - August.

2. *M. neglecta* Wallroth; *M. rotundifolia* L.

Similar to *M. parviflora* but differs in its larger flowers with calyx 5-8mm and petals 1-1.5cm, much exceeding calyx; fruit of 13-15 mericarps; mericarps ± smooth, sides without radiating striations, pubescent.

Bhutan: C - Thimphu district (Paro, 117). Weed of cultivation, 2400m.

This record requires confirmation. In India *M. neglecta* is predominantly a W Himalayan species.

3. *M. verticillata* L. Med: *Niga*

Annual or biennial herb; stems erect, to 1m, shoots stellate-pubescent. Leaves orbicular, obtusely 5-lobed, 3-7(-10) x 2-8(-15) cm, base cordate, margin crenate-serrate, thinly pubescent or glabrescent; petiole 5-7cm; stipules ovate, c 5mm. Flowers in axillary 3-5-flowered, dense fascicles, pedicels 3-10(-20)mm. Epicalyx segments linear, 4-5mm. Calyx 5-6mm, increasing to 8-11mm in fruit. Petals pink, 6-9mm. Staminal column c 3mm. Fruit 4-6mm across, enveloped by calyx; mericarps 10-12, c 2mm, dorsally slightly reticulate at margins, radiately striate on sides, glabrous or finely pubescent.

Bhutan: C - Ha district (Ha) and Thimphu district (Thimphu, Dotena, Paga, Paro, etc.); **Darjeeling:** Darjeeling; **Sikkim:** Lachung. Waste ground, 2500-2740m. July - October.

4. *M. sylvestris* L.

Biennial or perennial herb, stems erect or decumbent, 1-1.5m, younger shoots with sparse, spreading hairs. Leaves suborbicular, shallowly 5-lobed, 4.5-10 x 4-11cm (basal leaves up to 15 x 20cm), base cordate, margin crenate, sparsely pubescent; petiole 3.5-7.5cm; stipules lanceolate c 5mm. Flowers in dense, axillary 4-8-flowered fascicles; pedicels 2-3cm. Epicalyx segments oblong-lanceolate, 4-5mm. Sepals 5-7mm, not enlarging in fruit. Petals pink to purple, 20-25mm, 2-4 x as long as calyx. Staminal column 4-5mm. Fruit 5-7mm across, surrounded by calyx; mericarps 10-12, dorsally flat, strongly reticulate, glabrous or pubescent.

Chumbi: upper Chumbi Valley. 3650m. September.

8. ALCEA L.

Erect perennial herbs. Leaves palmately lobed; stipules deciduous. Flowers bisexual, large, in terminal spike-like racemes. Epicalyx segments 6–7, united at base, shorter than calyx. Petals emarginate. Staminal column 5-angled, glabrous, bearing anthers throughout. Carpels 2-celled, but only lower cell fertile. Fruit a schizocarp; mericarps numerous, indehiscent, in 1 whorl, grooved on back, hairy, 1-seeded.

1. *A. rosea* L.; *A. sinensis* Cavanilles, *Althaea rosea* (L.) Cavanilles. Eng: *Hollyhock*

Erect herb, with stout, hairy stems to 2m or more. Leaves ovate to suborbicular, 7–13 x 6–12cm, shallowly 3–5-lobed, base cordate or rounded, margin crenate, glabrous or sparsely stellate above, stellate-scabrid beneath; petioles 3–8cm. Pedicels 1–1.5cm. Epicalyx segments triangular 0.7–1.5cm. Calyx c 2cm lobes triangular. Petals 4–5cm, pink or red. Fruit c 2cm across. Mericarps c 30, c 7cm with parallel rugose wings.

Bhutan:C–Thimphu district (Paro and Tangu Gompa). Cultivated in gardens, 2370–2740m. July–October.

Native of E Mediterranean widely cultivated as an ornamental.

9. ABUTILON Miller

Herbs or shrubs, stellate-hairy throughout. Flowers axillary, solitary; pedicels jointed. Epicalyx absent. Sepals 5, connate at base or to middle. Petals 5, not clawed. Staminal column divided at apex into numerous filaments. Ovary 5–many-celled; style divided from near base, branches as numerous as cells; stigmas capitate. Fruit of 5–many mericarps, each 2–9-seeded, dehiscent.

1. Shoots without glandular hairs; calyx 5–10mm; mericarps 15–20

1. *A. indicum*

+ Shoots with glandular hairs; calyx 10–17mm; mericarps 5–12

2. *A. persicum*

1. *A. indicum* (L.) Sweet. Fig. 22h.

Erect annual or perennial subshrub, 0.5–2m; shoots minutely-stellately hairy and with scattered, longer, simple hairs. Leaves broadly ovate to orbicular, 2–15 x 2–15cm, acute or acuminate, base cordate, margin serrate to undulate, densely velvety beneath, indumentum usually thinner above; petioles 3–15cm; stipules filiform, 2–3mm. Pedicels 2–8cm. Calyx 5–10mm, lobes ovate to triangular, acute. Petals yellow or orange, obovate, 10–25mm. Staminal tube 5–8mm. Styles branched from near base; stigma capitate. Fruit cylindrical, truncate, 1.8–2cm across; mericarps 15–20, 2–3-seeded, compressed ± reniform but mucronate above and at inner margin, stellate-hairy.

Bhutan: S – Deothang district (Narfong, 117), C – Punakha district (Naki). Roadsides and waste ground, 2000m. August – February.

2. *A. persicum* (Burman f.) Merrill; *A. polyandrum* (Roxb.) Wight & Arnott

Similar to *A. indicum* but shoots glandular; leaves 4 – 20 x 3 – 16cm; petioles 2 – 9(–22)cm; stipules linear, 2mm; calyx 10 – 17mm, lobes lanceolate; petals 15 – 20mm; mericarps 5, oblong, not compressed.

Bhutan: locality unknown; **Darjeeling:** foothills. 300m. October – April.

10. SIDA L.

Annual or perennial herbs or shrubs. Leaves simple, pinnately or palmately veined; stipules persistent. Flowers in 1 – several-flowered axillary fascicles, or crowded at the end of branches. Pedicels jointed. Epicalyx absent. Sepals 5, connate to middle, lobes triangular, acuminate. Petals 5, not clawed. Staminal column 1.5 – 3mm, divided at apex into numerous filaments. Ovary 5 – 12-celled; style branches as numerous as cells; stigmas capitate. Fruit subglobose, of 5 – 12, 1-seeded mericarps, awnless or with 2 awns, dehiscent at apex or by disintegration of base.

1. Leaves cordate at base, palmately veined 2
+ Leaves cuneate or at most rounded at base, pinnately veined 4
2. Fruit with 8 – 10 mericarps; awns 3 – 5mm, bearing descending hairs
3. ***S. cordifolia***
+ Fruit with 5 mericarps; awnless or awns to 1mm, glabrous or bearing ascending hairs 3
3. Plant prostrate or ascending, at most with a few glandular hairs; pedicels 15 – 30mm **1. *S. cordata***
+ Plant erect, densely glandular-hairy; pedicel 4 – 15mm **2. *S. mysorensis***
4. Leaves glabrescent; stipules in each pair unequal, one usually lanceolate, 2 – 3-veined **4. *S. acuta***
+ Leaves glabrescent above, pubescent or tomentose below, stipules in each pair similar, filiform 5
5. Mericarps 5; branches often with spiny tubercles at base of petioles
5. ***S. spinosa***
+ Mericarps (6 –)8 – 12; branches without spiny tubercles at base of petioles
6. ***S. rhombifolia***

1. *S. cordata* (Burman f.) Borssum Waalkes; *S. humilis* Cavanilles, *S. veronicifolia* Lamarck

Slender, prostrate to ascending herb, 20 – 80cm, branched at base; shoots with short, stellate and simple hairs and longer, simple, patent hairs. Leaves broadly ovate, 1 – 5(–6) x 1 – 4(–5)cm, acuminate, base cordate, margins crenate to serrate, sparsely stellate below and with sparse, appressed, mainly simple hairs above; petiole 10 – 30mm; stipules filiform, 2 – 6mm. Flowers axillary, solitary or in 2 – 3-flowered racemes, pedicels 1.5 – 3cm. Calyx 5 – 8mm. Petals yellow, obtriangular, 6 – 8mm. Style arms 5. Mericarps 5, 2.5 – 3mm, not reticulate, awnless or with awns to 1mm, glabrous or with ascending hairs.

Bhutan: C – Thimphu district (Thimphu); **Sikkim:** Rangpo. Sandy hillsides, 2440m. March – August.

Yields strong fibres (34).

2. *S. mysorensis* Wight & Arnott

Similar to *S. cordata* but shoots erect and viscid; indumentum denser and with many simple, glandular hairs; flowers in several-flowered axillary fascicles; pedicels 1 – 1.5(–1.7)cm.

Bhutan: locality unknown; **Darjeeling:** terai at Siliguri and Gareedhura. Roadsides and secondary forest, 200 – 300m. September – March.

Records of *Sida glutinosa* Cavanilles from Samchi and Tashigang districts, Bhutan (117) probably refer to this species.

3. *S. cordifolia* Wight & Arnott

Erect annual or perennial subshrub, to 1m, branched throughout, shoots densely stellate-tomentose and with longer, simple, patent hairs. Leaves ovate to oblong, rarely orbicular, 2 – 6 x 1.5 – 4cm, obtuse to acute, base cordate, margin crenate, tomentose; petiole 2 – 4cm; stipules filiform, 4 – 7mm. Flowers axillary and solitary below and crowded at ends of branches, pedicels 1 – 2.5cm. Calyx 7 – 8mm. Petals cream to pale yellow, obovate, c 12mm. Style branches 8 – 10. Mericarps 8 – 10, c 4mm, reticulate; awns 3 – 4mm, bearing descending hairs.

Bhutan: S – Phuntsholing district (Phuntsholing, 117); **Darjeeling:** Balasun. Weed of cultivation, open habitats, 120 – 300m. July – October.

4. *S. acuta* Burman f.; *S. carpinifolia* L.f. Nep: *Jaharu*, *Khareto*

Erect or ascending annual or perennial herb or subshrub, 0.5 – 1m, branched throughout, shoots thinly stellate-pubescent becoming glabrous. Leaves narrowly lanceolate to lanceolate, 1 – 5(–8) x 0.4 – 1.5(–2)cm, acute, base cuneate, rarely rounded, margin serrate, glabrescent, petiole 3 – 4mm; stipules of each pair unequal, filiform to linear-lanceolate, 3 – 10mm. Flowers axillary, solitary or 2 – 5 flowered; pedicel 2 – 3mm. Calyx 5 – 8mm. Petals yellow, obovate, 8 – 10(–12)mm. Style branches 5 – 10. Mericarps 5 – 8(–10), c 2.5mm, reticulate; awns c 1mm, glabrous or with ascending hairs.

Bhutan: S – Samchi, Phuntsholing and Gaylegphug districts, C – Tashigang district; **Darjeeling:** Ryang, Kurseong, Pankabari; **Sikkim:** Gangtok and Rangpo. Subtropical forest, waste places, roadsides and open habitats, 200 – 1200m. December – May.

The Bhutanese material belongs to the typical subsp. *acuta*.

5. *S. spinosa* L.

Erect annual or perennial subshrub 0.5 – 1m, branched throughout; shoots stellate-tomentose, often with spiny tubercles at base of petioles. Leaves ovate to orbicular, 1 – 5 x 0.5 – 3.5cm, obtuse, base cuneate to rounded, margin serrate, tomentose below, glabrescent above; petiole 0.5 – 1(–2)cm; stipules filiform 3 – 6mm. Flowers axillary, solitary or in 2 – 5-flowered fascicles, pedicels 8 – 15mm. Calyx 5 – 6mm. Petals pale yellow or yellow, obtriangular, c 7mm. Style arms 5. Mericarps 5, c 2.5mm, smooth, awnless or with awns to 1mm long, bearing ascending hairs.

Bhutan: C – Punakha district (Rinchu and Wangdu Phodrang); **Darjeeling:** terai. Roadsides, garden weed and open habitats, 200 – 1830m. April – August.

6. *S. rhombifolia* L.

Erect, ascending or prostrate, annual or perennial subshrub, to 1m; shoots stellate-pubescent to tomentose. Leaves lanceolate to orbicular, often rhombic, 2 – 8 x 1 – 4cm, acute, rounded or retuse, base cuneate, margin serrate, glabrescent above, tomentose below; petiole 2 – 4mm; stipules filiform, 3 – 10mm. Flowers axillary, solitary or in 2 – 3-flowered fascicles, pedicels 1 – 2cm. Calyx 9 – 10mm. Petals yellow or pale orange, obliquely obtriangular, 0.8 – 1(–2)cm. Style arms (6 –)8 – 12. Mericarps (6 –)8 – 12, 2.5 – 3mm, faintly reticulate on back, mucous or with awns to 2mm, glabrous or bearing ascending hairs.

Bhutan: S – Phuntsholing district (Phuntsholing) and Gaylegphug district (Tama), C – Punakha district (Punakha) and Tashigang district (near Tashigang); **Darjeeling:** foothills. Roadsides, waste ground etc., 250 – 1830m. July – November.

Yields strong and high-quality fibres (34, 126). A very variable species, particularly in leaf shape. Two subspecies are recorded: the common subsp. *rhombifolia*, an erect undershrub with rhombic or lanceolate leaves and subsp. *retusa* (L.) Borssum-Waalkes (*S. alnifolia* L.) a prostrate to ascending subshrub with obovate to orbicular leaves, recorded from Punakha district (Samtengang) and Sikkim (Choongtam).

11. URENA L.

Herbs or shrubs, stellate-hairy throughout. Leaves unlobed or shallowly to deeply palmately lobed, palmately veined, with 1 – 3 linear or elliptic glands at base of veins beneath. Stipules deciduous. Flowers bisexual, mostly axillary, solitary or in 1 – 3 fascicles, sometimes clustered at the ends of branches. Epicalyx of 5 narrowly lanceolate to elliptic segments, connate to middle, accrescent in fruit.

Sepals 5, connate to middle; lobes triangular. Petals 5, not clawed. Staminal column with subsessile anthers throughout upper half. Ovary 5-celled; style 10-branched near apex; stigmas capitate. Fruit subglobose, of 5 indehiscent 1-seeded mericarps; each trigonous, ovoid, dorsally convex and covered with hooked bristles.

1. *U. lobata* L. Nep: *Kurey Pat* (117). Fig. 22i&j.

Erect, annual or perennial herb or shrub, 0.5 – 2m. Leaves ovate to orbicular, unlobed or shallowly to deeply 5-lobed, 3 – 11 x 2 – 13cm, acute or obtuse, base cordate or rounded, margin serrate, softly pubescent beneath, sparsely pubescent and almost rough above; petioles 1 – 5(–9)cm; stipules filiform, 2 – 4mm. Pedicels 2 – 4mm, lengthening to 5 – 10mm in fruit. Epicalyx segments 5 – 6mm. Calyx 6 – 7mm, withering in fruit. Petals pink, 1 – 2cm. Staminal column 1 – 1.5cm. Mericarps 4 – 6mm, hooked bristles c 2mm.

Bhutan: S – Samchi, Phuntsholing and Gaylegphug districts, C – Punakha and Tashigang districts; **Darjeeling:** Kurseong, Singtam, Lebong, Balasun, Siliguri, etc. Warm broad-leaved forest, waste ground and weed of cultivated areas, 200 – 1980m. August – February.

Yields strong fibres (34). The above records refer to typical subsp. *lobata* with unlobed or shallowly lobed leaves. One collection from the Darjeeling foothills belongs to the more lowland tropical subsp. *sinuata* (L.) Borssum-Waalkes (*U. sinuata* L.) which differs in its large deeply palmately lobed leaves.

12. MALVAVISCUS Fabricius

Shrubs, sometimes scrambling. Leaves pinnately or palmately veined. Stipules deciduous. Flowers bisexual, axillary, solitary or in terminal clusters. Epicalyx of 5 – 10 segments, shortly connate. Sepals 5, connate to middle, lobes triangular. Petals 5, toothed at base, erect not spreading. Staminal column exserted, 5-toothed at apex, pollen-bearing below apex. Ovary 5-celled; style 10-branched near apex; stigmas capitate. Fruit fleshy at first then drying and splitting into 5, 1-seeded indehiscent mericarps.

1. *M. arboreus* Cavanilles; *M. penduliflorus* DC.

Erect or climbing shrub, shoots stellate-pubescent and with simple hairs. Leaves ovate to broadly ovate, entire or 3 – 5-lobed, 3 – 10 x 1.5 – 8cm, acute, base rounded or cordate, margin serrate, thinly pubescent; petiole 1 – 2(–6)cm; stipules filiform 2 – 5mm. Pedicels c 1cm. Epicalyx segments 5 – 10, linear-oblong, c 1cm. Calyx 1 – 1.5cm. Petals scarlet, 2 – 7cm.

Bhutan: S – Phuntsholing district (Phuntsholing); **Darjeeling:** Kurseong. Cultivated in gardens, 250m. February.

Two varieties are recorded, var. *arboreus* from Darjeeling with leaves 3 – 5-lobed and corolla 2 – 3cm long and var. *penduliflorus* (DC.) Schery from Bhutan with leaves entire or sometimes 3-lobed and corolla 6 – 7cm long. Cultivated for its showy flowers.

Family 114. BOMBACACEAE

by D. G. Long & S.J. Rae

Deciduous trees, often with stellate hairs or peltate scales. Leaves alternate, digitately compound, stipulate. Flowers appearing before leaves, solitary on axillary peduncles, large, showy, bisexual, actinomorphic. Sepals 3 – 5, leathery, connate and cup-shaped at base. Petals 5, free. Stamens many, free or united into a tube; anthers 1-celled. Ovary superior, 5-celled; ovules many in each cell, axile; style 1; stigmas 5. Fruit a 5-valved capsule.

1. BOMBAX L.

Description as for Bombacaceae.

1. B. ceiba L.; *B. malabaricum* DC., *Salmalia malabarica* (DC.) Schott & Endlicher. Dz, Med: *Pema Geysar*; Sha: *Pema Geysar Shing*; Nep: *Simal* (34), *Simul*; Hindi: *Semal*; Eng: *Red Cotton Tree*, *Kapok Tree*. Fig. 21n – s.

Large tree to 30m; branches whorled, spreading horizontally; trunk buttressed at base, often bearing large conical spines. Leaves ± clustered towards branch ends, with 5 – 7 leaflets; petiole 8 – 22cm; leaflets elliptic, 9 – 20 x 4 – 6.5cm, caudate-acuminate, base cuneate, margins entire, glabrous; petiolules 1 – 2.5cm. Flowers appearing before leaves, solitary, axillary, borne towards branch ends; pedicels short stout. Calyx green, 1.5 – 3cm, with 3 – 5 unequal round lobes, silky hairy within. Petals crimson, thick, narrowly oblong-obovate, 7 – 11 x 2 – 4.5cm, stellate-pubescent, densely so outside. Stamens 3 – 5cm, shortly united at base. Style 4 – 6mm; stigma of 5 linear lobes c 5mm. Capsule ellipsoid, 10 – 15cm long, thickly white woolly within; seeds numerous.

Bhutan: S – Phuntsholing, Sarbhong and Gaylegphug districts, C – Punakha district (Punakha Dzong); **Darjeeling:** terai and lower hills. Subtropical and terai forests, often on silty soil close to rivers, native and cultivated, 200 – 1300m. January, February.

Wood used to make tea boxes and matches (34); bark produces a useful gum and various parts of the plant have medicinal uses (48, 126); the 'cotton' from the capsules is used as stuffing for mattresses, pillows etc. (34).

Family 115. STERCULIACEAE

by D.G. Long & S.J. Rae

Trees, shrubs or woody climbers, often with stellate hairs. Leaves alternate, simple, sometimes lobed, often palmately veined at base, stipulate. Flowers in axillary or terminal fascicles, cymes, panicles or racemes, bisexual or unisexual,

actinomorphic. Calyx 3 – 5-lobed, lobes free or united at base. Petals 5 or absent, free. Fertile stamens 5 – many, often connate partly or wholly into a tube or column; sometimes alternating with 5 or more staminodes. Ovary superior 4 – 5-celled; carpels free or partly to wholly united; ovules 2 or more per cell, axile; style simple or divided. Fruit a capsule or cluster of free follicles; seeds 1 to many, winged or not.

1. Leaf margins entire, lobed or not (sometimes irregularly toothed in *Pterospermum*) 2
- + Leaf margins regularly serrate or serrulate with small teeth, lobed or not (teeth somewhat distant in *Abroma*) 7

2. Flowers in panicles or racemes; petals absent; fruit of free spreading follicles 3
- + Flowers solitary or in cymes or corymbs; petals present; fruit capsular 5

3. Leaves ovate, unlobed, cordate at base; flowers in short, dense racemes 3 – 5cm; seeds winged **3. Pterygota**
- + Leaves palmately lobed or unlobed, if unlobed then cuneate or rounded at base; flowers in lax racemes or panicles 3 – 55cm; seeds unwinged 4

4. Calyx tubular, thick in texture and densely tomentose; follicles woody or leathery **1. Sterculia**
- + Calyx campanulate, thin in texture, glabrous or pubescent; follicles membranous, wing-like **2. Firmiana**

5. Climbing shrub; flowers numerous in cymes, minute (petals c 4mm); fruit a spiny capsule **9. Byttneria** (*B. grandifolia*)
- + Trees; flowers solitary, axillary or in few-flowered cymes or many-flowered corymbs, small to very large (petals 1 – 10cm); capsules stellate-pubescent, tomentose or warted 6

6. Flowers numerous in corymbs; calyx 0.4 – 1cm, shortly lobed; capsules obovoid, smooth **4. Reevesia**
- + Flowers solitary or few in cymes; calyx 5 – 12cm, lobed almost to base; capsules oblong, warted **6. Pterospermum**

FIG. 23. **Sterculiaceae**. a – f, *Sterculia villosa*: a, leaf; b, leaf indumentum; c, inflorescence; d, male flower; e, female flower; f, dehiscent capsule. g – k, *Firmiana colorata*: g, leaf; h, inflorescence; i, male flower dissected; j, female flower dissected; k, follicles and persistent calyx. l – p, *Pterygota alata*: l, leaf and inflorescence; m, male flower; n, female flower dissected; o, dehiscent follicle; p, seed. q – v, *Byttneria grandifolia*: q, leaf and inflorescence; r, dissected flower (2 sepals, 2 petals, 2 staminodal lobes and ovary removed); s, ovary; t, undehiscent capsule; u, dehiscent valve of capsule; v, seed. Scale: a, l, q x 1/4; g x 1/3; c, f, h, k, o, p, t, u x 1/2; i, j x 1 1/2; v x 1 3/4; d, e, m, n x 2; r x 7/2; b, s x 25. Drawn by G. Rodrigues.



7. Leaves distantly serrulate; flowers in leaf-opposed cymes; fruit a membranous winged capsule **8. Abroma**
 + Leaves closely serrate; flowers in axillary or terminal inflorescences; fruit capsular or follicular, not membranous 8
8. Large climbing shrub; flowers minute (petals to c 4mm); fruit a globose bristly capsule **9. Byttneria** (*B. pilosa*)
 + Erect shrubs or trees; flowers large (petals 9 – 40mm); fruit usually stellate-pubescent or softly pilose (in *Helicteres* cylindric and bristly) 9
9. Cultivated shrub with axillary and terminal many-flowered umbellate cymes **10. Dombeya**
 + Native trees or shrubs; flowers solitary or few in axillary fascicles, racemes or cymes 10
10. Shrubs; leaves ovate to oblong or lanceolate; base rounded, truncate or shallowly cordate **5. Helicteres**
 + Trees; leaves broadly ovate or suborbicular, cordate (usually deeply) at base **7. Eriolaena**

1. STERCULIA L.

Trees or large shrubs. Leaves unlobed or palmately lobed, palmately veined (or if pinnately veined often weakly 3-veined at base). Flowers unisexual (or some apparently bisexual), both sexes on one plant, borne in axillary panicles or racemes. Calyx campanulate, 5-lobed. Petals absent. Male flowers with staminal column bearing globose head with 10 – 15 sessile anthers; column later recurving. Female flowers with globose stellate-hairy stalked ovary, surrounded at base by ring of sterile anthers; style erect at first, later reflexed; stigma peltate or lobed; carpels partly free, separating after fertilisation. Fruit of 3 – 5-free spreading follicles, woody or leathery; seeds not winged.

The record of *S. balanghas* L. from Bhutan (80) is almost certainly based on a mislabelled Griffith specimen.

1. Leaves palmately lobed, broadly ovate or suborbicular **1. S. villosa**
 + Leaves unlobed, elliptic to oblanceolate 2
2. Flowers in erect panicles 3 – 7cm **4. S. lanceifolia**
 + Flowers in pendulous racemes 8 – 55cm 3
3. Leaves cuneate or narrowly rounded at base; calyx lobes densely pubescent, pilose within **2. S. hamiltonii**
 + Leaves broadly rounded or cordate at base; calyx lobes sparsely pubescent, not pilose **3. S. kingii**

1. *S. villosa* Smith. Sha: *Phrang Shing*; Nep: *Odal* (34). Fig. 23a - f.

Tree 10 - 15m, deciduous; twigs stout with large leaf scars. Leaves palmately 5 - 7-lobed, \pm clustered towards branch ends, membranous, broadly ovate or suborbicular, 15 - 50 x 15 - 50cm, base cordate, lobes acuminate, margins entire or lobes with 1 - 2 smaller lateral lobes towards apex, sparsely stellate-hairy above, stellate-tomentose beneath; petioles 15 - 40cm; stipules ovate-lanceolate 1.5 - 3cm, sub-persistent. Flowering panicles pendulous, slender, borne in axils of fallen leaves, 15 - 55cm, stellate-tomentose, pedicels 2 - 5mm. Flowers yellow. Calyx campanulate, tube 2.5 - 3mm; lobes 5 ovate 4 - 6mm. Fruit with 4 - 5 spreading tomentose follicles, red within, 5 - 8 x 3 - 5cm; seeds black.

Bhutan: S - Phuntsholing district (Phuntsholing) and Chukka district (Lower Raidak Valley), C - Tongsa district (Mangde Chu Valley); **Darjeeling:** foothills and terai. Subtropical and terai forests, 200 - 1325m. January - March.

A useful fibre plant (126).

2. *S. hamiltonii* (Kuntze) Adelbert; *S. coccinea* G. Don, *S. indica* Merrill. Nep: *Chiwariapat* (34).

Large shrub or small tree; branchlets slender. Leaves membranous, unlobed, elliptic 12 - 36 x 4 - 9cm, acuminate, base cuneate or narrowly rounded, margins entire, veins prominent beneath, sparsely stellate when young becoming glabrous; stipules lanceolate 5 - 7mm; petioles 2 - 13cm. Racemes slender, pendulous, 8 - 17cm; pedicels 5 - 10mm. Flowers green, pink within. Calyx lobes linear 12 - 16mm with reflexed margins, puberulous, pilose within. Fruit of 2 - 5 tomentose follicles 10 - 12.5cm, bright red outside, pink within; seeds 4 - 5, white.

Bhutan: S - Chukka district (Marichong) and Sarbhang district (Chirang road); **Darjeeling:** foothills. Subtropical forest, 600 - 900m. August - October.

3. *S. kingii* Prain. Nep: *Chiwariapat* (34).

Similar to *S. hamiltonii* but leaves broadly elliptic-obovate, 12 - 25 x 6 - 13cm, abruptly acuminate, base rounded or often shallowly cordate; petioles 3 - 9cm; flowers yellow; calyx lobes appearing broader due to less reflexed margins, sparsely pubescent, not pilose; fruit unknown.

Bhutan: S - Chukka district (above Chukka Dzong); **Darjeeling:** Rishap, Narchu River. Warm broad-leaved forest, 900 - 1800m. May, June.

4. *S. lanceifolia* G. Don; *S. roxburghii* Wall. Nep: *Chiwariapat* (34).

Tree, branches slender, sparsely stellate. Leaves unlobed, thinly coriaceous, elliptic, 8 - 19 x 4 - 6.5cm, abruptly acuminate, base rounded, margins entire, glabrous; petioles 1.7 - 3cm; stipules subulate. Flowering panicles erect, stellate-pubescent, 3 - 7cm. Flowers red. Calyx shortly united at base, lobes oblong, 5 - 10 x 2 - 3mm, flat, pubescent outside. Fruit of up to 5 scarlet minutely tomentose follicles up to 7cm; seeds black.

Darjeeling: Lebong. March, April.

S. ornata Masters is based on a Griffith collection, supposedly from Bhutan but of doubtful origin and identity.

2. FIRMIANA Marsili

Deciduous trees. Leaves palmately veined and usually palmately lobed. Flowers in axillary panicles borne in axils of previous year's leaves, unisexual, both sexes on same branch. Calyx tubular, 5-lobed, persistent. Petals absent. Stamens and ovary exerted from calyx on slender column; male flowers with 10 anthers; female flowers with ovary surrounded by ring of sterile anthers (smaller than in male flowers); carpels 5, free; style short. Fruit of 4 or 5 free membranous wing-like follicles, attached to column, each with 1–2 seeds attached on sides towards base, usually dehiscing before maturity.

1. Branches and leaves glabrous, calyx deep orange-red, 2–3cm. **1. F. colorata**
+ Branches and leaves stellate-hairy, flowers pale yellow, c 1.5cm

2. *F. fulgens*

1. F. colorata (Roxb.) R. Brown; *Sterculia colorata* Roxb. Nep: *Seto Odal* (34), *Phirphire* (34), *Labshi*. Fig. 23g–k.

Tree 20–25m, branches glabrous. Leaves shallowly to deeply 3-lobed, sometimes unlobed or 5-lobed, broadly ovate or suborbicular, 8–25 x 8–22cm, lobes acuminate, base cordate, margins entire, scattered stellate-hairy on lower surface when young, becoming glabrous; petiole glabrous 5–18cm; stipules lanceolate 3mm. Panicles many-flowered, 5–17cm long, usually appearing while tree is bare. Flowers deep orange-red. Calyx 2–3cm, narrowly funnel-shaped, slightly curved, stellate-tomentose, lobes triangular 4–5mm, pilose within. Follicles lanceolate 4–10 x 2–3cm, glabrous, 1- or 2-seeded.

Bhutan: S – Gayleghug, Sarbhang and Samchi districts; **Darjeeling:** Sukna Terai, Kurseong. Subtropical and terai forests, 300–1200m. March – April.

Inner bark yields a fibre; twigs and leaves used for cattle fodder.

2. F. fulgens (Masters) Corner; *F. pallens* (King) Stearn, *Sterculia fulgens* Masters. Nep: *Labshi* (34).

Similar to *F. colorata* but branches softly stellate-pubescent; leaves shallowly 3–5-lobed; lobes acute, becoming glabrous above, lower surface stellate-hairy; panicles 10–17cm, flowers pale yellow; calyx broadly funnel-shaped, c 1.5cm, glabrous within; follicles usually 1-seeded.

Darjeeling: Chenga Hill. 300m. April – May.

Roots of young trees have edible tubers (34).

3. PTERYGOTA Schott & Endlicher

Large trees. Leaves unlobed except on juvenile plants, palmately veined at base. Flowers in short, dense axillary racemes, unisexual, both sexes in same raceme. Calyx campanulate, divided almost to base, fleshy. Petals absent. Male flowers with short slender column bearing ring of 5 clusters of anthers around pistillode. Female flowers with 5 sessile carpels surrounded by 5 bundles of staminodes, styles recurved. Fruit of 1–5 long-stalked thick, fibrous follicles; seeds many, compressed, with large spongy wing.

1. *P. alata* (Roxb.) R. Brown; *Sterculia alata* Roxb. Nep: *Labshi* (34), *Nareola*, *Badam*. Fig. 231 – p.

Large tree to 35m; young branchlets densely brownish stellate. Leaves thinly leathery, ovate, 15–40 x 12–28cm, acute, base cordate, often unequally, palmately 5–7-veined at base, margin entire, glabrous; petiole 5–18cm; stipules subulate, c 5mm. Racemes short, dense, 3–5cm. Flowers red-brown stellate-tomentose. Calyx lobes linear, thick, 12–18mm. Follicles obliquely obovoid, with short conical point, c 12 x 10cm, brownish puberulous; seeds with obovate wing c 6 x 4cm.

Bhutan: S–Samchi, Sarbhang and Gaylegphug districts; **Darjeeling:** Mongpong and Tista Valley. Subtropical forests, often on river banks, 320–550m. February – April.

Often planted in Darjeeling district (34).

4. REEVESIA Lindley

Evergreen trees. Leaves unlobed, 3-veined at base. Flowers in branched terminal corymbs, bisexual. Calyx campanulate or funnel-shaped, irregularly 5-lobed. Petals 5, spatulate, clawed at base. Stamens and ovary united into long slender exerted column, bearing 15 sessile anthers united into globose head; ovary sessile within head, 5-celled and 5-lobed; stigma sessile, 5-lobed. Fruit a woody 5-valved capsule; seeds 1–2, winged.

1. Leaves stellate-pubescent beneath; calyx 7–10mm **1. *R. pubescens***
 + Leaves minutely stellate-puberulous beneath; calyx 4–5mm **2. *R. wallichii***

1. *R. pubescens* Masters. Nep: *Chipli Kawla* (34).

Tree to 15m; branches thinly stellate-pubescent. Leaves thinly coriaceous, ovate-elliptic, 8–18 x 4–10cm, acute, base truncate, margins entire, stellate-pubescent beneath; petioles 1–3cm. Corymbs 5–9cm across; flowers white. Calyx 7–10mm, campanulate. Petals with obovate limb 7–8mm, claw equalling calyx. Column 1.5–2.5cm. Capsules obovoid, up to 6cm, stellate-puberulous, with 5 narrow lobes; seeds oblong c 2.5cm.

Bhutan: S – Chukka district (Marichong) and Sarbhang district (Chirang road);
Darjeeling: Kurseong, Darjeeling. Subtropical forests, 1030 – 1200m. May – July.

2. *R. wallichii* R. Brown

Similar to *R. pubescens* but leaves rounded at base, minutely stellate-puberulous beneath; flowers smaller, calyx 4 – 5mm.

Bhutan: locality unknown (80); **Darjeeling:** foothills (34, 80).

These records require confirmation.

5. HELICTERES L.

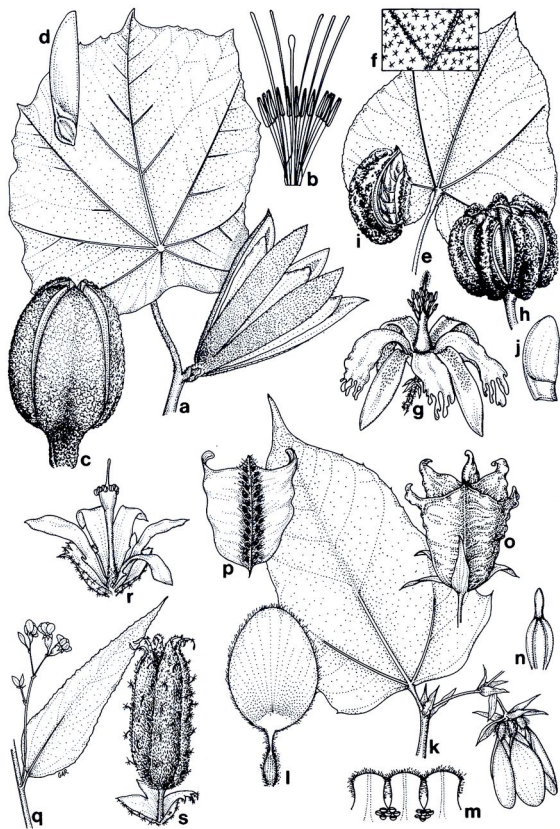
Shrubs. Leaves unlobed, 3 – 7-veined at base. Flowers in axillary fascicles, or in short racemes or spikes, bisexual. Calyx tubular 5-fid often unequally. Petals 5, showy, unequal, clawed, claw often appendaged. Column elongate 5-lobed, bearing 10 anthers between lobes. Ovary 5-celled, inserted in apex of column; styles 5, slender ± united. Fruit of 5 follicles separating when ripe; seeds not winged.

1. Leaves ovate to oblong, softly stellate-tomentose; calyx tube 9 – 13mm; ripe fruit 3.5 – 4.5cm **1. *H. hirsuta***
- + Leaves lanceolate or ovate-lanceolate, sparsely stellate-pubescent beneath, calyx tube 3 – 5mm; fruit 1.6 – 2cm 2
2. Leaf base rounded; flowers in short axillary fascicles or racemes 1 – 3cm
2. *H. plebeja*
- + Leaf base truncate; flower fascicles in slender lateral racemes 3 – 10cm
3. *H. elongata*

1. *H. hirsuta* Loureiro; *H. spicata* Masters

Shrub 1 – 2m, branches softly stellate-tomentose. Leaves thinly coriaceous, ovate to oblong, 7 – 18 x 3.5 – 8cm, acuminate, base rounded or shallowly cordate, often oblique, margins serrate or crenate, often irregularly, sometimes doubly serrate towards apex, palmately 5 – 7-veined at base, stellate-tomentose, densely so beneath; petioles 1 – 3cm; stipules subulate 3 – 7mm. Flowering spikes 3 – 7cm, with red-purple gland at base of each pedicel; pedicels very short. Calyx tubular, stellate-hairy, tube narrow 9 – 13mm; lobes unequal 2 – 3.5mm. Petals 5, reddish-

FIG. 24. *Sterculiaceae*. a–d, *Pterospermum acerifolium*: a, leaf and flower; b, stamens, staminodes and ovary; c, capsule; d, seed. e–j, *Eriolaena spectabilis*: e, leaf; f, leaf indumentum; g, flower; h, dehisced capsule; i, valve of capsule; j, seed. k–p, *Abroma augusta*: k, leaf and flower; l, petal; m, anthers and staminodal lobes; n, ovary; o, capsule; p, dehisced valve of capsule. q–s, *Helicteres plebeja*: q, leaf and inflorescence; r, dissected flower; s, capsule. Scale: c x 1/2; a, e, k, o, p, q x 1/2; h, i x 1/2; b, d, j, l x 1; g x 1/2; s x 2; r x 2 1/2; m, n x 3; f x 25. Drawn by G. Rodrigues.



purple, unequal, 2–3cm, claw appendaged, limb spatulate. Column 15–18mm; ovary cylindrical. Follicles straight 3.5–4.5cm, densely covered with bristles bearing stellate hairs.

Sikkim/Darjeeling: locality unknown (80). June–October.

2. *H. plebeja* Kurz; *H. glabriuscula* Masters. Fig. 24q–s.

Slender shrub to 1m; branches stellate-puberulous. Leaves membranous, lanceolate, 6–13 x 1.5–3.5cm, acuminate, base rounded, oblique, margins serrulate, 3–5-veined at base, stellate-pubescent beneath and on veins above, sometimes almost glabrous; petiole 2–6mm. Flowers in fascicles or short racemes 1–3cm; pedicels 2–3mm; flowers yellow tipped with violet. Calyx campanulate, stellate, tube 3–5mm, lobes unequal 2–3.5mm. Petals subequal 9–10mm, 2 shorter ones appendaged. Column c 5mm. Follicles 1.6–2cm, stellate-bristly, straight.

Darjeeling: terai, Bamunpokri, Panchkilla. 150–300m. June–August.

3. *H. elongata* Masters

Similar to *H. plebeja* but leaf base truncate; fascicles of flowers borne in slender leafless racemes 3–10cm.

Darjeeling: terai. 300m.

Will probably prove to be a form of *H. plebeja*.

6. PTEROSPERMUM Schreber

Trees. Leaves unlobed or palmately lobed, palmately veined at base. Flowers solitary or 2–3 on short, axillary peduncles. Bracteoles deeply divided into thick, linear lobes, early deciduous. Sepals 5, free, linear, deciduous. Petals 5, deciduous. Column short, lobed at apex, with 15 fertile stamens in 3's between 5 linear staminodes; filaments free, elongate. Ovary inserted in apex of column, 5-celled; style elongate, clavate. Fruit a woody 5-valved capsule; seeds winged.

1. Leaves broadly oblong, ovate or suborbicular, 15–40 x 9–30cm, often coarsely dentate or lobed, base peltate or cordate; stipules comb-like (pectinate); flowers 9–12cm **1. *P. acerifolium***
 + Leaves oblong-lanceolate, 9–15 x 3–4.5cm, unlobed, entire, base obliquely rounded; stipules subulate; flowers 4–6cm **2. *P. javanicum***

1. *P. acerifolium* (L.) Willdenow; *Pentapetes acerifolia* L. Nep: *Hattipaille*. Fig. 24a–d.

Tree to 30m; young branches finely pale tomentose. Leaves very variable in shape and size, lobed or not, thinly coriaceous, rounded, suborbicular or oblong, 15–40 x 9–30cm, apex truncate and coarsely toothed, often abruptly acuminate, base cordate or peltate, margins irregularly toothed or lobed, palmately 7–9-veined at

base, minutely pale tomentose beneath, glabrous above; stipules comb-like (pectinate), thick, 9 – 13mm; petioles 6 – 23cm. Flowers fragrant, solitary or 2 – 3 on short peduncle 0.5 – 2.5cm. Calyx lobes linear, villous, 9 – 12 x 0.6 – 1cm. Petals linear, white, 7 – 10 x 0.6 – 1cm, drying red. Column 2 – 2.5cm; staminodes 6 – 8cm; stamens 4 – 5cm; style 5 – 7cm, club-shaped, base villous. Capsule 9 – 15 x 4.5cm, warted and covered in brown ferruginous tomentum.

Bhutan: S – Samchi, Phuntsholing and Gaylegphug districts, C – Mongar district (Shongar); **Darjeeling:** Birik, Chunbati, Tista Valley. Subtropical and warm broad-leaved forests, 550 – 1300m. April – June.

Flowers collected and used as a disinfectant and to purify bedclothes; wood sometimes used. Native and planted.

2. *P. javanicum* Junghuhn; *P. blumeanum* Korthals

Differs from *P. acerifolium* in its much smaller oblong-lanceolate, entire leaves 9 – 15 x 3 – 4.5cm, apex acuminate, base obliquely rounded; stipules subulate; flowers smaller, calyx lobes 5 – 6cm; petals 3 – 5cm; column 10 – 12mm; stamens c 2cm; staminodes c 2.5cm; style 2 – 3cm.

Bhutan: S – Gaylegphug district (Lodrai Khola). Subtropical forest, 320m. March.

A Burmese-Malesian species not known previously from the Himalaya.

7. ERIOLAENA DC.

Trees. Leaves simple, unlobed or shallowly lobed, palmately 5 – 7-veined at base. Flowers bisexual, solitary, axillary, or in few-flowered cymes. Calyx deeply (4 –)5-lobed, lobes spreading. Petals (4 –)5-clawed, claw tomentose. Staminal column tubular, bearing numerous stamens in lower part, all fertile. Ovary 5 – 10-celled; style 5 – 10-lobed. Fruit a woody capsule, valves united until dehiscence; seeds winged.

1. Cymes 2 – 3-flowered; bracteoles linear, entire **1. E. spectabilis**
+ Flowers solitary; bracteoles ovate, deeply pinnately cut **2. E. wallichii**

1. *E. spectabilis* Masters. Fig. 24e – j.

Tree 6 – 10m; young branches stellate-hairy. Leaves coriaceous, broadly ovate, 5 – 13 x 4 – 9cm, acute, base cordate, margins serrate, sometimes shallowly lobed, stellate-pubescent above, closely tomentose below; petioles 2 – 5cm, stellate-tomentose; stipules linear 4 – 6mm. Cymes mostly 2 – 3-flowered; peduncle 2 – 7cm stellate-hairy, bracteoles at apex of pedicel linear, entire 6 – 10mm. Flowers yellow. Calyx lobes linear-lanceolate, 1.5 – 2.5cm, stellate-tomentose. Petals spatulate, limb 1.5 – 2cm, claw villous. Stamens 1.5 – 2cm. Ovary tomentose; style c 2cm, tomentose except apex. Capsule oblong or rounded, 6 – 8-lobed, valves 3 – 3.5cm, woolly on inner angle, with thick warty ridge on outside; seeds oblong, superposed.

Bhutan: C – Punakha, Mongar and Tashigang districts. Dry valleys and riversides, 1080 – 1670m. April – June.

Poultice made from roots used to heal wounds. Fibre used for rope-making (80).

2. *E. wallichii* DC.

Similar to *E. spectabilis* but leaves 7 – 17 x 5 – 15cm, more thickly and softly tomentose beneath; flowers solitary; bracteoles ovate, 1.5 – 2 x 1 – 1.5cm, deeply pinnately cut; calyx lobes 3 – 4cm; petals 3 – 4cm; fruit not seen.

Darjeeling: foothills (34).

Wood used for gunstocks, paddles and rice pounders.

A third species of *Eriolaena* is present in Bhutan (unlocalised Griffith specimen) and the Darjeeling terai (Bamunpokri) but the specimens lack inflorescences and bracts; they have leaves larger than in *E. spectabilis*, 14 – 17 x 10 – 15cm and densely puberulous, not softly tomentose, beneath. They are close to *E. candollei* Wall., a South Indian and Burmese species which has compound inflorescences and pinnatifid bracteoles.

8. ABROMA Jacquin

Shrubs or small trees. Leaves unlobed or palmately lobed, palmately 5 – 7-veined at base. Flowers bisexual in few-flowered cymes, borne on leaf-opposed peduncles. Calyx deeply 5-lobed. Petals 5; claw concave, glandular at base. Staminal cup 5-lobed anthers many, borne between staminodal lobes. Ovary sessile, 5-celled; styles 5, coherent. Fruit a 5-winged membranous capsule; seeds not winged.

1. *A. augusta* (L.) L.f. Nep: *Sanu Kapasi* (34); Eng: *Devil's Cotton*. Fig. 24k – p.

Shrub 2 – 4m, young branches softly stellate-tomentose. Leaves ovate to suborbicular, unlobed or shallowly 3 – 5-lobed, 18 – 27 x 10 – 24cm, acuminate, base truncate or cordate, margins distantly serrulate, pubescent on veins above, stellate-pubescent or tomentose below; 5 – 7-veined at base; petiole 1 – 22cm; stipules narrow lanceolate, 4 – 6mm, deciduous. Cymes 5 – 7cm, 2 – 5-flowered. Flowers pendent. Calyx lobes lanceolate, 1.4 – 1.7cm, pubescent. Petal limb spatulate, 2 – 2.5 x 1 – 1.4cm, purplish brown, pilose on margins and base, attached at base to a broadened pilose claw, c 8mm. Ovary villous. Capsule obovoid, 4 – 5 x 4 – 5cm, 5-winged, pubescent; wings broadest at apex; valves silky-hairy within, dehiscing at apex.

Bhutan: S – Samchi, Phuntsholing, Chukka and Deothang districts; **Darjeeling:** Darjeeling, Badamtam, Sivoke, Rilli Valley. Subtropical forest, 500 – 1070m. June – August.

Root used medicinally for menstrual disorders and snake bites. Stems used as a fibre crop. Seeds edible (34). Probably introduced (34).

9. BYTTNERIA Loeffling

Shrubs, usually climbing. Leaves unlobed or palmately lobed, 5–7-veined at base. Flowers bisexual, minute, in much branched axillary and terminal cymes. Calyx deeply 5-lobed. Petals 5, minute, fleshy, hooded. Staminal cup with 5 staminodal lobes (over which petals fit) alternating with 5 fertile stamens. Ovary sessile, 5-celled; style minute, simple or 5-lobed. Fruit a spiny 5-valved capsule; seeds not winged.

1. Leaves unlobed, margins entire; fruit with rigid stout puberulous spines

1. B. grandifolia

- + Leaves 3–5-lobed, rarely unlobed, margins serrulate; fruit with flexible barbed bristles **2. B. pilosa**

1. B. grandifolia DC.; *B. aspera* Wall. Fig. 23q–v.

Large woody climber with stout trunk; branchlets stellate-pubescent. Leaves unlobed, broadly ovate or suborbicular, 12–31 x 10–21cm, abruptly acuminate, base cordate, margins entire, almost glabrous above, mid-vein eglandular, minutely stellate-pubescent on veins below; petioles 5–14cm, stellate-pubescent; stipules early caducous. Cymes 3–9cm long, many-flowered, subumbellately branched, tomentose. Flowers minute. Calyx lobes 2.5mm. Petal limb lanceolate, 2.5mm, yellow-green outside; claw concave, purplish, c 1.5mm. Capsule globose, puberulous c 3cm diameter, covered with stout curved spines 6–9mm; seeds ovoid, c 10 x 6mm.

Bhutan: S – Chukka, Sarbhang and Gaylegphug districts; **Darjeeling:** Terai, Dulka Jhar, Mongpo, Darjeeling, Tista Valley, etc. Margins of subtropical forests, 290–800m. March–July.

2. B. pilosa Roxb.

Similar to *B. grandifolia* but more hairy throughout; leaves mostly 3–5-lobed, rarely unlobed, 7–15 x 6–16cm, margins serrulate, coarsely stellate-pubescent and pilose especially on veins, mid-vein beneath with linear gland 7–15mm near base; capsule 2–2.5cm, densely covered with barbed bristles.

Darjeeling: Pankabari. Subtropical forests, 600m. May–July.

Leaves and fruits edible.

10. DOMBEYA Cavanilles

Shrubs. Leaves unlobed, palmately veined at base. Flowers bisexual, numerous in rounded axillary and terminal umbellate cymes. Calyx lobes 5, reflexed. Petals 5, showy, subsistent. Column bearing 5 linear staminodes and 10–20 fertile stamens. Ovary 2–5-celled; style slender, 5-lobed at apex. Fruit a 5-valved capsule, seeds unwinged.

1. D. aff. mastersii Hooker

Subshrub to 2m, stellate-hairy throughout. Leaves ovate, 6–14 x 5–10cm, acuminate, base cordate, margins coarsely serrate; petioles 3–6cm. Umbels c 1 cm diameter, on long peduncle. Calyx lobes lanceolate, 1.5–2cm. Petals pink, obovate, c 2cm.

Bhutan: S – Phuntsholing. Cultivated in garden of Bank, 250m. February.

Cultivated as an ornamental. This plant may be of hybrid origin as the true *D. mastersii*, a native of tropical Africa, has white flowers.

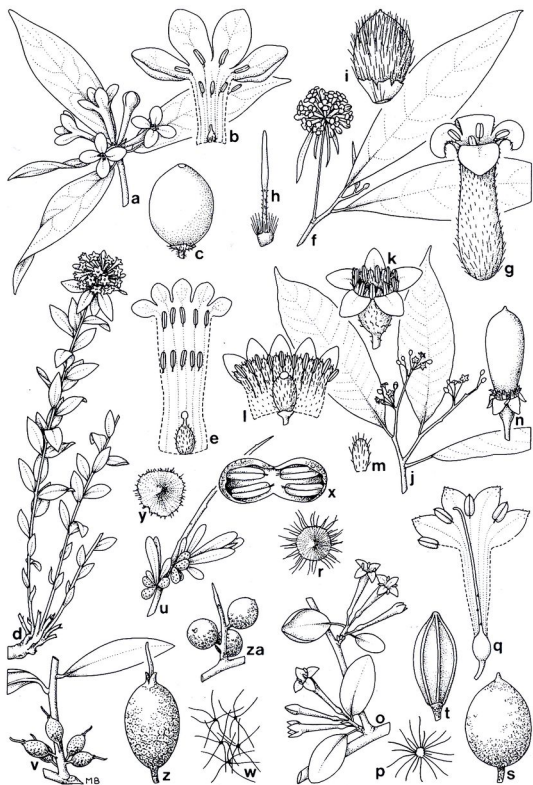
Family 116. THYMELAEACEAE

by S.J. Rae

Shrubs or trees, rarely herbs, with tough fibrous inner bark. Leaves alternate, simple, pinnately veined, entire, exstipulate. Flowers in axillary or terminal, umbellate or globose heads, bisexual, actinomorphic. Perianth tubular; lobes 4–5, spreading, imbricate in bud, sometimes with scales at mouth within. Stamens 8–10, adnate to perianth tube, often arranged in 2 whorls. Ovary superior, 1–2-celled; ovules 1–2 per cell, apical; style slender; stigma capitate to oblong. Fruit a capsule, drupe or nut, 1–2-seeded.

1. Trees; leaves with close parallel veins; flowers 5-merous **1. Aquilaria**
- + Herbs or shrubs, leaf veins not close and parallel; flowers 4-merous (or 5-merous in *Stellera*) 2
2. Herbs with erect, simple, leafy shoots arising from woody rootstock **2. Stellera**
- + Much branched shrubs 3
3. Flowers yellow, numerous (30–40) in globose, pendulous clusters; leaves sparsely silky-pubescent **3. Edgeworthia**
- + Flowers white, pink or sometimes yellow, 3–12 in erect terminal or lateral clusters; leaves glabrous **4. Daphne**

FIG. 25. **Thymelaeaceae** and **Elaeagnaceae**. **Thymelaeaceae**. a–c, *Daphne bholua*: a, flowering shoot; b, dissected flower; c, drupe. d & e, *Stellera chamaejasme*: d, part of plant showing single flowering shoot; e, dissected flower. f–i, *Edgeworthia gardneri*: f, flowering shoot; g, flower; h, ovary and style; i, drupe. j–n, *Aquilaria malaccensis*: j, flowering shoot; k, flower; l, dissected flower; m, staminodal scale; n, capsule. **Elaeagnaceae**. o–t, *Elaeagnus parvifolia*: o, portion of flowering shoot; p, stellate hair from upper surface of leaf; q, dissected flower; r, scale from calyx; s, drupe; t, stone. u–za, *Hippophae salicifolia*: u, branchlet with leaves and male flowers; v, branchlet with female flowers; w, stellate hairs from upper surface of leaf; x, male flower; y, scale from calyx of male flower; z, female flower; za, fruits. Scale: d, f, j x ½; a, o, v, za x 1; u x 1½; b, c, n x 2; g, s, t x 2½; e, q x 3; h, i x 3½; x, z x 4; k, l x 5; m x 8; w x 15; y x 20; p x 25; r x 35. Drawn by M. Bates.



1. AQUILARIA Lamarck

Evergreen trees. Leaves with fine, close, parallel lateral veins. Flowers in axillary or terminal umbels. Perianth 5-lobed. Stamens 10, shortly exerted, alternating with 10 erect silky scales borne at mouth of corolla tube. Ovary villous, 2-celled; stigma large, sessile. Fruit a leathery or woody 2-valved capsule borne in base of persistent perianth, 1 – 2-seeded.

I. A. malaccensis Lamarck; *A. agallocha* Roxb. Hindi?: *Agar*; Eng: *Eagle Wood*, *Indian Aloe-wood*. Fig. 25j – n.

Tree 30 – 40m. Leaves elliptic-lanceolate, 7 – 10 x 3 – 4cm, shortly caudate-acuminate, base rounded or cuneate, glabrous and with fine, close, parallel lateral veins; petioles 3 – 5mm. Umbels 8 – 10-flowered; pedicels 3 – 5mm. Perianth 4 – 6mm, white or greenish, campanulate, densely villous within, lobes oblong 3 – 4mm. Capsule woody, obovoid 3 – 4 x 2.5cm.

Bhutan: S – Phuntsholing district (Phuntsholing, cultivated) and Deothang district (Deothang). Native and cultivated in forestry nursery, 200m. April.

A rare native species in S Bhutan. Injured or infected wood yields a valuable incense-producing gum (*Agar*), for which the plant is cultivated.

2. STELLERA L.

Perennial, clump-forming herb with woody rootstock and stem-bases producing simple, erect, annual leafy shoots. Leaves spirally arranged in 4 ranks. Flowers in rounded terminal heads. Perianth 5-lobed, without scales. Disc forming a linear appendage on one side. Stamens 8 – 10, in 2 whorls. Ovary 1-celled; style short, stigma capitate. Fruit borne in base of perianth, indehiscent, 1-seeded (80).

I. S. chamaejasme L. Fig. 25d&e.

Plants forming large rounded clumps; annual shoots 15 – 30cm, glabrous. Leaves elliptic to lanceolate, 1.3 – 2 x 0.5 – 1cm, acute, base cuneate or rounded, sessile. Flower heads terminal, 2.5 – 3cm diameter, surrounded by a pseudo-involucre of whorled upper leaves; flowers sweet-scented. Perianth tube 6 – 10mm, red; lobes c 3mm, white within, red outside. Fruit ovoid, 2 – 3mm.

Bhutan: N – Upper Pho Chu valley (Lhedi). Open mountain slopes, 3650m. May – July.

Reputedly poisonous to stock.

3. EDGEWORTHIA Meisner

Evergreen shrubs. Leaves scattered. Flowers in axillary, globose, pedunculate heads. Perianth cylindrical, bracteate at base, 4-lobed, without scales. Disc a shallow lobed cup. Stamens 8, in 2 whorls. Ovary villous, 1-celled, with elongate style and stigma. Fruit borne in base of persistent perianth.

1. E. gardneri (Wall.) Meisner. Dz: *De Shing*; Sha: *Shogo Shing Ballingmeen*; Nep: *Kagate, Argayle* (34). Fig. 25f - i.

Shrub 2 - 4m. Leaves elliptic-oblongate, 5 - 20 x 1.5 - 4.5cm, acute, base cuneate or attenuate, glabrous above, sparsely appressed silky beneath; petioles 0.5 - 1cm. Flowers numerous in pendulous heads 3 - 4.5cm diameter, sweet-scented; peduncle 1 - 6cm, silky; bracts linear, 1 - 1.5cm, silky. Perianth tube 10 - 15mm, densely creamy-white silky; lobes yellow, broadly ovate, 2 - 4mm, recurved-spreading. Fruit ovoid, c 5 x 3mm, covered with long, stiff, pale hairs.

Bhutan: S - Phuntsholing district (Kamji) and Chukka district (Chukka, Bunakha, Putli Bhir and Chasilakha), C - Tongsa district (Tashiling and Shamgang);

Darjeeling: Sureil. Cool laurel-dominated and evergreen oak forest, 1670 - 2400m. February - May.

Bark used in paper making.

4. DAPHNE L.

Evergreen or deciduous shrubs or small trees. Flowers in terminal or lateral, sessile or peduncled, umbellate or globose heads. Perianth 4-lobed, without scales. Stamens 8, in 2 whorls. Ovary 1-celled; style very short. Fruit a coriaceous or fleshy 1-seeded drupe.

1. Shrubs more than 1m; leaves 6 - 20cm (occasionally shorter in *D. bholua*) 2
+ Shrubs less than 1m; leaves 2 - 6.5cm 4
2. Shrub 2 - 6m; lateral veins of leaves conspicuous, widely spreading; flower clusters several in upper leaf axils **1. D. involucrata**
+ Shrubs 1 - 3m; lateral veins of leaves inconspicuous, ascending; flower clusters solitary, terminal 3
3. Perianth tube pink or purplish, 7 - 12mm, densely sericeous; lobes white, ovate, rounded or subacute, spreading; drupes black **2. D. bholua**
+ Perianth tube white, 10 - 25mm, sericeous; lobes, white triangular slightly reflexed; drupes red **3. D. sureil**
4. Compact rounded shrub 30 - 60 (- 100)cm, with single stout stem; flowers purplish, fragrant; perianth tube glabrous **4. D. retusa**
+ Suckering multi-stemmed shrub 20 - 30cm, stems slender; flowers yellow, not fragrant; perianth tube densely hairy **5. D. ludlowii**

1. D. involucrata Wall.; *D. wallichii* (Meisner) Meisner *nom. illeg.*; *Eriosolena wallichii* Meisner *nom. illeg.* Nep: *Seti-barwal* (34), *Chhota Argayle* (34), *Bimbiri*.

Shrub (?evergreen) 2 - 6m; leaves elliptic-lanceolate, 7 - 15 x 1.5 - 4cm, acuminate, base cuneate; glabrous; petioles 3 - 7mm. Flower heads solitary or up to 4 together in upper leaf axils, each head composed of 4 - 7 sessile flowers borne

on slender peduncle 4 – 11mm, enclosed by 2 ovate thinly sericeous scales persisting until flowers open. Flowers fragrant. Perianth tube white, 8 – 12mm, densely sericeous; lobes ovate, 3 – 5mm, pinkish. Fruit ovoid, c 8mm, black.

Bhutan: S – Chukka district (Marichong and Tala); **Darjeeling:** Rongbe, Darjeeling. Mixed broad-leaved forest, 1200 – 2000m. November – February.

2. *D. bholua* D. Don; *D. cannabina* sensu F.B.I. p.p. non Loureiro. Dz: *De Shing*; Tongsa: *Shoko Shing*; Sha: *Shogo Shing*, *Shugu Shing*; Nep: *Kagate* (34), *Argaye* (34). Fig. 25a – c.

Shrub 1 – 3.5m, evergreen. Branchlets pubescent becoming glabrous. Leaves clustered at branch ends, thinly coriaceous, elliptic-oblongate (3.5 –)6 – 13(– 17) x 1 – 2.5cm, acute or acuminate, base cuneate. glabrous, ± sessile. Inflorescence of terminal 5 – 15-flowered clusters, subsessile, produced from 2 ovate sericeous non-persistent scales. Flowers strongly fragrant, sessile. Perianth tube pink or purplish, 7 – 12mm, sericeous; lobes white, ovate, 5 – 7 x 3 – 5mm, obtuse or subacute, spreading. Drupes ovoid, black, c 8 x 5mm.

Bhutan: S – Chukka and Deothang districts, C – Ha, Thimphu, Punakha and Tongsa districts; **Darjeeling; Sikkim.** Evergreen oak, Blue Pine, Spruce, Hemlock and Fir forests, 1980 – 3400m. February – May.

The above description and records apply to the typical evergreen var. *bholua* which is very variable in leaf shape and size. Var. *glacialis* (Smith & Cave) B.L. Burt is a dwarf high altitude shrub 15 – 60cm with deciduous leaves and flowers appearing before the leaves. It is recorded from alpine Darjeeling (Tonglo and Sandakphu), Sikkim (Lachung, Phalut and Karponang) and Chumbi (Rinchengong) between 2600 and 3500m.

The bark of *D. bholua* is widely used in paper-making in Bhutan. The species is prized as an ornamental shrub on account of its strongly fragrant flowers.

3. *D. sureil* W.W. Smith & Cave; *D. shillong* Banerji. Nep: *Kagate* (34), *Argaye* (34), *Bale Khagate*.

Similar to *D. bholua* but a larger shrub 1 – 2m; leaves pale green, lanceolate, 5 – 20 x 1 – 4cm, shortly, sometimes bluntly acuminate, borne on petioles 3 – 10mm; flower clusters subsessile or on peduncle 3 – 15mm, scales not persistent; flowers white or creamy, weakly fragrant; perianth tube 10 – 25mm, sparsely to densely sericeous; lobes ovate-triangular, 5 – 10mm, acute, reflexed; drupes c 10mm, orange-red.

Bhutan: S – Chukka and Deothang districts, C – Punakha, Tongsa and Tashigang districts; **Darjeeling:** common in foothills; **Sikkim:** Yoksam. Warm broad-leaved and evergreen oak forests, 1220 – 2130m. September – January.

Like *D. bholua* its bark is used in paper manufacture.

4. *D. retusa* Hemsley

Compact rounded shrub, 30 – 60(– 100)cm; shoots covered with thick spongy bark. Leaves clustered at branch ends, coriaceous, oblanceolate-spathulate, 2 – 5 x

0.5 – 1cm, obtuse or retuse, base attenuate, glabrous, margins revolute; ± sessile. Inflorescence c 5-flowered in terminal sessile clusters produced from scaly buds, scales oblong, acute with densely ciliate edges. Flowers fragrant. Perianth tube 10 – 12mm, glabrous, purplish; lobes broadly elliptic, 5 – 7mm, whitish. Drupes ovoid, red, 10 x 7mm.

Bhutan: C – Thimphu and Bumthang districts, N – Upper Mo Chu and Upper Bumthang Chu districts. On rocky hillsides and wet ravines, 3700–4200m. May – June.

5. *D. ludlowii* Long & Rae

Low multi-stemmed, suckering, shrub 20 – 30cm; young shoots tomentose, becoming glabrous. Leaves not or loosely clustered towards branch ends, thinly coriaceous, oblanceolate, 3 – 6.5 x 1 – 2cm, shortly acuminate to a narrow, retuse point, base attenuate, glabrous, margins weakly revolute; petioles 5 – 7mm. Inflorescence a 10–25-flowered sessile terminal cluster, produced from scaly buds, scales oblong c 8mm long, acute with densely ciliate margins. Flowers not fragrant. Perianth tube 7 – 9mm, densely hairy, pale to bright yellow; lobes ovate 4 – 5 x 1 – 3mm, rounded. Drupes not seen.

Bhutan: C – Bumthang district (Phephe (Peipe) La). Mixed Rhododendron, Hemlock and Spruce forest, 3350 – 3580m. May.
Endemic to Bhutan.

Family 117. ELAEAGNACEAE

by R. A. Clement

Trees or shrubs, mostly with silvery, yellow or brown scales, sometimes spiny. Leaves usually coriaceous, simple, alternate, pinnately veined, petiolate; stipules absent. Monoecious or dioecious; flowers solitary or in clusters or racemes, actinomorphic, bisexual or unisexual. Sepals 2 – 8, united. Petals absent. Stamens 4 – 8, inserted on calyx, free. Ovary superior, 1-celled; style elongate. Fruit drupe-like, indehiscent, containing a single stone.

1. Flowers bisexual; calyx 4-lobed, 15 – 20mm **1. Elaeagnus**
+ Flowers unisexual (plants dioecious); calyx minutely 2-lobed, 2 – 4mm
2. Hippophae

1. ELAEAGNUS L.

Leaves entire. Flowers clustered on short axillary shoots, bisexual. Calyx tube constricted above the ovary, breaking at constriction as fruit develops; lobes 4, usually spreading. Stamens 4, inserted in mouth of calyx. Style not exerted.

1. Calyx tube tubular above constriction 2
 + Calyx tube obconical above constriction 4
2. Calyx tube above constriction 6mm or more; fruit pear-shaped 9–10mm, with small blunt beak at apex **4. E. pyriformis**
 + Calyx tube above constriction 5mm or less; fruit ellipsoid, 15mm or more long, without beak 3
3. Pedicels at flowering 1–3mm; leaves elliptic to oblong-elliptic, 2.3cm or more wide **1. E. conferta**
 + Pedicels at flowering 5–7mm; leaves lanceolate, 2.2cm or less wide
3. E. caudata
4. Leaves 6.5cm or more, scaly above when young; fruit 16–18mm
2. E. infundibularis
 + Leaves less than 6.5cm, stellate-hairy above when young; fruit 6.5–8mm
5. E. parvifolia

1. E. conferta Roxb.; *E. arborea* Roxb., *E. latifolia* sensu F.B.I. p.p. non L. Nep: *Goeli* (34), *Malindo* (34).

Straggling shrub; axillary branches sometimes spinose. Leaves elliptic to elliptic-oblong, 4.7–7.7 x 2.3–3.8cm, shortly acuminate, base rounded, margin obscurely undulate, upper surface glabrescent, lower surface densely silver-scaly with some scattered brownish scales; petiole 5–11mm. Flowers in axillary clusters; pedicels 1–3mm. Calyx c 9.5mm, above constriction tubular, 4-angled; lobes ovate, c 3mm. Stamens inserted in throat; filaments 1–1.2mm; anthers c 0.8mm. Style hairy. Fruit ellipsoid, when young c 18 x 10mm.

Bhutan: S – Samchi district (near Gokti); **Darjeeling:** terai and foothills (34). Subtropical forest, 550m. ?February.

Fruit edible (34). The name *E. conferta* has sometimes been misapplied to *E. caudata* and literature records require confirmation.

2. E. infundibularis Momiyama. Sha: *Chhongbling Shing*; Nep: *Gweli*, *Gweylo*, *Malindo*.

Shrub. Leaves elliptic to oblong-elliptic, 6.5–10 x 2.6–4.9cm, shortly acuminate, base rounded to rounded-cuneate, margin ± undulate, upper surface glabrescent, lower surface densely silver-scaly with some scattered reddish brown scales; petiole 8–12mm. Flowers on very short axillary shoots; pedicels 3–5mm. Calyx 11–13mm, above constriction obconical with spreading lobes; lobes ovate, 2–3mm. Stamens inserted in throat; filaments c 0.5mm; anthers 1.5mm. Style glabrous. Fruit oblong-ellipsoid, 16–18 x 9–11mm.

Bhutan: S – Chukka district (Awakha), C – Punakha, Tongsa and Tashigang districts; **Darjeeling:** Secondary scrub on hillside, 1840–2100m. September.

3. *E. caudata* Momiyama; *E. conferta* sensu Momiyama non Roxb.

Shrub to 4m. Leaves narrowly ovate-lanceolate, 9.8 – 6.5 x 1.2 – 2.2cm, acuminate, base rounded-cuneate; upper surface initially sparsely scaly, becoming glabrous but remaining punctate where scales lost; lower surface densely scaly; petiole 8 – 12mm. Pedicel 5 – 7mm. Calyx c 10mm; above constriction tubular, 4-angled, 6 – 7.5mm; lobes ovate, 2.5 – 3.5mm. Stamens inserted in throat just below lobes; anthers subsessile, 1.7 – 2mm. Style glabrous, ± equal to calyx tube. Fruit ellipsoid, c 15 x 10mm.

Bhutan: C – Thimphu district (between Yosepang and Hongtso; above Taba), and Tongsa district (Chendebi); **Darjeeling/Sikkim:** locality unknown. In Blue Pine scrub and in moist Oak/Spruce forest, 2650 – 2790m. September – March.

The above records and description refer to var. **caudata**.

4. *E. pyriformis* Hook. f.

Climbing or straggling spiny shrub; young branches covered with brown scales. Leaves elliptic to elliptic-oblong, 7.2 – 5.6 x 2.3 – 3.7cm, shortly acuminate or acute, base cuneate to ± rounded, margin entire to obscurely undulate, coriaceous, upper surface with scattered silver scales becoming glabrous, lower surface densely silver-scaly; petiole 5 – 7mm. Flowers clustered on short axillary shoots; pedicel 2 – 3mm. Calyx 10 – 15mm; above constriction tubular, apparently 4-angled, 8 – 8.5mm; lobes triangular-ovate, c 2.5mm. Stamens with filaments c 1mm. Style hairy, hairs near base stellate. Fruit pear-shaped with short beak at apex, 9 – 10 x 6 – 7mm, densely covered with yellowish brown scales.

Bhutan: S – Samchi district (Daina Khola); **Darjeeling:** Dumsong Terai. Secondary subtropical and terai forest, 380m. October.

5. *E. parvifolia* Royle; *E. umbellata* sensu F.B.I. non Thunberg. Dz: *Bji*; Sha: *Dhangboor-zoo, Dhangboor-say*; Nep: *Gweli*. Fig. 25o – t.

Spiny shrub, 1 – 5m. Leaves narrowly oblong-elliptic to ± elliptic, 1.7 – 6.4 x 0.9 – 2cm, acute or rounded, base cuneate to rounded; lower surface silver-white, densely scaly; upper surface glabrescent, initially stellate-hairy; petiole 3 – 6mm. Flowers 1 – 3 in leaf axils on young shoots. Calyx 12 – 14mm, above constriction narrowly obconical, 9 – 10mm, white to greenish yellow, densely scaly; lobes spreading, ovate, 3 – 3.5mm. Stamens inserted in throat just below lobes; anthers subsessile, 1.8 – 2.1mm. Style hairy, slightly longer than calyx tube. Fruit red, ellipsoid, 6.5 – 8 x 4.5 – 6mm.

Bhutan: S – Chukka district, C – Ha, Thimphu, Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Mo Chu district; **Chumbi.** Roadsides and stream banks in dry valleys, among scrub or in Blue Pine forest, 1100 – 3200m. March – June.

Fruit edible; foliage lopped for fodder.

2. HIPPOPHAE L.

Spiny deciduous shrubs. Leaves entire, lower surface densely stellate or peltate-hairy; subsessile to petiolate. Dioecious; flowers grouped at base of lateral shoots. Male flowers in small catkins that appear before the leaves; perianth segments 2; stamens 4; disc small. Female flowers in small racemes, appearing with the leaves; perianth segments fused, 2-lobed; style stigmatic on one side. Fruit a globose or elliptic berry.

1. Shrub less than 1m; leaves 2cm or less with appressed scales on lower surface 3. *H. tibetana*
+ Shrub 2 – 3m; leaves 3.5cm or more, tomentose on lower surface 2
2. Leaves 6mm or more wide 1. *H. salicifolia*
+ Leaves 5mm or less wide 2. *H. rhamnoides*

1. *H. salicifolia* D. Don. Dz: *Tare, Tari Caum*; Med: *Tarbu*. Fig. 25u – za.

Shrub 2 – 3m. Leaves linear-oblong, 4.2 – 6.2 x 0.6 – 1.2cm, margin usually revolute, upper surface stellate-hairy but \pm green; lower surface tomentose, whitish with usually reddish brown midrib; petiole 2 – 3mm. Male flowers 2.5 – 3(–4)mm; anthers 2 – 2.5mm. Female flowers c 2mm. Fruit globose, 5 – 7 x 5 – 7mm, orange-yellow to greenish brown.

Bhutan: C – Ha district (Ha) and Thimphu district (Tsalimaphe, Paro, Babesa and below Taba); **Sikkim:** Lachen and Lachung. Moist gravel or stony areas, often beside rivers or streams, 2133 – 2755m. April – July.

Leaves are used to make tea; the fruits are used for polishing gold and silver.

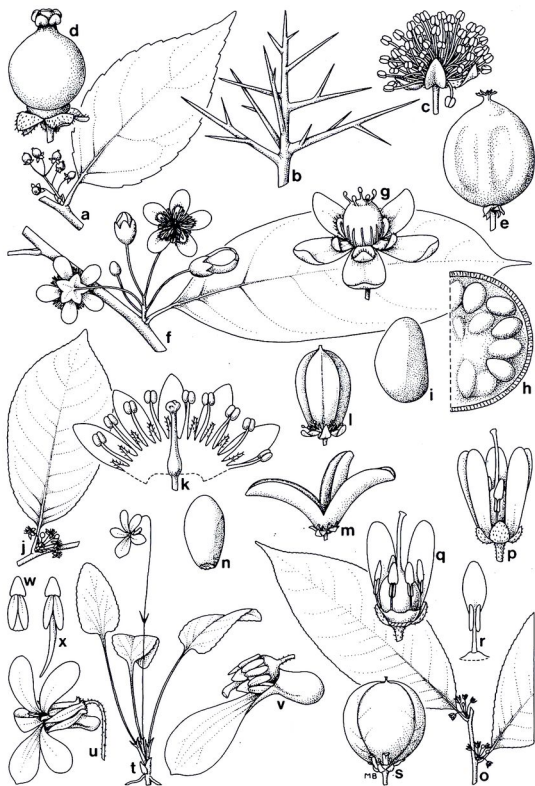
2. *H. rhamnoides* L. subsp. *gyantsensis* Rousi

Similar to *H. salicifolia* but with leaves narrower, 3.5 – 5.5 x 0.3 – 0.5cm, whitish on lower surface (including midrib); fruit elliptic, 5 – 7 x 3 – 5mm.

Sikkim: Nathu La. Alpine slopes.

The records from Paro (117) may refer to *H. salicifolia*.

FIG. 26. Flacourtiaceae and Violaceae. Flacourtiaceae. a – e, *Flacourtia jangomas*: a, leaf and female inflorescence; b, spine from trunk of young tree; c, male flower; d, female flower; e, fruit. f – i, *Gynocardia odorata*: f, leaf and male inflorescence; g, female flower; h, t.s. half fruit; i, seed. j – n, *Casearia graveolens*: j, leaf and inflorescence; k, dissected flower; l, undehisced capsule; m, dehisced capsule; n, seed. Violaceae. o – s, *Rinorea bengalensis*: o, part of flowering shoot; p, flower; q, dissected flower with two sepals and three petals removed; r, stamen; s, fruit. t – x, *Viola betonicifolia*: t, plant in flower; u, flower; v, stamens and spurred lower petal; w, upper stamen; x, lower stamen with nectariferous spur. Scale: h, o x 1/2; b, f, j x 1/2; a, i, s, t x 1/2; g x 1; m x 1/2; l, u x 1 1/2; e x 2; n x 3; v x 3 1/2; c, w, x x 4; k, p, q x 5; d x 6; r x 10. Drawn by M. Bates.



3. *H. tibetana* Schlechtendal

Small shrub, 10–60(–80)cm. Leaves linear-oblong, 12–20 x 2.5–4mm, margin flat, densely scaly, upper surface greyish, lower surface whitish with scattered reddish brown scales and reddish brown midrib; petiole c 1mm. Male flowers c 2mm; anthers c 1.5mm. Female flowers not seen. Fruit globose to elliptic, c 9 x 9mm, yellowish green.

Bhutan: N – Upper Mo Chu district (Laya to Laum Thang); **Sikkim:** Lungma Chu. Dry gravelly or rocky places, especially on riverbeds, 3650 – 4724m. May.

Family 118. FLACOURTIACEAE

by R. A. Clement

Trees and shrubs, sometimes spiny on trunk or branches. Leaves simple, alternate, usually distichous, pinnately veined, entire, crenate or serrate; stipules caducous. Flowers in axillary fascicles or racemes, occasionally borne on trunk, actinomorphic, bisexual or unisexual (then plants dioecious). Calyx 4 – 5-lobed. Petals absent or present, usually equalling sepals in number. Stamens 4 – many; staminodes sometimes present, sometimes alternating with stamens. Ovary superior or rarely partly inferior, 1-celled; ovules numerous, parietal; styles free or united. Fruit a fleshy capsule or berry.

1. Flowers with calyx and petals (sometimes similar in appearance but forming 2 distinct whorls) 2
- + Flowers without petals 3
2. Leaves oblong, entire; dioecious, flowers unisexual **1. Gynocardia**
- + Leaves elliptic, crenate-serrate; flowers bisexual **4. Homalium**
3. Flowers in short axillary racemes, unisexual; tree, trunk bearing compound spines at least when young **2. Flacourtia**
- + Flowers in axillary fascicles, bisexual; shrub or tree without spines **3. Casearia**

1. GYNOCARDIA R. Brown

Glabrous trees. Leaves entire. Dioecious; flowers in fascicles; females borne on trunk; males axillary. Sepals 5, united. Petals 5. Disc lobed. Ovary superior; styles 5 with cordate stigmas. Fruit a large subglobose berry with thick rind; seeds obovoid.

1. *G. odorata* R. Brown. Sha: *Dorkho Shing*; Nep: *Gante, Bandre* (34), *Ramphal* (34). Fig. 26f - i.

Spreading tree 10 - 20m. Leaves dark green, coriaceous, oblong, 13.5 - 22 x 5 - 7.8cm, apiculate, base \pm rounded, margin slightly uneven, pale beneath, lateral veins prominent beneath and somewhat decurrent on midrib; petiole 1 - 1.5cm. Male flowers in small, few-flowered racemes in leaf axils; pedicel up to 3cm; calyx 7 - 10mm, lobes obtuse; petals yellowish green, oblong, c 15mm, with ciliate scale (disc lobe) attached at base; stamens many, anthers basifixed. Female flowers similar to, but larger than males; staminodes 6 - 15, hairy; styles short. Berry 7 - 12cm diameter, brown, rough-textured, glabrous; seeds c 2cm, embedded in pulp.

Bhutan: S - Samchi, Chukka, Sarbhang, Gaylegphug and Deothang districts; **Darjeeling:** terai and foothills, Rongbe, Tista, Mongpu, etc.; **West Bengal Duars:** Buxa. Subtropical and terai forests, 300 - 1219m. April - May.

Fruit pulp poisonous and used to kill fish, but becomes edible after boiling (34, 48).

2. FLACOURTIA L'Héritier

Trees or shrubs, often spiny. Leaves serrate or crenate. Dioecious; flowers in small axillary or terminal racemes. Sepals 4 - 5. Petals absent. Disc minute. Anthers versatile. Female flowers without stamens; ovary superior; styles 2 or more; disc fleshy. Fruit an indehiscent drupe; seeds obovoid.

1. *F. jangomas* (Loureiro) Rauschel; *F. cataphracta* Willdenow. Nep: *Khorsane Khanra*. Fig. 26a - e.

Small tree, 3(-10)m; trunk covered with compound spines up to 10cm, at least when young; young stems initially pubescent, soon glabrous. Leaves ovate to ovate-oblong, 4.5 - 7.5(-9.5) x 2 - 3.4(-4)cm, acuminate, base rounded, margin crenate-serrate, \pm glabrous, midrib pubescent; petiole 2 - 5(-10)mm, pubescent. Male flowers 5 - 6mm diameter; calyx \pm rotate, lobes c 2.5mm, pubescent inside; stamens numerous. Female flowers with similar calyx; ovary 2 - 3mm, subglobose; styles 4 - 6, united, c 1mm. Fruit subglobose, 1.5 - 2cm long, dull purple to blackish; seeds 4 - 5, embedded in yellowish pulp.

Bhutan: S - Sarbhang district (Singi Khola); **Darjeeling:** not common (34). Subtropical terai forest, 390m. March - April.

Frequently cultivated, but apparently wild in Bhutan.

3. CASEARIA Jacquin

Trees or shrubs. Leaves entire, crenate, serrate or denticulate, often punctate-glandular; stipules caducous. Flowers bisexual, axillary in fascicles with many small bracts. Calyx deeply 4 - 6-lobed, persistent. Petals absent. Stamens (6 - 8(-12), united with staminodes into a short tube at base; staminodes equalling

stamens in number, hairy at apex. Disc absent. Ovary superior, 1-celled; style short, usually obscurely 3-lobed. Fruit fleshy but firm, subglobose or ellipsoid, 3-valved; flower parts persisting at base; seeds ovoid.

1. Leaves oblong, at least 3 x longer than wide; calyx glabrous 2
- + Leaves elliptic or oblong-elliptic, less than 3 x longer than wide; calyx at least partly pubescent 3

2. Leaves pubescent on lower surface, margin serrulate; pedicels up to 2mm
3. *C. vareca*
- + Leaves glabrous on both surfaces, margin subentire; pedicels 3 – 5mm
5. *C. aff. zeylanica*

3. Mature leaves hairy on veins of lower surface, base oblique; pedicels 5 – 10mm
4. *C. kurzii*
- + Mature leaves glabrous, base not normally oblique; pedicels up to 5mm ... 4

4. Leaves elliptic to oblong-elliptic, base cuneate or sometimes rounded; pedicels completely pubescent 1. *C. glomerata*
- + Leaves broadly elliptic, truncate or rounded at the base; pedicels glabrous above articulation 2. *C. graveolens*

1. *C. glomerata* Roxb. Nep: *Barkaunle* (34).

Shrub or tree to 10m. Leaves elliptic to oblong-elliptic, 6.5 – 16.5 x 3 – 7cm, shortly acuminate, base cuneate or sometimes rounded, margin crenate-serrulate or denticulate, mature leaves glabrous; petiole 6 – 11mm. Flowers yellow-green, arising from a number of small bracts; pedicels 4 – 5mm, completely pubescent. Calyx 2 – 3mm, pubescent. Stamens 8; staminodes about half length of stamens, hairy. Style less than 1mm, 3-lobed. Fruit ellipsoid, c 14 x 10mm, yellow-orange.

Bhutan: C – Tongsa district (Tashiling to Tongsa), C/N – Punakha/Upper Mo Chu district (Mishichen to Khosa); **Darjeeling:** Phedang, Rongbe, Kurseong, Kalimpong. Mixed evergreen and warm broad-leaved forests, 1219 – 2286m. April – May.

The name *C. glomerata* is used in a broad sense as it is beyond the scope of this account to resolve the confusion surrounding its precise application.

2. *C. graveolens* Dalzell. Sha: *Shekpa Shing*; Nep: *Barkaunle* (34). Fig. 26j – n.

Shrub or tree, 3 – 12m. Leaves broadly elliptic, 7.5 – 16 x 4.5 – 8cm, usually shortly acuminate, base usually truncate, sometimes rounded, margin obscurely crenate-serrate, glabrous; petiole 8 – 17mm. Flowers green; pedicels up to 4mm, glabrous above articulation near base. Calyx c 3mm, always pubescent at base, hairy or glabrous above, lobes deflexed. Stamens 6 – 8; staminodes ± oblong, about half length of stamens, densely hairy. Style c 1mm, 3-lobed. Fruit trigonous-ellipsoid, 10 – 12 x 7 – 10mm, fleshy but firm, orange; seeds c 4.5 x 3mm.

Bhutan: S – Samchi, Sankosh and Gaylephug districts, C – Tashigang district;
Darjeeling: Tista Valley, Darjeeling. Subtropical forest in valleys and ravines, also cultivated, 280 – 1350m. March.

The flowers are reported to have an unpleasant smell.

3. *C. vareca* Roxb.

Shrub or small tree, c 3m; young stems pubescent. Leaves oblong, 7.5 – 16 x 2.5 – 4.5cm, abruptly narrowed to acute point at apex, base rounded-cuneate, margin serrulate, glabrous above, hairy on veins below; petiole 5 – 12mm. Flowers greenish yellow; pedicels up to 2mm, glabrous above articulation. Calyx c 2mm, glabrous. Stamens usually 8; staminodes shorter than stamens, hairy. Style less than 1mm, obscurely 3-lobed. Fruit subglobose or broad ellipsoid, c 7 x 6mm, orange, splitting into 3 valves.

Bhutan: S – Sarbhang district (Lao Pani) and Gayleggphug district (between Gaylephug and Tori Bari); **Darjeeling:** Siliguri. Subtropical terai forest, 150 – 400m. May.

4. *C. kurzii* Clarke

Tree to 15m; shoots pubescent. Leaves oblong-elliptic, 9 – 13.5 x 4 – 5cm, acute or shortly acuminate, base rounded-oblique, margin crenate-serrate, glabrous above, pubescent on veins below; petiole c 1cm. Pedicels 5 – 10mm, pubescent. Calyx 2 – 3mm, pubescent. Stamens usually 10; staminodes slightly shorter than filaments, hairy. Style apparently capitate. Fruit not seen, described as c 15mm long, black when ripe.

Darjeeling: Kalimpong. Warm broad-leaved forest, 762 – 1219m. October.

5. *C. aff. zeylanica* (Gaertner) Thwaites

Tree of 12m. Leaves oblong, 9.5 – 23 x 3.4 – 6cm, acute, base rounded-cuneate, sometimes slightly unequal, margin subentire, glabrous; petiole 10 – 12mm, channelled above, glabrous. Flowers fragrant; pedicels 3 – 5mm, glabrous. Calyx 2.5mm, glabrous. Stamens 8; staminodes c 2/3 length of filaments, hairy. Style ± capitate. Fruit not seen.

Bhutan: C – Tongsa district (N of Shamgong). Forested hillside, 1400m. June. Only one collection of this taxon has been seen.

4. HOMALIUM Jacquin

Trees. Leaves crenate-serrate. Flowers in fascicles on axillary spikes, bisexual. Calyx tubular, 4 – 5-lobed. Petals 4 – 5. Stamens 4 – 5. Ovary superior. Styles 3 – 4. Fruit a capsule.

1. *H. zeylanicum* (Gardner) Bentham; *H. bhamoense* Cubbitt & W.W.Smith

Tree, 10 – 15m. Leaves ± elliptic, 7 – 14.5 x 5 – 7.5cm, acute or shortly acuminate, base subtruncate to cuneate, crenate-serrate, sparsely pubescent on both surfaces;

petiole 7 – 10mm. Spikes long, slender. Calyx c 3mm; tube funnel-shaped, adnate to base of ovary; lobes linear-oblong, c 1.5mm, ciliate. Petals linear-oblong, 2 – 2.3mm, ciliate, inserted in throat of calyx.

Darjeeling: foothills. In forest, 305 – 1219m. April – June.

Family 119. VIOLACEAE

by A.J.C. Grierson

Herbs, shrubs or small trees. Leaves alternate, simple, stipulate. Flowers solitary or fasciculate, bisexual, actinomorphic or zygomorphic. Sepals 5, free. Petals 5, free, all alike or the lowermost spurred and larger than the others. Stamens 5, all alike with filaments distinct or connate into an annular disc; connectives all enlarged apically or the two lowermost produced at base into petal spur. Ovary 3-valved, superior, 1-celled; ovules 1 – many, placentation parietal; style simple. Fruit a loculicidal capsule.

1. Shrubs or small trees; flowers actinomorphic; petals all alike **1. Rinorea**
+ Herbs; flowers zygomorphic; lower petal enlarged into a spur at base

2. *Viola*

1. **RINOREA** Aublet

Shrubs or small trees. Stipules deciduous. Flowers several, in axillary fascicles. Sepals coriaceous. Petals linear-oblong, all alike. Stamens inserted on annular disc; connectives enlarged apically. Capsule subglobose; seeds few, rounded.

1. R. bengalensis (Wall.) O. Kuntze; *Alsodeia bengalensis* Wall. Nep: *Kalipat*. Fig. 260 – s.

Shrub or tree to 5(–20)m. Leaves ovate – elliptic, 8 – 15 x 4 – 6cm, acuminate, base rounded or cuneate, margin serrulate, usually with a small cluster of hairs in axils of veins beneath, otherwise glabrous; subsessile or petiole up to 1cm. Fascicles 4 – 6-flowered; pedicels 0.7 – 1cm, articulated at base. Sepals ovate, 1.5mm, ciliate. Petals 4 x 1.2mm, greenish-white. Filaments c 0.5mm; anthers \pm as long; connective ovate, c 1 x 0.7mm; annular disc 0.8mm tall. Ovary ovoid; style 1.5mm; stigma slightly enlarged. Capsule 0.7 – 1(–1.5)cm, usually 3-seeded; seeds c 4mm diameter.

Darjeeling: Chauwa Jhora and Sivoke. Broad-leaved forest.

2. VIOLA L.

Sha: *Mamphung Ngon* applies to all *Viola* species.

Annual or perennial herbs, stemless or stems short, sometimes stoloniferous. Leaves all basal or alternate on stems; stipules free or adnate to petiole. Flowers solitary, axillary, sometimes cleistogamous, zygomorphic; peduncles usually with a pair of bracts attached near middle. Sepals 5, prolonged at base into small appendages below point of insertion, persistent. Petals 5, unequal, oblong or narrowly obovate, the lowermost one prolonged behind into a short spur. Anthers connivent around ovary; connectives enlarged and broadened surrounding style, connectives of the two lower stamens prolonged at base into a nectariferous appendage and projecting into petal spur. Style often enlarged distally; stigma simple or lobed. Fruit a loculicidal capsule.

The following doubtful species have also been recorded from E Himalaya: *V. cameleo* Boissieu, *V. placida* Becker, *V. sikkimensis* Becker and *V. thomsonii* Oudemans. These require further study and are not treated here.

1. Leaves attenuate or rounded and scarcely cordate at base 2
- + Leaves distinctly cordate at base (bases sometimes scarcely cordate in *V. betonicifolia* but then leaves twice as long as broad) 3
2. Annual or slender perennial, sometimes shortly stoloniferous; leaves 1–2cm broad, pubescent **1. *V. diffusa***
- + Perennial with branching rootstock, not stoloniferous; leaves 4–8mm broad. **2. *V. kunawarensis***
3. Petals predominantly yellow 4
- + Petals predominantly white, bluish or mauve 5
4. Petals with brownish purple reticulation outside; spur saccate, c 2mm, rounded **3. *V. biflora***
- + Petals pure yellow outside; spur slender, acute, 4–5mm..... **4. *V. wallichiana***
5. Rootstock with an ovoid scaly bulb **5. *V. bulbosa***
- + Rootstock without a bulb 6
6. Leaves narrowly oblong-ovate, usually more than twice as long as broad, lamina distinctly decurrent on petiole **6. *V. betonicifolia***
- + Leaves broadly ovate or suborbicular, as long as broad or sometimes 1.5(–2) times as long, lamina not or scarcely decurrent on petiole 7
7. Plants not stoloniferous 8
- + Plants stoloniferous 9

8. Leaves 1 – 5 x 0.5 – 3.5cm, obtuse or acute, pubescent (hairs c 0.9mm); lateral petals pubescent within 7. *V. bhutanica*
 + Leaves 2–9 x 2–7cm, abruptly acuminate, sparsely pubescent (hairs c 0.5mm); lateral petals glabrous within 8. *V. paravaginata*
9. Leaves broadly ovate or suborbicular, obtuse or subacute, margins broadly and shallowly crenate, usually completely glabrous; sepal appendages rounded 9. *V. hookeri*
 + Leaves ovate, acute or acuminate, margins crenate-serrate, usually at least sparsely pubescent; sepal appendages acute 10
10. Petioles ± densely retrorse-pubescent; sepal appendages c 1mm 10. *V. pilosa*
 + Petioles glabrous or sparsely pubescent; sepal appendages c 3mm 11. *V. hamiltoniana*

1. *V. diffusa* Gingins

Annual or slender perennial, sometimes shortly stoloniferous. Leaves ovate, 1.75 – 3 x 1 – 2cm, obtuse, base rounded, scarcely cordate, lamina decurrent on petiole, sparsely pubescent with straight hairs (c 0.75mm) on both surfaces; petioles pubescent; stipules pale, lanceolate up to 12mm, ciliate. Flowers on slender, glabrous peduncles 5 – 8cm; bracts linear-lanceolate, 5 – 6 mm, sparsely ciliate. Sepals lanceolate, c 3mm, acute, sparsely ciliate near base; appendage c 1mm, acute. Petals c 7mm, pale blue, greenish yellow at base, glabrous within; lowest petal purple streaked. Capsule oblong-ovoid, c 5mm, glabrous.

Bhutan: S – Gaylegphug district (Sham Khara), C – Tongsa district (near Shamgong); **Darjeeling:** Sureil, Mongpu, Lebong, Darjeeling, Kalimpong. Warm broad-leaved forest slopes, 915 – 2100m. February – April.

2. *V. kunawarensis* Royle

Dwarf perennial with slender branching rootstock, not stoloniferous. Leaves elliptic to spatulate, 7 – 15 x 4 – 8mm, obtuse, base cuneate or attenuate, margins entire, glabrous; petioles c 1.5cm; stipules membranous, c 4mm, adnate to petiole except at apex, glandular-ciliate. Peduncles scarcely longer than leaves, bracts linear-lanceolate c 2mm. Sepals ovate, c 3mm, ± acute, glabrous; appendage very short, rounded. Petals c 8mm, purplish with dark purple veins, yellow at base, glabrous within; spur saccate c 2mm. Capsule ovoid, c 5mm, glabrous.

Sikkim: Lhonak. Alpine slopes, 4880 – 5200m. June – July.

3. *V. biflora* L.; *V. biflora* sensu F.B.I. p.p.

Perennial with nodular rootstock, nodes rounded, pale, estoloniferous. Stems up to 15cm glabrous. Leaves broadly ovate, 6 – 20 x 10 – 30mm, obtuse or subacute, base cordate usually deeply so, margin shallowly serrate, pubescent especially on upper surface; petioles up to 4cm, glabrous; stipules ovate, leafy, c 2.5 – 7mm, entire

or usually gland-toothed near apex. Peduncles with weak linear bracts 1 – 3mm. Sepals lanceolate, c 4mm, shortly ciliate; appendage much reduced, rounded. Petals 8 – 11mm, yellow, upper 4 sharply reflexed, glabrous within, lowermost petal strongly reddish purple streaked, all purplish-reticulate outside; spur saccate, c 2mm. Capsule ovoid, c 6mm, glabrous.

Bhutan: C – Ha, Thimphu, Tongsa, Bumthang and Mongar districts; **Darjeeling; Sikkim; Chumbi.** In damp, shaded Fir forest margins, 2285 – 3350m. June – September.

Plants with shorter stems and petioles which are densely short spreading hirsute have been segregated as var. *hirsuta* Becker; so far specimens have only been recorded from Sikkim and Chumbi.

4. *V. wallichiana* Gingins; *V. biflora* sensu F.B.I. p.p. non L.

Very similar to *V. biflora* but petal spur slender, acute, 4 – 5 mm; lowest petal less distinctly purple-streaked; petals pure yellow outside without purplish reticulation.

Darjeeling: Tonglo; **Sikkim:** Phallut, Kanglasa and Karponang. Forest margins, 2740 – 3350m. June – July.

5. *V. bulbosa* Maximowicz; *V. tuberifera* Franchet

Estoloniferous perennial; rootstock with an ovoid or globose scaly bulb. Stems very short, 1 – 1.5cm. Leaves broadly ovate to suborbicular, 1 – 2.5 x 1 – 2.5cm, rounded, base cordate, margin shallowly crenate, sparsely pubescent on both surfaces; petioles 1.5 – 3cm, glabrous; stipules membranous, linear-lanceolate 6 – 8mm, sparsely toothed. Peduncles 2.5 – 6 cm, glabrous; bracts linear, 4 – 5mm. Sepals narrowly ovate, c 5 mm, obtuse, glabrous, appendage c 1mm, rounded. Petals c 8mm, white, glabrous within, the lowermost especially streaked with purple; spur c 2mm, saccate.

Bhutan: C – Thimphu and Tongsa districts, N – Upper Mo Chu district. Damp slopes amongst scrub, 2400 – 3900m. April – May.

6. *V. betonicifolia* Smith; *V. patrinii* DC. var. *napaulensis* DC., *V. inconspicua* auct. non Blume. Dz: *Togala Mito*. Fig. 26t – x.

Estoloniferous perennial. Leaves narrowly oblong-ovate, 2.5 – 5.5 x 0.75 – 2.5cm, usually more than twice as long as broad, obtuse, base truncate or shallowly cordate, margins very shallowly crenate-serrate, usually ± glabrous above, sometimes pubescent beneath; petioles 2 – 12cm, glabrous or pubescent, lamina decurrent on it near apex; stipules adnate to petiole, membranous, upper 3 – 5mm free, lanceolate, acuminate, entire or with few teeth. Peduncles 5 – 15cm, glabrous or pubescent; bracts linear-lanceolate c 6mm. Sepals, ovate 5 – 6mm, acute; appendage c 2mm obtuse. Petals bluish or white with purple lines, 8 – 10mm; laterals pubescent within; spur thick, 5 – 6mm, obtuse. Capsule ovoid, c 7mm, acute.

Bhutan: C – Thimphu district (near Thimphu, Dotena and Kyapcha) and Punakha district (Lometsawa, Bowdaka Valley); **Sikkim.** River banks and damp ground, 2370 – 2500m. May – June.

7. *V. bhutanica* Hara

Estoloniferous perennial. Leaves ovate, 1–5 x 0.5–3.5cm, obtuse or acute, base cordate, margin serrate-crenate, pubescent above (hairs c 0.9mm), glabrous or pubescent beneath; petiole 0.5–12cm, pubescent or glabrous; stipules lanceolate, c 10mm, sparsely glandular-toothed, adnate to petiole in lower half. Peduncles 2–12cm, glabrous or pubescent; bracts linear, c 4mm. Sepals ovate, 4–5mm, acute; appendages c 1mm, rounded, glabrous or pubescent. Petals 10–14mm, white or purplish with dark purple streaks, lateral petals pubescent within; spur 2–3mm, saccate. Capsule ovoid, c 7mm.

Bhutan: C – Thimphu, Punakha, Tongsa, Bumthang and Mongar districts. Damp wooded banks, 2450–3500m. April–June.

8. *V. paravaginata* Hara

Estoloniferous perennial; rhizomes ± horizontal. Leaves ovate, 2–9 x 2–7cm, abruptly acuminate, base deeply cordate, margin shallowly crenate, glabrous or sparsely pubescent above, pubescent along veins beneath (hairs c 0.5mm); petioles 3–16cm glabrous; stipules ovate-lanceolate c 10 x 4mm brownish, margin sparsely glandular-ciliate. Peduncles 5–13cm; bracts linear c 4mm. Sepals lanceolate c 3.5mm; appendage 1–2mm, crenate. Petals 8–9mm, white or mauve with purple streaks, lateral petals glabrous within.

Bhutan: C – Thimphu district (near Drugye Dzong); **Sikkim:** near Phallut. Amongst bamboo, 3300–3350m. May.

9. *V. hookeri* Thomson; *V. hookeri* sensu F.B.I. p.p.

Stoloniferous perennial. Leaves broadly ovate or suborbicular, 2–4 x 1.5–3cm, obtuse or subacute, base cordate, margin broadly and shallowly crenate, usually completely glabrous; petioles 1–7cm; stipules ovate-lanceolate, c 1cm, brownish, sparsely fimbriate. Peduncles 3.5–8cm, glabrous; bracts linear, 5–7mm. Sepals oblong, c 4 x 1mm, acute; appendage c 1mm, rounded, glabrous. Petals 8–10mm, white, glabrous within, the lowermost one violet-streaked within; spur 2–3mm, saccate, rounded.

Bhutan: C – Ha, Thimphu and Mongar districts; **Darjeeling:** Tonglo and Senchal; **Sikkim:** Lachen, Laghep, Yakla, Bakkim. Moist ground in forest shade, 2285–3000m. April–June.

FIG. 27. Stachyuraceae, Passifloraceae and Tamaricaceae. **Stachyuraceae.** a–i, *Stachyurus himalaicus*: a, leaves; b, inflorescences; c, male flower; d, dissected male flower with stamens and pistillode; e, bract; f, sepal; g, petal; h, dissected female flower with ovary and staminodes; i, fruit. **Passifloraceae.** j–l, *Passiflora geminiflora*: j, part of flowering shoot; k, flower; l, fruit. m & n, *Adenia trilobata*: m, leaf and inflorescence; n, fruit. **Tamaricaceae.** o–w, *Tamarix dioica*: o, flowering shoot; p, leaves; q, male flower; r, sepal; s, petal; t, stamens; u, undehisced capsule; v, dehisced capsule; w, seed. x–zb, *Myricaria albiflora*: x, part of flowering shoot; y, dissected flower with two sepals and two petals removed; z, stamens; za, undehisced capsule; zb, seed. Scale: m x ¼; a, j, n x ½; b, o x ⅔; x x 1; k x 2½; x x 2½; za x 3; c, d, e, f, g, h, i x 4; p, u, v, y x 5; q, r, s, t, w, z, zb x 6. Drawn by M. Bates.



10. *V. pilosa* Blume; *V. glaucescens* Oudemans, *V. serpens* Roxb. p.p.

Stoloniferous perennial. Leaves 2–4.5 x 1.5–4cm, acute, base deeply cordate, margin crenate-serrate, sparsely pubescent; petioles up to 10cm, ± densely retrorse-pubescent; stipules ovate-lanceolate, 8–15mm, deeply fimbriate, pubescent. Peduncles 2–6cm, sparsely pubescent; bracts linear-lanceolate, c 4mm. Sepals 4–5mm, ciliate, pubescent at base; appendage c 1mm acute. Petals 8–10mm, mauve, pubescent within; spur 3–4mm rounded.

Bhutan: S – Chukka district, C – Thimphu, Punakha, Tongsa and Tashigang districts, N – Upper Mo Chu district; **Sikkim.** Moist ground around forests and margins of cultivation, 1400–3500m. February – May.

V. canescens Roxb. has also been recorded from E Himalaya (73, 101); this is a W Himalayan plant which seems doubtfully distinct from *V. pilosa*.

11. *V. hamiltoniana* D. Don; *V. arcuata* Blume, *V. distans* Wall.

Similar to *V. pilosa* but leaves sparsely pubescent above, glabrous beneath; petioles glabrous or sparsely pubescent; stipules lanceolate 8–10mm, brown, margins fimbriate with a few long teeth; peduncles 3.5–6cm; bracts 8–10mm; sepals ovate 6–7mm acute, appendage 3mm, acute, margin dentate or entire; petals white, c 10mm, glabrous or sparsely pubescent within, spur c 3mm, saccate, rounded.

Bhutan: S – Phuntsholing, Chukka, Sarbhang and Gaylegphug districts; **Darjeeling.** Banks in warm broad-leaved forests, 1170–2540m. February – May.

Family 120. STACHYURACEAE

by A. J. C. Grierson

Deciduous shrubs. Leaves alternate, simple, pinnately veined; stipules small, deciduous. Dioecious; flowers in axillary, spike-like racemes, actinomorphic, unisexual, subtended by two well-developed bracts. Sepals 4(–5), in 2 pairs, free. Petals 4(–5), imbricate, free. Stamens 8. Ovary superior, 4-celled; ovules numerous, axile; style short; stigma capitate, obscurely 4-lobed. Fruit dry, indehiscent, many-seeded.

1. STACHYURUS Siebold & Zuccarini

Description as for Stachyuraceae.

1. *S. himalaicus* Benth. Nep: *Chure Lahara* (34). Fig. 27a–i.

Shrub, sometimes straggling, up to 7m. Leaves ovate-elliptic, 4–12 x 3–5cm, acuminate, base rounded; margins finely serrate, ± glabrous on both surfaces; petiole 1–1.5cm; stipules linear, 2mm. Flowers appearing before leaves, yellowish-green or pinkish-red, in racemes 4–5cm; bracts ovate, brownish, 3mm. Sepals

obovate, c 5 x 3mm. Petals obovate, c 6 x 4mm. Stamens in male flowers 4–5mm; staminodes in female flowers c 2mm. Ovary, including style, 6mm in female flower; pistillodes in male flowers 4mm. Fruit subglobose, 6mm diameter, with shrivelled styler remains at apex.

Bhutan: S – Deothang district, C – Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** Tonglu, Pankabari; **Sikkim:** Lachen, Yoksam, etc. Broad-leaved forests, 1550–2745m. April–May.

Two distinct colour forms occur: one with lemon-yellow flowers and another with red or deep pink flowers. In flower the plants bear a superficial resemblance to *Ribes himalense*.

Family 121. PASSIFLORACEAE

by A.J.C. Grierson

Herbaceous or woody climbers with axillary stipules. Leaves alternate, entire or palmately lobed, palmately veined; stipules small, deciduous. Usually dioecious; flowers in axillary cymes, actinomorphic, bisexual or unisexual; floral parts perigynous; pedicels articulated near apex. Sepals 5, connate into tube at base. Petals as many as, and alternating with sepals, borne near base of calyx tube. Extra-staminal corona, consisting of sterile filaments, sometimes present. Stamens 5; filaments united below and raised on an androgynophore. Ovary 1-celled, with 3 parietal placentae; ovules numerous; styles 3, connate at base; stigmas capitate. Fruit a capsule or berry.

1. Flowers bisexual, openly campanulate; corona filamentous **1. Passiflora**
 + Flowers unisexual, tubular; corona absent **2. Adenia**

1. PASSIFLORA L.

Leaves simple; petiole often glandular. Flowers bisexual in axillary cymes or solitary. Calyx tube open-campanulate. Petals 5, free, inserted near base of calyx. Corona of 1 or more whorls, filamentous. Stamens 5. Ovary ovoid or globose, borne on androgynophore. Fruit berry-like, indehiscent; pulp mucilaginous.

1. Leaves narrowly ovate, unlobed; flowers several on axillary peduncles; petals 6–9mm; fruit 0.8–1.5cm diameter **1. P. geminiflora**
 + Leaves broadly ovate, 3-lobed; flowers solitary; petals 2.5–3cm; fruit 4–5cm diameter **2. P. edulis**

1. P. geminiflora D. Don; *P. napalensis* Wall. Fig. 27j–1.

Stems c 2.5m, angular. Leaves ovate, 4–7 x 3–4cm, acute, base truncate or shallowly cordate, glabrous on both surfaces, with 1–4 rounded glands 1–2mm

on each side of midrib; petiole 3–5cm, with a pair of glands below middle; stipules linear, 5–6 mm. Flowers whitish on 2 short peduncles, each dividing into 2–6 pedicels 2–2.5cm. Sepals and petals 6–9mm. Filaments of corona and androgynophore 3–4mm. Free upper part of filaments and styles 4–5mm. Fruit globose, 0.8–1.5cm diameter.

Bhutan: S—Chukka district (Chukka), C—Tongsa district (between Tongsa and Tashiling) and Mongar district (Unjar); **Darjeeling:** Kalimpong, Lebong, Darjeeling; **Sikkim:** Choongtam, Lachen. In moist warm broad-leaved forests, 1200–2100m. July–September.

2. *P. edulis* Sims. Eng: *Purple Granadilla*.

Similar to *P. geminiflora* but leaves broadly ovate in outline, deeply 3-lobed, 10–12 x 12–14cm, bluntly serrate; petiole 2–3cm; flowers solitary on peduncles 4–5cm; sepals oblong, 3–3.5 x 1cm, ± coarsely serrate; petals oblong, 2.5–3 x 0.5–0.7cm, white; corona in 4–5 whorls, 1.5–2.5cm, white, purplish at base; androgynophore c 10mm; style c 10mm; fruit ovoid or globose, 4–5cm, yellow or purplish; seeds ovoid, 5–6 x 3–4mm; pulp greenish.

Sikkim: Tholung Valley. 1050m. May.

Native of Central and South America; widely cultivated for its delicious fruit pulp.

2. ADENIA Forsskal

Leaves entire or palmately lobed with a pair of glands at the junction of leaf base and petiole. Dioecious (rarely monoecious); inflorescence cymose, central flower replaced by a tendril. Sepals connate into a calyx tube. Petals 5, free, included within calyx. Corona absent. Disc glands 5, linear, inserted near base. Male flowers with 5 stamens; pistillode minute. Female flowers larger than males; staminodes subulate; ovary oblong. Fruit berry-like, dry or fleshy.

1. Leaves deeply palmately lobed **1. A. trilobata**
 + Leaves unlobed **2. A. cardiophylla**

1. *A. trilobata* (Roxb.) Engler; *Modecca trilobata* Roxb. Sha: *Dakor*. Fig. 27m&n.

Stems up to 20m. Leaves usually deeply 3-lobed (sometimes 5–7-lobed); lobes elliptic to lanceolate, 9–15 x 3cm, acuminate, base cordate or sagittate, glabrous on both surfaces, blade glands usually 2, 2–5mm diameter; petiole 5–8cm, with 2 rounded glands 4–5mm diameter at junction with leaf. Peduncles 5–20cm, bearing up to 50 flowers in males, 4–8 flowers in females. Male flowers: calyx tube 10mm including triangular lobes; petals obovate, 6–8 x 2–2.5mm, lacinate, inserted near base of calyx; filaments 6–9mm, connate in lower half; anthers 3.5–4 x 0.7–1mm; disc glands 1.5–2mm; pistillode 1mm. Female flowers: calyx tube 12–13mm; petals 3–4 x 1.5mm, serrulate, inserted near base of calyx; disc glands 1–1.5mm; ovary ellipsoid 4.5 x 2.5mm, on gynophore 1–2mm; styles 1–2mm,

connate at base. Fruit oblong or obovoid, slightly 3-angular, 5 – 6 x 2 – 3cm, greenish.

Bhutan: S – Chukka district (Marichong), Sarbhang district (above Sarbhang) and Deothang district (S of Deothang); **Darjeeling:** Birik, Mongpu, Kalimpong. Hot subtropical forest slopes, 600 – 1000m. May – June.

2. A. cardiophylla (Masters) Engler; *Modecca cardiophylla* Masters

Stems up to 25m. Leaves entire (rarely 3-lobed), ovate, 10 – 15(–25) x 8 – 10(–19)cm, acute, roundly cordate and 3–5-veined at base, glabrous on both surfaces, margins entire; petiole 3 – 7(–10)cm; glands at leaf base subglobose 2 – 3mm. Peduncles 3 – 5(–18)cm, up to 20-flowered in males, 1 – 3-flowered in female plants; pedicels 5 – 10mm. Male flowers: calyx tube 9 – 10mm including calyx teeth; petals narrowly triangular, 5 – 7 x 2.5 – 3.5mm, entire or serrate, inserted near mouth of calyx; filaments 3 – 5mm, united below; anthers 4 – 5mm; disc glands 2mm; pistillode 1.5 – 2mm. Female flowers: calyx tube 10 – 13mm including teeth; petals ovate-oblong, 4.5 – 7mm, irregularly denticulate, inserted near mouth of calyx; staminodes 2 – 3mm, connate at base; disc glands 1.5mm; ovary ellipsoid, 4 – 4.5 x 2.5 – 4mm; styles 1 – 2mm, connate at base. Fruit obovoid, 5 – 11 x 2.5 – 7cm; gynophore 4 – 7.5cm.

Darjeeling: Chunbati, Pankabari and Kodabari. 760 – 910m. May – August.

Family 122. BIXACEAE

by D. G. Long & S. J. Rae

Small trees or shrubs; indumentum of peltate scales. Leaves alternate, simple, entire, palmately veined at base, stipulate. Flowers in terminal panicles, bisexual, actinomorphic; pedicels glandular. Sepals 5, free, deciduous. Petals 5, free. Stamens numerous. Ovary superior, 1-celled; ovules parietal, numerous; style slender; stigma 2-lobed. Fruit a 2-valved capsule; seeds numerous.

1. BIXA L.

Description as for Bixaceae.

1. B. orellana L. Nep: *Sindur*

Shrub or small tree 1 – 3m. Leaves subcoriaceous, ovate, 8 – 20 x 5 – 14.5cm, acuminate, base truncate or cordate, minutely peltate-scaly beneath; petiole 3 – 10cm; stipules c 5mm, sheathing terminal bud, early caducous. Panicles to 10 x 7cm, densely brown scaly, many-flowered; pedicels 6 – 10mm, with 5 glands below calyx. Sepals suborbicular, 8 – 10mm, densely scaly. Petals pinkish, obovate, 1.8 – 2cm. Stamens with free filaments; anthers horseshoe-shaped. Capsules red, subglobose, 3 – 4cm, covered in slender red prickles c 1cm.

Bhutan: S – Phuntsholing district (Phuntsholing); **Darjeeling:** Jalpaiguri. Cultivated in foothills and terai.

Native of tropical America. An orange-red dye (*Annatto*, *Arnatto*) is extracted from the seeds and used to dye skin and colour food.

Family 123. TAMARICACEAE

by A.J.C. Grierson

Shrubs or small trees, ± glabrous. Leaves alternate, simple, lanceolate or scale-like, sessile; stipules absent. Monoecious or dioecious; flowers in terminal or lateral bracteate racemes or spikes, actinomorphic, bisexual or unisexual. Sepals and petals 5, alternating. Stamens 5 or 10, free or connate at base. Ovary superior, 1-celled; ovules numerous, placentation basal or parietal; styles 3 or stigmas 3, sessile. Fruit a capsule dehiscent by 3 valves. Seed with a tuft (coma) of twisted hairs at apex.

1. Leaves scale-like 0.8–1.5mm; stamens 5; filaments equal, free to base; stigmas on elongate styles **1. Tamarix**
 + Leaves lanceolate or linear 3.5–7mm; stamens 10; filaments unequal, connate to middle; stigmas sessile **2. Myricaria**

1. TAMARIX L.

Shrubs or small trees. Leaves, scale-like, differing in size on vegetative and flowering shoots. Monoecious or dioecious; inflorescence of simple or branched spike-like racemes; flowers bisexual or unisexual, each subtended by a bract. Stamens 5; filaments equal, free. Styles 3, elongate or club-shaped.

1. Flower unisexual (plants dioecious); leaves completely sheathing stem at base **1. T. dioica**
 + Flowers bisexual; leaves half-sheathing stem at base **2. T. indica**

1. T. dioica Roth. Fig. 27o–w.

Tree 2–3m. Leaves acuminate, completely surrounding stem at base, those on vegetative shoots 2mm, those on flowering shoots 2.5mm. Dioecious; racemes 2–6 x 0.5cm, flowers reddish. Sepals obovate, 1.5 x 1mm, rounded. Petals obovate, 2.5 x 1mm, acute. Male flowers: filaments 2.5mm; pistillode absent. Female flowers: ovary narrowly ovoid, 2.5mm; styles 1.2mm, thickened at apex. Capsule 5mm. Seeds ovoid, 0.6mm, with tuft of hair 1.5mm.

Bhutan: S – Phuntsholing district (Torsa River); **Darjeeling:** Kalijhora, Sivoke and Tista Valley. River shingle in subtropical zone, 200–230m. July.

2. *T. indica* Willdenow; *T. gallica* L. var. *indica* (Willdenow) Hook. f., *T. troupii* Hole.

Similar to *T. dioica* but a shrub or tree 2–6(–8)m; leaves half-sheathing stem at base, those on vegetative shoots 0.8–1mm, those on flowering shoots 1.6–2mm; racemes 3.5–15 x 0.3–0.5cm, bracts 1.5mm; flowers bisexual; sepals ovate 0.8mm, margin serrulate; petals obovate, 1.25–1.5mm; filaments 1.5–1.75mm; styles club-shaped 0.6mm; capsules narrowly ovoid, 2.5mm; seeds oblong, 0.3mm, with tuft of hair 1.6mm.

Bhutan: S – Gayleghug district (Gayleghug). River bank, 270m.

This record (117) requires confirmation.

2. MYRICARIA Desvaux

Erect or prostrate shrubs. Leaves of two kinds on main and lateral shoots, lanceolate to linear. Inflorescence of terminal or lateral, bracteate racemes or spikes; flowers bisexual, 5-merous. Stamens 10, alternately long and short; filaments connate in lower half. Ovary ovoid, triquetrous; stigmas sessile.

1. Stems prostrate; floral bracts 6–10mm; sepals 4.5–6mm; petals 5–8mm, pinkish; fruiting capsules 10–13mm **1. *M. rosea***
 + Stems erect; floral bracts 4–7mm; sepals 3–4mm; petals 4–5mm, white; fruiting capsules 8–10mm **2. *M. albiflora***

1. *M. rosea* W.W. Smith; *M. germanica* (L.) Desvaux var. *prostrata* (Bentham & Hook. f.) Dyer p.p.

Prostrate, much-branched shrub with densely leafy branches 10–30cm. Leaves on main vegetative shoots lanceolate, 4–6 x 1–1.5mm, subacute, base narrowed, sessile, margins entire; leaves on lateral shoots linear, 2.5 x 0.5mm. Flowers fragrant, in dense bracteate racemes 3–7cm; bracts lanceolate 10 x 3mm; pedicels 2–3mm. Sepals linear-lanceolate, 6 x 2mm, white-margined. Petals oblanceolate, 7 x 3mm, pink or purplish. Capsule narrowly ovoid, 3-angular, 10–12mm; seeds oblong 1.5mm.

Bhutan: C – Ha, Thimphu and Tongsa districts, N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Dzongri. Stream sides, 3350–4250m. May – August.

2. *M. albiflora* Grierson & Long. Fig. 27x – zb.

Similar to *M. rosea* but stems erect 1–2m, reddish brown; leaves on main shoots ovate-lanceolate, 3.5–7 x 1–2mm, those of lateral branches linear, 2–3 x 0.5–0.75mm, subacute; racemes 3–6cm, bracts ovate-lanceolate, 3.5–7 x 1–2mm, white-margined; sepals lanceolate, 3–4mm; petals white, obovate-spathulate, 4–5 x 2–2.5mm; capsule ovoid, 8–10mm, sessile.

Bhutan: C – Ha district (Ha Dzong) and Thimphu district (Tsalimaphe, Paro and below Taba); **Sikkim:** Lingmuthang; **Chumbi.** Gravel beds by streams and rivers, 2130 – 3050m. July – September.

M. germanica (L.) Desvauz has been recorded, possibly in error for *M. albiflora*, from Paro (117). It differs from *M. rosea* in its erect habit, its bracts which are broadly ovate at base with broad membranous dentate margins, tapering above into a lanceolate entire apex and by its seeds which bear a stalked tuft of hairs.

Family 124. ELATINACEAE

by A. J. C. Grierson

Aquatic or semi-aquatic herbs. Leaves simple, opposite, entire, stipulate. Flowers bisexual, actinomorphic, solitary, 3-merous. Sepals membranous, obtuse, connate at base. Petals \pm spreading, membranous. Ovary superior, 3-celled; ovules numerous, placentation axile; stigmas 3, minute. Capsule \pm globose; seeds many.

1. ELATINE L.

Description as for Elatinaceae.

1. *E. ambigua* Wight. Fig. 28a – e.

Dwarf, sprawling herb; stems rooting at nodes. Leaves oblanceolate, 3.5 – 6 x 1.5 – 2mm, obtuse, base narrowed, sessile; stipules oblong, c 1.5mm, lacerate. Peduncles 1 – 1.5mm. Sepals oblong, c 1mm. Petals broadly ovate or elliptic, 1.5 x 1.5mm, subacute, pink. Capsule c 1.5mm diameter; seeds oblong, c 1mm, \pm terete, slightly curved, transversely rugulose.

Bhutan: C – Punakha district (Lometsawa). Paddy field, 2200m.

FIG. 28. Elatinaceae, Caricaceae and Datisceae. Elatinaceae. a – e, *Elatine ambigua*: a, plant; b, flowering branch; c, flower; d, fruit; e, seed. Caricaceae. f – k, *Carica papaya*: f, fruiting plant; g, male inflorescence; h, male flower; i, male flower dissected; j, female flower; k, t.s. fruit. Datisceae. l – o, *Tetrameles nudiflora*: l, leaf; m, part of male inflorescence; n, male flowers; o, female inflorescence; p, female flower. Scale: f x $\frac{1}{40}$; k x $\frac{1}{5}$; o x $\frac{1}{5}$; g, j, l x $\frac{1}{2}$; m x 1; i x $1\frac{1}{3}$; h x $1\frac{1}{2}$; a x $2\frac{1}{2}$; b x 5; n x 6; p x 7; c, d x 10; e x 20. Drawn by M. Bates.



Family 125. CARICACEAE

by A.J.C. Grierson

Small, palm-like tree. Leaves large, deeply palmately divided, containing milky latex, exstipulate. Dioecious (or sometimes monoecious); flowers among leaves on upper part of stem, 5-merous, unisexual (rarely bisexual); males in long corymbiform panicles; female buds 2-4 axillary, usually only one maturing. Male flowers with a low calyx rim; corolla narrowly tubular with spreading lobes; stamens 10, epipetalous, in 2 whorls, alternately with short filaments and sessile; pistillode small. Female flowers: \pm sessile, calyx small; petals free almost to base; staminodes absent; ovary of 5 united carpels, superior; stigmas 5-branched. Fruit a fleshy capsule with parietal placentas; seeds numerous.

1. CARICA L.

Description as for Caricaceae.

1. C. papaya L. Nep: *Mewa* (34); Hindi: *Papita* (34); Eng: *Papaya*, *Pawpaw*. Fig. 28f-k.

Stems 3-4(-10)m. Leaves ovate or orbicular in outline, 30-60 x 30-60cm, deeply palmately divided into 7-9 sharply toothed, pinnatifid lobes; petioles 40-60(-100)cm. Flowers fragrant; male panicles 30-40(-100)cm, pendulous; calyx minute; corolla creamy yellow, tube 2.5-3(-6)cm, lobes spreading, 10 x 1.5mm; anthers 1.5-2mm; filaments 1.5mm (small solitary fruit sometimes forming from a female flower at end of male rachises). Female flowers on peduncles 1-2cm; calyx lobes oblong 5-8mm; petals lanceolate, 5-6 x 0.8-1.5cm. Fruit yellow or orange at maturity, ellipsoid or narrowly obovoid, 20-30 x 8-15cm, \pm 5-angular, flesh thick, pinkish-orange. Seeds ellipsoid, 5 x 3mm, black, wrinkled.

Bhutan: cultivated in subtropical areas and warm temperate inner valleys e.g. at Samchi and Tashigang; **Darjeeling:** cultivated in terai. March-April.

Native of Tropical America, now widely cultivated for its luscious edible fruit, which also has medicinal properties (126).

Family 126. DATISCACEAE

by A.J.C. Grierson

Large deciduous trees. Leaves alternate, simple, exstipulate. Dioecious; flowers appearing before leaves, in axillary panicles or pendulous spikes, actinomorphic, unisexual. Sepals 4, oblong, connate at base; petals absent. Male flowers saucer shaped; stamens 4; pistillode minute. Female flowers: ovary inferior, 1-celled,

obovoid or ellipsoid, with parietal placentas bearing numerous ovules; styles 3, bifid, inserted on margin of ovary. Fruit a capsule.

1. TETRAMELES R. Brown

Description as for Datisceae

1. T. nudiflora R. Brown. Nep: *Maina Kath* (34), *Moina*. Fig. 281 - o.

Large buttressed tree, 25 - 45m. Leaves broadly ovate, 9 - 26 x 9 - 20cm, acuminate, base cordate or truncate, margins dentate, upper surface \pm glabrous, pubescent beneath; petioles 4 - 10cm. Male flowers: in lax panicles 15 - 20cm; floral cup including sepals c 1.5mm diameter; stamens exserted, filaments 4mm. Female flowers: spikes pendulous, 15 - 20cm, flowers in whorls of 3 - 8, sessile, ellipsoid, 4mm including sepals; styles exserted, c 1mm, stigmas obliquely club-shaped. Capsule obovoid, 5 - 6 x 4 - 4.5mm, ribbed.

Bhutan: S - Samchi, Phuntsholing and Gayleghug districts. **Darjeeling:** Chunbati. Native in subtropical forests but also cultivated in plantations, 300 - 900m. April.

One of the tallest tree species of the Himalayan foothills; very fast-growing and often cultivated for its valuable timber.

Family 127. BEGONIACEAE

by A. J. C. Grierson

Succulent herbs; rootstocks tuberous or rhizomatous; stemless or stemmed. Leaves alternate, simple, palmately or pinnately veined, often ovate, asymmetrically cordate at base; stipules leafy, \pm persistent. Monoecious; flowers in terminal or axillary cymes, unisexual, subzygomorphic; perianth parts petaloid. Male flowers: perianth of 2 outer, valvate, opposite segments and 0 - 2 smaller, inner segments; stamens numerous, free or connate below. Female flowers: perianth of 2 - 5 segments, outer ones larger than inner; ovary inferior, 2 - 4-celled; placentation axile, ovules numerous; styles (2 -)3(- 4), free or connate at base; stigmas \pm tortuously branched. Fruit a capsule, often unequally winged, variously dehiscent or breaking up irregularly; seeds very numerous, minute.

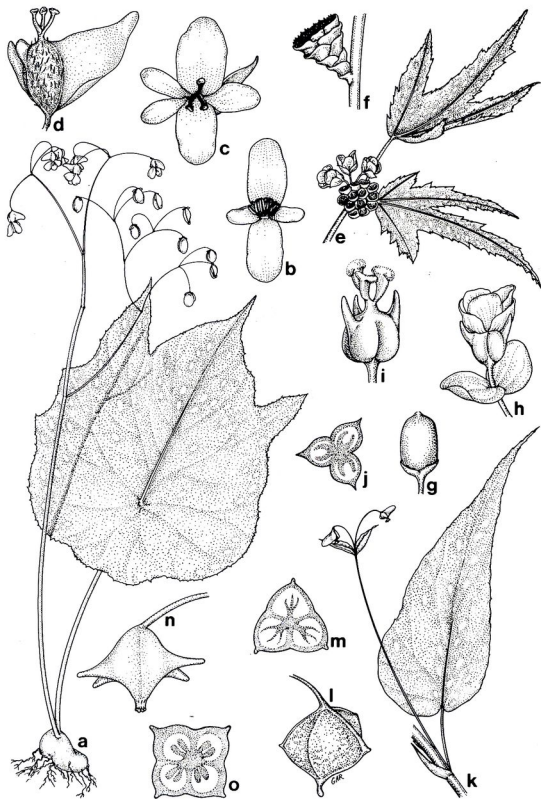
1. BEGONIA L.

Description as for Begoniaceae.

Many *Begonia* species are valued horticulturally as foliage plants.

1. Leaves peltate (petiole attached in lower half of lamina) **1. B. josephii**
 + Leaves not peltate (petiole attached at base of lamina) 2
2. Leaves symmetrically truncate or cordate at base with respect to petiole ... 3
 + Leaves asymmetrically truncate or cordate (sometimes nearly symmetrical in *B. hatacoa*) 8
3. Leaves deeply (more than half width) lobed and coarsely toothed
 2. B. sikkimensis
 + Leaves not or very shallowly lobed, entire or serrate 4
4. Leaves 1 – 2 per plant, basal **3. B. dioica**
 + Some leaves, at least, cauline 5
5. Leaves 3 – 6 x 3 – 5cm, rounded or weakly cordate at base; flowering stems up to 10(– 15)cm; plants \pm glabrous 6
 + Leaves 10 – 14 x 7 – 8.5cm, distinctly cordate at base; flowering stems up to 20cm; plants hairy 7
6. Longest wing of capsule 10 – 12mm, horizontal or ascending
 4. B. ovatifolia
 + Longest wing of capsule c 15mm, strongly ascending **5. B. rubella**
7. Bracts entire; capsule with one wing longer than others **6. B. picta**
 + Bracts lacerate; capsule \pm equally 3-winged **7. B. satrapis**
8. Leaves coarsely serrate, sometimes more deeply (more than half width) 2 – 3-lobed; inflorescences bearing squarish receptacles containing oblong bulbils
 8. B. gemmipara
 + Leaves mostly finely and regularly serrate, unlobed or shallowly lobed (coarsely toothed or lobed in *B. palmata*); inflorescences without receptacles 9
9. Leaves ovate-lanceolate, usually twice as long as broad 10
 + Leaves broadly ovate, less than twice as long as broad 14
10. Capsule angular, unwinged **9. B. inflata**
 + Capsule winged 11

FIG. 29. **Begoniaceae**. a – d, *Begonia josephii*: a, whole plant; b, male flower; c, female flower; d, fruit. e – j, *Begonia gemmipara*: e, part of plant with flowers and bulbils; f, receptacle with bulbils; g, bulbil; h, flower; i, fruit; j, t.s. fruit. k, *Begonia hatacoa*: part of plant in fruit. l & m, *Begonia inflata*: l, fruit; m, t.s. fruit. n & o, *Begonia roxburghii*: n, fruit; o, t.s. fruit. Scale: a x ¼; e, k x ½; b, c, f x 1½; d, h, l, m x 2; i, j, n, o x 2½; g x 15. Drawn by G. Rodrigues.



11. Stipules deciduous **11. B. nepalensis**
 + Stipules persistent 12
12. Stipules ovate, acuminate, 2 – 3cm **12. B. hatacoa**
 + Stipules c 1cm 13
13. Perianth persistent; capsules 3-celled **13. B. pedunculosa**
 + Perianth deciduous; capsules 2-celled **14. B. griffithiana**
14. Flowers white or pink 15
 + Flowers yellow 19
15. Ovary, pedicels, stems, petioles and sometimes leaves coarsely pubescent with deflexed broad-based hairs **15. B. cathcartii**
 + Plants glabrous or pubescent with thin hairs 16
16. Leaves weakly crenulate-serrulate; capsule 4-angular, unwinged **10. B. roxburghii**
 + Leaves coarsely dentate to deeply lobed (rarely almost entire); capsules distinctly winged 17
17. Leaves deeply (up to half width) lobed **17. B. palmata**
 + Leaves coarsely dentate (rarely subentire) 18
18. Stems short, up to 10cm; capsules pubescent **16. B. annulata**
 + Stems commonly over 20cm; capsules glabrous **18. B. megaptera**
19. Stems very short; leaves entire or shallowly lobed; stems and petioles stiffly spreading pubescent **19. B. xanthina**
 + Stems 20 – 30cm; leaves deeply (up to half width) lobed; stems and petioles brownish tomentose **20. B. flaviflora**

1. B. josephii A.DC. Fig. 29a – d.

Rootstock tuberous; stem absent or very short. Leaves usually all basal, ovate or oblong-ovate, (2 –)4 – 25(– 40) x (0.8 –)2 – 18(– 25)cm, acuminate, base rounded, peltate, margin finely serrate, sometimes \pm coarsely 3 – 5-lobed with acuminate lobes, glabrous or sparsely pubescent above, pubescent especially on veins beneath; petioles up to 20cm. Peduncles 7 – 35cm; bracts ovate, c 5mm, deciduous. Male flowers white or pink, outer perianth segments orbicular or elliptic, c 5 – 10 x 5mm, inner ones elliptic, 5 – 7 x 2 – 3mm. Stamens few c 2.5mm. Female flowers: perianth similar to males or slightly smaller; styles 2 – 3mm, branches tortuous or bulbous. Capsules ellipsoid, c 9 x 6mm, shaggily pubescent or glabrous, with one triangular wing c 12mm, horizontal or \pm ascending, acute or subacute, and 2 smaller wings, c 1 – 2mm.

Bhutan: C – Thimphu, Punakha, Tongsa and Tashigang districts, N – Upper Kuru Chu district; **Darjeeling.** Moist rocks in shady situations, 1830 – 2740m. July – September.

2. B. sikkimensis A. DC.

Rootstock rhizomatous; stems 15 – 20(– 45)cm. Leaves \pm symmetrical, suborbicular in outline, 15 – 30cm diameter, deeply lacinate into irregular segments, sometimes divided almost to base; segments acuminate, coarsely toothed and lobed, \pm glabrous; petioles 5 – 20cm; stipules linear-lanceolate, 1(– 2)cm. Peduncles 10 – 15cm; bracts broadly ovate, c 2cm, red, deciduous. Perianth segments elliptic, 1 – 1.5cm, red. Stamens numerous, forming a globose mass c 5mm diameter. Styles 2, connate at base, branches tortuous. Capsules c 10 x 4mm, becoming inverted; largest wing obovate, 12 x 15mm, rounded, finely striate; smaller wings 1 – 2mm broad.

Bhutan: S – Chukka district (near Chukka); **Darjeeling:** Balasun, Sureil, Darjeeling, Rongbe; **Sikkim:** Chakung, Hee. In forests, 900 – 3650m. August – October.

3. B. dioica D. Don; *B. amoena* A.DC., *B. tenella* D. Don.

Rootstock tuberous; stemless. Leaves ovate, symmetric, 4 – 11.5 x 3 – 7cm, acuminate, base cordate to almost truncate, margin \pm coarsely serrate, glabrous; petioles 5 – 17cm. Peduncles somewhat longer than petioles, bearing 2 – 5 flowers. Perianth white or pink; segments elliptic or obovate, outer ones 1.5 x 0.7 – 1cm, inner ones 8 x 3 – 4mm; perianth of female flowers persistent. Capsule obovoid, c 10 x 6mm, pubescent at first; wings subequal, 4 – 5mm, at top of capsule, horizontal or ascending, tapering towards base.

Bhutan: Punakha district (Neptenka); **Darjeeling:** Siri Khola, Rimbik and Palmajua (101). 1500 – 2200m. August.

4. B. ovatifolia A.DC.

Rootstock tuberous; stemless or stems up to 5cm. Leaves broadly ovate, 3 – 6 x 3 – 5cm, acute or \pm rounded at apex, base rounded or weakly cordate at base, margin obscurely crenulate-serrulate, sparsely pubescent above, shaggy along veins beneath; petioles 1.5 – 6cm. Peduncles 7 – 10 cm, bearing up to 10 flowers. Perianth white or pink, largest segments 5 x 4mm. Stamens united on a column c 1mm. Capsules c 10 x 6mm; largest wing 10 – 12mm, \pm ascending, acute; smaller wings 3 – 7mm, styles usually persistent.

Bhutan: C – Mongar district (Bagha La); **Darjeeling:** Sivoke Terai, Rungit, Tista Valley, Rongbe, Darjeeling. On moist shaded rocks, 150 – 1675m. August.

5. B. rubella D. Don; *B. scutata* A.DC.

Similar to *B. ovatifolia* but stems 7 – 15cm; leaves larger, 10 – 14 x 7 – 8.5cm, distinctly cordate at base; largest perianth segment c 15 x 10cm; fruit with a narrower longer wing which is more strongly ascending.

Bhutan: C – Thimphu district (Hinglai La) and Tongsa district (Tongsa Dzong);
Darjeeling: Rishap. 1220m. August.

6. *B. picta* Smith

Rootstock tuberous; stemless or with stems up to 20cm. Leaf usually only 1, basal, sometimes with another cauline leaf, ovate 5 – 15 x 3 – 9cm, acuminate, base \pm equally cordate, margin finely serrate-dentate, sometimes weakly lobed, coarsely hairy on upper surface, hairs warty at base; petioles 1.5 – 12cm. Outer perianth segments broadly elliptic, 10 – 15 x 8 – 10mm, white or pink, inner segments 5 – 6 x 2 – 3mm. Stamens numerous, forming a globose mass c 5mm in diameter. Styles 3, connate at base, each deeply divided into 2 twisted branches; ovary shaggily pubescent. Capsules ellipsoid, 10 – 15 x 7mm; wings \pm ascending, triangular, the larger 2 – 2.5cm, the smaller pair 0.7 – 1cm.

Darjeeling: Punkabari, Mongpu, Kurseong, Rungit, Ryang and Tista Valley. 600 – 1200m. August – September.

7. *B. satrapis* Clarke

Rootstock tuberous; stems 15 – 30cm, sometimes trailing and rooting at base. Leaves ovate or reniform, 8 – 11 x 5 – 11cm, subacute or acuminate, base rounded or cordate, margin dentate or denticulate, teeth ending in fine hairs, pubescent above, reddish villous on veins beneath; petioles 2.5 – 12cm; stipules lanceolate often pubescent. Peduncles elongate, longer than leaves, reddish pubescent; bracts oblong-lanceolate, 1.5 – 2cm, persistently shaggily hairy, deeply divided. Flowers white or pink, outer perianth segments elliptic, c 15 – 20 x 10mm, ciliate and pubescent outside. Mature capsules not known, probably \pm equally winged.

Darjeeling: Badamtam, Phedonchen, Sivoke, Darjeeling, Rungit. 600 – 1525m. August – September.

8. *B. gemmipara* Hook. f. Fig. 29e – j.

Rootstock tuberous; stems 5 – 40cm. Leaves \pm ovate, 5 – 10 x 3 – 5cm, acuminate, base usually asymmetrical, truncate or cordate, margin coarsely serrate or up to 5-lobed, usually glabrous; petioles 3 – 4cm. Flowers \pm pendulous, white or pink-striped, pedicels with a pair of elliptic, persistent bracts, c 6 x 4mm. Perianth segments suborbicular, c 5 x 5mm. Fruit body 7 x 10mm; wings \pm equal, c 4mm at upper margin. Flowers often replaced by squarish receptacles, c 10 x 10mm, filled with oblong bulbils.

Darjeeling: Tonglo, Senchal, Darjeeling, Rongbe; **Sikkim:** Kulhait, Lachung. 2133 – 3000m. August – October.

9. *B. inflata* Clarke. Fig. 29 l&m.

Stems up to 120cm. Leaves narrowly ovate, 10 – 18 x 3 – 6cm, acuminate, base very obliquely cordate, margin remotely denticulate, glabrous; stipules lanceolate, c 1cm, acuminate. Flowers white, in short axillary cymes; bracts lanceolate.

Capsules turbinate, trigonous, c 8 – 10mm long and broad, each angle distinctly ribbed but unwinged.

Bhutan: C – Mongar district (Shongar); **Darjeeling:** Rishap. In moist forest, 900m. August.

10. *B. roxburghii* (Miquel) A.DC. Fig. 29n&o.

Similar to *B. inflata* but leaves more broadly ovate, 15 – 35 x 12 – 25cm; fruit pendent, 4-angular, 12 – 15mm diameter, succulent, borne close to main stem on pedicels 1.5 – 2cm, angles obtuse ending in short ascending horns.

Darjeeling: Mendong, Selim, Rungit and Mongpo. 150 – 1525m. June – September.

11. *B. nepalensis* (A.DC.) Warburg; *B. gigantea* Clarke

Rhizomatous; stems 75 – 100cm, usually unbranched, glabrous. Leaves ovate-oblongate, 15 – 27 x 4 – 11cm, caudate-acuminate, base obliquely cordate, shallowly toothed, pubescent on veins beneath, otherwise glabrous; petioles up to 3cm; stipules lanceolate, deciduous. Peduncles repeatedly 2 – 3 times branched. Perianth segments 2 (or sometimes 3 in female flowers), ovate, 7 – 10 x 7 – 9mm, pink. Stamens numerous, forming a globose mass c 4mm diameter. Capsules ellipsoid, c 12 – 15 x 5mm, becoming inverted, with a large triangular wing, c 1.5cm, somewhat ascending, rounded or ± acute distally, and 2 smaller wings, c 1 – 1.5cm.

Bhutan: S – Samchi district (117) and Gaylegphug district (117); **Darjeeling:** Tista Valley, Sivoke, Panchkilla, Great Rungit. In moist shady forests, 270 – 500m. November – March.

12. *B. hatacoa* D. Don; *B. rubro-venia* Hook.f. Fig. 29k.

Rhizomatous. Stems 10 – 30cm. Leaves ovate-lanceolate, 7 – 15 x 3 – 7cm, acuminate, base ± obliquely rounded, scarcely cordate, margin subentire or ± distantly dentate, pubescent on veins beneath; petioles 3 – 12cm; stipules ovate, up to 20 x 10mm, acuminate, persistent. Peduncles c 10cm, bearing a few flowers terminally; bracts similar to stipules. Outer perianth segments ovate, c 10 x 7mm, inner ones c 6 x 4mm, pink or white, streaked pink. Stamens numerous; connective produced. Capsule c 12 x 6mm, becoming reflexed, largest wing oblong, c 15 x 10mm.

Bhutan: S – Gaylegphug district (Dakpai and Batase), C – Tashigang district (Gamri Chu); **Darjeeling:** Lal, Rishap, Sureil, Rongbe and Tista Valley. Wet, rocky river banks and shaded forests, 270 – 1650m. May – October.

13. *B. pedunculosa* Wall.

Similar to *B. nepalensis* but stems 12 – 23cm, somewhat flexuose, sometimes bulbiferous in leaf axils above; leaves ovate-lanceolate, 6 – 11 x 1.5 – 4.5cm, acuminate, base obliquely cordate, margin finely serrate-dentate, pubescent on veins beneath; petioles 1 – 3.5cm; stipules lanceolate, c 10 x 2mm; peduncles 3 – 5cm, ± dichotomously branched; bracts lanceolate, c 5 mm; outer perianth segments

2, suborbicular, c 5 x 7mm, pink; inner segments linear-oblong, usually shorter than outer; capsule c 7 x 4mm, with one \pm ascending wing, c 10mm and 2 smaller wings, c 2 – 3mm; perianth persistent on capsule.

Bhutan: S – Chukka district (Marichong). In moist subtropical forest, 1220m. November.

14. *B. griffithiana* (A.DC.) Warburg; *B. episcopalis* Clarke

Very similar to *B. nepalensis* but stems pubescent above; leaves usually narrowly lanceolate, 10 – 22 x 3 – 5cm, caudate-acuminate, base obliquely rounded or cordate; petioles up to 10 mm; stipules lanceolate, 10 – 12mm, persistent; male and female flowers with 4 perianth segments, outer ones 10 – 12mm, inner ones 4 – 6mm, pink; capsules c 13 x 5mm; largest wing c 12mm, triangular but rounded distally, smaller wings c 1mm.

Bhutan: S – Deothang district (Satsalor, Chungkar and Deothang). On cliff ledges and rocks in subtropical and warm broad-leaved forests, 300 – 1525m. November.

15. *B. cathcartii* Hook. f.

Rootstock rhizomatous. Stems up to 30cm, when young bearing coarse deflexed hairs with broad bases (leaving white lenticular scars where these have fallen). Leaves ovate, 6 – 10 x 3.5 – 6cm, acuminate, base obliquely cordate, margin serrate-dentate, ciliate, pubescent above, glabrous or with a few coarse hairs along veins beneath; petioles 3 – 10cm, bearing coarse, deflexed hairs. Outer perianth segments suborbicular, 1.5 – 2.5 x 1.5 – 2.5 cm, white, often with reddish, coarse hairs outside; inner segments obovate, 1 – 1.5 x 1 – 1.5cm. Stamens numerous, forming a globose mass c 8mm diameter. Style branches convolute; ovary \pm densely hairy. Capsule c 10 x 4mm, with one large wing c 1cm, \pm ascending, rounded toward base, and 2 smaller wings c 5mm.

Bhutan: S – Samchi and Deothang districts (near Chungkar), C – Tongsa district (Tongsa); **Darjeeling:** Mongpu, Tonglo, Ghoom, Sureil, Sukna; **Sikkim:** between Damthang and Tendong. Dense subtropical jungle, 920 – 2285m. May – August.

16. *B. annulata* K. Koch; *B. griffithii* Hook.f.

Stems short, up to 10cm, bearing persistent lanceolate stipules. Leaves ovate, 5 – 11 x 3 – 8cm, acuminate, base obliquely cordate, margin coarsely serrate-lobed (rarely subentire), pubescent on both surfaces, often variegated above; petiole 3 – 11cm, spreading brown pubescent; stipules lanceolate 13 x 5mm, brown. Cymes few-flowered; peduncles 5 – 10cm. Perianth segments obovate, up to 2 x 1.5cm, white tinged pink, pubescent externally. Stamens forming a globose mass 5mm diameter. Styles convoluted. Capsules (immature) pubescent; one wing much longer than others, crested.

Bhutan: S – Phuntsholing district (Kamji), Chukka district (Sinchu La area) and Gaylephug district (Chabley Khola). Damp rocky slopes in warm broad-leaved forest, 1600 – 1800m. May – June.

17. B. palmata D. Don; *B. laciniata* Roxb.

Rootstock rhizomatous; stems short, up to 15cm, finely shaggy-pubescent. Leaves broadly ovate or suborbicular, 7 – 10 x 6 – 20 cm, coarsely, acutely toothed or lobed, sometimes to middle, symmetrically or \pm obliquely cordate at base, densely pubescent, especially beneath; petioles 5 – 25cm; stipules triangular, 10 – 15 mm, acuminate. Flowers white or pink; bracts obovate c 8 x 7mm; perianth segments 8 – 12 x 8mm, pubescent outside. Stamens numerous in a globose mass c 7mm diameter. Styles 2, divided almost to base into 2 convoluted branches; ovary pubescent. Capsule becoming inverted, c 20 x 7mm, with one long wing c 2.7 x 1.5cm and two smaller wings c 6mm.

Darjeeling: Sureil, Kurseong, Rishap, Lebong, Goompahar, etc. 1830 – 2133m. May – June.

18. B. megaptera A.DC.

Rootstock rhizomatous; stems up to 45cm, \pm glabrous. Leaves ovate, 10 – 15 x 5 – 7cm, acuminate, base unequally cordate, margin undulate-angular, scarcely dentate, \pm glabrous; petioles 2.5 – 10cm; stipules lanceolate, c 15mm, glabrous, persistent. Peduncles elongate up to 20cm; bracts 2 – 2.5cm, glabrous, deciduous. Flowers pink; outer perianth segments oblong, 1.5 x 1cm. Stamens numerous, united at base. Styles 2, c 7mm. Capsules becoming inverted, 12 – 15 x 5 – 7mm, glabrous; longest wing attached below apex, up to 2cm long; smaller wings c 3mm.

Bhutan: S – Chukka district (Chukka) and Deothang district (Dewangiri), C – Punakha district (Sinchu La); **Darjeeling:** Senchal, Sitong, Pankabari. Fissures of moist rock, 600 – 2100m. June, September – November.

19. B. xanthina Hook. f.

Similar to *B. flaviflora* but stems short or none; leaves 15 – 25cm, acuminate, base obliquely cordate, margin sinuately denticulate, green and glabrous above, reddish and hispid on veins beneath; petiole \pm as long as lamina; stipules ovate; peduncles twice as long as petioles, bearing a many-flowered corymb at the apex; perianth segments yellow, tinged with red outside; stamens numerous; fruit becoming inverted, the largest wing c 2.3 x 0.7cm, rounded, striate.

Darjeeling: Dumsong, Kurseong; **Sikkim:** Tumlong. 1220 – 1830m. July – September.

20. B. flaviflora (Clarke) Hara; *B. laciniata* Roxb. var.? *flava* Clarke

Rhizome thick, softly brown tomentose. Stems erect, 20 – 30 cm, at first appressed brown tomentose. Leaves ovate, 10 – 30 x 7 – 18cm, acuminate, base obliquely cordate, sinuate-lobed, lobes 1 – 3cm, brownish tomentose on veins beneath; petioles up to 20cm, brown tomentose; stipules lanceolate. Peduncles up to 11cm; pedicels brown tomentose; bracts oblong, 2 – 3cm, yellow, glabrous, deciduous. Flowers yellow; outer perianth segments ovate, 1.5 – 2cm, sparsely pilose at base outside. Stamens numerous, forming a globose mass c 6mm diameter.

Capsules becoming inverted, c 13 x 5mm; longest wing attached below apex, c 1.5mm; smaller wings c 2mm.

Darjeeling: Senchal, Darjeeling; **Sikkim:** Tendong Peak. 2350 – 2400m. July.

Family 128. CUCURBITACEAE

by A. J. C. Grierson

Climbing or trailing herbs or subshrubs. Leaves alternate, simple, palmately or pedately lobed, or compound, exstipulate; tendrils axillary, solitary, simple or branched. Monoecious or dioecious; flowers in axillary racemes, corymbs, panicles, fascicles or solitary, small or large, 5-merous (but calyx 3 – 4-lobed in *Zanonia*). Calyx tubular or campanulate; sepals rarely free. Petals inserted on margin of calyx tube, free or connate, yellow or white. Male flowers: stamens inserted on calyx tube, sometimes 5 (usually in 2 – 2 – 1 arrangement), more often reduced to 3 (two 2-celled, one 1-celled); anthers straight, curved or conduplicate (i.e. folded together lengthwise); pistillode present or not. Female flowers: calyx and corolla usually as in male; ovary inferior, carpels 3, usually 1-celled, sometimes 3-celled, ovules 1 – many, styles 3 free or connate, stigmas often bifid, staminodes present or not. Fruit a dehiscent or indehiscent berry or capsule; seeds usually many, compressed, horizontal, erect or pendulous, tuberculate or smooth, rarely winged.

The arrangement of genera and species follows the check-list of Cucurbitaceae by Jeffrey (185).

Key based mainly on female flowers

1. Female flowers usually solitary or few; stamens 3, (or 5 in *Indofevillea*, *Thladiantha*, *Siraitia* and some *Luffa* species); styles united 2
- + Female flowers usually in racemes or panicles; stamens 5; styles free 22

2. Calyx tube elongate, ± cylindrical 1.5 – 10cm 3
- + Calyx tube campanulate, usually less than 1cm (but up to 1.5cm in *Lagenaria*) 8

3. Corolla lobes fimbriate, white at least within 4
- + Corolla lobes entire, mostly yellow, sometimes white 5

4. Leaves coriaceous; calyx tube 7 – 10cm; fruit globose 7 – 15cm diameter **16. Hodgsonia**
- + Leaves herbaceous; calyx tube 1.5 – 5cm; fruit oblong 1 – 12.5cm **17. Trichosanthes**

5. Leaves usually deeply 3 – 7-lobed; corollas yellow; male flowers solitary or 2
19. Biswarea
 + Leaves usually angular or shallowly 3 – 5-lobed (sometimes deeply in *Gymnopetalum*); male peduncles paired, one 1-flowered, other racemose.. 6
6. Leaves minutely white scabrid on both surfaces; corollas white
18. Gymnopetalum
 + Leaves not scabrid; corollas yellow 7
7. Anthers conduplicate; ovule in each cell solitary, erect
20. Herpetospermum
 + Anthers straight; ovules in each cell 2 – 3, pendulous **21. Edgaria**
8. Leaves pedate, 5 – 7-foliolate; anthers united into a horizontal ring; fruit obliquely club-shaped, sparsely echinate **13. Cyclanthera**
 + Leaves simple, lobed (sometimes pedately in *Momordica*) or not; anthers straight or conduplicate; fruits various 9
9. Petioles with two rounded glands near apex **5. Lagenaria**
 + Petioles without glands 10
10. Calyx lobes usually expanded and leaf-like at apex; fruits large, globose or ovoid, 20cm or more diameter, fleshy **15. Cucurbita**
 + Calyx lobes not expanded and leaf-like; fruit similar or otherwise 11
11. Anther connective produced into a glandular crest at apex; fruit large, ovoid or spherical, succulent **11. Cucumis**
 + Anther connective not produced into a glandular crest (but produced into a point in *Schizopepon bicirrhosus*); fruit otherwise 12
12. Fruits dehiscent by an apical, circumscissile lid, flesh fibrous; male flowers in racemes **7. Luffa**
 + Fruits indehiscent or dehiscent by valves; male flowers racemose or not...13
13. Tendrils 3 – 5-branched; female flowers solitary from same axil as male raceme; ovary with solitary ovule; fruit pear-shaped, coarsely ridged, fleshy
14. Sechium
 + Tendrils simple or 2-branched; female and male flowers usually in different axils; ovules more than one, fruits various 14
14. Leaves ovate-oblong, triangular or 5-lobed, base \pm cordate, 5-veined, often with rounded glands on the undersides at vein axils; fruit oblong, 3 – 6 x 2cm, with scattered glands on surface **8. Solena**
 + Leaves variously shaped; leaves and fruit not glandular 15

15. Stamens 5, all 1-celled; leaves ovate, subentire or denticulate 16
 + Stamens 3, one 1-celled, two 2-celled; leaves lobed or ovate, margin toothed (but ovate and subentire in *Schizopepon bicirrhosus*) 18
16. Male flowers in branching corymbs, bracts linear, female flowers in clusters; fruit ovoid, 15(- 30?) x 10cm **1. Indofevillea**
 + Male flowers in racemes; fruits smaller or unknown 17
17. Male racemes with oblong bracts, 10 x 7mm, toothed above, corolla c 15mm; female flowers solitary, ebracteate; fruit oblong, 5 - 6 x 3 - 3.5cm, densely hairy **2. Thladiantha**
 + Male racemes crowded, bracts elliptic, 7 - 15mm entire, corolla 8 - 10mm; female flowers and fruit unknown **3. Siraitia**
18. Flowers of both sexes solitary, on peduncles 3 - 9(- 14)cm, with a rounded bract near base or sheathing flower; fruit oblong, muricate or echinate **4. Momordica**
 + Male flowers usually racemose, female flowers often solitary or in fascicles; fruit spherical or ovoid, smooth 19
19. Leaves deeply 3 - 5-lobed (divided more than half width), softly white warted; flowers in axillary fascicles; fruit globose, 1.5 - 2cm diameter **6. Diplocyclos**
 + Leaves shallowly lobed or unlobed; flowers in axillary fascicles or racemes; fruit globose, up to 1cm diameter, or ovoid 20
20. Stems and leaves stiffly hairy; flowers mostly in sessile fascicles.. **10. Mukia**
 + Stems and leaves softly pubescent; flowers in racemes or shortly-stalked fascicles 21
21. Flowers in shortly stalked fascicles **9. Zehneria**
 + Flowers in racemes **12. Schizopepon**
22. Leaves entire, cordate; fruits cylindrical or club-shaped, 6 - 10 x 2.5 - 3cm, truncate at apex **22. Zanonía**
 + Leaves pedately or palmately divided into 3 - 7 leaflets; fruits club-shaped or otherwise 23
23. Fruits trigonous or obconical **25. Gomphogyne**
 + Fruits not as above 24
24. Fruits globose; tendrils simple **26. Gynostemma**
 + Fruits subcylindric or club-shaped; tendrils simple or bifid 25

25. Seeds with a long, apical wing **23. Nealsomitra**
 + Seeds completely surrounded by a narrow wing **24. Hemsleya**

Key based on plants with male flowers only

1. Leaves trifoliolate or pedately 5 – 9-foliolate 2
 + Leaves simple, lobed or not 7
2. Stamens united into a head, anther cells forming a ring **13. Cyclanthera**
 + Stamens free or connate at base, anthers straight 3
3. Leaflets 3 4
 + Leaflets 5 – 9 5
4. Corolla lobes obtuse; plants woody **23. Nealsomitra**
 + Corolla lobes long acuminate; plants herbaceous **26. Gynostemma**
5. Calyx and corolla 5 – 8mm **24. Hemsleya**
 + Calyx and corolla 0.5 – 4mm 6
6. Calyx segments c 2mm **25. Gomphogyne**
 + Calyx segments c 0.5mm **26. Gynostemma**
7. Leaves unlobed 8
 + Leaves lobed 14
8. Stamens 3 9
 + Stamens 5 11
9. Flowers solitary; corolla lobes fairly large, 2 – 3 x 1.5 – 2cm, yellow
4. Momordica
 + Flowers usually several to many; corolla lobes smaller 10
10. Peduncles, if present, unpaired, flowers in clusters, sessile or stalked; corolla
 c 5mm **8. Solena**
 + Peduncles paired, one bearing a solitary flower, the other racemose; corolla 10
 – 15mm **21. Edgaria**
11. Flowers in panicles 12
 + Flowers in racemes (or rarely solitary in *Thladiantha*) 13
12. Leaves herbaceous, pubescent beneath, cordate at base **1. Indofevillea**
 + Leaves coriaceous, glabrous, ± truncate at base **22. Zanonia**

13. Tendril simple; bracts c 10mm, toothed above **2. Thladiantha**
 + Tendril bifid; bracts 7 – 15mm, entire **3. Siraitia**
14. Stamens 5 15
 + Stamens 3 16
15. Annuals; calyx campanulate, without nectaries **7. Luffa**
 + Vigorous perennials; calyx cup-shaped with pouched nectaries **14. Sechium**
16. Tendrils simple 17
 + Tendrils with 2 or more branches 20
17. Connectives extended above anthers and crested **11. Cucumis**
 + Connectives otherwise 18
18. Stems bristly-hispid; flowers in axillary clusters **10. Mukia**
 + Stems smooth, \pm glabrous; flowers otherwise 19
19. Flowers in fascicles or corymbs **9. Zehneria**
 + Flowers solitary or in racemes **18. Gymnopetalum**
20. Corolla lobes less than 0.5cm 21
 + Corolla lobes 0.7 – 5cm or more 22
21. Leaves pedately 3 – 7-lobed; flowers in sessile clusters borne in same axil as female flowers **6. Diplocyclos**
 + Leaves shallowly lobed; flowers in racemes or panicles; dioecious **12. Schizopepon**
22. Corolla lobes fimbriate 23
 + Corolla lobes not fimbriate 24
23. Racemes brown tomentose; corolla lobes 5cm, fimbriae 10 – 15cm **16. Hodgsonia**
 + Racemes glabrous or pubescent but not tomentose; corolla lobes 1 – 3cm including fimbriae **17. Trichosanthes**
24. Corollas tubular at base, cup-shaped above 25
 + Corolla \pm campanulate 26
25. Anthers folded **19. Biswarea**
 + Anthers straight **20. Herpetospermum**

26. Calyx teeth expanded and leaf-like above 15. *Cucurbita*
 + Calyx teeth not expanded above 27
27. Flowers solitary on long peduncles 5. *Lagenaria*
 + Flowers in elongated racemes 7. *Luffa*

1. INDOFEVILLEA Chatterjee

Somewhat woody. Leaves simple, ovate, petiolate; tendrils bifid. Dioecious; male flowers in branched puberulous corymbs; sepals free, longer than petals; stamens 5, in 2-2-1 arrangement; anthers 1-celled, reniform. Female flowers not known. Fruit clustered, ovoid; seeds horizontal, compressed.

1. I. khasiana Chatterjee. Nep: *Indrenee*.

Large climber; stems coarsely ridged, ± glabrous. Leaves ovate, (21-)23- 30 x (13-)19- 20cm, abruptly acuminate, base cordate, distantly denticulate, puberulous on the veins on both surfaces; petioles 6- 7cm. Male corymbs c 17cm; sepals ovate, 6mm; petals ovate, 4mm; stamens, 5 free. Fruit ovoid, 15(- 30) x 10cm; seeds ellipsoid, compressed, 2.5- 3(- 4?) x 1.5- 1.7(- 2) x 0.4cm, dark brown, smooth.

Bhutan: S- Gaylephug district (Taklai Khola) and Deothang district (8km N of Samdrup Jongkhar). Subtropical forests, 320- 550m.

2. THLADIANTHA Bunge

Herbs with tuberous roots. Leaves entire, petiolate; tendrils simple. Dioecious; male flowers in crowded racemes, rarely solitary; calyx shortly campanulate, lobes spreading; corolla campanulate, yellow; stamens 5, in 2-2-1 arrangement; anthers 1-celled, straight. Female flowers solitary; calyx and corolla as in male; staminodes 5, elongate; ovary oblong; styles connate, 3-fid at apex. Fruit oblong, berry-like; seeds obovoid, compressed.

1. T. cordifolia (Blume) Cogniaux; *T. calcarata* Clarke. Nep: *Bun Karela*. Fig. 31a.

Leaves ovate, 8.5- 17 x 6.5- 12cm, acuminate, base deeply cordate rounded, margins denticulate, appressed-scrabrid on upper surface, softly pubescent beneath; petioles c 7cm. Male peduncles 7cm; bracts oblong, 10 x 7mm, toothed at apex. Male flowers: calyx lobes linear-oblong, 10mm, connate at base; corolla lobes ovate, 1.5- 2.5 x 0.8cm, connate below middle; stamens on filaments 4mm, anthers ± as long. Female flowers: apparently ebracteate; ovary ellipsoid, 1.3 x 0.7cm, densely pubescent; styles 0.8cm. Fruit oblong, 2.5- 3 x 1.5- 2cm; seeds ovoid, 4- 5 x 3- 4 x 0.2mm, rugose.

Bhutan: S- Chukka, Gaylephug and Deothang districts, C- Punakha, Tongsa and Tashigang district; **Darjeeling:** Rungno, Balasun, Mongpu, Tista, Darjeeling. Warm broad-leaved forests, 1500- 2300m. April - September.

3. *SIRAITIA* Merrill

Annual(?) herbs. Leaves simple; tendrils usually bifid. Dioecious; male flowers clustered at end of racemes; calyx campanulate, lobes spreading; petals ovate, free, spreading; stamens 5, free, in 2-2-1 arrangement; anthers 1-celled, conduplicate. Female flowers and fruit not known.

1. *S. sikkimensis* (Chakravarty) Jeffrey; *Neoluffa sikkimensis* Chakravarty

Stems 5-angular, brownish tomentose. Leaves ovate, 7-15 cm long and broad, acute or acuminate, base shallowly cordate, entire, glabrous above, tomentose beneath; petioles 5-8 cm. Male flowers yellow, 20-35 in racemes or fascicles on peduncles c 10 cm; pedicels 1-2 cm; bracts elliptic, 7-15 mm; calyx lobes 3-5 mm, connate at base; petals oblong-ovate, 8-10 x 3-4 mm; filaments 0.5-1 mm; anthers 1-2 mm.

Darjeeling: near Sitong, 450 m.

4. *MOMORDICA* L.

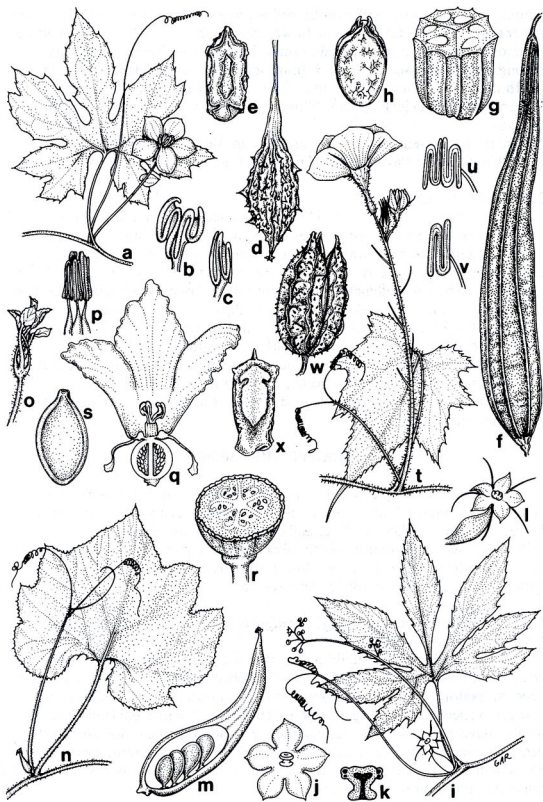
Perennial herbs. Leaves simple, unlobed or pedately lobed; tendrils simple. Monoecious or dioecious; flowers small or large, solitary. Male flowers: calyx tube short, limb campanulate, lobes 5; corolla campanulate, 5-lobed almost to base; stamens 3, anthers coherent, ultimately free, one 1-celled, two 2-celled, conduplicate. Female flowers similar to male; ovary oblong or ellipsoid; styles slender, connate; stigmas 3. Fruit oblong or cylindrical, muricate or echinate; seeds oblong, compressed.

1. Monoecious; stems puberulous; leaves suborbicular in outline, pedately 5-7-lobed **1. *M. charantia***
 + Dioecious; stems glabrous; leaves ovate, lobed or not **2. *M. dioica***

1. *M. charantia* L. Tongsa: *Khagtang*; Sha: *Kairu*; Nep: *Karela*; Eng: *Bitter Cucumber*. Fig. 30a-e.

Leaves suborbicular in outline, 4-7(-12) cm long and broad, pedately 5-7-lobed; lobes ovate or oblong. Male flowers on peduncles 3-5 cm, with a suborbicular bract 5-15 mm long and broad in lower half; calyx lobes ovate, 7 x

FIG. 30. Cucurbitaceae. a-e, *Momordica charantia*: a, leaf, tendril and male flower; b, c, anthers; d, fruit; e, seed. f-h, *Luffa acutangula*: f, fruit; g, t.s. base of fruit; h, seed. i-m, *Cyclanthera pedata*: i, part of flowering shoot with male raceme and solitary female flower; j, male flower with anther head; k, t.s. anther head; l, female flower; m, fruit, cut away to show seeds. n-s, *Cucurbita moschata*: n, part of flowering shoot with female flower; o, calyx; p, stamens; q, l.s. female flower; r, t.s. ovary; s, seed. t-x, *Herpetospermum pedunculatum*: t, part of flowering shoot with male flowers; u, v, anthers; w, fruit; x, seed. Scale: n x $\frac{1}{16}$; i, t x $\frac{1}{4}$; a, f, m, o, q, w x $\frac{1}{2}$; d, g x 1; r x $\frac{1}{10}$; l, s x $1\frac{1}{2}$; e, h, p, u, v, x x 2; j x 3; b, c x 5; k x 10. Drawn by G. Rodrigues.



2.5mm, united in lower half; corolla yellow, lobes oblong, 15 x 4mm, connate in lower third; stamens 4mm. Female flowers on peduncles 5 – 10cm, bracteate near base; ovary ovoid, 7mm, mucicate. Fruits ellipsoid, 8 – 20cm, tuberculate; seeds oblong, subcompressed, c 12 x 6 x 3mm, sculptured, embedded in red pulp.

Bhutan: S – Phuntsholing and Gaylephug districts, C – Mongar district (Lingmethang); **Darjeeling:** terai. Climbing on other vegetation, 270–900m. April – August.

Widely cultivated; young fruit are rich in Vitamin C and much used as a vegetable; they also have medicinal properties; leaves edible and nutritious (157).

2. *M. dioica* Willdenow

Leaves ovate, 4–11 x 3–8(–11)cm, acuminate, base cordate, unlobed, or with 3–5 ovate lobes, ± glabrous; petioles 1–3cm; tendrils simple. Male peduncles 3–9(–14)cm; flowers surrounded by an ovate, sheathing bract 3 x 5cm, at apex; calyx lobes oblong, 15 x 7mm; corolla lobes yellow, 2–3 x 1.5–2cm. Female flowers on ebracteate peduncles 13–15cm; calyx lobes narrowly triangular, 8mm; corolla lobes similar to male; ovary ovoid-ellipsoid, densely coarse-hairy. Fruit ellipsoid, 3–5 x 2–3cm, densely soft-echinate; seeds ovoid, 6–7 x 5–6mm, emarginate with a narrow neck, irregularly corrugated.

Bhutan: S – Deothang district (near Deothang); **Darjeeling:** Great Rungit Valley. Amongst shrubs, 300–900m. May – July.

Often cultivated for its fruit which are used as a vegetable; young shoots and leaves also edible (157).

5. LAGENARIA Seringe

Annuals. Leaves simple, petiolate; tendrils unequally bifid. Monoecious, flowers large, white, solitary. Male flowers: on long peduncles; calyx campanulate; petals 5, free; stamens 3; filaments free; anthers loosely coherent, conduplicate, one 1-celled, two 2-celled. Female flowers: calyx tube short; petals as in male; staminodes 3; ovary cylindrical; style short, thick; stigmas 3, bilobed. Fruit indehiscent, variously shaped; seeds obovoid, compressed.

1. *L. siceraria* (Molina) Standley; *L. vulgaris* Seringe. Sha: *Chhong*; Eng: *Bottle Gourd, Calabash Gourd*.

Leaves broadly ovate or suborbicular, 10–40cm long and broad, acute or shortly acuminate, base cordate, shallowly 3–5-lobed, sparsely pubescent especially beneath; petioles 5–10(–30)cm with 2 small rounded glands at apex. Male flowers: on peduncles as long as petioles; calyx tube 1.5cm, teeth lanceolate, 5mm; petals obovate, 3–4 x 2–3cm; anthers 7–8mm. Female flowers: on shorter peduncles than male; ovary c 2cm, villous; styles and stigmas 8mm. Fruits globose, 15cm diameter, or cylindrical up to 1.8m; seeds obovoid, 16–20 x 8 x 3mm, with minutely pubescent sculptured lines.

Sikkim/ Darjeeling: locality not known (179).

Fruit of wild forms have hard, woody outer layers impervious to water, the pulp is bitter and unpalatable; shells have been used for carrying water or for floats for fishing. Cultivation has resulted in fruits without woody outer layers and with soft, sweetish flesh; these are given different names according to shape. As a vegetable, gourds are gathered while tender, increasing maturity results in coarseness of flesh and hardness in seeds. Probably native of tropical Africa (157).

6. DIPLOCYCLOS (Endlicher) Post & Kuntze

Leaves deeply palmately 3 – 5-lobed; tendrils usually bifid. Monoecious; flowers small, yellowish; male and female in common axil. Male flowers: calyx broadly campanulate; corolla campanulate; stamens 3; one anther 1-celled, two 2-celled, cells slightly flexuous. Female flowers: calyx and corolla as in male; staminodes 3, small; ovary subglobose; styles slender. Fruit berry-like, globose, many-seeded; seeds ovoid, attenuate at base, turgid, surrounded by a thickened margin.

1. D. palmatus (L.) Jeffrey; *Bryonia laciniosa* sensu F.B.I. non L., *Bryonopsis laciniosa* auct. non (L.) Naudin. Nep: *Bon Kakra*

Leaves suborbicular in outline, 6 – 12 x 6 – 12cm, lobes elliptic acuminate, base cordate, margins entire or shallowly serrate, becoming roughened with small white pustules above; petioles 2 – 6cm. Flowers in ± sessile clusters of 5 – 6 flowers; calyx teeth 2.5mm, connate below; corolla 3 – 4mm; anthers 1.2mm, curved; ovary at first 5mm. Fruit globose, c 2cm diameter, covered with rounded whitish blotches; seeds 5 x 3 x 3mm, pale coloured.

Bhutan: S – Phuntsholing and Gaylephug districts (117); **Darjeeling:** foothills and terai. 550 – 610m. August – October.

7. LUFFA Miller

Annuals. Leaves simple, lobed; petioles eglandular; tendrils bifid or more divided. Monoecious; male flowers in racemes; calyx tube campanulate; petals free, spreading, obcordate or obovate; stamens 3 or 5; anthers convoluted, one 1-celled, two 2-celled when 3; all 1-celled when stamens 5. Female flowers: solitary, sometimes from common axil with male; calyx tube short; petals as in male but larger; staminodes 3, rarely 5; ovary elongate; ovules numerous horizontal; style columnar; stigmas bilobed. Fruit cylindrical, often fibrous within, usually dehiscing by an apical lid; seeds compressed, ovoid.

1. Stamens 3; fruit 10-angular **1. L. acutangula**
 + Stamens 5, sometimes 3; fruit smooth or tuberculate 2

2. Petals 1.5 – 2cm; fruit small, tuberculate **2. L. graveolens**
 + Petals 2 – 5cm; fruit larger, smooth **3. L. aegyptiaca**

1. L. acutangula (L.) Roxb. Eng: *Angled Loofah*. Fig. 30i – m.

Leaves 7 – 15(– 20)cm long and broad, shallowly, palmately 5 – 7-angled, acute or acuminate, base cordate, coarsely pubescent on both surfaces; petioles 3 – 8(– 12)cm; tendrils 3-fid. Male and female flowers often from same axil; males on peduncles 10 – 15cm; pedicels 1 – 4mm, with small elliptic bracts bearing a few circular glands; calyx campanulate, c 1cm; petals obcordate, 2.5 x 1.5 – 2cm; stamens c 6mm. Female flowers on peduncles 5 – 7(– 10)cm; petals 3.5 x 3cm; ovary ellipsoid, 2.5cm, pubescent. Fruit club-shaped, 15 – 30cm (sometimes up to 3m) with 10 prominent, longitudinal ridges; seeds 11 – 12 x 7 – 8 x 2 – 3mm, blackish.

Bhutan: S – cultivated near Phuntsholing; **Darjeeling:** terai, e.g. at Dulka Jhar. 150m. September.

The immature fruit is eaten as a popular vegetable and is widely cultivated.

2. L. graveolens Roxb.

Leaves suborbicular, 4 – 6(– 12)cm long and broad, shortly 5-lobed, acute, base cordate, papillose-scabrid on upper surface, pubescent beneath; petioles 3 – 4(– 7)cm; tendrils 3(– 5)-fid. Male and female flowers often in same axil. Male flowers: peduncles 15 – 30cm, with elliptic glandular bracts, 3 – 5mm long, near base; calyx tube 5mm, teeth 5 – 6mm; petals oblong, 1.5 – 2cm; stamens 5. Female flowers on shorter peduncles, usually solitary. Fruit 4 – 6 x 2.5 – 3cm, tuberculate or echinate; seeds 6 x 4 x 2mm, whitish.

Darjeeling: foothills. 300 – 600m. September – October.

3. L. aegyptiaca Miller; *L. cylindrica* (L.) Roemer. Nep: *Ghiroula, Bon Giroula*; Eng: *Smooth Loofah*.

Leaves suborbicular in outline, 10 – 15(– 25)cm long and broad, 5-lobed, acuminate, base cordate, coarsely pubescent on both surfaces; petioles 3 – 10(– 12)cm; tendrils 4 – 5-fid. Male and female flowers often in same axil. Male flowers: peduncles 10 – 15cm, 15 – 20-flowered; pedicels c 5mm, bearing elliptic glandular bract; calyx teeth 10mm, united in lower half; petals 2 – 5 x 1 – 4cm; stamens 3 or 5, c 7mm. Female flowers: peduncles 2 – 10cm; staminodes 3 – 5. Fruits ellipsoid-cylindric, 15 – 30 x 6 – 10cm, smooth, with 10 dark green longitudinal lines, fibrous within; seeds ellipsoid, 12 x 7 x 2mm, black, margin almost winged.

Bhutan: S – Phuntsholing, Sankosh and Gaylegphug districts; **Darjeeling:** Sivoke and Darjeeling. Cultivated, 200 – 600m. October – December.

Immature fruits 15 – 20cm long are peeled and cooked as a vegetable. Mature fruits are the source of commercial *loofah*, the dry fibrous skeletons which are used as filters and scrubbing implements.

flowers solitary or 2; peduncles 10mm; ovary ellipsoid, 6mm. Fruit reddish-yellow, 10 – 12 x 7 – 10mm; seeds obovoid, compressed, 4 – 5 x 2 – 3 x 1mm.

Bhutan: S – Gaylegphug district (near Betni Khola, 117) and Deothang district (near Garrison Engineer's Camp, 117); **Darjeeling:** Tista Valley, Darjeeling, September.

2. *Z. maysorensis* (Wight & Arnott) Arnott; *Z. baueriana* Endlicher

Leaves blackish when dry, ovate or weakly lobed, 4 – 6 x 3 – 5cm, acuminate, base cordate, denticulate, glabrous beneath. Monoecious; male peduncles 2 – 2.5cm, bearing 3 – 7 flowers; calyx 2mm, pubescent within; corolla lobes ovate-triangular, 2.5mm; filaments 1mm. Female flowers solitary, on peduncles 3 – 5mm. Fruit globose, 10 – 12mm diameter, reddish at maturity; seeds obovoid, 5 x 3 x 1mm, compressed, narrowly margined.

Bhutan: C – Tashigang district (Lungten Zampa); **Darjeeling:** Lebong, Kurseong, Pankabari, Kalimpong, Balasun and Rishap. Amongst shrubs, 900 – 1800m. August – October.

3. *Z. scabra* (L.f.) Sonder; *Z. hookeriana* Arnott.

Similar to *Z. maysorensis* but dioecious.

Sikkim: locality not known (80); record probably based on misidentified specimens of *Z. maysorensis* from Darjeeling district.

10. MUKIA Arnott

Bristly annual. Leaves simple, 3 – 5-lobed; tendrils simple. Monoecious; flowers in axillary clusters. Male flowers: calyx campanulate, teeth 5; corollas 5-lobed; stamens 3, two anthers 2-celled, one 1-celled, cells straight. Female flowers: calyx and corolla as in male; ovary ovoid, hispid. Fruit globose, indehiscent; seeds ovoid, compressed.

1. *M. maderaspatana* (L.) Roemer; *M. scabrella* (L.f.) Arnott

Stems stiffly hairy. Leaves broadly ovate in outline, 4 – 10 x 4 – 10cm, acuminate, base cordate, margin toothed, ± hispid on both surfaces. Male flowers: calyx narrow, 3 – 4mm, including hispid teeth; corolla lobes 1.5 – 2mm; stamens 1.5mm. Fruit 1cm diameter, red and glossy at maturity; seeds ovoid, 4 x 3 x 1.5mm, surrounded by a low margin, surface minutely roughened.

Bhutan: S – Phuntsholing and Gaylegphug districts, C – Tongsa district (Tama) and Tashigang district (Shali); **Darjeeling:** Kurseong, Siliguri, Jalpaiguri, Dulka Jhar. 600 – 1800m.

11. CUCUMIS L.

Stiffly hairy annuals. Leaves simple, slightly lobed; tendrils simple. Monoecious; flowers solitary or few, axillary. Male flowers: calyx campanulate, teeth 5, subulate;

corolla 5-lobed; stamens 3, inserted near base of calyx, two anthers 2-celled, one 1-celled, conduplicate; connective produced above in a glandular crest. Female flowers: calyx and corolla similar to male; staminodes 3, linear; ovary oblong or globose; style surrounded by an annular disc near base; stigmas 3 or 5. Fruit smooth or slightly tubercled.

1. Young fruits smooth and softly hairy 1. **C. melo**
 + Young fruits tuberculate, stiffly hairy 2. **C. sativus**

1. C. melo L. Eng: *Melon*. Fig. 31b.

Leaves broadly ovate, 8 – 15 x 8 – 15cm, acute, base cordate, 5-angular, hispid; petioles 10cm. Male flowers 2 – 3; calyx teeth narrowly triangular, 8mm, connate below, coarsely pubescent; corolla yellow, lobes obovate, 1 – 1.5cm, connate; anthers 2.5mm, appendages 1.5mm. Female flowers: ovary ellipsoid, softly hairy, style 2mm, stigmas 2mm. Fruit of various shapes and sizes; seeds ovoid, compressed, 10 – 12 x 5 x 2mm, pale.

1. Cultivated plants, robust; fruits variously shaped var. **melo**
 + Wild plants, slender; fruits oblong var. **agrestis**

var. **melo**

Many forms of melon are cultivated, differing in size, colour of skin and pulp. They are extensively used as dessert fruits but are sometimes eaten unripe as a vegetable. Probably native of Africa (157).

var. **agrestis** Naudin

Fruit oblong-ellipsoid, 5 x 3cm, probably inedible.

Bhutan: S – Phuntsholing district (Torsa River) and Deothang district (Samdrup Jongkhar); **Darjeeling:** Gangachora. Waste ground, 300 – 500m. May – June.

2. C. sativus L. Eng: *Cucumber*

Very similar to *C. melo* but ovary cylindrical, stiffly hairy, hairs with tuberculate bases; fruits narrowly oblong, club-shaped, smooth, glabrous.

Two varieties are cultivated for their edible fruit, which may be eaten raw or cooked:

1. Leaves 3 – 5-lobed; ovary with 3 placentae; fruit greenish var. **sativus**
 + Leaves 7 – 9-lobed; ovary with 5 placentae; fruit mottled yellow and brown
 var. **sikkimensis**

var. **sativus**

Bhutan: C – Tongsa district (Dakpai, 117).

var. **sikkimensis** Hook. f.

Sikkim: locality unknown (80).

12. SCHIZOPEPON Maximowicz

Leaves simple; tendrils bifid. Dioecious; male flowers in racemes or panicles; calyx campanulate, 5-lobed; corolla deeply 5-lobed; stamens 3, coherent, inserted near base of calyx; anthers one 1-celled and two 2-celled; cells straight, connective produced or not. Female flowers solitary or few, axillary; calyx and corolla similar to male; ovary ovoid, 3-celled; style thick; stigmas 3, bilobed; ovules 1 – 2 in each cell, pendulous. Fruits small, ovoid, indehiscent; septa disappearing to give a 1-celled, 1 – 3-seeded fruit; seeds ovoid, margins thick, crenulate.

1. Anther connective not produced **1. *S. longipes***
 + Anther connective produced **2. *S. bicirrhosus***

1. *S. longipes* Gagnepain; *S. dioica* Cogniaux

Leaves ovate, 3 – 5(– 7) x 2 – 3(– 5)cm, acuminate, base cordate, slightly 3-lobed; petioles 2 – 3(– 4)cm. Male racemes 5 – 6cm; pedicels 6 – 10mm; calyx campanulate, 2 – 2.5mm; corolla lobes yellow, triangular, 3 – 4mm; anthers 1mm. Fruit oblong-ovoid, slightly verrucose.

Bhutan: C – Mongar/Tashigang district (Kole La); **Darjeeling.** On bushes, 1980m. August.

2. *S. bicirrhosus* (Clarke) Jeffrey; *Melothria bicirrhosa* Clarke

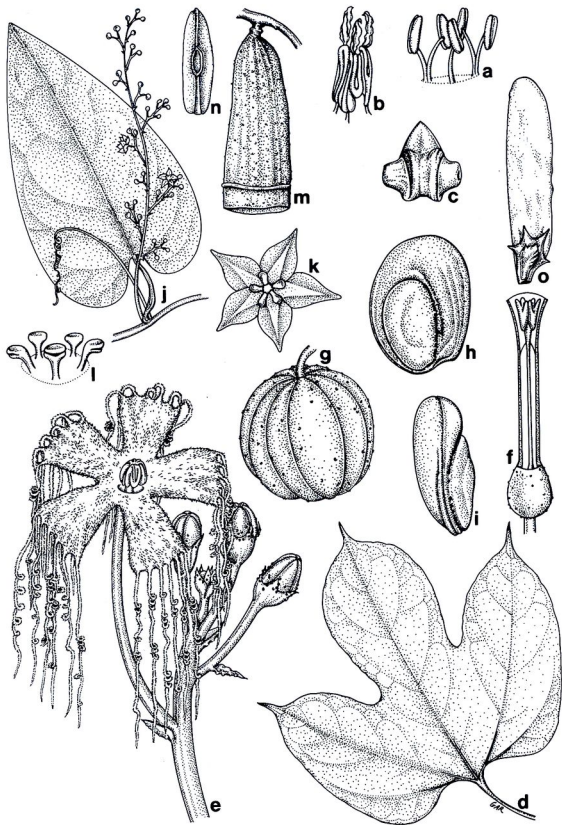
Similar to *S. longipes* but leaves up to 10 x 7cm, on petioles 5 – 7cm; connective elongated 1 – 1.5mm above anthers; female flowers not known.

Bhutan: N – Upper Mo Chu district (Gasa). 2285m. August.

13. CYCLANTHERA Schrader

Annuals. Leaves pedate; tendrils bifid. Monoecious; male flowers borne in clusters in racemes; calyx cup-shaped, teeth subulate; corolla deeply 5-partite; anthers connate into a head, cells united into a ring. Female flowers solitary or 2, in common axil with male; calyx and corollas similar; ovary obliquely ovoid. Fruit club-shaped, curved, sparsely echinate; seeds ovoid, compressed.

FIG. 31. Cucurbitaceae. a, *Thladiantha cordifolia*: stamens. b, *Cucumis melo*: stamens with glandular crests. c, *Trichosanthes cordata*: seed. d – i, *Hodgsonia macrocarpa*: d, leaf; e, male inflorescence; f, dissected female flower with corolla tube cut away to show ovary and style; g, fruit; h, i, seed showing aborted seed attached laterally. j – n, *Zanonia indica*: j, part of flowering shoot with male inflorescence; k, male flower; l, stamens; m, fruit; n, seed. o, *Neolalsomitra clavigera*: seed. Scale: g x 1/6; n x 1/4; d x 1/3; e, f, h, i, j, m x 1/2; o x 1/2; k x 2; c x 2 1/2; a x 4; b x 5; l x 20. Drawn by G. Rodrigues.



1. C. pedata (L.) Schrader. Dz: *Ola Chato*; Eng: *Korila*. Fig. 30i – m.

Leaves broadly ovate in outline; leaflets 5, elliptic, 6 – 13 x 1.5 – 4cm, acuminate, base slender, margins serrate, marginal leaflets deeply divided; petioles 6 – 10cm. Male peduncles 8 – 10cm; calyx 2.5 – 3mm, including teeth; corolla yellow, lobes 2mm, connate; filaments 0.8mm; anther head 1 – 1.25mm diameter. Female flowers ± sessile in axil; stigma subglobose, c 1mm diameter. Fruiting peduncles 0.5 – 2cm; fruit greenish white, up to 15 x 6cm, setae none or few; seeds ovoid 10 x 6mm, confined to basal end.

Bhutan: cultivated e.g. Thimphu and Dotena; **Darjeeling:** Kalijhora. 300 – 2560m. July – September.

Immature fruits sold in market as vegetable; native of Tropical South America.

14. SECHIUM P. Browne

Vigorous perennial; roots large, tuberous. Leaves simple, shallowly 3 – 5-lobed; tendrils 3 – 5-fid. Monoecious; male flowers in racemes; calyx cup-shaped with pouched nectaries at base, teeth subulate; corolla 5-partite; stamens 5, filaments connate; anthers sigmoid, obscurely paired in 2 – 2 – 1 arrangement. Female flowers similar but smaller than male, solitary in same axil as male; ovary ovoid, 1-celled, with solitary ovule pendulous from apex; style short; stigma subglobose. Fruit large, fleshy, coarsely ridged; seed ovoid, compressed, germinating within fruit.

1. S. edule (Jacquin) Swartz. Eng: *Chayote*

Leaves broadly ovate, shallowly 3 – 5-lobed, 10 – 15 x 10 – 15cm, acuminate, base cordate, margin subentire, scabrid on upper surface; petioles 10cm. Male inflorescences 10 – 30(– 50)cm, calyx 5 – 6mm; corolla yellowish, lobes oblong, 6 – 7mm. Female flowers greenish, subsessile; ovary obovoid; style 2 – 4mm; stigma subglobose, 4mm broad. Fruit pear-shaped, 15 x 8cm, green or yellowish.

Bhutan: cultivated and sold in Thimphu market; **Darjeeling:** Kalimpong. 1200m.

Fruits are sold as vegetables; it is said that every part of the plant may be eaten at some stage: roots, leaves, flowers, fruit and seeds. Native of Tropical America.

15. CUCURBITA L.

Annuals. Leaves simple, shallowly lobed; tendrils 3 – 4-branched. Monoecious; flowers large, yellowish. Male flowers solitary; calyx lobes linear, usually expanded and leaf-like at apex; corolla lobes acute, spreading; stamens 3; anthers connate into a column, one 1-celled, two 2-celled, conduplicate. Female flowers solitary; calyx and corolla as in male; staminodes 3; style short; stigma 3-lobed. Fruit large, fleshy; seeds ovoid, compressed.

1. C. moschata (Lamarck) Poiret. Eng: *Pumpkin*. Fig. 30n – s.

Leaves broadly ovate, up to 20 x 20cm, shallowly 5-lobed, acute, base cordate, denticulate, scabrid on both surfaces; petioles 30 – 40cm. Calyx lobes linear, 2.5 – 5cm, with a leaf-like apex 5mm or more broad; corolla 6 – 14cm; stamens linear, 3 – 4cm. Ovary ellipsoid, 4 x 2cm, on peduncle 4cm. Fruit globose or ovoid, 20cm or more diameter; peduncle broadened terminally; seeds ovoid, 2 x 1.2 x 0.2cm, whitish or pale brown, smooth, surrounded by a marginal line.

Bhutan: cultivated at Tashigang; **Sikkim.** 1400m. June.

Native of tropical America cultivated for its edible fruits which display great variation in size and shape (157).

16. HODGSONIA Hook. f. & Thomson

Large climbers. Leaves simple, 3 – 5-lobed; tendrils usually bifid. Dioecious; male flowers in racemes; calyx tube elongate, 5-lobed, lobes with 5 – 6 fimbriate segments; corolla rotate; stamens 3; anthers exserted, connate, one anther 1-celled, two 2-celled, conduplicate. Female flowers solitary; calyx and corolla as in male; ovary globose, 1-celled; stigma 3-lobed, lobes bifid; ovules 12. Fruit large, subglobose; perfect seeds usually 6, with a barren seed attached at side.

1. H. macrocarpa (Blume) Cogniaux; *H. heteroclita* Hook. f. & Thomson. Sha: *Tersha*; Nep: *Kanan Champa Lahara*, *Ghewphal*, *Ghiuphal*. Fig. 31d – h.

Stems 20 – 30m, angular. Leaves coriaceous, suborbicular in outline, 20 – 32 x 25 – 42cm, lobes oblong, apiculate, base cordate, glabrous on both surfaces, lobed to middle. Male inflorescence minutely brown tomentose; calyx tube 7 – 10cm, lobes 5mm, calyx and bracts densely studded with glands; corolla 5cm, yellow outside, white within, fimbriate processes up to 10cm. Female flower on peduncle 3 – 5cm. Fruits 7 – 15 x 7 – 15cm, brown tomentose; seeds ellipsoid, 6 – 7 x 3 – 4 x 1.5cm.

Bhutan: S – Sarbhong district (Lam Pati and Burborte Khole) and Gaylephug district (near Gaylephug); **Darjeeling:** Selim, Tingleng and Darjeeling. In subtropical forest, 280 – 1200m. March – May.

17. TRICHOSANTHES L.

Leaves simple, sometimes lobed; tendrils usually 2 – 5-fid. Dioecious or monoecious; male flowers white, racemose or rarely solitary, often bracteate; calyx tube elongate, 5-lobed above; corolla 5-lobed, lobes oblong, fimbriate; stamens 3, inserted on calyx tube, connate, rarely free; one anther 1-celled, two 2-celled, conduplicate. Female flowers solitary; calyx and corolla as in male; staminodes absent; ovary ovoid or ellipsoid. Fruit indehiscent; seeds oblong, broader than long, ± angular.

1. Male flowers solitary or 2; anthers free **1. T. dioica**
 + Male flowers in racemes; anthers connate 2
2. Male racemes with minute, linear bracts 1 – 2mm **2. T. cucumerina**
 + Male racemes with large, oblong or rounded bracts 0.5 – 4.5cm 3
3. Leaves unlobed or obscurely lobed (rarely distinctly 3-lobed in *T. truncata*) 4
 + Leaves shallowly to deeply lobed 5
4. Leaves ovate, base rounded or truncate **3. T. truncata**
 + Leaves ovate, base cordate **4. T. cordata**
5. Leaves softly pubescent or subglabrous on upper surface 6
 + Leaves roughly pubescent or scaly on upper surface 7
6. Leaves glabrous; male peduncles 9 – 15cm; calyx tube 4.5 – 5cm **5. T. khasiana**
 + Leaves ± rough on both surfaces; male peduncles 2 – 8cm; calyx tube c 2.5cm **6. T. ovigera**
7. Leaves coarsely pubescent **7. T. wallichiana**
 + Leaves scaly or pitted at first **8. T. lepiniana**

1. T. dioica Roxb.

Leaves ovate oblong, 5 – 7 x 5 – 6cm, acute, base cordate, distantly toothed or denticulate, coarsely tuberculate on both surfaces; tendrils 2 – 4-fid. Dioecious; male peduncles 2 – 3cm; calyx tube 3 – 4cm, lobes subulate, 4 – 5mm; corolla lobes oblong, 1.5cm including fimbriate margin; anthers oblong, 3.5 x 1.5mm. Female peduncles 2 – 4mm; ovary oblong, villose. Fruit orange-yellow, 5 – 12 x 2 – 6cm; seeds subglobose, 6 – 7 x 5 x 4mm.

Darjeeling: Badamtam and Siliguri. 600m. June.

2. T. cucumerina L.; *T. anguina* L.

Leaves suborbicular, 7 – 10 x 8 – 12cm, acute or acuminate, base cordate, margin toothed or denticulate, entire or shallowly lobed, shortly pubescent beneath; petiole 2 – 7cm; tendrils 2 – 3-fid. Monoecious; male peduncles 6 – 15cm, puberulous, 8 – 15-flowered; pedicel 1 – 2cm; calyx tube 1.5cm, teeth erect 1.5mm; corolla lobes white, oblong, 7 – 10mm; anthers connate, oblong, 3 x 1.5mm. Female peduncles 3 – 12mm; ovary ellipsoid; style 15 – 18mm. Fruit 5 – 6 x 3.5 – 4cm, green with white stripes at first, later yellowish, pulp red, bitter; seeds 8 – 10, oblong, 10 – 12 x 6 x 3 – 4mm, margin undulate.

Darjeeling: locality unknown.

var. **anguina** (L.) Haines; Eng: *Snake Gourd*.

Fruits 1.5 – 2m long, 4 – 10cm broad, with 7 – 8 white stripes when immature, orange when ripe, pulp sweet.

Sikkim: locality unknown (179).

Young fruits are cooked as a nutritious vegetable (157).

3. **T. truncata** Clarke; *T. ovata* Cogniaux

Leaves thinly coriaceous, ovate, 13 – 21 x 6 – 15cm, unlobed or rarely 3-lobed, acuminate, base rounded or truncate, margin entire or remotely denticulate, glabrous on both surfaces; petioles 4 – 6cm; tendrils 2 – 3-fid. Male peduncles c 20cm, 15 – 20-flowered; pedicels 1 – 3mm; bracts oblong, 1.4 – 1.6 x 3 – 5mm, acuminate, entire or with a few teeth; calyx tube 2 – 3cm, shortly tomentose, teeth linear, 5 – 7 x 1.5mm; corolla tomentose externally. Female flowers and fruit not known.

Bhutan: S – Gayleghug district (Lodrai Khola); **Darjeeling:** Rishap, Ryang and Rhenok. Subtropical forests, 300 – 900m. March – May.

4. **T. cordata** Roxb. Fig. 31c.

Leaves ovate or rarely 5-lobed, 12 – 20 x 9 – 12cm, acuminate, base cordate, margins denticulate or crenate-dentate, shortly pubescent on both surfaces; petioles 5 – 10cm; tendrils 2 – 3-fid. Dioecious; male peduncles 12 – 20cm, 4 – 8-flowered; bracts oblong, 4 x 1 – 1.5cm; calyx tube 5 x 0.7cm, pubescent, teeth erect, 10 – 15 x 2 – 3mm; petals shortly papillose; anthers 14 x 3 – 4mm. Female flowers subsessile; ovary oblong on peduncles 1 – 2cm. Fruit globose, reddish; seeds obovoid, 8 x 8 x 5mm, convoluted.

Bhutan: C – Mongar district (Shongar); **Darjeeling:** Tista, Darjeeling. 300 – 900m. June – October.

5. **T. khasiana** Kundu

Leaves ovate-suborbicular, 9 – 15 x 8 – 13cm, deeply palmately 3(– 5)-lobed, acuminate, base truncate or emarginate, with scattered glands on lower surface, glabrous. Male peduncles 9 – 15cm, loosely few-flowered at apex; bracts ovate, 2 – 4.5cm, subentire or crenate; calyx tube 4.5 – 5cm, 8.5 – 10mm broad at apex, teeth lanceolate, 8 – 10 x 5 – 6cm. Female peduncles 1.5 – 2.5cm; calyx teeth subulate, 6 – 8 x 1.5 – 2mm; ovary ellipsoid. Fruit oblong-ellipsoid, 11 – 12.5 x 3.5 – 5cm, subacute at both ends; seeds ovate-oblong, 10 – 14 x 5 – 8 x 2mm, smooth.

Darjeeling: locality unknown.

6. **T. ovigera** Blume; *T. himalense* Clarke, *T. dicaelosperma* Clarke

Leaves suborbicular in outline, 10 – 15 x 10 – 15cm, deeply palmately 3-lobed (rarely unlobed), lobes lanceolate, acuminate, base cordate, margin denticulate, ± rough on both surfaces; petioles 3 – 6cm; tendrils bifid. Male peduncles 2 – 8cm, 4 – 10-flowered near apex; pedicels 5 – 20mm; bracts acuminate, 5 – 10mm, sparsely pubescent; calyx tube 2.5cm, 3mm broad at apex, teeth subulate 6 – 7mm;

corolla unknown; anthers 3 x 1.5mm. Fruit ellipsoid, 8 – 10 x 2.5 – 3cm; seeds brownish, 6 – 7 x 7 x 5mm, turgid.

Darjeeling: Rungit Valley, Mongpu, Pomong, Selim; **Sikkim:** Bakkim, Kulhait, Yoksam. Subtropical and warm broad-leaved forests, 150 – 1525m. August – October.

7. *T. wallichiana* (Seringe) Wight; *T. multiloba* Clarke

Leaves suborbicular in outline, 10 – 20 x 10 – 20cm, deeply 3 – 9-lobed, lobes oblong or lanceolate, acuminate, base rounded, margin denticulate or dentate, coarsely pubescent above, glands clustered between veins on lower surface; petioles 3 – 10cm; tendrils 2 – 3-fid. Male peduncles 15 – 35cm, pubescent, 6 – 12-flowered; bracts broadly ovate, 2.5 – 3cm, base sheathing, toothed above; calyx tube 5 – 5.5cm, 12 – 14mm wide at apex, teeth 1 – 1.5 x 0.5 – 0.6cm; petals obovate, 3 – 4cm; anthers 12 – 13 x 3mm. Female peduncles 2 – 4cm; ovary oblong. Fruit oblong-ovoid, c 8 x 5cm, reddish; seeds squarish, 15 – 18mm, 7mm thick.

Bhutan: C – Punakha and Tashigang districts, N – Upper Mo Chu and Upper Kuru Chu districts; **Darjeeling:** widespread; **Sikkim:** Lachen. In mixed rain forest, 240 – 2440m. July – August.

8. *T. lepiniana* (Naudin) Cogniaux. Nep: *Indrenee*

Similar to *T. wallichiana* but leaves more shallowly 3 – 5-lobed, 13 x 15cm, punctate above at first, later densely scaly along veins and with a few glands in vein axils beneath; tendrils 2 – 3-fid. Male peduncles 15 – 20cm; bracts obovate, 4.5 x 3cm, sheathing at base, fimbriate above; calyx tube 5cm, 5 – 7mm wide at apex, teeth lanceolate, 1.5 x 0.5cm; petals obovate, 2 – 3cm, lacinate; female peduncles 1.5 – 3cm. Fruit scarlet, ovoid, 8 x 6cm; seeds blackish, oblong, 15 x 7 x 2.5mm.

Bhutan: S – Deothang district (Morong), C – Tongsa district (Shamgong) and Mongar district (Kori La); **Darjeeling:** Rishap, Darjeeling, Lebong. In warm mixed forests, 1200 – 2100m. May – August.

Flowers open at night.

18. GYMNOPETALUM Arnott

Probably perennial. Leaves simple, angular or shallowly lobed; tendrils simple. Monoecious; male flowers solitary or in racemes; calyx tube elongate, subcylindric, pubescent, teeth linear-subulate; corolla lobes oblong ovate; anthers connate, one 1-celled, two 2-celled, conduplicate. Female flowers always solitary; peduncles short. Fruit ovoid; seeds small, ovoid-compressed.

1. *G. chinense* (Loureiro) Merrill; *G. cochinchinensis* (Loureiro) Kurz.

Leaves ovate, 4 – 10 x 4 – 10cm, shallowly (to half leaf width) 3-lobed, acuminate, base deeply cordate, margin toothed, ± scabrid on both surfaces; petioles 3 – 4cm. Male flowers solitary or in racemes of 3 – 8 flowers; peduncles 3 – 15cm; bracts ovate-oblong, deeply toothed; calyx tube 2.5 – 3cm, 3 – 4mm broad at mouth,

teeth 5 – 6 x 0.6mm; corolla lobes white, oblong-ovate, 2.5 x 1 – 1.2cm; anthers 7 x 2mm. Female peduncles 1 – 7cm. Fruit ovoid, 3.5 – 5 x 1.5 – 3cm, reddish, base subacute, apex ending in longish dry acumen; seeds brownish, ovoid-compressed, 7 – 8 x 3 – 4 x 1.5 – 2mm, distinctly margined, rugulose.

Bhutan: S – Gaylephug district (near Gaylephug), Deothang district (Samdrup Jongkhar); **Darjeeling:** Rungit and Tista Valleys, Siliguri. Terai forests and in plantations, etc., 300 – 900m. May – September.

19. BISWAREA Cogniaux

Large climbers. Leaves simple, deeply lobed; tendrils bifid. Dioecious; male peduncles often 2 per axil, one 1-flowered, the other racemose; calyx tube narrowly cylindrical, mouth campanulate; corolla yellow, tubular at base, cup-shaped above; stamens 3; anthers connate, conduplicate, connective not produced. Female flowers solitary; calyx and corolla as in male; ovary oblong; stigmas 3-lobed; ovules 12 – 16 in each cell in 2 rows, horizontal. Fruit oblong, 3 valved; seeds ellipsoid, compressed, smooth.

1. *B. tonglensis* (Clarke) Cogniaux; *Warea tonglensis* Clarke non Nuttall

Leaves ovate or suborbicular in outline, 15 – 25 x 12 – 20cm, moderately to deeply 3 – 7-lobed, lobes triangular, lanceolate or sublinear, acuminate, base deeply cordate; petioles 6 – 9cm. Male peduncles often paired, one 1-flowered, 1 – 2cm, the other 4 – 8-flowered, 10 – 15cm, pubescent, ebracteate; calyx tube 3 – 3.5cm villose, 13 – 17mm broad at mouth; teeth lanceolate, 10 – 16 x 3 – 4mm; corolla lobes 3 – 5 x 1.5 – 2.5cm; anthers 7 x 5mm. Female peduncles 7 – 10cm. Fruit oblong, 10 – 12 x 4 – 4.5cm; seeds 1 – 1.5 x 0.7 – 1cm.

Darjeeling: Tonglo, Senchal, Rungbe; **Sikkim:** Choka. 1830 – 3050m. July – September.

20. HERPETOSPERMUM Hook. f.

Leaves simple, lobed; tendrils bifid. Dioecious; male peduncles two per axil, one 1-flowered, the other with an elongate raceme; calyx tube cylindrical; corolla yellow, tubular at base, campanulate above; stamens 3; anthers connate, one 1-celled, two 2-celled, connective not produced. Female flowers usually solitary; calyx and corolla as male; ovary oblong; stigmas 3-, bifid; ovules up to 4 in each cell, pendulous. Fruit trigonous, fibrous, 3-valved to middle; seeds oblong, compressed smooth.

1. *H. pedunculatum* (Seringe) Clarke; *H. caudigerum* Clarke. Fig. 30t – x.

Leaves ovate, 7 – 16 x 5 – 12cm, slightly to moderately 3 – 5-lobed, acuminate, base cordate, margin serrate or denticulate, pubescent on both surfaces; petiole 2.5 – 10cm. One male peduncle 1-flowered, 5 – 10(– 16)cm, the other 5 – 10-flowered, 10 – 15(– 40)cm, ebracteate. Calyx tube 2 – 2.5cm, 8 – 9mm broad at apex, teeth

filiform, 5 – 10mm; corolla lobes ovate, 2.5 x 1.5 – 2cm; anthers 5 – 6 x 3mm. Female peduncles 1 – 3cm. Fruit ellipsoid, 7 – 8 x 3 – 4cm, stiffly hirsute; seeds oblong, \pm compressed, 13 x 4 – 5 x 3mm, brownish, sculptured.

Bhutan: C – Thimphu district (Sharna Sampa, Dotena), Punakha district (Wangdu Phodrang) and Tongsa district (Tashiling), N – Upper Mo Chu district (N of Gasa); **Darjeeling;** **Sikkim.** On river banks, 2133 – 3050m. August – October.

21. EDGARIA Clarke

Annual. Leaves simple; tendrils bifid. Dioecious; male peduncles usually paired, one 1 flowered, the other with an ebracteate raceme; calyx tube elongate, teeth subulate; corolla rotate, lobes deeply divided; stamens 3; anthers connate, one 1-celled, two 2-celled, cells straight. Female flowers solitary; peduncles short; calyx and corolla as in male; ovary ellipsoid, stigmas 3, bilobed; ovules 2 – 3 in each cell, pendulous. Fruit trigonous, 3-celled, fibrous, 3-valved to middle; seeds 6 – 9, oblong, compressed.

1. *E. darjeelingensis* Clarke

Leaves ovate, 9 – 12 x 6 – 8cm, unlobed or very shallowly 5-lobed, acuminate, base cordate, margin undulate, denticulate, pubescent on both surfaces; petioles 5 – 9cm. Male peduncle with solitary flower 3cm, that with raceme 10 – 12cm; calyx tube 1.5cm, teeth 1 – 2mm; corolla lobes ovate, 1 – 1.5cm; anthers 4 – 5mm. Fruit ellipsoid, 6 – 7 x 3 – 4cm, hirsute; seeds 13 x 9 x 2mm.

Bhutan: S – Gaylegphug district (Rani Camp, 117); **Darjeeling:** Balasun, Kurseong, Darjeeling, Gumpahar, Mongpu, Tonglu. Roadsides and scrub, 1500 – 2740m. June – September.

22. ZANONIA L.

Woody climber. Leaves simple, coriaceous, entire; tendrils simple or bifid. Dioecious; flowers in racemes or panicles. Male calyx 3(– 4)-lobed, connate at base; corolla rotate, 5-lobed; stamens 5, free; anthers transversely oblong, 1-celled. Female calyx and corolla similar to male; staminodes 5, short; ovary elongate; styles 3, bifid at apex; ovules 2 per cell, pendulous. Fruit pendent, cylindrical or somewhat trigonous, truncate at apex, 3-valved, valves opening inwards, base attenuate; seeds large, ovoid or oblong-compressed, surrounded by a membranous wing.

1. *Z. indica* L. Fig. 31j – n.

Leaves ovate, 8 – 12(– 16) x 5 – 8(– 10)cm, acute, base cordate or rounded, glabrous; petiole 1.5 – 3cm. Male peduncles 15 – 30(– 40)cm; calyx lobes broadly ovate, 3 x 3mm; corolla lobes yellowish, 6 – 8mm; ovary 10 – 12mm. Fruit brownish, 7 – 10 x 2.5 – 3cm; seeds yellowish, embryo 1.5 – 2 x 1cm, surrounded by wing 6 – 6.5 x 1.5cm.

Bhutan: S – Deothang district (Wamrung, 117), C – Tashigang district (Rongtung, 117); **Sikkim:** locality unknown (179). 2300m.

23. NEOALSOMITRA Hutchinson

Woody climber. Leaves 3-foliolate; tendrils bifid. Dioecious; male flowers in panicles; calyx tube cup-shaped; corolla tube short, lobes deeply cut; stamens 5, free; anthers straight, 1-celled. Female flowers in racemes; ovary 1-celled or imperfectly 3-celled, styles 3; stigmas semicircular. Fruit pendent, subcylindric, 3-valved at apex, valves opening inwards; seeds compressed, obovoid, with oblique, translucent, apical wing.

I. N. clavigera (Wall.) Hutchinson; *Alsomitra clavigera* Hook. f. Fig. 31o.

Leaflets oblong-lanceolate, lateral ones asymmetrical, middle leaflet 7 – 12 x 2 – 5cm, acuminate, entire, usually with 1 – 2 glands at base. Male calyx lobes lanceolate, 1.5 – 2mm, puberulous; corolla lobes ovate, 2 – 2.5mm. Female flower with club-shaped ovary. Fruit subcylindrical, 6 – 7 x 1.5 – 2.5cm, yellowish; seeds 10 x 8mm, apical wing 20 x 8mm.

Bhutan: C – Tashigang district (Pintsogong); **Darjeeling:** Kurseong and Siliguri. Subtropical and terai forests, 1220 – 1370m. September – February.

24. HEMSLEYA Cogniaux

Leaves pedately 5 – 7-foliolate; tendrils bifid. Dioecious; male flowers in racemes or panicles; calyx lobes deeply cut; corolla rotate, deeply divided almost to base; stamens 5; anthers linear, minute, 1-celled. Female flowers in smaller lax racemes; ovary cylindrical; style short, 3-lobed, lobes bifid. Fruit club-shaped, base attenuate, apex truncate, 3 valved, many-seeded; seed compressed-ellipsoid, surrounded with a wing.

I. H. macrocarpa Jeffrey; *H. graciliflora* sensu Chakravarty non (Harms) Cogniaux

Leaflets lanceolate or oblanceolate, 3 – 15 x 1 – 4cm, acuminate, base narrowed, margin crenate serrate. Male racemes 5 – 12cm; calyx segments triangular, 5 x 3mm, reflexed; corolla yellowish, lobes 7 – 8 x 3 – 4mm. Female flowers unknown. Fruit 7 – 8 x 2 – 2.5cm, 10-angled; seed embryo 1.2 x 0.7cm, surrounded by wing 1 – 3mm.

Arunachal Pradesh: locality not known (179).

25. GOMPHOGYNE Griff.

Leaves pedately 5 – 9-foliolate; tendrils simple or bifid. Dioecious; male flowers in panicles, minute; sepals lanceolate; petals lanceolate; stamens 5, united at base, anthers rounded, 1-celled, straight. Female flowers few in corymbs; sepals and

petals as in male; ovary obovoid. Fruit obconical, 1 – 3-seeded; seeds oblong-compressed.

1. *G. cissiformis* Griff.

Leaflets oblanceolate, 2.5 – 5.5 x 0.75 – 1.5cm, acuminate, base narrowed, subpetiolate, regularly serrate, ± glabrous; petiole 2.5 – 6cm. Male panicles 20 – 30cm; sepals 2mm; petals ovate-lanceolate, 3.5 – 4mm, narrowly acuminate, base connate; stamens 0.5mm. Female flowers: usually only 1 or 2 maturing. Fruit 10 – 15 x 7 – 12mm; seeds 7 x 4mm, rounded at base, somewhat pointed at apex.

Bhutan: S – Chukka district (near Chukka), C – Punakha district (Kencho); **Darjeeling:** Dumsong; **Sikkim:** Lachung. 1400 – 2130m. October.

In the typical variety the fruiting peduncles are long, with glabrous fruits; in var. *villosa* Cogniaux the peduncles are shorter and the fruit tomentose; the latter is recorded from Sikkim.

26. GYNOSTEMMA Blume

Leaves pedately 3 – 5-foliolate; tendrils simple. Dioecious; flowers minute. Male flowers in elongate panicles; pedicels articulate; calyx shortly lobed; corolla lobes lanceolate, long-pointed; stamens 5; filaments connate at base; anthers 2-celled, cells long, straight. Female panicles short; calyx and corolla as in male; ovary spherical; styles 3, bifid. Fruit globose, 1 – 3-seeded; seeds broadly ovoid.

1. *G. pentaphylla* (Thunberg) Makino; *G. pedata* Blume

Leaflets ovate or elliptic, 4 – 10(– 14) x 2 – 5cm, acuminate, base attenuate, margin serrate, ± glabrous; petiole 3 – 5(– 7)cm, petiolules 1 – 4mm. Male panicles 15 – 45cm, pubescent; calyx lobes triangular, 0.5mm; corolla lobes 2 – 2.5 x 0.5mm, subulate. Fruits 7 – 9mm diameter; seeds trigonous, 2.5 – 3.5 x 2.5 – 3mm, compressed, wrinkled.

Bhutan: S – Deothang district, C – Punakha, Tongsa and Mongar districts; **Darjeeling:** widespread. In moist forests, 900 – 3000m. August – October.

Family 129. LYTHRACEAE

by D.G. Long and S.J. Rae

Annual or perennial herbs, shrubs or trees. Leaves opposite, often decussate, or whorled, simple, entire, pinnately veined, exstipulate or with minute stipules (*Lagerstroemia*). Flowers solitary or in clusters in leaf or bract axils, often forming terminal racemes, spikes or panicles, bisexual, actinomorphic or weakly zygomorphic. Floral parts perigynous. Calyx tubular at base, 4 – 6-lobed, often persistent. Petals 4 or 6, free, borne on rim of calyx tube, sometimes minute or absent. Stamens 4 – 12 or many, inserted within calyx tube. Ovary superior, 2 – 6-

celled, base attached to calyx tube and surrounded by an annular nectary disc; style 1, slender; stigma capitate; ovules numerous, axile. Fruit a capsule, dehiscent by valves, sometimes circumscissile or irregularly fragmenting, usually subtended or enclosed by persistent calyx; seeds many.

1. Annual, biennial or perennial herbs 2
- + Shrubs or trees 4
2. Stems bristly pubescent; flowers solitary, interpetiolar, zygomorphic; calyx with short basal spur; petals showy, 8 – 12mm **3. Cuphea**
- + Stems glabrous; flowers in spikes or condensed axillary racemes, actinomorphic; calyx not spurred at base; petals minute, 0.5 – 1.5mm, or absent 3
3. Flowers in condensed axillary cymes; capsule circumscissile
 - 1. Ammannia**
 - + Flowers in (often bracteate) terminal or lateral spikes; capsule 2 – 4-valved
2. Rotala
4. Leaves gland-dotted; flowers in short axillary cymes 2 – 3.5cm; calyx tubular, showy; petals inconspicuous **4. Woodfordia**
- + Leaves not gland-dotted; flowers in axillary or terminal panicles 5 – 30cm; calyx cup-shaped or funnel-shaped, not showy; petals showy 5
5. Cultivated shrub with branchlets becoming spinous; leaves oblanceolate to elliptic, 1.5 – 3.5cm; flowers 4-merous; petals not clawed; capsule irregularly fragmenting **5. Lawsonia**
- + Native or cultivated trees or shrubs, unarmed; leaves ovate-elliptic to oblong, 3 – 22cm; flowers mostly 6-merous; petals clawed; capsule 3 – 6-valved
6. Lagerstroemia

1. AMMANNIA L.

Annual herbs, glabrous. Leaves opposite, sessile. Flowers in condensed axillary cymes, 4-merous, actinomorphic. Calyx united below into campanulate tube; lobes short, triangular. Petals minute or absent. Stamens 4. Capsule membranous, circumscissile or dehiscent irregularly.

1. *A. baccifera* L.

Erect, much-branched herb 10 – 60cm. Leaves oblong to oblanceolate, 10 – 70 x 2 – 13mm, acute, base cuneate, rounded or weakly cordate; those of lateral branches smaller. Cymes dense, sessile, 5 – 20-flowered; pedicels 0.5 – 1.5mm. Calyx tube 1 – 1.5mm diameter. Petals absent. Style very short. Capsule globose, 1 – 1.5mm diameter, irregularly circumscissile.

Bhutan: locality unknown. Streamsides, ditches, mud banks, rice fields, in subtropical zone. October – January.

2. ROTALA L.

Annual or perennial, aquatic, amphibious or terrestrial herbs, glabrous. Leaves opposite and decussate, or whorled, sessile. Flowers in spikes, each subtended by a bract and 2 bracteoles, actinomorphic. Calyx 4(–5)-lobed, campanulate. Petals 4(–5) or absent. Stamens 4(–5). Capsule 2–4-valved, surrounded by persistent calyx.

1. Leaves whorled; petals absent **4. R. mexicana**
 + Leaves opposite and decussate; petals 4(–5) 2
2. Perennial herb; leaves suborbicular; capsule 4-valved **1. R. rotundifolia**
 + Annual (? rarely perennial) herbs; leaves obovate-spathulate or oblong; capsule 2- or 3-valved 3
3. Stems narrowly winged; leaves obovate-spathulate, attenuate at base; capsule 2-valved **2. R. indica**
 + Stems broadly winged; leaves oblong, cordate at base; capsule 3-valved
3. R. cordata

1. R. rotundifolia (Roxb.) Koehne; *Ammannia rotundifolia* Roxb. Fig. 32a–e.

Creeping, often tufted perennial herb; stems angled; leafy shoots decumbent or erect, 8–20cm. Leaves opposite, suborbicular, 5–17 x 4–15mm, rounded, base rounded or cordate, margin entire; lower submerged leaves sometimes oblong-obovate. Flowers in terminal leafless spikes 1–4cm, subsessile, 4-merous. Bracts ovate, 2–3mm, reddish tinged; bracteoles linear. Calyx 1mm, lobes 0.5mm. Petals purple or pink, 1–1.5mm. Style short. Capsule 4-valved, 1.5mm diameter.

Bhutan: C – Mongar district (Lhuntse); **Darjeeling:** terai, Kurseong, Mongpu etc. Rice fields, ditches, marshes, pond margins, 300–1800m. November–May.

2. R. indica (Willdenow) Koehne; *Ammannia peploides* Sprengel. Fig. 32f–i.

Decumbent or erect, often much-branched annual herb; stems narrowly winged, 10–30cm. Leaves opposite, obovate-spathulate, 8–20 x 4–8mm, acute or

FIG. 32. **Lythraceae.** a–e, *Rotala rotundifolia*: a, flowering shoot; b, flower; c, dissected calyx, corolla and stamens; d, ovary; e, fruit with persistent calyx. f–i, *Rotala indica*: f, flowering shoot; g, flowers, h, dissected calyx, corolla and stamens; i, ovary. j–m, *Woodfordia fruticosa*: j, part of flowering branch; k, flower; l, dissected calyx, corolla and stamens; m, ovary. n–q, *Lagerstroemia hirsuta*: n, flowering panicle and leaf; o, flower with petals removed; p, capsule; q, seed. Scale: j x $\frac{2}{3}$; n x $\frac{1}{2}$; p x $\frac{2}{3}$; a, f x 1; q x $\frac{1}{4}$; o x $\frac{1}{2}$; l, m x 2; k x 3; b, c, d, e, g x 8; h x 11; i x 12. Drawn by M. Bates.



rounded, base attenuate, margin thickened. Flowers in congested, lateral spikes, each flower borne in the axil of spreading leaf-like bract, 4-merous. Bracts 3–5mm; bracteoles 2, linear. Calyx tube c 1.5mm, lobes 0.8mm. Petals pink, 0.5mm. Style 0.5–1mm. Capsule 2-valved, ellipsoid.

Bhutan: S–Samchi district (Samchi, 117), Phuntsholing district (Phuntsholing, 117); also collected by Griffith but locality unknown; **Sikkim/Darjeeling:** locality unknown. Rice fields, ditches etc, 300–500m. January–December.

3. *R. cordata* Koehne; *R. diversifolia* Koehne

Similar to *R. indica* but an erect, less-branched herb 20–45cm; stems broadly 4-winged; leaves oblong, 10–25 x 4–8mm, with cordate base; flowers 4(–5)-merous, in terminal and axillary spikes; capsule 3-valved.

Darjeeling: Siliguri. Wet ground and streamsides in terai, ?300m. December.

4. *R. mexicana* Chamisso & Schlechtendal; *Ammannia pygmaea* Kurz

Small annual often tufted herb; stems erect, 2–7cm, simple or branched, sometimes floating. Leaves in whorls of 2–4, spreading; aerial leaves linear-lanceolate, 3–8 x 0.4–1.5mm, obtuse, base cuneate. Flowers in bracteate spikes, minute, sessile, 4-merous; bracts leaf-like. Calyx minute, c 0.8mm including acute lobes. Petals absent. Style very short. Capsule 3-valved, c 0.5mm diameter.

Darjeeling: Siliguri and Labhath. Pools and marshy ground in terai and foothills, ?300–2500m. October.

3. CUPHEA Browne

Annual or biennial herbs. Leaves opposite, decussate. Flowers solitary, interpetiolar, zygomorphic. Calyx tubular, expanded at base into a short spur, 6-lobed, lobes unequal. Petals 6, inserted on calyx tube, upper two larger. Stamens 12, borne within calyx tube in two rows, unequal, not exerted. Capsule membranous, ellipsoid, enclosed in persistent calyx tube, dehiscing with a single longitudinal split to expose seeds on elastic placentae.

1. *C. procumbens* Cavanilles

Erect annual, 35–100cm; stems bristly-pubescent. Leaves lanceolate, 4–8 x 0.8–2.1cm, bluntly pointed, base cuneate, sparsely bristly on both surfaces; petioles on lower leaves 2–8mm, upper subsessile. Flowers borne laterally between petioles; pedicels 3–11mm, bristly. Calyx tube purplish, 1.3–1.6cm, cylindrical below with a short broad spur near base, funnel-shaped at mouth, shortly 6-lobed, upper lobe larger. Petals bright pink, upper pair 12 x 7mm, lower ones 8 x 4mm. Uppermost two stamens longer, densely woolly. Capsule c 10 x 5mm.

Darjeeling: Lebong. Open woodland, 1280m. July–August.

Native of Mexico, cultivated and naturalised in Indian region.

4. WOODFORDIA Salisbury

Shrubs. Leaves opposite, gland-dotted, subsessile. Flowers in short axillary cymes, weakly zygomorphic. Calyx showy, tubular, slightly curved, constricted above base, mouth oblique, with 6 short lobes alternating with 6 minute teeth. Petals 6, inconspicuous, inserted within mouth of calyx between lobes. Stamens 12, inserted towards base of calyx tube, curved, long-exserted, showy. Capsule membranous, fragmenting irregularly, enclosed in persistent calyx.

1. W. fruticosa (L.) Kurz; *W. floribunda* Salisbury. Dz: *Zange Shing*; Nep: *Dhanyaro*. Fig. 32j – m.

Shrub 1 – 3m; stems pubescent, bark peeling. Leaves lanceolate, 7 – 11 x 1.2 – 3cm, acuminate, base rounded or shallowly cordate, sessile, minutely whitish or greyish puberulous and with blackish gland-dots beneath, sparsely pubescent above. Cymes compact, 2 – 3.5cm long. Flowers bright brick-red. Calyx tube 10 – 13mm, lobes triangular, 2mm, alternating with small teeth c 0.6mm. Petals lanceolate, c 3mm. Filaments red, 12 – 17mm. Capsule ellipsoid, c 8 x 4mm.

Bhutan: S – Gaylephug district (Birti, 117), C – Punakha district (near Wangdu Phodrang), Tongsa district (Mangde Chu valley) and Tashigang district (Pintsogong); **W Bengal Duars:** Buxa; **Darjeeling:** Tista valley, Darjeeling, Gok, Mungpoo. Streamsides and scrub in dry valleys, 610 – 1500m. March – May.

An attractive ornamental shrub. Dry flowers yield a yellow dye used to dye silk (48), and are used medicinally in treatment of dysentery.

5. LAWSONIA L.

Shrubs or trees, glabrous, sometimes spiny. Leaves opposite. Flowers in large terminal panicles, actinomorphic. Calyx tube short, cup-shaped; lobes 4, triangular, persistent. Petals 4, wrinkled, inserted at top of calyx tube. Stamens 8, inserted in pairs between the petals. Capsule globose, irregularly fragmenting.

1. L. inermis L.; *L. alba* Lamarck. Eng: *Henna*.

Erect shrub or tree 2 – 4m; branchlets becoming spinous. Leaves oblanceolate to elliptic, 1.5 – 3.5 x 0.6 – 1.5cm, acute, base attenuate, sub-sessile. Panicles 8 – 17cm, sweet-scented. Calyx persistent, tube campanulate 1mm, lobes 2mm. Petals yellow or creamy, obovate, 3mm. Capsule c 5mm, black.

Darjeeling: Siliguri terai. December – April.

Cultivated as a hedge plant; leaves used to make the dye *Henna* (16, 126).

6. LAGERSTROEMIA L.

Trees or shrubs. Leaves mostly opposite, distichous, or a few upper ones alternate; stipules minute, conical. Flowers in axillary and terminal panicles, actinomorphic. Calyx tube funnel-shaped, lobes (4 –)6. Petals (4 –)6, inserted at

apex of calyx tube, clawed; limb suborbicular, wrinkled. Stamens many, inserted towards base of calyx tube, exerted, outer 6 much longer than others. Capsule leathery or woody, 3 – 6-valved; seeds numerous, winged.

1. Leaves 12 – 22cm; calyx tube with 12 prominent ribs; petals bluish-purple
3. L. hirsuta
 - + Leaves 3 – 10cm; calyx tube with 6 shallow indistinct ribs; petals white or pink
2
2. Native; leaves elliptic-oblong, glaucous beneath; petals white, c 6 x 4mm
1. L. parviflora
 - + Cultivated; leaves obovate-oblong, not glaucous beneath; petals white or pink, c 25 x 15mm **2. L. indica**

1. L. parviflora Roxb. Sha: *Buram Shing*; Nep: *Sida, Sidha, Burri Damera, Bhot Duanyaro* (34), *Borderi* (34).

Shrub or tree 3 – 20m; branchlets pubescent. Leaves coriaceous, ovate-elliptic, 3 – 10 x 2 – 4.5cm, acute, base rounded, margin undulate, glabrous, but veins and midrib sometimes pubescent, glaucous beneath, subsessile. Panicles 5 – 20cm; pedicels 5 – 10mm. Flowers 6-merous. Calyx tube cup-shaped, c 2mm long, 5mm diameter, scarcely ribbed; lobes triangular 2mm. Petals white, limb 4mm diameter, with claw 2mm. Style c 7mm. Capsule woody, oblong, 1.5 – 2.5 x 1.2cm.

Bhutan: S – Phuntsholing (117), Gaylegphug (117) and Sarbhang districts, C – Tongsa district (117); **Darjeeling:** Sivoke, Rungtong, Pashok, Badamtan. Subtropical forest slopes. 180 – 650m. April – July.

Wood hard and durable and sometimes used for housebuilding and to make charcoal (16, 34).

2. *L. indica* L.

Shrub or tree 2 – 6m, deciduous; branchlets angled, pubescent or glabrous. Leaves obovate-oblong, 3 – 8 x 1.5 – 4cm, obtuse, or subacute, base cuneate or rounded, pubescent on both surfaces when young becoming glabrous above, pubescent on veins and midrib beneath, subsessile. Panicles 5 – 20cm, not condensed, puberulous. Flowers (4–)6-merous. Calyx tube campanulate, 5 – 6mm, faintly ribbed, lobes triangular, 4 – 5mm. Petals white or pink, limb 1.5cm, claw 1cm. Style c 1cm. Capsule globose, c 7mm diameter.

Bhutan: S – Phuntsholing. Cultivated in garden. 200m. April – May.

Native of China cultivated as an ornamental.

3. L. hirsuta (Lamarck) Willdenow; *L. reginae* Roxb., *L. flos-reginae* Retzius nom. illeg. Nep: *Jarul*. Fig. 32n – q.

Tree 6 – 10(–20)m, branchlets smooth. Leaves thin coriaceous, elliptic-oblong, 12 – 22 x 5 – 11cm, shortly acuminate or acute, base rounded, glabrous; petioles 6 – 10mm. Panicles terminal, 12 – 30cm, brown puberulous. Flowers 6-

merous. Calyx tube cup-shaped, 6–9mm, distinctly 12-ribbed, lobes triangular, 5–7mm, erect or reflexed, persistent. Petals bluish purple, limb c 3cm, claw 3mm. Stamens many, unequal. Style 1.8–2.1cm. Capsule subglobose, 3 x 2.5cm, woody.

Bhutan: S – Phuntsholing and Gayleghphug districts (cultivated); **Darjeeling:** indigenous in eastern Darjeeling district (34) and cultivated in towns and villages, 300–600m. May–July.

Cultivated both for its showy flowers and valuable timber (16, 48, 126).

Family 130. MYRTACEAE

by D.G. Long & S.J. Rae

Evergreen trees or shrubs. Leaves leathery, opposite or alternate, rarely in whorls of 3, entire, pinnately veined, usually pellucid-dotted; stipules minute or absent. Flowers in cymes or racemes, rarely solitary, axillary, actinomorphic, bisexual. Floral parts epigynous. Calyx tubular and united to ovary at base, lobes 4 or 5, usually free. Petals 4 or 5, free (or united and shed as a cap in *Eucalyptus* and some *Syzygium*). Stamens many, free. Ovary inferior, 2–5-celled; ovules 2–many, axile; style long, simple; stigma capitate. Fruit a fleshy berry, dry capsule or nut.

1. Leaves opposite; flowers solitary or in cymes; fruit a berry 2
- + Leaves alternate; flowers in axillary umbels or terminal spikes; fruit a capsule 4

2. Flowers usually numerous, in terminal or axillary cymes, glabrous; calyx usually with tapering stalk-like base **2. Syzygium**
- + Flowers solitary, axillary (or up to 3 on short axillary peduncle), pubescent; calyx abruptly narrowed at base 3

3. Leaves 5–7cm, lateral veins not prominent beneath; calyx tube 1.5 x 1.2mm; fruit globose c 0.8cm; native **1. Eugenia**
- + Leaves 7–15cm; lateral veins prominent beneath; calyx tube c 5 x 3mm; fruit pear-shaped up to 5 x 4cm; introduced and cultivated **5. Psidium**

4. Flowers in terminal spikes; calyx 5-lobed; stamens red **3. Callistemon**
- + Flowers in axillary umbels; calyx tube unlobed; stamens white or creamy **4. Eucalyptus**

1. EUGENIA L.

Shrubs or small trees; branchlets pubescent. Leaves opposite, lamina with intramarginal vein, exstipulate. Flowers solitary or appearing racemose at base of young vegetative branch, each flower borne on peduncle, with 2 bracteoles at base of calyx

tube. Calyx tube not narrowed into a fleshy stalk at base and not extending above ovary; lobes free, spreading, not enlarged and fleshy in fruit. Petals free. Stamens borne on flat, often pubescent disc surrounding style at mouth of calyx tube. Fruit succulent, bearing persistent calyx lobes.

1. *E. bracteata* (Willdenow) Roxb.; *Syzygium ruscifolium* (Willdenow) Santapau & Wagh. Fig. 33a&b.

Large shrub or tree to 16m; young branchlets densely red-brown hairy. Leaves elliptic, 5–7 x 2–2.5cm, bluntly acuminate, base cuneate, red-brown pubescent when young, becoming glabrous, intra-marginal vein faint; petioles 5–8mm. Flowers red-brown pubescent; peduncle 5–10mm. Calyx tube funnel-shaped, 1.5 x 1.2mm, densely hairy; lobes 4, rounded, c 2mm. Petals white, glabrous, spatulate, c 6mm. Stamens white c 10mm. Fruit globose, c 8mm, with persistent calyx lobes.

Darjeeling: Lat and Tista Valley. River banks in terai, 910m. April–May.

2. SYZYGIIUM Gaertner

Glabrous trees. Leaves opposite, rarely in whorls of 3, lamina with intramarginal vein. Flowers in terminal or axillary paniculate cymes; flowers sessile, bracteoles falling early. Calyx tube narrowed into a fleshy stalk (pseudopedicel) at base, tube extending above top of ovary; lobes 4, small or sometimes much enlarged and fleshy in fruit, sometimes deciduous or shed as a cap. Petals 4, rarely 6 or 7, small, united and shed early as a cap, or larger and free. Stamens borne on disc within mouth of calyx tube. Ovary 1–3-celled. Fruit usually succulent, sometimes bearing persistent calyx.

Records of *Syzygium caryophyllaeum* Gaertner from Darjeeling (34) have not been confirmed.

- | | |
|--|-------------------------------|
| 1. Stamens long, 1–3cm; calyx lobes conspicuous, 1.5–5mm long, persistent (caducous in <i>S. smalianum</i>) | 2 |
| + Stamens short, 0.2–0.7cm; calyx lobes 0.5–1mm, inconspicuous or early caducous | 8 |
| 2. Leaves often in whorls of 3, sessile and subcordate at base.... 1. <i>S. formosum</i> | |
| + Leaves opposite, distinctly petiolate and cuneate or rounded at base (sometimes subcordate in <i>S. aqueum</i>) | 3 |
| 3. Cymes terminal and in axils of uppermost leaves | 4 |
| + Cymes borne in axils of lower and fallen leaves | 7 |
| 4. Calyx tube short, c 8mm, lobes caducous | 6. <i>S. smalianum</i> |
| + Calyx tube elongate, 10–17mm, lobes persistent | 5 |

5. Leaves 5 – 12cm broad, rounded or subcordate at base **4. S. aqueum**
 + Leaves 2.5 – 5.5cm broad, cuneate at base 6
6. Leaves lanceolate; calyx tube 7 – 10mm broad at mouth, lobes 4 – 5mm; petals c 1.5cm; cultivated **2. S. jambos**
 + Leaves elliptic; calyx tube 3 – 4mm broad at mouth, lobes 2 – 4mm; petals 0.8 – 1.2cm; native **3. S. ramosissimum**
7. Leaves elliptic-oblongate, 2.5 – 5cm broad, glossy above; flowers numerous, borne in 3's on branches of cyme, sessile; calyx tube abruptly narrowing into stalk, 3 – 5mm long **5. S. praecox**
 + Leaves obovate-elliptic, 5 – 10.5cm broad, not glossy above; cymes 3 – 7-flowered, flowers solitary on slender pedicels 3 – 20mm; calyx tube gradually tapering, 6 – 8mm long **7. S. kurzii**
8. Cymes terminal and/or axillary on leafy shoots 9
 + Cymes mostly borne in axils of fallen leaves on older branches, sometimes some borne in axils of lower leaves but never terminal 11
9. Petiole 4 – 7mm; calyx tube long 7 – 15mm, gradually tapering
9. S. claviflorum
 + Petiole 11 – 20mm; calyx tube short 3 – 5mm, tapering or abruptly narrowed 10
10. Calyx tube 4 – 5mm, cup suddenly contracted into stalk-like base; stamens 4 – 7mm **8. S. venosum**
 + Calyx tube funnel-shaped, tapering and not suddenly contracted into stalk-like base **10. S. cumini**
11. Lateral veins numerous, slender, inconspicuous, usually weakly prominent on both surfaces 12
 + Lateral veins few (up to 18 pairs), conspicuous, prominent beneath (sometimes also with much weaker transverse veins) 13
12. Petiole 4 – 7mm; calyx tube 7 – 15mm **9. S. claviflorum**
 + Petiole 15 – 20mm; calyx tube 3 – 5mm **10. S. cumini**
13. Leaves broadly elliptic or broadly ovate, 9 – 19 x 5 – 12cm; cymes large, 7 – 24 x 5 – 10cm; calyx campanulate, without stalk-like base
11. S. operculatum
 + Leaves elliptic obovate or oblanceolate 8 – 14 x 2 – 8cm; cymes small 1 – 7 x 1 – 5cm; calyx funnel-shaped with stalk-like base 14

14. Leaves thickly coriaceous, brown when dry; stalk-like base of calyx tube stout **12. S. tetragonum**
 + Leaves thinly coriaceous, greenish when dry; stalk-like base of calyx tube slender **13. S. balsameum**

1. **S. formosum** (Wall.) Masamune; *Eugenia formosa* Wall., *Jambosa formosa* (Wall.) G. Don. Nep: *Ambake* (34), *Ambarke*. Fig. 33i&j.

Tree to 12m. Leaves mostly in whorls of 3 towards branch ends, sometimes opposite, thickly leathery, elliptic-oblongate, 20 – 42 x 7 – 17cm, shortly and bluntly acuminate, base sessile and subcordate, veins prominent beneath. Cymes borne on old wood below leaves, 4 – 7-flowered, 3 – 8cm diameter. Flowers fragrant; peduncles 0.5 – 4cm; pedicels 1 – 5cm, slender. Calyx tube funnel-shaped, 12 – 20 x 10 – 16mm, tapering and stalk-like at base; lobes 4, thick, rounded c 5 x 8mm, free, persistent. Petals 4, white or pinkish, suborbicular, c 12mm. Stamens white, 2 – 2.5cm. Style 3 – 3.5cm. Fruit white when ripe, subglobose, ?3cm or more (immature 2cm) diameter, crowned by persistent calyx lobes.

Bhutan: S – Sarbhang district (Phipsoo Khola, native) and Gaylephug district (Gaylephug, cultivated); **Darjeeling:** foothills and terai; **West Bengal Duars:** Buxa. On river banks in subtropical and terai forests, and cultivated in towns and villages, 150 – 600m. March, April.

Cultivated for its edible fruit.

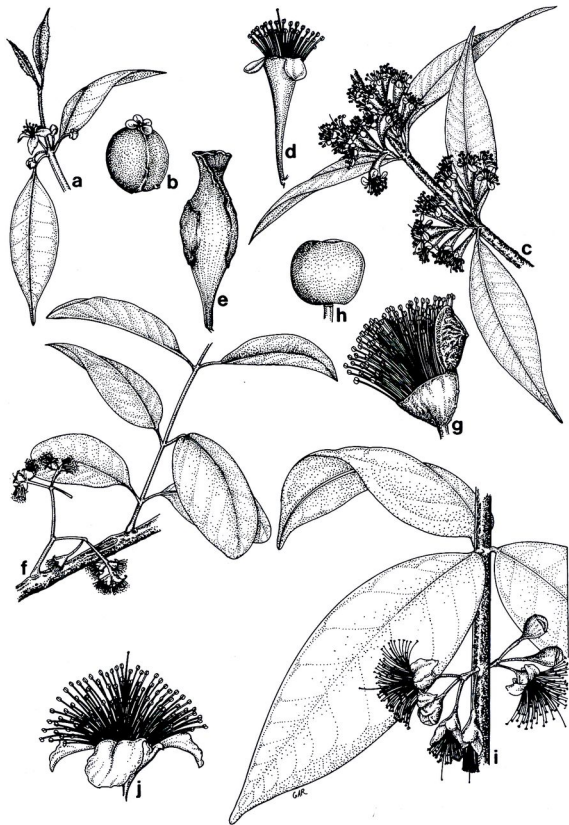
2. **S. jambos** (L.) Alston; *Eugenia jambos* L., *Jambosa vulgaris* DC. Eng: *Rose Apple*.

Tree to 10m. Leaves opposite, leathery, lanceolate, 7 – 18 x 2.5 – 5.5cm, acuminate, base cuneate, lateral and intramarginal veins slender and prominent beneath; petioles 4 – 8mm. Cymes rounded, terminal and in uppermost leaf axils, 5 – 8cm diameter, 3 – 9-flowered. Peduncle 1 – 3cm; pedicels 7 – 15mm. Calyx tube funnel-shaped, 11 – 17 x 7 – 10mm, long attenuate and stalk-like at base; lobes pale green, rounded, 4 – 5mm, persistent, free. Petals 4, white or pale yellow, broadly obovate up to 1.5cm. Stamens white 2 – 3cm. Style 2.5 – 3.5cm. Fruit globose, up to 4cm diameter, crowned by persistent calyx lobes.

Darjeeling: cultivated in terai. March – May.

Cultivated for its sweet edible fruit.

FIG. 33. **Myrtaceae.** a & b, *Eugenia bracteata*: a, flowering branch; b, fruit. c – e, *Syzygium claviflorum*: c, flowering branch; d, flower; e, fruit. f – h, *Syzygium operculatum*: f, part of flowering branch; g, flower; h, fruit. i & j, *Syzygium formosum*: i, part of flowering shoot; j, flower. Scale: a, f, i x 1/2; c x 3/4; j x 1; b x 1 1/2; d, e x 2; h x 2 1/2; g x 3 1/2. Drawn by G. Rodrigues.



3. *S. ramosissimum* (Blume) Balakrishnan; *Eugenia ramosissima* (Blume) Duthie, *Jambosa ramosissima* (Blume) Cowan & Cowan. Nep: *Harre Jamuna* (34).

Tree to 15m. Leaves opposite, leathery, elliptic, 7–13 x 2.5–5cm, acuminate, base cuneate, veins slender, weakly prominent beneath; petiole 5–8mm. Cymes terminal, rounded, 4–8cm diameter, 3–15-flowered. Flowers fragrant; peduncle 1–2cm; pedicels slender 4–12mm. Calyx tube obconical or narrowly funnel-shaped, 10–13 x 3–4mm; lobes thick, rounded, 2–4mm, unequal. Petals white, suborbicular, concave, 8–12mm, free. Stamens 1.5–2cm. Style 1.8–2.2cm. Fruit not seen.

Bhutan: S – Samchi district (Khagra Valley and Tamangdhanra Forest) and Gaylephug district (above Tatapani); **Darjeeling:** Kali Jhora, Rungit valley, Riang, Soonduc. Subtropical and terai forests, 300–700m. February–March (–May).

Similar to *S. jambosa* but easily distinguished by its elliptic leaves and smaller flowers with narrower calyx tube.

4. *S. aqueum* (Burman f.) Alston; *Eugenia aquea* Burman f.

Similar to *S. jambos* but leaves ovate-elliptic, 14–30 x 5–12cm, shortly, bluntly acuminate, base rounded or shallowly cordate; cymes 5–13cm diameter; peduncle 3–6cm; flowers sessile or on very short pedicel; calyx tube 13–15 x 10–12mm; lobes 3–4mm; stamens 1.5–2cm; fruit subglobose, 1–1.5cm diameter.

Darjeeling: locality unknown. Cultivated, 300m.

Native of Java, cultivated for its edible fruit.

5. *S. praecox* (Roxb.) Rathakrishnan & Nair; *Eugenia praecox* Roxb., *E. wallichii* Wight, *Syzygium wallichii* (Wight) Walpers. Nep: *Jaman* (34).

Tree to 10m. Leaves opposite, elliptic-oblongate, 8–17 x 2.5–5cm, acuminate, base cuneate, glossy above, veins prominent beneath, intra-marginal vein strong; petiole 1–1.5cm. Cymes borne in axils of lower and fallen leaves, 4–8cm diameter, many-flowered. Flowers sessile, borne in 3's. Calyx tube 3–5 x 3–4mm, abruptly constricted into stalk-like base; lobes 4, rounded, 1.5–2mm, persistent. Petals white, rounded, concave, 2.5–4.5mm, free but usually shed together early as a cap. Stamens 1.5–2cm. Style 1.5–2cm. Fruit ellipsoid, c 10 x 5mm, crowned with persistent calyx.

Bhutan: S – Deothang district (Deo River); **Darjeeling:** Darjeeling, Tista Valley, Jalpaiguri Duars, Mal Forest. Subtropical and terai forests, often near water, 300–600m. December–February.

6. *S. smalianum* (Brandis) Long; *Eugenia smaliana* Brandis

Similar to *S. praecox* but leaves elliptic, broader, 9–15 x 4–6cm; cymes terminal and in axils of upper leaves, 3–11-flowered; calyx tube larger, c 8 x 6mm, lobes rounded, 2–4mm, unequal, early caducous; petals c 4mm, free but falling early although not as a cap; stamens 1.3–1.5cm; fruit unknown.

Bhutan: S – Sarbhang district (between Noonpani and Tori Bari). Steep warm broad-leaved forest with *Altingia*, *Terminalia myriocarpa*, etc., 990m. March.

Elsewhere only known from Assam and Burma. Although similar to *S. jambos* and *S. ramosissimum* in its inflorescence, its sessile flowers and short calyx tube ally it to *S. praecox*.

7. *S. kurzii* (Duthie) Balakrishnan; *Eugenia kurzii* Duthie, *Eugenia cerasiflora* Kurz non Miquel, *Jambosa kurzii* (Duthie) Cowan & Cowan. Nep: *Jaman* (34), *Ambake* (34).

Similar to *S. praecox* but leaves obovate-elliptic, 12 – 27 x 5 – 10.5m, base cuneate to rounded, prominently veined beneath but with variably-developed intramarginal vein; petiole 0.5 – 1.5cm; cymes smaller, 3 – 4cm diameter, 3 – 7-flowered, flowers borne singly on slender pedicels 3 – 20mm; calyx tube funnel-shaped, 6 – 8 x 4 – 6mm, lobes c 3mm; petals 5 – 8mm, free and not shed as a cap; stamens 1 – 1.5cm; fruit subglobose, immature 2.5 x 3cm.

Bhutan: S – Chukka district (Chukka and Marichong) and Sarbhang district (above Noonpani); **Darjeeling:** Rongbe, Lopchu, Sureil, Mamrung. Warm broad-leaved forests, often on streamsides, 890 – 1830m. June – November.

Variable in leaf shape and size, development of intramarginal vein and flower size.

8. *S. venosum* DC.; *Eugenia frondosa* Duthie, *E. areolata* (DC.) Duthie. Sha: *Mitsu Shing*.

Tree 6 – 25m. Leaves leathery, elliptic to obovate, 8 – 12 x 2.5 – 6cm, abruptly acuminate or caudate, base attenuate, glossy above, veins numerous, slender, weakly prominent on both surfaces, intra-marginal vein conspicuous; petiole 1.1 – 2cm. Cymes terminal and axillary, 4 – 8cm diameter, many-flowered; peduncle 2 – 6cm. Flowers sessile. Calyx 4 – 5 x 4 – 5mm, cup abruptly narrowed into stalk-like base, very shallowly lobed. Petals white, 4mm, shed together as flowers open. Stamens cream, 4 – 7mm. Style c 4mm. Fruit obovoid, c 1cm, fleshy when ripe, pinkish crimson.

Bhutan: S – Chukka district (Chukka), C – Punakha district (Tang Chu valley) and Tashigang district (Dangme Chu valley and Ghunkarah); **Darjeeling:** Kalimpong and terai. Warm broad-leaved forests and river banks in dry valleys, 300 – 1410m. June – November.

The record of *S. toddalioides* (Wight) Walpers (*Eugenia toddalioides* Wight) from Sikkim (80) is based on material of *S. venosum* from Kalimpong. Some specimens named *S. oblatum* (Roxb.) Cowan & Cowan (*Eugenia oblata* Roxb.) from Darjeeling district also belong here.

9. *S. claviflorum* (Roxb.) Cowan & Cowan; *S. leptanthum* (Wight) Niedenzu, *Acmenosperma claviflora* (Roxb.) Kausel, *Eugenia claviflora* Roxb. Nep: *Harre Jamuna* (34), *Jaman*. Fig. 33c - e.

Tree to 12m. Leaves coriaceous, lanceolate or elliptic, 9 - 12 x 2 - 4cm, acuminate, base cuneate, veins numerous not prominent, intra-marginal vein inconspicuous; petiole 4 - 7mm. Cymes compact, short and rounded, in lower and fallen leaf axils, 3 - 5cm diameter, 5 - 25-flowered; peduncle 5 - 15mm. Flowers sessile. Calyx funnel-shaped, tube 7 - 15 x 3 - 5mm, with very short caducous lobes. Petals 6 - 7, white, rounded 2 - 2.5mm, mostly shed early. Stamens 3 - 6mm. Style 4 - 7mm. Fruit cylindrical or turbinate, c 2 x 1cm, succulent, purple.

Bhutan: S - Sarbhang district (Chirang road and Singi Khola); **Darjeeling:** Tista etc. Subtropical forests, 260 - 990m. March - April.

A variable species. The E Himalayan plants differ from those from Chittagong and elsewhere in their much smaller flowers and leaves, and may be subspecifically distinct. Fruit edible.

10. *S. cumini* (L.) Skeels; *Eugenia jambolana* Lamarck, *E. cumini* (L.) Druce. Dz: *Nyasse Shing*; Sha: *Mitsu Shing*, *Mennmse Say Shing*; Nep: *Jamuna*.

Tree to 25m. Leaves coriaceous, elliptic, sometimes ovate or obovate, 6 - 13 x 3 - 6cm, acuminate, base cuneate, veins numerous, intra-marginal vein \pm conspicuous; petiole 1.5 - 2cm. Cymes borne in axils of older and fallen leaves, c 8cm diameter, many-flowered; peduncle 0.5 - 10cm. Flowers sessile. Calyx funnel-shaped, tube 3 - 5 x 2 - 3mm, tapering into stalk-like base, lobes shallow, persistent. Petals creamy, 2mm, shed as a cap. Stamens 2 - 5mm. Style 2 - 4mm. Fruit obliquely obovoid, 1 x 0.6cm, crimson, becoming black when ripe.

Bhutan: S - Phuntsholing, Sankosh and Deothang districts, C - Punakha district; **Darjeeling:** Ryang, Darjeeling, Salgara, Sivoke. Subtropical and warm broad-leaved forests, 200 - 1580m. February - August.

Wood useful and durable (48). A valuable firewood species for the humid tropics (130). Closely related to *S. venosum* but differing in calyx not abruptly narrowing. Records of *S. fruticosum* (Roxb.) DC. (*Eugenia fruticosa* Roxb.) from Darjeeling district (34) refer to this species.

11. *S. operculatum* (Roxb.) Neidenzu; *Eugenia operculata* Roxb., *Cleistocalyx operculatus* (Roxb.) Merrill & Perry. Nep: *Kyamuna* (34), *Piamun* (34). Fig. 33f - h.

Tree. Leaves thinly coriaceous, broadly ovate or broadly elliptic, 9 - 19 x 5 - 12cm, obtuse or bluntly apiculate, base rounded to truncate or cuneate, with 7 - 12 pairs of prominent veins, intra-marginal vein faint; petiole 0.8 - 2cm. Cymes in axils of lower and fallen leaves, 7 - 24 x 5 - 10cm, many-flowered; peduncle 2 - 5cm. Flowers sessile. Calyx campanulate, tube 2 - 4 x 2 - 3mm, without stalk-like base; lobes c 1mm, sometimes shed as a cap as flower opens. Petals white, c 1mm, shed as a cap. Stamens 2 - 3mm. Style 4mm. Fruit globose, c 0.5cm diameter, black, crowned by low rim.

Darjeeling: terai at Siliguri and Sivoke. Terai and Sal forests, 300–600m. April – June.

Leaves turn bright red in cool season. Wood used for building; fruit used in treatment of rheumatism.

12. *S. tetragonum* (Wight) Walpers; *Eugenia tetragona* Wight. Nep: *Chamlane* (34), *Karphal* (34).

Tree to 10m. Leaves thickly coriaceous, brown when dry, oblanceolate-elliptic, 8–12 x 4.5–8cm, acuminate, base cuneate, lateral veins 10–18 pairs, prominent beneath. Cymes short, in axils of fallen leaves, 2–7 x 1–5cm; peduncle 2–6cm. Flowers sessile, fragrant. Calyx funnel-shaped, tube 2–3 x 2mm, stout at base, lobes very short. Petals shed as a cap. Stamens c 2mm. Fruit globose, red (immature) 6mm.

Bhutan: S – Chukka district (Sinchu La) and Sarbhang district (Chirang road);

Darjeeling: foothills and terai. Subtropical and warm broad-leaved forests, 600–1220m. October – December.

Wood useful for tool handles and for making charcoal (34).

13. *S. balsameum* (Wight) Walpers; *Eugenia balsamea* Wight.

Similar to *S. tetragonum* but differing in leaves thinly coriaceous, greenish when dry, elliptic, obovate or oblanceolate, shortly acuminate; cymes slender 1–3 x 1–2cm; calyx tube tapering to slender base.

Darjeeling: Jalpaiguri and Dulka Jhar. Terai forests, 300–600m. November – December.

3. CALLISTEMON R. Brown

Shrubs or small trees. Leaves alternate, leathery, often linear, with intramarginal vein, exstipulate. Flowers numerous in terminal spikes, each flower subtended by caducous bract and 2 bracteolés. Calyx lobes 5. Petals 5, free. Stamens long-exserted, showy. Ovary 3-celled. Fruit a 3-valved capsule, bearing remains of calyx.

1. *C. citrinus* (Curtis) Skeels. Eng: *Red Bottle Brush*.

Shrub or small tree to 10m; branchlets pubescent. Leaves coriaceous, linear lanceolate, 4–7 x 0.4–1cm, sharply pointed, base cuneate, sessile, faintly reticulate, sparsely pilose becoming glabrous. Spikes 5–12 x 3–4cm. Calyx tube campanulate, 3 x 2.5mm, whitish pubescent; lobes ovate, 1.2mm. Petals obovate, c 5mm. Stamens bright red, c 2cm. Fruit woody, cup-shaped, 5 x 4mm.

Bhutan: S – Deothang district (Samdrup Jongkhar). Cultivated in garden. 500m. April – August.

Native of Australia, cultivated for its showy flowers.

4. EUCALYPTUS L'Héritier

Trees with smooth bark flaking or peeling as long strips. Leaves leathery, alternate (often opposite in young plants), often pendulous, gland-dotted and with intra-marginal vein. Flowers in axillary umbels or terminal panicles. Bracts shed early. Calyx tube unlobed or lobes united with petals into a lid. Petals united into a lid, shed as flower opens. Stamens exserted, showy, sometimes outer ones sterile. Ovary 3 – 4(–6)-celled. Fruit a dry woody capsule, opening at top by valves.

A very large genus of which many species have been introduced into cultivation as timber trees. Others are valued as tropical firewood species (130). A number of these hybridize and present great difficulties in identification. Several additional taxa may be cultivated in Bhutan, Darjeeling and Sikkim. Only mature leaves are described as juvenile foliage is often very different.

1. Leaves linear-lanceolate, 12–28 x 1.5–3cm; peduncles slender, terete; capsule hemispheric **1. E. tereticornis**
 + Leaves ovate-lanceolate, 9–16 x 3–7cm; peduncle stout, flattened; capsule cylindrical **2. E. robusta**

1. E. tereticornis Smith. Eng: *Forest Red Gum*.

Tree 10–20m. Adult leaves coriaceous, linear-lanceolate, weakly curved, 12–28 x 1.5–3cm, acuminate, base obliquely cuneate, often unequal, green on both surfaces, venation obscure; petioles 1.5–2.5cm. Flowers 5–8, in axillary umbels 3–3.5cm diameter, on slender, terete peduncles 1–1.5cm. Calyx tube goblet-shaped, 6–8 x 5mm, base slender, stalk-like. Lid conical, 11–13 x 5mm. Stamens creamy, 8–10mm. Capsule hemispheric, c 7mm diameter, with 4 exserted ascending valves.

Bhutan: S – Sarbhang district, C – Punakha, Mongar and Tashigang districts. Cultivated, 460–1800m. March–April.

Native of Australia, cultivated in plantations and gardens as a timber and ornamental species.

2. E. robusta Smith. Eng: *Swamp Mahogany*.

Similar to *E. tereticornis* but adult leaves ovate-lanceolate, 9–16 x 3–7cm, pale beneath; peduncles stout, flattened, 1.5–2.5cm; calyx tube c 12 x 7mm, without slender stalk-like base; capsule cylindrical, up to 18 x 11mm, valves immersed.

Bhutan: C – Tashigang district (Tashigang). Cultivated, 1400m. April–May. Native of Australia.

5. PSIDIUM L.

Small trees or shrubs. Leaves opposite, with lateral veins arching at ends but not forming a complete intra-marginal vein except near apex; stipules minute, subulate.

Flowers solitary or up to 3 on axillary peduncle; bracteoles falling early. Calyx 2–4-lobed, tube shortly extended above ovary. Petals 4 or 5, free. Stamens borne at mouth of calyx tube. Ovary 4- or 5-celled. Fruit a large fleshy berry, many-seeded, bearing persistent bases of calyx lobes.

1. P. guajava L. Sha: *Beppasive*; Nep: *Ambak* (34); Eng: *Guava*.

Large shrub or small tree to 6m; branchlets finely pubescent. Leaves oblong-elliptic, 7–15 x 3–7cm, acute, base rounded, pubescent beneath, sparsely so above, lateral veins parallel, prominent beneath; petioles 4–6mm; stipules minute, 0.4–0.6mm, often caducous. Flowers mostly solitary on pubescent peduncle 1–3cm (sometimes in 3's and then subsessile on peduncle); bracteoles subulate, caducous. Calyx tube obovoid, c 5 x 3mm, constricted at apex, pubescent; lobes leathery, ovate, 8–10 x 6–9mm, unequal (when 2-lobed, lobes broader). Petals white, obovate, up to 15 x 10mm. Fruit pear-shaped up to 5 x 4cm.

Bhutan: S – Phuntsholing, cultivated; **Darjeeling:** cultivated in terai and foothills, and often naturalised (34). 200–350m. April–July.

Native of tropical America widely cultivated for its edible fruit.

Family 131. SONNERATIACEAE

by D.G. Long and S.J. Rae

Large evergreen glabrous trees; trunk often buttressed. Leaves opposite, borne in one plane, simple, pinnately veined, entire, exstipulate. Flowers large, in terminal corymbose cymes, opening at night, actinomorphic, bisexual, (4–)6(–8)-merous. Calyx with funnel-shaped tubular base adnate to base of ovary, lobes thick. Petals free, showy, crumpled. Stamens numerous, free, inserted on calyx tube, inflexed in bud; anthers versatile. Ovary superior, 4–8-celled; style simple, elongate, curved; stigma capitate; ovules numerous, axile. Fruit a leathery capsule, (4–)6–8-valved; seeds many, minute, tailed at both ends.

1. DUABANGA Hamilton

Description as for Sonneratiaceae.

1. D. grandiflora (DC.) Walpers; *D. sonneratioides* Hamilton. Nep: *Lampate*. Fig. 34a–d.

Tree 20–30m; branches drooping. Leaves rigid, ovate-oblong, 15–30 x 7–13cm, acuminate, base cordate and almost sessile, dark green above, pale beneath, veins parallel and prominent beneath, with intramarginal vein; petiole thick, 3–6mm. Corymbs terminal, drooping, 3–20-flowered; flowers unpleasantly scented. Pedicels stout, 2–3cm. Calyx cup 2–3cm diameter; lobes green, thick, triangular,

1.6 – 2cm. Petals obovate, white, 3 – 4 x 2 – 2.5cm. Style 6 – 8cm. Capsule subglobose, 4 – 4.5cm diameter, deeply dividing into 6 – 8 valves; seeds filiform, 4 – 6mm.

Bhutan: S – Samchi, Phunthsholing, Sarbhang, Gaylegphug and Deothang districts, C – Tongsa, Mongar and Tashigang districts; **Darjeeling:** Tista and Rungit Valleys, foothills and terai. Subtropical and terai forests, especially on river banks, 220 – 1200m. December – March.

A fast-growing species; wood useful for building (48). Although typical of the foothills and terai, this species is found in the deep valleys of Bhutan reaching as far north: as Sherngang, Mongar and Tashi Yangtisi.

Family 132. PUNICACEAE

by D.G. Long & S.J. Rae

Shrubs or small trees, often spiny. Leaves opposite or subopposite, sometimes crowded on short lateral shoots, simple, entire, pinnately veined, exstipulate. Flowers terminal and axillary, solitary or few in clusters, actinomorphic, bisexual. Floral parts epigynous. Calyx lobes 6 or 7, tube adnate to ovary. Petals 6 or 7, showy, free, crumpled. Stamens numerous, borne on calyx tube; anthers versatile. Ovary inferior, 8 – 13-celled, cells often in 2 or 3 layers; style slender; stigma capitate; ovules numerous, axile and parietal. Fruit berry-like with leathery rind, pulpy within, containing many seeds; calyx persistent.

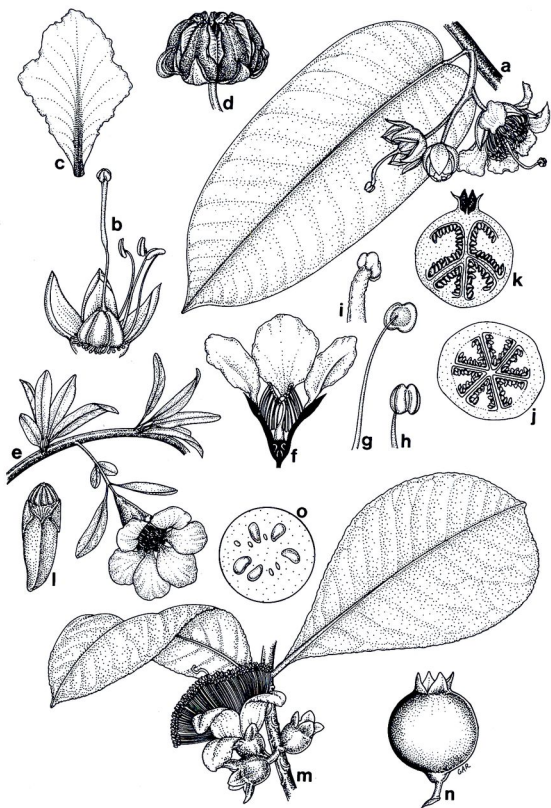
1. PUNICA L.

Description as for Punicaceae.

1. P. granatum L. Dz: *Chindu*; Sha: *Thalem, Tahalem, Thalem Sey, Thalem Shing*; Med: *Sindu, Sendu*; Eng: *Pomegranate*. Fig. 34e – l.

Shrub or small tree, 2 – 3m, glabrous; branchlets often spine-tipped. Leaves elliptic-oblongate, 3.5 – 7 x 1 – 2cm, obtuse often mucronate, base attenuate, margins entire, glabrous; petiole 2 – 10mm. Flowers axillary. 1 – 2 per axil, bright

FIG. 34. **Sonneratiaceae, Punicaceae and Lecythisaceae.** **Sonneratiaceae.** a–d, *Duabanga grandiflora*: a, leaf and inflorescence; b, dissected flower with petals, three sepals, and most stamens removed; c, petal; d, capsule. **Punicaceae.** e – l, *Punica granatum*: e, part of shoot with flower; f, l.s. flower; g, h, stamens; i, tip of style and stigma; j, t.s. fruit; k, l.s. fruit; l, seed. **Lecythisaceae.** m – o, *Careya arborea*: m, leaves and inflorescence; n, fruit; o, t.s. fruit. Scale: a, d, e, j, k, m x ½; b, c, f, n, o x 1; l x 2½; i x 3; g, h x 6. Drawn by G. Rodrigues.



red, fleshy. Calyx red, tube funnel-shaped, c 10 x 7mm; lobes triangular 6 – 9mm, persistent. Petals bright red, obovate, 1.5 – 2.2cm, crumpled. Stamens numerous, yellow. Style bent near apex, 8mm; stigma capitate. Fruit globose, 4.5 – 6cm diameter, crowned by the persistent calyx.

Bhutan: C – Thimphu, Punakha and Tashigang districts; **Darjeeling:** terai. Cultivated and amongst scrub on dry hillsides, 1200 – 2400m. March – July.

Flowers yield a red dye (126). Cultivated for its showy flowers and edible fruit, apparently naturalised in dry inner valleys of Bhutan.

Family 133. LECYTHIDACEAE

by D.G.Long and S.J.Rae

Deciduous trees or low shrubs. Leaves alternate, often crowded towards branch ends, simple, pinnately veined, exstipulate. Flowers showy, in short bracteate spikes, bisexual, actinomorphic, often opening at night. Floral parts epigynous. Calyx with campanulate tube adnate to ovary; lobes 4, thick. Petals 4, free. Stamens numerous, united at base into several whorls, outermost staminodial. Ovary inferior, 4- or 5-celled; style terminal, simple; stigma capitate; ovules many per cell, axile. Fruit large, fibrous, many-seeded.

1. CAREYA Roxb.

Description as for Lecythidaceae.

1. Tree 10 – 20m **1. C. arborea**
+ Small shrub 10 – 20cm **2. C. herbacea**

1. *C. arborea* Roxb.; ?*C. sphaerica* Roxb. Nep: *Kumbi, Kumbhi*. Fig. 34m – o.

Deciduous tree 10 – 20m, glabrous. Leaves crowded towards branch ends, obovate, 15 – 30 x 10 – 19cm, rounded and often bluntly apiculate, base long attenuate, margins crenate-serrate; petiole very short, 5 – 15mm. Spikes terminal, 3 – 7cm, 3 – 8-flowered; bracts leafy, 0.5 – 7cm. Flowers sessile. Calyx tube 10 – 15mm, green; lobes thick, rounded, 8 – 10mm. Petals greenish-white, oblong-spathulate, c 4 x 1.3cm. Stamens whitish, 4 – 5cm; outer staminodes crimson. Style 4 – 5.5cm. Fruit ovoid-globose, c 9 x 5cm, with persistent erect calyx lobes; seeds compressed, ellipsoid, 1.5 x 1cm.

Bhutan: S – Samchi, Phuntsholing and Gayleghug districts; **Darjeeling:** foothills and terai. Cultivated around villages in subtropical zone, 200 – 500m. April, May.

Cultivated for its durable timber, and for its bark, flowers and fruit which are used medicinally. *C. sphaerica* Roxb. has been recorded from 'Sikkim' (probably Darjeeling), but is scarcely distinct.

2. C. herbacea Roxb.

Similar to *C. arborea*, but a low subshrub 10 – 20cm, arising from a perennial woody rootstock; leaves 10 – 20 x 4 – 8cm, obtuse or bluntly apiculate, margin serrulate; flowers 1 – 4 in short terminal racemes; calyx reddish tinged; petals pinkish tinged, 2.5 – 3cm; fruit globose, 2.5 – 3.5cm.

Darjeeling: terai at Siliguri and Jalpaiguri. Savannah grasslands and deciduous forest subject to burning, 150 – 200m. December – April.

Family 134. MELASTOMATACEAE

by R. A. Clement

Shrubs or herbs; indumentum of stellate, scale-like or simple hairs. Leaves opposite, decussate, rarely alternate by abortion, sessile or petiolate, entire or inconspicuously denticulate, main veins 3–7, palmate and parallel; stipules absent. Flowers bisexual, actinomorphic, in cymes, panicles or clustered, rarely solitary. Calyx 3 – 5-lobed. Petals 3 – 5, free or connate at base. Stamens usually 8 or 10, rarely 3; filaments geniculate (kneed) or not; anthers dehiscing by pores; connective often produced at the base. Ovary inferior, 3 – 5-celled; ovules numerous, axile; style simple. Fruit a berry or capsule; seeds small, numerous.

- | | |
|--|------------------------|
| 1. Herbs | 2 |
| + Shrubs | 4 |
| 2. Petals 3; fruit 3-angled | 4. Sonerila |
| + Petals 4; fruit 4-angled or terete | 3 |
| 3. Leaves evenly distributed along stem; calyx ± tubular, not winged; petals entirely free | 1. Osbeckia |
| + Leaves mostly grouped near top of stem; calyx obpyramidal, conspicuously 4-winged; petals united in lower part | 5. Sarcopyramis |
| 4. Stem, leaves and petioles glabrous; leaves somewhat fleshy; flowers borne on old wood | 7. Medinilla |
| + Stem, leaves or petioles hairy; leaves not fleshy; flowers borne on young wood | 5 |
| 5. Stamens unequal in length | 6 |
| + Stamens all equal in length | 7 |

6. Petals 5; leaves less than 12cm long; calyx covered in fimbriate-margined, scale-like hairs **2. Melastoma**
 + Petals 4; leaves usually more than 12cm long; calyx indumentum of small, stellate hairs **3. Oxyspora**
7. Inflorescence usually cymose, if paniculate then few-flowered and fairly dense **1. Osbeckia**
 + Inflorescence a large, lax panicle **6. Pseudodissochaeta**

1. OSBECKIA L.

Herbs or shrubs, often with 4-angled branches. Leaves with white crystalliferous cells (visible with hand-lens) often at base of hairs, sometimes arranged in lines. Inflorescence of terminal cymes or small, dense panicles. Calyx usually with hairy appendages on tube and between lobes; lobes 4 or 5, deciduous. Petals 4 or 5. Stamens 8 or 10, equal; anthers long, with a beak. Ovary 4- or 5-celled, usually hairy at apex. Style long. Capsule enclosed by persistent calyx tube, dehiscing by 4 or 5 pores at apex.

1. Flowers 4-merous 2
 + Flowers 5-merous 5
2. Petals 2 – 4mm; stem hairs spreading **2. O. muralis**
 + Petals 12 – 17mm; stem hairs appressed or spreading 3
3. Calyx appendages terete with tufted hairs (appearing stellate). **1. O. stellata**
 + Calyx appendages flattened, ciliate 4
4. Leaves up to 3 x as long as broad, subsessile **3. O. capitata**
 + Leaves more than 3 x as long as broad, petiolate; petiole 1 – 2.5mm **4. O. chinensis**
5. Leaves hairy on upper surface **5. O. nepalensis**
 + Leaves glabrous on upper surface **6. O. nutans**

FIG. 35. **Melastomataceae** and **Rhizophoraceae**. **Melastomataceae.** a – c, *Osbeckia capitata*: a, flowering shoot; b, flower bud; c, stamen. d, *Osbeckia stellata*: compound hairs from calyx lobes. e, *Medinilla himalayana*: stamen. f & g, *Oxyspora paniculata*: f, short stamen; g, long stamen. h – l, *Melastoma normale*: h, flowering shoot; i, upper surface of leaf; j, scales on calyx cup; k, long stamen; l, short stamen. m, *Sonerila maculata*: stamen. n – q, *Sarcopyramis napalensis*: n, flowering stem; o, stamens; p, calyx and ovary; q, style and stigma. **Rhizophoraceae.** r – u, *Carallia brachiata*: r, leaf and inflorescence; s, stipules and bracts; t, flowers; u, dissected flower. Scale: r x 1/2; h x 2/3; a, s x 1; k, l, n, t x 2; b x 2 1/2; c, e, f, g, p, u x 3; m x 4; d, o, q x 5; i x 10; j x 18. Drawn by M. Bates.



1. *O. stellata* Ker-Gawler. Sha: *Ardongmo Shing*; Nep: *Lal Angeri* (34). Fig. 35d.

Perennial herb or shrub 60–100(–360)cm; stems branched, sometimes winged, with dense or sparse, appressed or spreading hairs. Leaves ovate-oblong or elliptic, 6.5–14.5 x 2.1–4.5cm, acute to acuminate, base subcordate to cuneate, sparsely or densely appressed-hairy on both surfaces, veins 5–7; petiole 7–21mm, upper leaves sometimes sessile. Inflorescences terminal and in upper leaf axils, paniculate, few to many-flowered; pedicel 0.5–3mm, up to 6mm in fruit. Calyx 13–25mm, tube subglabrous to densely hairy, some hairs tufted (appearing stellate) on a terete appendage; appendages up to 6.5mm long, glabrous or hairy at apex; lobes 4, triangular to oblong, 8–13mm, ciliate, some hairs tufted at apex, hairy or glabrous on outer surface. Petals 4, pinkish white to red-purple, obovate to broadly obovate, 16–27mm, usually ciliate. Stamens 8, 20–35mm; anthers (including beak) 10–17mm. Fruit 10–20mm; capsule hairy at apex.

This species is extremely variable and a number of authors (see synonymy below) have recognized the differences at specific level. Hansen (184), however, considers the taxa poorly defined and has recognized varieties within *O. stellata*. This treatment is adopted here and three varieties are recorded from our area:

var. *stellata*

Stems with appressed hairs, not winged; calyx densely hairy, appendages with stellately-arranged hairs at the apex.

Bhutan: S–Phuntsholing, Sarbhag and Deothang districts, C–Tongsa district; **Darjeeling:** Ryang, Birik, Tista, Rungit, Kalimpong. In grassland and clearings in warm broad-leaved forest, 305–1650m. August–October.

var. *rostrata* (D. Don) C.Hansen; *O. rostrata* D. Don, *O. darjeelingensis* Giri & Nayar, *O. arunkumarensis* Nayar & Giri

Stems with appressed hairs, sometimes winged; calyx glabrous to sparsely hairy, appendages sparse or absent, often glabrous at the tip.

Bhutan: locality unknown; **Darjeeling:** terai. Wet places in grassland or subtropical forests, 150–1220m. December–January (34).

var. *crinita* (Naudin) C.Hansen; *O. crinita* Naudin, *O. sikkimensis* Craib. Nep: *Chulasi* (34).

Stems with dense, spreading or sometimes reflexed hairs, not winged; calyx appendages often dark purple, usually with stellately-arranged hairs at apex.

Bhutan: C–Punakha, Tongsa and Mongar districts, N–Upper Mo Chu district; **Darjeeling; Sikkim.** Open hillside, rock crevices, 1520–2290m. July–October.

2. *O. muralis* Naudin; *O. truncata* Arnott

Erect annual herb, 16–30cm; stems branched or not, ± villous, hairs spreading. Leaves ovate-elliptic, 2.2–4.3 x 1.1–2.1cm, acute, base rounded to cuneate, appressed-hairy on both surfaces, with 3 main veins; petiole 2–4mm. Inflorescence a terminal cluster of few to 12 flowers; pedicel up to 3mm. Calyx 3–4mm, tube

hairy, hairs in groups or on small flattened appendages; lobes 4 with shorter appendages between, triangular, 1 – 2mm, ciliate. Petals 4, purple, obovate, 2 – 4mm. Stamens 8, c 2.5mm; anthers 0.5 – 1mm. Fruit 4.5 – 6mm; capsule hairy at apex.

Darjeeling: terai. In moist localities, 150m. October.

3. *O. capitata* Walpers. Fig. 35a – c.

Perennial herb, 10 – 30cm; stems appressed-hairy. Leaves ovate to ovate-elliptic, 1 – 2.7 x 0.6 – 1.5cm, acute, base rounded to subcordate, appressed-hairy on both surfaces, subsessile. Inflorescence terminal, 2 – 3-flowered, flowers subsessile. Calyx 11 – 14mm, tube with or without ciliate appendages; lobes 4, triangular to ovate, 6 – 8mm, ciliate. Petals 4, lilac to purple, broad obovate, 12 – 14mm, ciliate at apex. Stamens 8, 12 – 14mm; anthers (including beak) 5 – 7mm. Fruit 6 – 8mm; capsule with bristly hairs at apex.

Bhutan: S – Chukka district, C – Thimphu, Punakha and Tashigang districts, N – Upper Mo Chu district. Open grassland or banks, in *Quercus griffithii* forest, 1525 – 3050m. July – September.

4. *O. chinensis* L.

Perennial or rarely annual herb up to c 1m; stems appressed-hairy. Leaves ovate-elliptic to narrowly oblong, 3 – 5 x 0.3 – 1cm, acute, base acute to rounded, usually sparsely hairy with appressed to somewhat spreading hairs, upper surface striate; petiole 1 – 2.5mm. Inflorescence a dense terminal cluster, usually 2 – 10-flowered; pedicel up to 3mm in fruit. Calyx 7 – 11mm, tube with or without flattened ciliate appendages; lobes 4, ovate or triangular, 6 – 7mm, ciliate. Petals 4, pink, red, purple or blue, rarely white or yellowish, broadly ovate, 12 – 17mm. Stamens 8, 8 – 9mm; anthers (including beak) 5 – 6mm. Fruit 4.5 – 8mm; capsule with some hairs at apex.

Darjeeling: Great Rungit Valley, Balasun; **West Bengal Duars:** Buxa. Open grasslands or open forest, dry or marshy ground, 150 – 1525m. October.

E Himalayan material all belongs to var. **chinensis**. Variable in leaf form (upper leaves at least, narrowly oblong), sometimes appearing very similar to *O. capitata*.

5. *O. nepalensis* Hooker. Sha: *Tekaling Shing*.

Shrub up to 2m; stems appressed-hairy, branched. Leaves narrowly ovate-oblong to elliptic, 4 – 13.5 x 1.3 – 4cm, acute, base cordate to rounded, appressed-hairy, upper surface striate; sessile or on petiole up to 3mm. Inflorescence mainly terminal, paniculate, few- to many-flowered; pedicel 1 – 3mm, lengthening in fruit. Calyx 15 – 18mm, tube with appressed ciliate appendages; lobes 5, oblong-ovate, 8 – 10mm, ciliate. Petals 5, pink, mauve or white, broadly obovate, 15 – 20mm, ciliate at apex. Stamens 10, 13 – 15mm; anthers (including beak) 7 – 10mm. Fruit 8 – 10mm; capsule hairy at apex.

Bhutan: C – Punakha district (Punakha, Rinchu, Wangdu Phodrang and Toiberong) and Tongsa district (Tongsa); **Darjeeling:** foothills and terai. On steep hillsides or among scrub, often near water, 610 – 1800m. July – September.

Material from Bhutan and Darjeeling is referred to the typical var. **nepalensis**.

6. *O. nutans* Clarke

Small shrub, 0.75 – 1.5m; stems appressed hairy. Leaves narrowly ovate-lanceolate, 2.7 – 5.7 x 0.4 – 1cm, acuminate, base rounded cuneate, veins 3 – 5; lower surface glabrous except for appressed hairs on veins, yellowish green; upper surface glabrous, conspicuously striate; petiole up to 3mm. Inflorescences terminal, 1 – 4-flowered; pedicel up to 11mm. Calyx 12 – 15mm, tube subglabrous; lobes 5, oblong-ovate, acuminate, 8 – 11mm, ciliate. Petals 5, pink, mauve or purple, obovate, 13 – 16mm, with few hairs at apex. Stamens 10, c 12mm; anthers (including beak) 4.5 – 6mm. Fruit subglobose, 4 – 7mm long; capsule hairy at apex.

Bhutan: C – Tongsa district (Tama and Tintibi); **Darjeeling:** Rongbe, Ryang, Birik, Tista, Darjeeling. Open rocky slopes, 305 – 1100m. October, December.

2. MELASTOMA L.

Shrubs. Leaves opposite; veins 5 – 7. Inflorescences terminal; flowers clustered. Calyx campanulate, covered with fimbriate-margined scale-like hairs; lobes 5, deciduous. Petals 5. Stamens 10, unequal; 5 long with elongated connective, 5 short; anthers dehiscing by apical pores. Ovary 5-celled, hairy at apex; style long, simple. Fruit enclosed in the persistent calyx tube, becoming pulpy within.

1. Young stem covered with appressed scale-like hairs, scabrous to touch; upper leaf surface with rows of white cells at base of very short (0.5mm or less) hairs

1. *M. malabathricum*

- + Young stem covered with shaggy spreading hairs, ± soft to touch; upper leaf surface usually without rows of white cells at base of longer (0.5 – 1mm) hairs

2. *M. normale*

1. *M. malabathricum* L. Nep: *Tulasi* (34).

Bushy shrub up to 4m. Stems densely appressed-hairy; hairs mostly flattened, scale-like, scabrous. Leaves elliptic to lanceolate-elliptic, 8 – 11.5 x 2.7 – 3.5cm, acute or shortly acuminate, base rounded, cuneate, veins 5; upper surface with rows of white cells at base of very short hairs, hairs 0.5mm or less, ± scabrous; lower surface shortly hairy, ± scabrous; petiole 7 – 15mm. Calyx 12 – 20mm, tube densely covered with appressed, fimbriate-margined, scale-like hairs; lobes triangular-oblong, 7 – 9mm. Petals mauve to rose-purple, obovate, 22 – 27mm. Fruit subglobose, truncate at apex, 8 – 10 x 8 – 9mm.

Darjeeling: terai and foothills. Roadsides, waste places, 305 – 1070m. April.

2. *M. normale* D. Don. Sha: *Tekaling Shing*; Nep: *Angerey*. Fig. 35h – 1.

Similar to *M. malabathricum*, but differing in its ± spreading stem hairs; hairs on upper leaf surface longer (0.5 – 1mm), soft to touch, and calyx lobes longer, usually 9 – 10mm long.

Bhutan: S – Samchi, Phuntsholing and Chukka districts, C – Tongsa, Mongar and Tashigang districts; **Darjeeling; West Bengal Duars:** Buxa. Among scrub and on forest margins, 305 – 1830m. December – June.

3. OXYSPORA A.DC.

Shrubs, often large. Leaves petiolate with main veins connected by many parallel secondary veins, veins prominent on lower surface. Inflorescence a long, lax panicle. Calyx 4-toothed. Petals 4. Stamens 8, unequal, 4 long, 4 short; anthers spurred or not, connective with or without appendage. Ovary inferior, 4-celled; style simple. Fruit a dry capsule with 8 prominent ribs.

1. Leaves with minute stellate hairs on veins on lower surface; petiole hairy

1. O. paniculata

+ Leaves glabrous; petiole glabrous **2. O. cernua**

1. O. paniculata (D. Don) DC. Sha: *Mizuma Laga*; Nep: *Tulasi* (34). Fig. 35f&g.

Shrub up to 2.5m. Leaves ovate to ovate-elliptic, 11.5 – 29 x 5 – 13.5cm, shortly acuminate, base rounded, rarely subcordate, margin obscurely dentate; upper surface glabrous, minutely tuberculate; lower surface stellate-hairy, mainly on veins; petiole 2.5 – 7cm, with tuft of hairs at top. Inflorescence drooping, c 20cm long, rachis terete. Calyx ± tubular, 5 – 7mm, stellate-hairy; teeth triangular, c 1mm long. Petals pink, ovate-oblong, c 1cm. Stamens up to 18mm long; long anthers 8 – 11mm, with small lump on connective near base; short anthers 3.5 – 4mm, with spur on connective. Style 8 – 10mm, curved at apex. Capsule ± ellipsoid, c 11 x 6mm.

Bhutan: S – Phuntsholing, Chukka and Gaylephug districts, C – Punakha, Mongar and Tashigang districts, N – Upper Mo, Chu and Upper Kuru Chu districts; **Darjeeling:** Lebong, Kurseong, Farseng, Sivoke, Badamtam, etc.. Among shrubs in subtropical forest, 680 – 2130m. August – October.

2. O. cernua (Roxb.) Triana

Similar to *O. paniculata*, but differs in having glabrous leaves and petioles; inflorescence rachis 4-angled, at least at base; anthers not spurred; capsule c 9 x 5mm.

Bhutan: S – Deothang district (above Samdrup Jongkhar); **Darjeeling.** Edge of ravine in hot jungle, 600m. ?October – November.

4. SONERILA Roxb.

Small herbs with or without distinct stems. Leaves opposite, petiolate. Inflorescences pedunculate; flowers few, often in scorpioid spikes. Calyx persistent, tube fused to ovary; lobes 3, triangular. Petals 3. Stamens 3, equal; anthers short or

attenuate at apex, connective without appendage. Ovary 3-celled; style simple, filiform. Fruit a capsule, dehiscent at apex.

1. Anthers less than 1mm; erect herb with slender stem **1. S. tenera**
 + Anthers 2.5mm or more; herbs with or without distinct stem 2
2. Stemless herb; calyx 5mm or less 3
 + Herb with distinct (but sometimes short) stem; calyx 6mm or more
2. S. maculata
3. Calyx c 3.5mm; petioles without rufous bristles at base; anthers c 3mm
3. S. kurzii
 + Calyx 4 – 5mm; petioles with rufous bristles at base; anthers c 4mm
4. S. khasiana

1. S. tenera Royle

Erect herb up to 14cm; stems slender, sometimes winged. Leaves ovate-elliptic, 1.4 – 3.5 x 1.2 – 1.8cm, cuneate, often attenuate at base, subentire to serrulate, with scattered, pilose hairs mainly on upper surface; petiole 2 – 8cm. Peduncle 1 – 3cm, sometimes branched. Calyx ± tubular, 4 – 5mm, with few spreading glandular hairs, lobes c 0.5mm. Petals rose-purple, ovate, c 1.8cm. Stamens c 2mm; anthers oblong-elliptic, 0.7 – 0.8mm. Capsule tubular-obconical, 5 – 7mm.

Sikkim: locality unknown (73).

2. S. maculata Roxb. Fig. 35m.

Herb 8 – 27cm, with distinct but sometimes short stem. Leaves elliptic to ovate, 2.6 – 6(–9.4) x 2 – 4.3cm, rounded to cordate and often unequal at base, serrulate, usually ciliate, pilose on both surfaces; petiole 0.8 – 3(–4.2)cm. Peduncle 2.5 – 4cm. Calyx ± tubular-oblong, c 7mm, with scattered pilose hairs, lobes c 1mm. Petals mauve, elliptic, c 5.5mm, ciliate. Stamens c 7mm; anthers c 4mm. Capsule obconical, c 8mm, obscurely ribbed.

Bhutan: locality unknown.

This record is based on a single specimen collected by Griffith.

3. S. kurzii Clarke

Small, almost stemless herb. Leaves ovate to suborbicular, 1.5 – 2.7 x 1.6 – 2.6cm, usually obtuse, base usually cordate, serrulate and ciliate, pilose; petiole 17 – 30mm. Peduncle 3.2 – 4.7cm. Calyx ± tubular, c 3.5mm, lobes 0.7mm. Petals rose-mauve, broadly elliptic, 5 – 7mm. Stamens c 7mm; anthers c 3mm. Capsule obconical, 3.5mm.

Darjeeling: Labdah, Rishap, Rongbe, Puttabong; **Sikkim:** Damthang. 1220 – 2440m. August – September.

4. S. khasiana Clarke

Small herb, stemless. Leaves ovate, 1.4 – 2 x 0.9 – 1.2cm, acute, truncate to cordate at base, serrulate and ciliate, with scattered pilose hairs mainly on upper surface; petiole 10 – 32mm, rufous bristles at base. Peduncle 1.6 – 5cm. Calyx \pm tubular, 4 – 5mm, lobes c 1mm. Petals mauve to red, obovate, acute, 7 – 8mm. Stamens 8 – 8.5mm; anthers 3.7 – 5.2mm. Capsule oblong.

Bhutan: S – Gayleghug district (54km from Gayleghug to Shemgang); **Sikkim/ Darjeeling:** locality unknown. 1650m. September.

5. SARCOPIRAMIS Wall.

Subglabrous herbs; stem 4-angled. Leaves opposite, 3 – 5-veined, petiolate. Inflorescences axillary and terminal; flowers in small clusters. Calyx 4-winged, tube glabrous; lobes 4. Petals 4, connate in lower part. Stamens 8, equal; connective with small lobes at base; anthers not spurred, each cell obtuse at apex with notch between cells. Ovary 4-celled; style enlarging at apex; stigma circular, papillose. Fruit a capsule, dehiscent by 4 valves at apex.

1. S. napalensis Wall. Fig. 35n – q.

Erect herb, 9 – 34cm. Leaves ovate to ovate-lanceolate, 2.5 – 9 x 0.9 – 4cm, base truncate to cuneate, margin serrulate, upper surface sparsely hairy, lower surface subglabrous; petiole 10 – 45mm. Calyx obpyramidal, c 4.5mm; lobes 1 – 1.5mm, deeply divided to somewhat fimbriate. Petals pink to rose-purple, ovate, 7mm. Stamens about half as long as petals. Fruit obpyramidal, c 7 x 5mm.

Bhutan: S – Chukka district, C – Tongsa/Bumthang (Yuto La), Mongar and Tashigang districts, N – Upper Mo Chu district; **Darjeeling; Sikkim.** In warm broad-leaved forest or *Rhododendron arboreum* scrub, 760 – 3350m. July – September.

6. PSEUDODISSOCHAETA Nayar

Shrub. Leaves opposite, petiolate or sessile, 5 – 7-nerved. Inflorescence a large terminal panicle. Calyx obscurely 4-lobed; tube fused to ovary. Petals 4. Stamens 8, equal; anthers dorsally spurred, ventrally auriculate, connective scarcely produced. Ovary 8-celled; style filiform. Fruit a berry; seeds numerous.

1. P. assamica (Clarke) Nayar

Shrub c 2m; stems with coarse, spreading hairs. Leaves ovate-oblong, 7.5 – 16 x 2.2 – 5cm, acuminate, base rounded, somewhat oblique, margin obscurely denticulate, upper surface glabrous, lower surface with some hairs on main veins; petiole 3 – 5mm, densely coarsely hairy. Calyx tubular-campanulate, 5.5 x 4mm. Petals mauve, \pm ovate, narrowing abruptly to obtuse apex, c 6.5mm. Stamens c 7mm; anthers c 4.5mm with short spur. Fruit subglobose, truncate at apex, (immature) c 5 x 4mm.

Bhutan: locality unknown.

This record is based on an unlocalised Griffith collection.

7. MEDINILLA Gaudichaud-Beaupré

Shrubs, erect or scandent, sometimes epiphytic. Leaves glabrous, somewhat fleshy. Inflorescence few-flowered, lateral or terminal cymes. Calyx obovoid; limb truncate, short. Petals 4, inserted in throat of calyx. Stamens 8, equal; filaments not geniculate; anthers incurved near apex, thickened at base and sometimes spurred. Ovary 4 – 5-celled. Berry crowned by calyx limb.

1. Leaves mostly petiolate, petiole up to 10mm; inflorescence 2 – 3cm

1. M. erythrophylla

+ Leaves sessile or subsessile; inflorescence up to 6cm long 2

2. Inflorescence 4 – 6cm; branchlets terete **2. M. himalayana**

+ Inflorescence 'short'; branchlets subquadrangular **3. M. pauciflora**

1. M. erythrophylla Lindley; *M. rubicunda* sensu Clarke. Dz: *Bogitenga*.

Shrub, often epiphytic, 1 – 2m. Leaves elliptic, 6 – 13 x 2 – 6cm, acuminate, base cuneate or rounded-cuneate; petiole up to 10mm. Inflorescence axillary, 3 – 5-flowered, 2 – 3cm. Calyx 3 – 4mm, limb c 1mm. Petals pink, ± oblong, acuminate, c 10mm. Stamens c 10mm; anthers 4.5 – 5.5mm, with short spur. Berry globose, c 7mm, blackish.

Bhutan: S – Deothang district (117); **Darjeeling:** Tista; **Sikkim:** Gangtok, Yankeung; **W. Bengal Duars:** Buxa. Broad-leaved forests, 550 – 1520m. August.

2. M. himalayana Hook.f. Fig. 35e.

Shrub, often epiphytic, 0.75 – 1.25m. Leaves sessile or subsessile, elliptic, 5.8 – 12 x 2.1 – 4.5cm, acuminate, base cuneate or rounded-cuneate, often paler on lower surface, with 3 – 5 prominent veins. Inflorescence axillary or terminal, trichotomous, usually 5 – 7-flowered, 4 – 6cm. Calyx 3 – 4mm; limb very short, c 1mm, truncate. Petals red or pink, oblong, acuminate, c 14 x 5mm. Stamens c 12mm, inserted on throat of calyx; anthers c 6.5mm, with short, blunt spur at base. Style c $\frac{3}{4}$ length of petals; stigma capitate. Berry globose, truncate at apex, c 6 x 6mm, red.

Bhutan: S – Phuntsholing district (above Rinchening); **Darjeeling:** above Lopchu, Dhobi Jhora, Ghoom. Subtropical forest, 760 – 2280m. July – August.

3. M. pauciflora Hook.f.

Differs from *M. himalayana* in its subquadrangular (not terete), short branchlets and few-flowered cymes.

Darjeeling: Rungit Valley (34).

Family 135. RHIZOPHORACEAE

by R. A. Clement

Trees or shrubs. Leaves simple, opposite, entire or serrulate near apex, glabrous, petiolate; stipules interpetiolar, caducous. Flowers bisexual, actinomorphic, in dense, axillary cymes. Calyx 5–8-lobed, tube adnate to ovary. Petals 5–8. Stamens twice number of calyx lobes; anthers 4-locular, dehiscing by a valve. Ovary inferior, 1-locular. Styles connate; stigmas 4. Fruit subglobose. Seeds 1 – few.

1. CARALLIA Roxb.

Description as for Rhizophoraceae.

1. *C. brachiata* (Loureiro) Merrill; *C. integerrima* DC., *C. lucida* Roxb. Nep: *Palamkath* (34). Fig. 35r – u.

Evergreen tree, up to 10m. Leaves coriaceous, oblong-elliptic, 9.5 – 22 x 4.1 – 9.2cm, base cuneate, apex shortly acuminate; petiole 7 – 12mm. Flowers in bracteate clusters, subsessile. Peduncle 1.7 – 2.5cm, branched near apex. Calyx obconical, 5 – 6mm; lobes triangular, 1.7 – 2mm. Petals white, ± obovate, c 2mm, fimbriate at apex. Fruit c 5 x 5mm.

Bhutan: S – Sarbhang district (above Jhogi Dhanra); **Darjeeling:** foothills and terai, e.g. Tista Valley, Dulka Jhar. Subtropical and terai forests, 150 – 760m. March.

Produces useful timber (48).

Family 136. COMBRETACEAE

by R. A. Clement

Trees, shrubs (often climbing) or subshrubs. Leaves alternate, opposite or whorled, simple, usually entire, petiolate, sometimes with glands at base of lamina or on petiole; stipules absent. Flowers in spikes, often arranged as a panicle, or in globose heads, bisexual, upper flowers sometimes male. Calyx 4- or 5-lobed; tube adnate to ovary, upper part breaking off after anthesis. Petals 4 or 5 or absent. Stamens twice number of calyx lobes; anthers usually versatile. Disc present or absent. Ovary inferior, 1-celled; style simple. Fruit indehiscent or dehiscent, 1-seeded.

- | | |
|--------------------------------|---|
| 1. Trees; petals absent | 2 |
| + Shrubs; petals present | 3 |

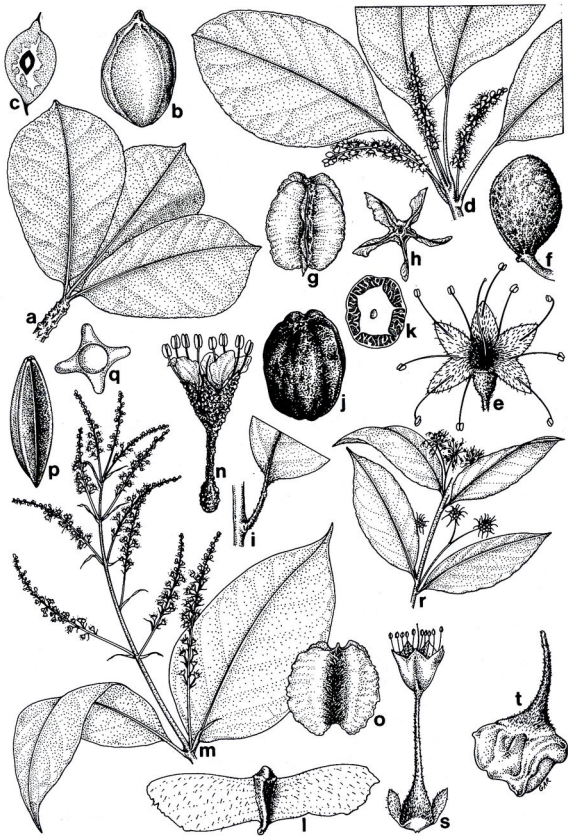
2. Leaves 8cm or more; flowers in spikes **1. Terminalia**
 + Leaves 7cm or less; flowers in small globose heads **4. Anogeissus**
3. Flowers less than 1cm, petals very small, white or yellowish; fruit with 4 or 5 wings **2. Combretum**
 + Flowers more than 7cm; petals showy, crimson; fruit 5-angled **3. Quisqualis**

1. TERMINALIA L.

Deciduous or semi-evergreen trees; trunk usually buttressed. Leaves alternate or subopposite, often clustered towards ends of branches, entire, crenulate or serrulate, usually with a pair of glands at base of lamina or on petiole. Inflorescence of spikes sometimes arranged as panicles. Flowers often with strong, unpleasant smell, upper flowers in spike sometimes male. Calyx 5-lobed, upper part cup- or funnel-shaped above constriction; lobes triangular. Petals absent. Fruit a drupe or 2- or 5-winged nut.

1. Petiole with prominent stalked glands near base of lamina; fruit a nut, conspicuously winged 2
 + Petiole with inconspicuous, usually sessile, glands; fruit a drupe, sometimes ridged 3
2. Fruit 2-winged, c 0.4 x 1.4cm; calyx subglabrous above; flower spikes usually pink **5. T. myriocarpa**
 + Fruit (4 -)5-winged, c 5 x 4.8cm; calyx pubescent above; flower spikes white or yellowish green **6. T. alata**
3. Petiole 2 - 8cm, glands, when present, in middle or upper part near base of lamina; fruit pubescent **1. T. bellirica**
 + Petiole 3cm or less, glands, when present, in upper part or on base of lamina; fruit glabrous 4
4. Leaves obovate, base narrow, cordate or truncate; branches whorled on trunk and spreading horizontally **2. T. catappa**
 + Leaves oblong-elliptic to elliptic, base rounded to cuneate 5

FIG. 36. *Combretaceae*. a - c, *Terminalia catappa*: a, leaves; b, fruit; c, l.s. fruit. d - f, *Terminalia bellirica*: d, leaves and inflorescences; e, partly dissected flower; f, fruit. g & h, *Terminalia alata*: g, fruit; h, t.s. fruit. i - k, *Terminalia chebula*: i, leaf base and petiole with glands; j, fruit; k, t.s. fruit. l, *Terminalia myriocarpa*: fruit. m - o, *Combretum flagrocarpum*: m, flowering shoot; n, flower; o, fruit. p & q, *Combretum acuminatum*: p, fruit; q, t.s. fruit. r - t, *Anogeissus acuminata*: r, flowering and fruiting branch; s, flower; t, fruit. Scale: a, d x ¼; m x 1/3; b, c, g, h, k, o, r x ½; f, j, p x ¾; i, q x 1; e, l, x 4; n, s x 6; t x 7. Drawn by G. Rodrigues.



5. Leaves pubescent at least on veins on lower surface; fruit subglobose
 + Leaves glabrous; fruit ellipsoid, rarely subglobose **3. T. chebula**
4. T. citrina

1. T. bellirica (Gaertner) Roxb. Dz, Sha, Med: *Baru, Baroo*; Nep: *Barra* (34). Fig. 36d - f.

Large semi-evergreen tree, 20m or more. Leaves clustered towards ends of branches, coriaceous, elliptic to obovate, 9.5 - 19.7 x 6.2 - 10.8cm, acute or very shortly acuminate, base cuneate, margin subentire, papillose when dry, glabrescent, initially sparsely pilose on upper surface and veins of lower surface; petiole 2 - 8cm, glands inconspicuous, usually present mid-way down petiole. Spikes 4 - 12cm, in axils of upper leaves. Calyx 4.5 - 5.5mm, pubescent, broadly cup-shaped above constriction; lobes c 1.2mm. Disc densely hairy. Fruit a drupe, subglobose to obovoid, 2.5 - 3.3 x 1.7 - 2.3cm, pubescent.

Bhutan: S - Phuntsholing district (Phuntsholing, cultivated) and Sarbhong district (Sarbhong), C - Punakha district (Punakha) and Tashigang district (Tashigang Dzong); **Darjeeling:** common, Siliguri, Tista, etc.. Dry subtropical forests, 200 - 1372m. March, May - June.

Timber useful but not durable (48). Sometimes cultivated; oil from fruit (*Belleric Myrobalan*) is used medicinally (126).

2. T. catappa L.; *T. procera* Roxb. Nep: *Badam*; Eng: *Indian Almond*. Fig. 36a - c.

Large tree, up to 25m. Leaves clustered towards ends of branches, obovate, 22 - 25.7 x 8.5 - 9.5cm, obtuse or acute, base narrowly cordate or sometimes truncate, margin subentire to obscurely crenate, usually glabrous when mature; petiole 0.5 - 2.5cm, glands usually present near apex. Spikes axillary, 8 - 12cm; upper flowers male. Calyx c 4.5mm, pubescent to subglabrous; lobes c 1.2mm. Disc densely hairy. Fruit a drupe, ovoid to ellipsoid, 3.5 - 4.4 x 2.6 - 3.4cm, laterally compressed, 2-ridged, glabrous when mature.

Darjeeling. Cultivated in subtropical zone, 610m.

A valuable firewood crop for the humid tropics (130); fruit yields an oil used medicinally (126).

3. T. chebula Retzius. Dz, Sha, Med: *Aru, Aroo*; Nep: *Harra* (34). Fig. 36i - k.

Deciduous tree to 25m; young growth with reddish brown indumentum. Leaves coriaceous, ovate-oblong or elliptic, 8 - 20 x 6 - 11cm, usually acute, base rounded to cuneate, sometimes slightly unequal, margin entire, glabrescent, often with hairs on margin or veins; petiole 2 - 3cm, bearing 2 inconspicuous glands near apex. Spikes axillary or terminal, 5 - 14cm, paniced; rachis with reddish hairs. Calyx 3 - 3.5mm, glabrous; lobes c 0.5mm. Disc densely hairy. Fruit a drupe, smooth or with 5 ridges, subglobose, 2.8 - 4.5 x 1.5 - 2.5cm, glabrous.

Bhutan: S - Chukka district (Bunakha) and Sarbhong district (Longa Khola);

Darjeeling: common. Subtropical and terai forests, often near rivers, 300 – 1981m. April – June.

The most important member of the genus in the Indian subcontinent. Dried fruit used medicinally (*Chebulic Myrobalan*), for tanning, and as a dye (126).

4. *T. citrina* (Gaertner) Roxb. Sha: *Aaroo*.

Similar to *T. chebula* but leaves oblong-elliptic to elliptic, apex acuminate, glabrous when mature; fruit ellipsoid, rarely subglobose, 2 – 3 x 1 – 2cm.

Bhutan: S – Chukka district (Marichong) and Gaylephug district (117);

Darjeeling: not common. 270 – 1050m.

Difficult to distinguish in the herbarium, *T. citrina* is said to have a straighter stem, brighter foliage and narrower fruits than *T. chebula*. Decoction of fruits taken for coughs and colds.

5. *T. myriocarpa* Heurck & Mueller. Nep: *Pani Saj* (34), *Panisaj*. Fig. 36 l.

Semi-evergreen tree up to 45m, young growth reddish pubescent. Leaves coriaceous, oblong to oblong-elliptic, 8.5 – 23.5 x 3.4 – 11cm, acute or shortly acuminate, base often slightly unequal, truncate to subcordate, margin subentire to serrulate, glabrous, sometimes pubescent on lower surface; petiole 5 – 15mm, glands stalked, prominent. Spikes paniced, 10 – 17.5cm, densely flowered, usually pink. Calyx c 3mm, pubescent below, subglabrous above constriction; lobes c 1mm. Disc glabrous or sparsely hairy. Fruit a nut, 0.3 – 0.4 x 1.3 – 1.5cm, 2-winged, hairy, yellow or yellowish brown.

Bhutan: S – Phuntsholing (cultivated), Chukka and Deothang districts;

Darjeeling: common but often felled for timber. Subtropical forest, 305 – 1219m. October – November.

Timber durable, used for house-building. Planted in S Bhutan (as at Phuntsholing) up to 1000m.

6. *T. alata* Roth; *T. tomentosa* (Roxb.) Wight & Arnott, *T. crenulata* sensu Cowan & Cowan non Roth. Nep: *Paka Saj* (34). Fig. 36g&h.

Large tree up to 30m, young growth reddish pubescent. Leaves oblong to ovate-oblong, 13 – 23 x 4.5 – 10.6cm, acute to acuminate, base clearly unequal, each side ± truncate, margin subentire, tomentose to subglabrous; petiole 6 – 13mm, bearing prominent, stalked glands at or near apex. Spikes paniced, 5 – 12cm, white or yellowish green, often with galls. Calyx 2 – 3mm, pubescent-tomentose; lobes 0.7 – 1mm. Disc densely hairy. Fruit a nut, c 5 x 4.8cm, (4–)5-winged, glabrous, usually reddish brown when mature.

Darjeeling: foothills and terai, common, e.g. Mongpu, Tista, Selim, Pankabari. Subtropical mixed deciduous forest, 240 – 914m. June – August.

A valuable timber species on account of its hard, durable wood.

2. COMBRETUM Loefling

Climbing shrubs or decumbent subshrub. Leaves opposite or in whorls of 3, rarely alternate, often scaly; petiole without glands. Spikes often arranged as a panicle, terminal or in upper leaf axils. Flowers bisexual. Calyx 4- or 5-lobed, with upper part cup- or funnel-shaped, often scaly. Petals 4 or 5, small. Disk hairy, rarely absent. Fruit with 4 or 5 wings or longitudinal ridges, dry, usually indehiscent.

1. Subshrub, up to 0.4m; leaves subacute or obtuse at apex, lower alternate
6. C. nanum
 - + Large climbing shrub up to 4m; leaves acuminate, opposite or in whorls of 3
2
2. Flowers 5-merous; fruit 5-winged **1. C. decandrum**
 - + Flowers 4-merous; fruit 4-winged or ridged 3
3. Leaves obovate, narrowly subcordate at base, mostly in whorls of 3; petiole 2 – 5mm **5. C. griffithii**
 - + Leaves elliptic, elliptic-oblong or ovate-elliptic, rarely somewhat obovate, cuneate to rounded at base, opposite; petiole 4mm or more 4
4. Fruit 4-ridged, 1cm or less wide; leaf-veins closely spaced, ± parallel
7. C. acuminatum
 - + Fruit 4-winged, c 2.5 – 3.5cm wide; leaf-veins not closely spaced, not parallel
5
5. Leaves thin-textured, upper surface papillose when dry but lacking peltate scales, lower surface with tufts of hair in main vein axils **3. C. wallichii**
 - + Leaves coriaceous, upper surface papillose or not when dry, with brown or white peltate scales, lower surface usually without tufts of hair in vein axils
6
6. Young stems pubescent; leaf veins pubescent, at least on upper surface; fruit with lacinate scales (2 – 4mm) between wings **2. C. flagrocarpum**
 - + Young stems glabrous, with scales; leaves glabrous, with scales; fruit with appressed, peltate scales between wings **4. C. punctatum**

1. C. decandrum Roxb.; *C. roxburghii* Sprengel. Nep: *Kali Lahara* (34).

Evergreen climbing shrub; branches subscaudent or pendent; bark reddish brown, somewhat flaking. Leaves oblong-elliptic to obovate, 6.5-15.5 x 3.1 – 6.8cm, acuminate, base rounded to rounded-truncate, glabrous with pilose veins on lower surface; leaves among spikes, creamy-white, conspicuous; petiole 2 – 12mm. Spikes short, dense, 1.5 – 7.5cm, arranged as panicle, densely villous-pubescent. Calyx 5 – 6mm, broadly cup-shaped above constriction, pubescent or villous; lobes

5, very narrowly triangular, 1.5 – 2mm. Petals 5, oblong, acute, densely hairy, slightly exceeding calyx lobes. Fruit c 25 x 15mm, 5-winged, mid-brown.

Darjeeling: common, e.g. Pankabari, Sivoke, Tista. Subtropical and terai forests, 150 – 1000m. December-February.

2. *C. flagrocarpum* Clarke. Sha: *Khangroo*; Nep: *Sheti Lahara*. Fig. 36m – o.

Large climbing shrub, young growth reddish brown pubescent. Leaves coriaceous, elliptic, oblong-elliptic or ovate-elliptic, 9.5 – 20 x 3.7 – 9.5cm, shortly acuminate, base rounded to cuneate, margin often pilose, main veins pubescent, upper surface with scattered, brownish, peltate scales, lower surface with similar scales and sessile glands; petiole 5 – 10mm. Spikes in upper leaf axils or grouped at ends of branches, 4 – 10.5cm. Calyx 4.5 – 6mm, broadly funnel-shaped above constriction, densely glandular; lobes 4, 0.7 – 1.5mm. Petals 4, obovate, c 1½ x as long as calyx lobes, white to pink. Fruit c 3 x 3.5cm, 4-winged, red or dark brown with lacinate scales 2 – 4mm long between wings.

Bhutan: S – Phuntsholing, Chukka, Sarbhang and Gaylegphug districts, C – Mongar district; **Darjeeling:** common. Subtropical and warm broad-leaved forests, 150 – 1550m. May – August.

3. *C. wallichii* DC.

Climbing shrub. Leaves elliptic to elliptic-oblong, rarely somewhat obovate, 5.5 – 11 x 3 – 6.8cm, acute to acuminate, base cuneate to rounded, papillose when dry, upper surface glabrous; lower surface with scattered, whitish scales, some hairs in tufts in vein axils and sometimes on veins; petiole 5 – 8mm. Spikes 7.5 – 10cm, in upper leaf axils. Calyx 5 – 5.5mm, broadly funnel-shaped above constriction, scattered peltate-scaly; lobes 4, narrowing to fine tip, 1 – 1.5mm. Petals 4, narrowly obovate, ± equalling calyx lobes. Fruit c 2.5 x 3.5cm, 4-winged, glandular and with lacinate, sometimes reduced scales between wings.

Bhutan: C – Punakha district (Wangdu Phodrang and Neptengkha) and Mongar district (Lhuntse); **Darjeeling:** foothills; **Sikkim:** Lachen, Namchi, Yoksam, Dentam, Kulhait. Waste places, old cultivation, etc., 1219 – 2438m. May.

4. *C. punctatum* Blume; *C. squamosum* Roxb.

Large climbing shrub, c 4m; young stems densely peltate-scaly. Leaves coriaceous, elliptic to oblong-elliptic, 3.5 – 15.5 x 7 – 9cm, usually abruptly shortly acuminate, base rounded to cuneate, punctate when dry, upper leaves often narrower, glabrous, with dense peltate scales; petiole 10 – 15mm. Spikes sometimes arranged in form of small panicle, 3 – 5.5cm, terminal or in upper leaf axils, densely scaly. Calyx c 7mm, ± funnel-shaped above constriction; lobes 4, narrowly triangular, c 1mm. Petals 4, spatulate, ± equal to calyx. Fruit c 3 x 2.5cm, 4-winged, yellow-brown, with some peltate scales between wings.

Bhutan: S – Samchi district (Kana Bharti Khola) and Sarbhang district (Phipsoo Khola); **Darjeeling:** Siliguri, Darjeeling. Terai forest especially near rivers, 120 – 450m. October.

The above description refers to subsp. *squamosum* (G. Don) Exell the only subspecies in this area.

5. *C. griffithii* Heurck & Mueller; *C. dasystachyum* Kurz. Nep: *Saje Lahara*.

Climbing shrub. Leaves opposite or in whorls of 3 at base of inflorescence, obovate or rarely elliptic, 9–22 x 3.5–9cm, acuminate, narrowed and ± cordate at base, minutely papillose above; lower surface with scattered brown scales and few hairs on veins; petiole 2–5mm. Spikes 4–5.5cm, in axils of upper leaves; bracteoles linear-lanceolate, 3.5–6mm. Calyx c 3.5mm, funnel-shaped above constriction, peltate-scaly; lobes 4, c 1.2mm. Petals 4, obovate, slightly longer than or ± equalling calyx lobes, yellowish. Fruit c 2.8 x 2.8cm, 4-winged, yellow-brown to mid-brown, with scattered peltate scales between wings.

Bhutan: S – Samchi district (Chenari Khola) and Gaylegphug district (Karai Khola and Aie bridge); **West Bengal Duars:** Buxa. Subtropical forest, 457–510m. March.

6. *C. nanum* D. Don

Decumbent undershrub, up to 0.4m. Leaves alternate or opposite, elliptic to obovate-elliptic, 4–8.5 x 1.8–5.5cm, acute or slightly emarginate, base cuneate, minutely papillose when dry, glabrous, with scattered peltate scales when young; petiole 3–9mm. Spikes terminal or axillary, up to 8cm, pubescent. Calyx 5–7mm, cup-shaped above constriction, pubescent; lobes 4, 1.5–2mm, deflexed. Petals 4, obovate, 1½ x length of calyx lobes, yellowish. Fruit c 3 x 2.5cm, 4-winged, yellow-brown, glabrous or puberulent between wings.

Darjeeling: terai. Stony terai, 305m. March.

7. *C. acuminatum* Roxb. Fig. 36p&q.

Climbing shrub, branches glabrous. Leaves elliptic to oblong-elliptic, 9.5–15 x 4.2–7cm, acuminate, base cuneate or rounded, pubescent on veins of lower surface otherwise glabrous, scaly on both surfaces; petiole 4–8mm, glabrous, scaly. Spikes paniced, 3.5–5cm. Calyx c 3.8mm, cup-shaped above constriction, glabrous, densely scaly; lobes 4, c 1.4mm. Disc absent. Petals 4, narrowly obovate, shorter or longer than calyx lobes, yellowish. Fruit narrowly elliptic, c 4 x 1cm, usually longitudinally 4-ridged, brown.

Bhutan: locality unknown.

Somewhat doubtfully recorded from Bhutan on the basis of a Griffith collection, which may be mislabelled.

3. QUISQUALIS L.

Shrub. Leaves opposite, entire. Inflorescence a short, axillary or terminal spike. Flowers bisexual. Calyx 5-lobed; tube long and slender. Petals 5, conspicuous. Stamens 10, shorter than petals. Style long, slender, adnate to calyx tube. Fruit sharply 5-angled, dry, dehiscent.

1. *Q. indica* L.

Large climbing shrub, 3–4m. Leaves oblong to elliptic, 5–10 x 2.7–5.3cm, shortly acuminate, base rounded to truncate, upper surface glabrous except for veins, lower surface ± densely to sparsely pilose, sometimes also with sessile glands. Spikes 7–8cm. Calyx tubular, 6–6.5cm, tomentose with sessile glands; lobes c 2mm, deflexed. Petals ± oblong, c 1.5 x 0.6cm, crimson. Fruit ellipsoid, c 25 x 12mm, glabrous, blackish.

Bhutan: S – Phuntsholing district (Phuntsholing). Cultivated in garden, 200m. May.

Cultivated as an ornamental.

4. ANOGEISSUS (DC.) Guillemain & Perrottet

Tree. Leaves opposite or subopposite, entire. Flowers in dense globose heads, axillary and terminal, pedunculate. Calyx tube attenuate above ovary; limb cup-shaped, 5-lobed, deciduous. Petals absent. Stamens 10; anthers cordate, versatile. Fruits compressed, 2-winged, in dense heads.

1. *A. acuminata* (DC.) Guillemain & Perrottet. Fig. 36r – t.

Deciduous tree up to c 20m. Leaves narrowly ovate to elliptic, 5.5–7 x 1.8–1.9cm, acute, base rounded cuneate, sericeous especially on lower surface; petiole 3–5mm. Inflorescence solitary or rarely with 2 heads, c 12mm diameter; peduncle c 6mm. Calyx c 3.5mm, rusty pubescent-villous below, glabrous above; lobes c 0.6mm. Fruit ovate, c 4 x 5mm, with jagged lateral wing and persistent calyx tube forming beak c 5mm.

Darjeeling: locality unknown.

This record refers to var. **acuminata** and is based on a single collection from Darjeeling.

Family 137. ONAGRACEAE

by P.C. Hoch; *Circaea* D.L. Boufford

Perennial or annual herbs (in Bhutan), some woody at base, rarely aquatic. Leaves opposite or spiral, simple, entire or toothed; stipules absent or reduced. Flowers actinomorphic or zygomorphic, 2- or 4-merous, rarely 5–7-merous, bisexual, solitary or in axils of leaves, or in racemes, often subtended by reduced bracts. Floral tube short or absent. Sepals 2–5(–7), valvate. Petals 2–5(–7), free. Stamens as many as or twice as many as the sepals; anthers versatile or sometimes nearly basifixed. Ovary inferior, 1–5-celled; style simple; stigma lobed, clavate, or globose. Fruit a capsule, berry, or nut, loculicidal or indehiscent; seeds smooth or variously papillose, with or without an apical tuft of hairs (coma).

1. Sepals 2; fruit bristly with hooked hairs, 1-seeded 2. **Circaea**
 + Sepals 4 – 5; fruit not bristly with hooked hairs, many-seeded 2
2. Sepals persistent after anthesis; petals yellow; floral tube absent
 1. Ludwigia
 + Sepals deciduous after anthesis; petals pink, white, or yellow; floral tube present, or if absent then petals pink 3
3. Seeds with an apical tuft of hairs; capsules 1 – 2.5mm broad, not conspicuously ribbed; floral tube 0 – 3mm long 3. **Epilobium**
 + Seeds without an apical tuft of hairs; capsules 3 – 15mm broad, conspicuously ribbed; floral tube 4 – 130mm long 4. **Oenothera**

1. LUDWIGIA L.

Erect, perennial or annual herbs or shrubs of wet places. Leaves spiral or opposite, mostly entire. Flowers actinomorphic, borne singly or clustered, axillary, or in inflorescence; floral parts epigynous without a floral tube. Sepals 3 – 5(–7), persistent in fruit. Petals as many as sepals or absent, entire, yellow or white. Stamens as many as, or twice as many as sepals. Stigma entire, subglobose. Ovary 4 – 5-celled. Fruit an obovoid to shortly cylindrical capsule, irregularly dehiscent; seeds numerous, small, rounded or elongate, free or embedded in woody endocarp.

1. Stamens twice as many as sepals 2
 + Stamens as many as sepals, very rarely more in some flowers 3
2. Petals 5 – 17mm; seeds in several rows, free (not embedded in endocarp)
 1. L. octovalvis
 + Petals 2 – 3mm; seeds in lower 3/4 of capsule in one row and embedded in endocarp 4. **L. hyssopifolia**
3. Petals elliptic, 1 – 3 x 0.7 – 2mm; capsule terete; seeds 0.3 – 0.5 x 0.2 – 0.25mm, in several rows in each cell of capsule 2. **L. perennis**
 + Petals narrowly spatulate, 1.3 – 2.2 x 0.4 – 0.9mm; capsule ± 4-angled; seeds 0.5 – 0.6 x 0.3mm, in one row in each cell of capsule 3. **L. prostrata**

FIG. 37. **Onagraceae**. a – e, *Epilobium conspersum*: a, flowering stem; b, leaf; c, flower; d, capsule; e, seed. f – h, *Circaea repens*: f, flowering stem; g, flower; h, fruit. i – k, *Oenothera biennis*: i, flowering stem; j, dissected stamens and style; k, capsule. l – q, *Ludwigia hyssopifolia*: l, flowering and fruiting stem; m, flower; n, dehiscent capsule; o, undehiscent segment of woody endocarp; p, dehiscent segment of woody endocarp; q, seed. Scale: a x 1/2; f x 1/2; i x 3/8; l x 3/4; b, d x 1; c x 1/4; j x 1/2; e, k x 2; n x 3; h, m, o, p, q x 6; g x 10. Drawn by M. Bates.



1. *L. octovalvis* (Jacquemont) Raven; *Oenothera octovalvis* Jacquemont, *Jussiaea octovalvis* (Jacquemont) Swartz, *Jussiaea suffruticosa* L., non *L. suffruticosa* Walter

Robust, much-branched perennial herb, sometimes woody at the base, to 4m tall, subglabrous or with appressed or spreading pubescence. Leaves sublinear to subovate, 2 – 14.5 x 0.4 – 4cm, apex attenuate, base cuneate, submarginal vein distinct; petioles to 10mm. Sepals 4, ovate to lanceolate, 6 – 15 x 1 – 7.5mm. Petals yellow, broadly obovate or cuneate, emarginate, 5 – 17 x 4 – 17mm. Stamens 8, episepalous ones longer; anthers shedding pollen directly on stigma. Style 1.5 – 3.5mm. Capsules 1.7 – 4.5cm, terete, readily and irregularly loculicidal; fruiting pedicel to 10mm. Seeds in several rows in each cell, free, brown, rounded, 0.6 – 0.75 x 0.5 – 0.7mm including the inflated raphe which is equal in size to the body of the seed and evenly transversely ridged.

Bhutan: S – Gayleghug district (Gayleghug, 117); **Darjeeling:** Jogikhola, Darjeeling. Moist places, often near cultivation, 300 – 1500m. January – March.

2. *L. perennis* L.; *L. parviflora* Roxb., *Jussiaea perennis* (L.) Brenan

Annual herb to 1m, subglabrous or puberulent on younger parts. Leaves narrowly elliptic to lanceolate, 1 – 11 x 0.3 – 2.7cm, subacute, base narrowly cuneate; petioles 2 – 15mm, winged. Sepals 4, rarely 5, triangular, 2 – 3.5 x 0.7 – 1.8mm, glabrous or puberulent. Petals yellow, elliptic, 1 – 3 x 0.7 – 2mm. Stamens as many as sepals, rarely more. Style 0.7 – 1.5mm. Capsules glabrous or puberulent, 3 – 16(–19)mm, terete, readily and irregularly loculicidal, sessile or on a pedicel to 6mm, often nodding. Seeds in several rows in each cell, free, brown, with fine lines, ellipsoid-rounded, 0.3 – 0.5 x 0.2 – 0.25mm, with narrow, inconspicuous raphe.

Bhutan: S – Phuntsholing district (Phuntsholing, 117); **Darjeeling:** Siliguri, Kalimpong. Wet places, on flood plains and in rice fields, up to 1500m. September – January.

3. *L. prostrata* Roxb.

Annual herb 10 – 60cm, subglabrous, often reddish-tinged. Leaves elliptic or narrowly so, 1 – 13 x 0.3 – 2.7cm, acute, base narrowly cuneate, glabrous or with few hairs on veins; petioles 4 – 25mm. Sepals 4, deltoid, 1.3 – 2.5 x 0.7 – 1.1mm, glabrous. Petals yellow, narrowly spatulate, 1.3 – 2.2 x 0.4 – 0.9mm. Stamens 4. Style c 1mm. Capsule glabrous, 12 – 22mm, ± 4-angled, readily and irregularly loculicidal; seeds showing plainly as indentations in walls at maturity, subsessile. Seeds in one row in each cell, free, pale brown, speckled or with darker transverse stripes, ovoid, 0.5 – 0.6 x 0.3mm; raphe narrow.

Bhutan: S – Gayleghug district (Gayleghug, 117); **Darjeeling:** Sukna. Wet places, on river flood-plains and in rice fields in terai, 200 – 800m.

4. *L. hyssopifolia* (G. Don) Exell; *Jussiaea hyssopifolia* G. Don, *J. fissendocarpa* Haines. Fig. 37k – p.

Annual herb to 3m, sometimes woody at base, puberulent on young growth and inflorescence. Leaves lanceolate, 1 – 9 x 0.2 – 3 cm, acuminate, base narrowly cuneate; petioles 2.5 – 18mm. Sepals 4, lanceolate, 2 – 4 x 0.7 – 1.2mm, puberulent. Petals yellow, fading orange-yellow, elliptic, 2 – 3 x 1 – 2mm. Stamens 8, the episepalous set longer. Style 1 – 1.5mm. Capsule thin-walled, finely puberulent, 1.5 – 3cm, subterete, enlarged in upper part, sessile. Lower seeds in one row in each cell, brown, oblong, 0.7 – 0.85mm, each firmly embedded in a segment of relatively hard endocarp; seeds in upper inflated portion of capsule in several rows, light brown, ovoid, 0.35 – 0.5mm, free (not embedded).

Bhutan: S – Samchi district (Daina Khola) and Sarbhang district (Dol Khola). Wet weedy places, 360 – 410m. January – March.

2. CIRCAEA L.

by D.E. Boufford

Perennial herbs with tuberous-tipped stolons. Leaves opposite, subtire to sharply serrate, subglabrous to pubescent; petioles sparsely to densely pubescent. Inflorescence a panicle of racemes; flowers opening before elongation of raceme axis and clustered at apex of raceme on erect or ascending pedicels, or opening after raceme elongates and then loosely spaced on spreading pedicels. Sepals 2. Petals 2, notched at apex or subtire to emarginate. Stamens 2, opposite sepals. Ovary (in Bhutan) 1-celled; style 1, stigma 2-lobed. Fruit an indehiscent 1-seeded capsule covered with stiff hooked hairs.

1. Flowers on spreading pedicels, opening after raceme elongates and loosely spaced along raceme axis; pedicels glandular-pubescent..... **1. *C. repens***
 - + Flowers on erect or ascending pedicels, opening before raceme elongates and clustered at raceme axis; pedicels glabrous, rarely with a few glandular hairs
- 2
2. Leaves subtire, opaque, deep green; petals distinctly cleft at apex; ovaries pubescent at anthesis
 - + Leaves prominently serrate or dentate, translucent, pale green; petals emarginate or barely notched; ovaries glabrous at anthesis **2a. *C. alpina* subsp. *imaicola***
 - 2b. *C. alpina* subsp. *micrantha***

1. *C. repens* Ascherson & Magnus. Fig. 37e – g.

Herb to 1m; stems pubescent with falcately recurved hairs. Leaves narrowly to broadly ovate, rarely suborbicular, 1.8 – 9 x 1.5 – 5cm, acute to acuminate, base rounded or less often cordate or cuneate, margin minutely to prominently denticulate, deep green or reddish, opaque; petioles 1 – 5.5cm. Inflorescence and pedicels pubescent with stipitate-glandular hairs. Petals 1 – 2.3 x 1 – 2.9mm, white or pink,

cleft more than half their length. Fruit narrowly to broadly clavate, 2.5 – 4.2 x 0.9 – 1.6 mm, covered with stiff, translucent, hooked hairs.

Bhutan: S – Chukka district, C – Thimphu and Punakha districts, N – Upper Kuru Chu district; **Darjeeling:** Garibans, Darjeeling; **Sikkim:** Lachen. In shade of moist to wet temperate forests, 1500 – 3300m. July – November.

2a. *C. alpina* L. subsp. *imaicola* (Ascherson & Magnus) Kitamura

Herb to 45cm; stems pubescent with falcately recurved hairs. Leaves ovate to broadly ovate, rarely orbicular-ovate, 2 – 7 x 1.4 – 4.5cm, apex acute to very shortly acuminate, base truncate to rounded, rarely cuneate or subcordate, margin subentire or occasionally prominently dentate, deep green or reddish, opaque; petioles 0.7 – 3.5cm. Inflorescence pubescent with either or both stipitate-glandular and falcate hairs; pedicels glabrous. Petals 0.5 – 1.8 x 0.7 – 1.5mm, white or pink or pink-tinged only at apex, cleft to half their length. Fruit clavate, 2.1 – 2.5 x 0.5 – 1.1mm, covered with stiff, translucent, hooked hairs.

Bhutan: C – Bumthang district (Bumthang and Rudong La); **Darjeeling:** Phalut and Sandakphu; **Sikkim:** Lachung. Cool, moist places along streams, thickets, in deciduous and coniferous forests, 2000 – 4000m. July – October.

2b. *C. alpina* L. subsp. *micrantha* (Skvortsov) Boufford

Herb to 25cm; stems glabrous or minutely, rarely densely, pubescent with falcately recurved hairs. Leaves narrowly ovate to broadly triangular, 1 – 6.5 x 0.8 – 4cm, apex acute or very shortly acuminate, base cordate, margin sharply dentate to serrate, pale green, translucent; petioles 0.7 – 3cm. Inflorescence densely to sparsely pubescent with stipitate-glandular hairs; pedicels glabrous or with a few glandular hairs. Petals 0.6 – 1.5 x 0.6 – 1 mm, white or pink, entire or cleft less than 1/3 their length. Fruit clavate, 2.2 – 2.7 x 0.8 – 1.2mm, covered with soft to stiff, translucent or purple pigmented, hooked hairs.

Bhutan: C – Thimphu and Bumthang districts, N – Upper Mo Chu, Upper Pho Chu and Upper Kuru Chu districts; **Sikkim:** Yeumthang, Lachung Valley, Zemu Valley etc. Moist places, grassy alpine areas, thickets and montane coniferous forests, 3100 – 5000m. September – October.

3. EPILOBIUM L.

Perennial herbs (in Bhutan), erect or decumbent, densely pubescent to glabrous; stems often with raised pubescent lines decurrent from margins of petioles. Leaves opposite below inflorescence or spiral throughout, denticulate to serrulate or entire, sometimes pubescent. Flowers in axillary racemes. Sepals 4, equal, free or basally connate. Petals 4, notched at the apex or entire, subequal, free or basally connate. Stamens 8, mostly in two whorls; if so, the episepalous ones longer. Stigma 4-lobed, capitate or clavate. Capsules elongate, slender, 4-celled, loculicidal. Seeds many, with apical tuft of hair.

The terms *turion* and *sobole* are used below to describe the perennating basal branches of the *Epilobium* plant: a *turion* is a short, fleshy branch leaving dense scales at the base of the following year's flowering shoot; a *sobole* is similar but not condensed, often leaving rather loose scales on an elongated internode.

1. Leaves spiral throughout stem; floral tube absent; stamens in single whorl; style deflexed in early anthesis 2
- + Leaves opposite below inflorescence; floral tube present; stamens in two whorls; style erect throughout anthesis 3
2. Inflorescence elongated, many-flowered; secondary leaf veins inconspicuous; styles 10 – 20mm; pedicels 0.7 – 1.5cm **1. E. angustifolium**
- + Inflorescence short, leafy, with fewer flowers; secondary leaf veins conspicuous and reticulate; styles 5 – 8mm; pedicels 1.5 – 5cm **2. E. conspersum**
3. Stems and leaves covered with long villous hairs **11. E. trichophyllum**
- + Stems and leaves subglabrous or variously pubescent, but not villous 4
4. Plants with basal filiform stolons ending in condensed turions; leaves entire or scarcely serrulate, sublinear to lanceolate; seeds 1.3 – 2.2mm, fusiform
15. E. palustre
- + Plants with basal rosettes, turions or soboles, without stolons; leaves barely to conspicuously serrulate, narrowly lanceolate or wider; seeds less than 1.3mm (1.4 – 1.6mm but narrowly obovoid in *E. kingdonii*) 5
5. Stems pubescent all around, \pm lacking distinct raised hairy lines decurrent from petioles 6
- + Stems not pubescent all around, or if so only on upper stem and with raised hairy lines decurrent from petioles 7
6. Leaves with petioles 2 – 8mm; petals 4 – 7mm; stigma subcapitate
5. E. royleanum
- + Leaves subsessile; petals 7 – 10mm; stigma clavate
6. E. brevifolium subsp. **trichoneurum**
7. Leaves narrowly lanceolate to lanceolate, densely serrulate, subcoriaceous, with petioles 2 – 7mm; stems glabrescent below, with faint subglabrous lines decurrent from petioles 8
- + Leaves lanceolate or mostly broader, sparsely to densely serrulate, rarely subcoriaceous, subsessile or shortly petiolate; decurrent lines usually more conspicuous 9

8. Seeds papillose, 0.8 – 1mm; petioles 3 – 9mm; leaves narrowly lanceolate, with 30 – 50 teeth on each side **3. E. cylindricum**
 + Seeds reticulate, 0.8 – 1.3mm; petioles 2 – 5mm; leaves broader, with 15 – 35 teeth on each side **4. E. tibetanum**
9. Underground stems stout, \pm vertical, with turions or fleshy soboles with persistent coriaceous brown scales or leaves 10
 + Underground stems rhizomatous, with rosettes or leafy soboles, mostly devoid of coriaceous scales or leaves 12
10. Base of stem with fleshy sessile turions; sepals with tuft of spreading hairs at insertion; stigma clavate to subcapitate; petals 4.5 – 5.5mm ... **12. E. gouldii**
 + Base of stem with fleshy elongated soboles; sepals without tuft of hairs at insertion; stigma capitate; petals 5 – 14mm 11
11. Stems 10 – 60cm, simple or sparsely branched; leaves 1.5 – 7.5cm long, obscurely serrulate; petals 7 – 14mm; capsules 5 – 9cm....**10. E. sikkimense**
 + Stems 4 – 20cm, often much-branched from base; leaves 0.7 – 2.2cm long, densely serrulate; petals 5 – 6.5mm; capsules 3.5 – 5cm **13. E. williamsii**
12. Plants slender; leaves often elliptic, 1 – 1.6cm long, shorter than internodes; seeds reticulate **14. E. clarkeanum**
 + Plants stouter; leaves ovate to lanceolate, rarely elliptic, mostly more than 1.6cm long, equalling or exceeding internodes; seeds papillose 13
13. Plants loosely clumped; stems 8 – 25cm; seeds 1.4 – 1.6mm **8. E. kingdonii**
 + Plants not clumped; stems 15 – 80cm; seeds 0.8 – 1.1mm 14
14. Stems with 2 hairy lines decurrent from petioles; leaves ovate to lanceolate, acute; stigma capitate, surrounded by anthers at anthesis **7. E. amurense**
 + Stems with 4 (or rarely 2) hairy lines from petioles; leaves oblong or elliptic, obtuse or rarely acute; stigma capitate to broadly clavate, usually elevated above anthers at anthesis **9. E. wallichianum**

1. E. angustifolium L.; *E. spicatum* Lamarck, *Chamaenerion angustifolium* (L.) Scopoli, *Chamerion angustifolium* (L.) Holub

Robust rhizomatous herb forming large colonies; stems erect simple, 30 – 250cm, subglabrous to densely appressed stiffly hairy above. Leaves sublanceolate, 2.5 – 20 x 0.4 – 2.5cm, glabrous or with appressed stiff hairs on midrib beneath, obscurely denticulate, spirally arranged throughout, subsessile or shortly petiolate. Inflorescence an elongated simple raceme; pedicels 0.7 – 1.2cm; flowers drooping in bud. Floral tube absent. Sepals 9 – 13 x 1.6 – 2mm, greyish pubescent. Petals 12 – 15 x 7 – 8mm, entire, deep pink or rarely white. Ovaries densely white canescent,

1 – 2cm long; styles 10 – 20mm, initially sharply deflexed, becoming erect after anthers dehisce and reflex, base hairy. Stigma 4-lobed and recurved, exerted beyond anthers. Capsules 4 – 7cm, on pedicels 0.7 – 1.5cm. Seeds 1 – 1.3 x 0.3 – 0.4mm, irregularly pitted; tuft of hairs 9 – 12mm, white, persistent.

Bhutan: C – Thimphu district (Tremo La), N – Upper Mo Chu district (Chebisa) and Upper Pho Chu district (Gaffoo La); **Sikkim; Chumbi.** Widespread in open, disturbed montane areas, 2800 – 4000m. July – September.

Most collections from the Flora area appear on morphological grounds to be the tetraploid ($n = 36$) subsp. *circumvagum* Mosquin, although the diploid subsp. *angustifolium* occurs in southern Xizang (Tibet), and populations from higher elevations in Bhutan may also be this subspecies. Further study of this species in the Himalayan region, particularly including cytological analyses, is most desirable.

2. *E. conspersum* Haussknecht; *E. reticulatum* Clarke. Fig. 37a – d.

Similar to *E. angustifolium* but stems 30 – 120cm, densely appressed stiffly hairy; leaves oblong-lanceolate, 4.5 – 11 x 0.7 – 1.4cm, appressed stiffly hairy on all veins, denticulate, secondary veins conspicuous and reticulate; flowers suberect in bud, pendulous later; pedicels 1.5 – 4cm; sepals 11 – 15 x 3 – 5mm; petals 8 – 14 x 6 – 13mm, rose-purple; style 5 – 8mm; capsules 2.5 – 7.5cm, on pedicels 1.5 – 5cm; seeds 1 – 1.2 x 0.4 – 0.5mm; tuft of hairs tawny, persistent.

Bhutan: C – Thimphu district (Tremo La), N – Upper Mangde Chu district (Phage La); **Sikkim:** Zemu, Kangra Lama, Lhonak, Lachung; **Chumbi:** Yatung, Lemdung. Mountain and alpine screes and streambeds, 3000 – 4700m. June – September.

3. *E. cylindricum* D. Don

Erect herb with leafy basal soboles or rosettes; stems 10 – 110cm, much-branched above, glabrescent to sparsely appressed stiffly hairy above, with subglabrous raised lines on stems. Leaves narrowly lanceolate, 3 – 12 x 0.5 – 2cm, acute, base attenuate, subglabrous except on veins, densely serrulate; petiole 3 – 9mm. Inflorescence erect; pedicels 0.5 – 1.1 cm; flowers erect. Floral tube glabrous within. Sepals 3 – 6 x 1 – 2mm, appressed stiffly hairy. Petals 4.5 – 7 x 2.5 – 4.2mm, rose-purple to pink, rarely white, apical notch 0.8 – 1cm. Ovaries densely appressed stiffly hairy and sometimes sparsely glandular, 2 – 3.5cm; style 2 – 4mm; stigma capitate to broadly clavate. Capsules appressed stiffly hairy, 4 – 7.5cm, on pedicels 0.5 – 2.5cm. Seeds narrowly obovoid, 0.8 – 1 x 0.3 – 0.45 mm, papillose; tuft of hairs dull white, easily detached.

Bhutan: C – Thimphu district (Paro, Thimphu and Motithang) and Punakha district (Dochong La), N – Upper Bumthang Chu district (Lhabja); **Darjeeling:** Mongpu, Darjeeling; **Sikkim:** Lachen. Moist disturbed places, along mountain streams and roadsides, 1500 – 3000m. June – September.

4. E. tibetanum Haussknecht; *E. pseudobscurum* Haussknecht, *E. leiospermum* Haussknecht

Erect herb with leafy or fleshy basal soboles; stems 13–100 cm, much-branched, sparsely appressed stiffly hairy all around, glabrescent below, with subglabrous raised lines. Leaves lanceolate to narrowly oblanceolate, 2–7 x 0.5–1.7 cm, acute, base attenuate, subglabrous except on veins, serrulate; petiole 2–5 mm. Inflorescence erect; pedicels 0.4–1.2 cm; flowers erect. Floral tube subglabrous within. Sepals 3.5–5 x 1.3–1.7 mm. Petals pink to rose-purple, rarely white, 5–8 x 3–3.5 mm, apical notch 0.7–1.2 mm. Ovaries densely appressed stiffly hairy and eglandular, 1.4–2.3 cm; style 2.5–4 mm; stigma subcapitate to short clavate. Capsules 4–8.5 cm, on pedicels 1–3.2 cm. Seeds obovoid, 0.9–1.3 x 0.4–0.55 mm, reticulate (smooth); tuft of hairs dull white, easily detached.

Bhutan: C – Sakden district (between Nyakchung La and Sakden), N – Upper Bumthang Chu district (Kurmathang); **Sikkim:** Jongri; **Chumbi.** Moist places by ditches, streams and rivers in mountains, 2200–3800 m. June – September.

5. E. royleanum Haussknecht; *E. nepalense* auct. non Haussknecht

Ascending or erect herb with fleshy basal soboles that leave dark scales on stem; stems 10–65 cm, simple or much-branched above, densely appressed stiffly hairy all around, rarely with glandular hairs, or rarely subglabrous, without lines. Leaves narrowly ovate to lanceolate, 2–7 x 1–3 cm, acute, base attenuate to cuneate, appressed stiffly hairy on veins and margins, densely serrulate; petioles 2–8 mm, slightly clasping. Inflorescence suberect; pedicels 0.3–0.8 cm; flowers erect. Floral tube with ring of hairs within. Sepals 3.5–5.5 x 1–1.8 mm. Petals rose-purple to pink, 4–7 x 2.5–3 mm, apical notch 1 mm. Ovaries densely appressed stiffly hairy and sometimes glandular, 2–3 cm; style 2–3.5 mm; stigma subcapitate. Capsules 4–7 cm, appressed stiffly hairy, on pedicels 0.4–1 cm. Seeds obovoid, 0.8–1.2 x 0.3–0.45 mm, papillose; tuft of hairs dull white, easily detached.

Bhutan: C – Thimphu district (Kyapcha); **Sikkim:** locality unknown. Moist weedy places in mountains, near streams and roadsides, 1400–3200 m. July – October.

6. E. brevifolium D. Don subsp. **trichoneurum** (Haussknecht) Raven

Erect or ascending herb with fleshy soboles that leave scales at stem base; stems 15–90 cm, simple or branched above, appressed stiffly hairy throughout, rarely with mixed glandular hairs, without lines. Leaves elliptic-lanceolate to ovate, 1.5–5(–8) x 0.5–2.5 cm, subobtusate to acute, base rounded to subcuneate, appressed stiffly hairy on veins and margins, weakly serrulate, subsessile or with petioles 1–2 mm. Inflorescence suberect; pedicels 0.6–1.4 cm; flowers erect. Floral tube with a ring of hairs within. Sepals 4.5–6.5 x 1–1.5 mm, keeled. Petals pink to rose-purple, 7–10 x 3–4 mm, apical notch 1.5 mm. Ovaries appressed stiffly hairy and sometimes glandular, 1.8–4.5 cm; style 3–6 mm; stigma clavate. Capsules 3.5–7 cm, on pedicels 0.4–1.4 cm. Seeds obovoid, 1–1.1 x 0.4–0.5 mm, papillose; tuft of hairs dull white, easily detached.

Bhutan: C – Thimphu district (Thimphu) and Tashigang district (Rocha Chu Valley, Tashiyangtse); **Chumbi:** Moist, open or disturbed places near streams or roads, 1000 – 2400m. July – October.

7. ***E. amurense*** Haussknecht subsp. ***amurense***; *E. laetum* Wall., *E. nepalense* Haussknecht p.p.

Erect herb with leafy soboles or rosettes, rarely fleshy; stems 15 – 50cm, simple or sparsely branched, appressed stiffly hairy, often mixed with glandular hairs, with 2 densely appressed stiffly hairy raised lines through the internodes. Leaves ovate to lanceolate, 2 – 7 x 0.5 – 3 cm, acute, base rounded to attenuate, sparsely appressed stiffly hairy on veins and margins, sharply serrulate; petioles 2 – 6mm. Inflorescence suberect; pedicels 0.2 – 0.8cm; flowers suberect. Floral tube with ring of hairs within and tuft of hairs between sepals. Sepals 3.5 – 5 x 1 – 1.8mm. Petals white to rose-purple, 5 – 8 x 2.5 – 4.5mm, apical notch 1.5mm. Ovaries densely appressed stiffly hairy and glandular, 2 – 4cm; style 2 – 4.7mm; stigma subcapitate. Capsules 3.5 – 7cm, appressed stiffly hairy, on pedicels 0.5 – 1.5cm. Seeds oblong-obovoid, 0.8 – 1 x 0.3 – 0.4mm, coarsely papillose; tuft of hairs dull white, easily detached.

Bhutan: C – Thimphu district (Thimphu, Paga, Paro) and Mongar district (Lingitsi and between Sengor and Sheridrang), N – Upper Bumthang Chu district (Lhabja); **Darjeeling:** Tonglo, Kurseong, Senchal; **Sikkim:** Lachen, Jongri; **Chumbi:** Yatung. Moist disturbed places, 1800 – 3600m. June – October.

8. ***E. kingdonii*** Raven

Low, loosely clumped herb with fleshy soboles arising 2 – 6cm below surface; stems 8 – 25cm, simple or rarely branched, subglabrous below inflorescence with 2 raised appressed stiffly hairy lines, otherwise appressed stiffly hairy all around stem. Leaves ovate, 0.8 – 2.2 x 0.4 – 1.2 cm, subequal to internodes, acute, base cuneate to obtuse, sparsely appressed stiffly hairy on veins and margins, obscurely serrulate, subsessile or petioles up to 2mm. Inflorescence suberect; pedicels 0.4 – 1cm; flowers few. Floral tube with ring of hairs within. Sepals 3 – 5 x 1 – 1.5mm. Petals rose-purple, 7 – 8 x 4 – 4.5mm, apical notch 1 – 1.5mm. Ovaries appressed stiffly hairy and glandular, 1.4 – 2cm; style 4.5 – 5mm with few basal hairs; stigma capitate. Capsules 3.5 – 5.5mm, subglabrous, on pedicels 0.4 – 1.2cm. Seeds narrowly obovoid, 1.4 – 1.6 x 0.6 – 0.7mm, finely papillose; tuft of hairs dull white, easily detached.

Chumbi: Yadong (Yatung). On shaded moist slopes in mountains, 3300 – 3700m. August – October.

9. ***E. wallichianum*** Haussknecht; *E. wallichianum* subsp. *souliei* (Léveillé) Raven, *E. sykesii* Raven

Suberect herb with leafy soboles; stems 4-angled to subterete, 15 – 80cm, simple to much-branched, subglabrous below inflorescence with 4 raised appressed stiffly hairy lines, otherwise appressed stiffly hairy and glandular all around stem. Leaves subcoriaceous, oblong to elliptic, rarely subovate, 2 – 6 x 0.6 – 2.5cm, obtuse or

rarely acute, base subcordate to broadly cuneate, sparsely appressed stiffly hairy on veins and margins, serrulate, subsessile. Inflorescence nodding; pedicels 0.4 – 1.2cm; flowers nodding. Floral tube with ring of hairs within. Sepals 4 – 8 x 1 – 2.3mm. Petals pink to rose-purple, 5 – 13 x 3 – 6.5mm, apical notch 1.5mm. Ovaries appressed stiffly hairy and glandular, 1.8 – 4cm; style 4 – 8 mm, with few basal hairs; stigma capitate to broadly clavate. Capsules 4 – 7.5cm, appressed stiffly hairy and with glandular hairs; fruiting pedicels 1 – 2.5cm. Seeds oblong-obovoid, 0.9 – 1.1 x 0.3 – 0.4mm, papillose; tuft of hairs dull white, easily detached.

Bhutan: N – Upper Mo Chu district (Gasa), Upper Pho Chu district (Leji), and Upper Bumthang Chu district (Kurmathang); **Darjeeling:** Senchal, Kurseong, Singalila, **Sikkim:** Lachen, Sherabthang; **Chumbi:** Yatung, Reidung. Wet places by streams, on grassy slopes, and at edges of forests, 1800 – 4100m. July – September.

10. *E. sikkimense* Haussknecht; *E. sikkimense* subsp. *ludlowianum* Raven, *E. soboliferum* Raven, *E. squamosum* Raven, *E. trilactorum* Raven

Clump-forming herb with thick fleshy soboles that leave persistent brown basal scales; stems 10 – 60cm, simple to moderately branched, subglabrous below with 2 – 4 raised appressed stiffly hairy lines, otherwise appressed stiffly hairy and glandular all around stem. Leaves submembranous, ovate to oblong-lanceolate, 1.5 – 7.5 x 1 – 3.5cm, equalling or longer than internodes, subobtuse to acute, base cuneate or rounded, appressed stiffly hairy on veins and margins, serrulate, base sessile and clasping or petioles 1 – 3mm. Inflorescence nodding, leafy; pedicels 0.5 – 1cm; flowers suberect. Floral tube with ring of hairs within. Sepals 5.5 – 8 x 1.4 – 2mm, keeled. Petals pink to rose-purple, 7 – 14 x 4.5 – 8mm, notch 1.5 – 2.5mm. Ovaries appressed stiffly hairy and glandular, 1.5 – 3.5cm; style 3.5 – 5mm, with few basal hairs; stigma capitate. Capsules 5 – 9cm, appressed stiffly hairy and glandular, on pedicels 0.6 – 2cm. Seeds narrowly obovoid, 1 – 1.3 x 0.35 – 0.45mm, coarsely papillose; tuft of hairs dull white, easily detached.

Bhutan: C – Thimphu, Tongsa, Bumthang and Mongar districts, N – Upper Pho Chu, Upper Kuru Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling:** Tonglo; **Sikkim:** Lachung, Lhonak, Tsomgo; **Chumbi:** Champithang, Yatung. Cool moist rocky slopes or along streams, spruce-fir zone to alpine meadows, 2800 – 4400m. July – September.

11. *E. trichophyllum* Haussknecht

Short erect herb with short leafy soboles; stems scarcely 10cm, simple or sparsely branched from base, densely villous all around throughout. Leaves ovate, short, subacute, base abruptly rounded, villous on both sides, serrulate, sessile, the lower ones oblong-ovate, entire; flowers suberect. Ovaries villous; stigma capitate. Capsules densely villous, pedicels short. Seeds not known.

Sikkim: Latong. 3050 – 3650m. July.

12. *E. gouldii* Raven

Erect herb with condensed round subsurface turions that leave coriaceous basal scales; stems 10–30cm, strict, simple or barely branched, glabrous except for 2 raised, densely appressed stiffly hairy lines. Leaves ovate, 2–3 x 1–1.4cm, acute to subacuminate, base rounded, scarcely appressed stiffly hairy on veins and margins, serrulate, subsessile. Inflorescence nodding; pedicels 0.3–0.6cm; flowers slightly nodding. Floral tube with ring of hairs within and tuft of hairs at junction of sepals. Sepals 3.5–4.5 x 1–1.3cm. Petals rose-purple, 4.5–5.5 x 2.5–3.5mm, notch 1mm. Ovaries appressed stiffly hairy and glandular, 1.2–1.8cm; style 2.5–3mm, glabrous; stigma clavate to subcapitate. Capsules 4.5–6cm, on pedicels 0.5–1.5cm. Seeds obovoid, 0.9–1 x 0.3–0.4mm, finely papillose; tuft of hairs white, easily detached.

Sikkim: Lachung; **Chumbi:** Nathu La, Gautsa, Lingmathang. Alpine meadows, 3650–4350m. July–August.

13. *E. williamsii* Raven

Loosely clumped herb with fleshy elongated soboles that leave basal scales; stems suberect, 4–20cm, branched from base or simple, sparsely appressed stiffly hairy below with 2 obscure appressed stiffly hairy lines, pubescent all around above and rarely throughout, with mixture of glandular and eglandular hairs on inflorescence. Leaves ovate to subelliptic, 0.7–2.2 x 0.3–1cm, acute, base rounded or subcordate, equalling or longer than internodes, glabrous except for sparsely appressed stiffly hairy veins, densely serrulate, subsessile or petioles 1–2mm. Inflorescence nodding; pedicels 0.3–0.5cm; flowers suberect. Floral tube with ring of hairs within. Sepals 3–4.5 x 1–1.2cm, keeled. Petals rose-purple, 5–6.5 x 3–3.5mm, notch 1mm. Ovaries glandular or also with appressed stiff hairs, 1–2cm; style 2–4mm, glabrous; stigma capitate. Capsules 3.5–5cm, on pedicels 0.4–1cm. Seeds narrowly obovoid, 0.9–1.1 x 0.3–0.4mm, finely papillose; tuft of hairs dull white.

Sikkim: Jongri; **Chumbi:** Phari, Kalaeree. Open alpine meadows, by streams, or on gravel banks of glacial lakes, 3350–4900m. July–September.

14. *E. clarkeanum* Haussknecht

Dwarf slender herb with delicate leafy soboles that leave small brown basal scales; stems 10–20cm, simple or rarely branched at base, appressed stiffly hairy all around with inconspicuous raised lines. Leaves ovate to elliptic, obovate near base, 1–1.6 x 0.5–0.8cm, shorter than internodes, obtuse to subacute, base cuneate to subrounded, glabrous except for appressed stiffly hairy veins, obscurely serrulate, subsessile or petioles 1–2mm. Inflorescence nodding; pedicels 0.3–0.6cm; flowers slightly nodding. Floral tube with ring of hairs within. Sepals 2.5–3 x 1–1.2mm, keeled. Petals white, 5–6 x 3–3.5mm, notch 1mm. Ovaries appressed stiffly hairy, 1.2–1.5cm; style 3–3.2mm, glabrous; stigma capitate. Capsules 3.5–4cm, on pedicels 0.3–0.7cm. Seeds narrowly obovoid, 0.8–0.9 x 0.3–0.35mm, reticulate; tuft of hairs white, easily detached.

Sikkim: Changu, Jongri, Lachen. Very rare in moist alpine areas, 3650–4550m. July – August.

15. *E. palustre* L.

Erect perennial herb, forming filiform above-ground stolons with widely spaced small leaves, terminating in small fleshy turions; stems 15–70cm, simple to much-branched, appressed stiffly hairy all around to subglabrous on lower stem with indistinct lines. Leaves sublinear to narrowly lanceolate, 1.5–7 x 0.2–1.9cm, subacute, base cuneate, subglabrous except for appressed stiffly hairy margins and veins, entire to obscurely serrulate, subsessile. Inflorescence erect or nodding in bud; pedicels 0.8–1.5cm; flowers suberect. Sepals 2.5–4.5mm. Petals white or rarely pink, 3–7mm, notch 1mm. Floral tube subglabrous or with ring of hairs within. Ovaries greyish pubescent, 1.6–3cm; style 2–3.8 mm, glabrous; stigma clavate to subcylindric. Capsules 3–9cm, on pedicels 1–5cm. Seeds fusiform, 1.3–2.2 x 0.38–0.54mm, finely papillose; tuft of hairs white, persistent.

Tibet (Xizang): Cona. In marshy or boggy places from low elevations to alpine meadows, 200–4500m. June – September.

4. OENOTHERA L.

Annual, biennial or perennial herbs, caulescent or sometimes stemless, with taproot or spreading underground parts; basal rosette usually present, but often ephemeral. Leaves alternate, stipules absent. Flowers 4-merous, actinomorphic, in axils of upper leaves, opening about sunset or about sunrise. Floral tube well developed and prolonged beyond ovary, deciduous soon after anthesis. Petals yellow, purple or white. Stamens 8. Stigma deeply 4-lobed. Fruit a loculicidal capsule, rarely indehiscent, sessile or sometimes pedicellate, mostly straight, terete or somewhat 4-angled. Seeds usually numerous, naked, in 1–2(–3) rows or in clusters in each of the 4 locules.

1. Petals yellow, 15–50mm long; capsule sessile, not tapering to a stipe-like sterile portion **1. *O. biennis***
- + Petals rose to rose-purple, 4–12mm long; capsule tapering to a stipe-like sterile portion **2. *O. rosea***

1. *O. biennis* L. Eng: *Evening Primrose*. Fig. 37h–j.

Erect biennial herb, forming a basal rosette; stems 30–200cm, branching from base or above, or simple, with dense to scattered short appressed stiff hairs and longer spreading hairs, which are often swollen-based and glandular-puberulent. Rosette leaves 10–30 x 2–5cm; cauline leaves narrowly oblanceolate to oblanceolate or elliptic, 5–20 x 1–5cm, apex acute to long acute, base attenuate, surfaces moderately appressed stiffly hairy, the upper ones sometimes also erect-pubescent or glandular-puberulent, denticulate, often with wavy margins, sessile or

shortly petiolate; passing upward gradually into slender bracts. Inflorescence a simple spike, usually with secondary spikes below main one, appressed stiffly hairy and glandular-puberulent, sometimes also with longer swollen-based hairs; flowers opening about sunset. Floral tube 20 – 40 mm, yellowish, with scattered hairs. Sepals 12 – 25mm; subulate free tips 1 – 3mm. Petals yellow, 12 – 30 x 14 – 30mm, retuse to emarginate. Style 30 – 55mm; stigma surrounded by anthers, lobes 3 – 6mm. Capsules 2 – 4cm, 4 – 6mm thick at base, narrowly ellipsoid to ellipsoid, pubescent. Seeds angled, 1.1 – 2 x 0.6 – 1.1mm, dark brown, the surface regularly pitted.

Bhutan: C – Thimphu district (Taba). Open grassy ground, disturbed places, 1000 – 2400m. June – September.

Native of North America, grown as an ornamental and probably naturalised.

2. *O. rosea* Aiton

Erect or ascending perennial herb, flowering the first year; stems 10 – 40cm, branching throughout, densely appressed stiffly hairy, rarely also long villous. Leaves elliptic or rarely narrowly ovate, 2 – 5 x 1 – 2.5 cm, obtuse to acute, base attenuate, appressed stiffly hairy, subentire to sinuate-pinnatifid; petioles 2 – 25mm; uppermost reduced to linear-lanceolate bracts. Inflorescence a slender, erect spike; flowers opening about sunrise. Floral tube 4 – 8mm, slender, appressed stiffly hairy. Sepals 7 – 12mm, subulate free tips 0.1 – 0.5mm. Petals rose to rose-purple, 4 – 12mm. Style 8 – 14mm; stigma surrounded by anthers, lobes 1.5 – 2mm. Capsules 1.3 – 3cm, clavate, tapering to sterile stipe-like portion 0.5 – 2cm, appressed stiffly hairy. Seeds narrowly obovoid, 0.7 – 0.9 x 0.35 – 0.5mm, with finely granular surface, with a dark spot at each end.

Bhutan: C – Tongsa district (Shamgong). Weed in disturbed or cultivated areas, 1000 – 2000m. April – September.

Native of tropical America, widely cultivated and naturalised.

Family 138. HIPPURIDACEAE

by D.G.Long and S.J. Rae

Perennial, aquatic, glabrous herbs with creeping rhizomes and erect, simple, leafy, submerged or emergent shoots. Leaves whorled, linear, entire, exstipulate. Flowers minute, sessile, solitary in axils of upper leaves, bisexual or unisexual. Perianth an entire rim around top of ovary. Stamen 1, epigynous. Ovary inferior, 1-celled; style simple, long and slender, stigmatic down one side; ovule solitary, pendulous. Fruit an achene.

1. HIPPURIS L.

Description as for Hippuridaceae.

1. *H. vulgaris* L. Eng: *Mare's Tail*. Fig. 38a – c.

Leafy shoots emergent, 20 – 50cm (or longer in running water). Leaves spreading, 6 – 12 per whorl, linear, 6 – 20 x 1 – 2mm (in submerged forms up to 35mm long), sessile; apex thickened, subacute. Flowers pinkish. Stamen 1.5mm. Ovary 1.5mm; style 1.5mm. Achenes 2.5mm.

Chumbi: near Phari, Lingmathang and Gautsa. In sluggish backwater, 3660 – 4420m. April – June.

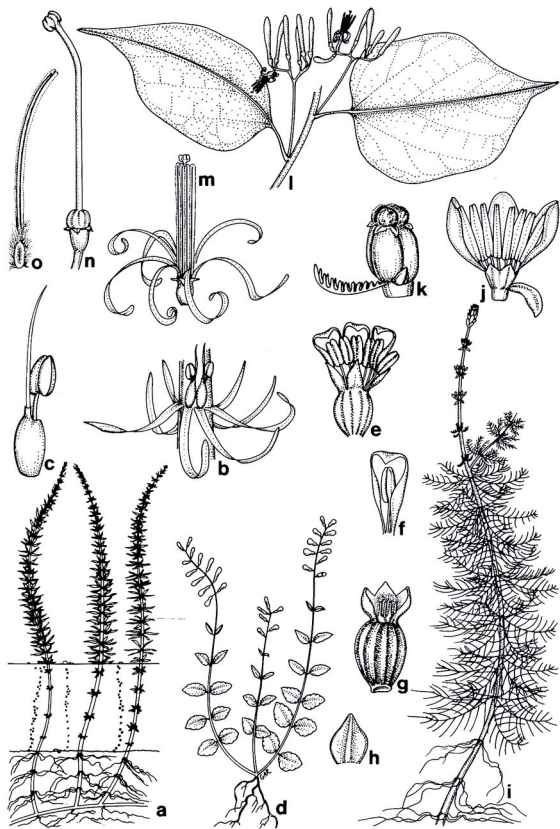
Family 139. HALORAGACEAE

by D.G. Long

Perennial, aquatic or terrestrial herbs, erect or prostrate. Leaves opposite or whorled, simple and unlobed or deeply pectinately lobed; exstipulate. Monoecious; flowers minute, bisexual or unisexual, actinomorphic, solitary or whorled in terminal, bracteate spikes. Floral parts epigynous. Calyx with tubular base adnate to ovary; lobes absent or 4. Petals 4, free, or absent. Stamens 8. Ovary inferior, 4-celled; styles 4, sometimes absent; stigmas 4, feathery or papillose; ovule 1 per cell, axile. Fruit a small, 1-seeded nut, or schizocarp separating into 4, 1-seeded nutlets.

1. Terrestrial herb; leaves opposite, toothed but unlobed; spikes bearing single bisexual flowers **1. Gonocarpus**
 + Aquatic herb; leaves whorled, deeply pectinately divided; spikes bearing whorled unisexual flowers **2. Myriophyllum**

FIG. 38. **Hippuridaceae, Haloragaceae and Alangiaceae.** **Hippuridaceae.** a – c, *Hippuris vulgaris*: a, habit; b, whorl of leaves and two flowers; c, flower. **Haloragaceae.** d – h, *Gonocarpus micranthus*: d, habit; e, flower with one petal and two stamens removed; f, petal and stamen; g, young fruit with one sepal removed to show stigmas; h, sepal. i – k, *Myriophyllum spicatum*: i, habit; j, male flowers; k, female flower and bract. **Alangiaceae.** l – o, *Alangium chinense*: l, part of flowering branch; m, flower; n, ovary and style; o, stamen. Scale: a x $\frac{1}{8}$; i, l x $\frac{1}{2}$; d x $1\frac{1}{2}$; m x $2\frac{1}{2}$; n, o x $3\frac{1}{2}$; b, j x 10; f, k x 15; e x 20; g x 25; h x 30; c x 40. Drawn by G. Rodrigues.



1. GONOCARPUS Thunberg

Small, perennial, terrestrial herbs; stems angular. Leaves simple, opposite, decussate, unlobed. Flowers in terminal often branched spikes, each flower solitary in axil of bract, bisexual. Calyx 4-lobed. Petals 4. Stamens 8, in two whorls, outer 4 enclosed by petals. Ovary 8-ribbed, 4-celled; stigmas sessile, feathery. Fruit a 1-seeded, ribbed nut bearing persistent calyx.

1. G. micranthus Thunberg; *Haloragis micrantha* (Thunberg) R. Brown. Fig. 38d - h.

Prostrate, glabrous herb with leafy, decumbent flowering stems 8 - 12cm; stems rooting at nodes. Leaves rather thick, ovate, 5 - 9 x 3 - 6mm, acute, base rounded, margins thickened and with several shallow teeth; petioles 1 - 2mm. Spikes slender, erect, branched, 2 - 5cm; flowers distant, on short pedicels c 0.5mm. Bracts lanceolate, c 1mm. Calyx lobes thick, triangular, c 0.5mm. Petals dark red, c 1mm. Fruit obovoid, c 1mm, strongly ribbed, smooth.

Bhutan: C - Bumthang district (Bumthang) and Mongar district (Rip La and Sengor), N - Upper Mo Chu district (Gasa and between Tamji and Goen Gaza); **Sikkim:** Lachung. Open grassy hillsides, 2400 - 3000m. July - September.

2. MYRIOPHYLLUM L.

Submerged, or shortly emergent, perennial aquatic herbs; leafy stems erect, branched, arising from underground rhizome. Submerged leaves whorled, deeply pectinately divided into filiform segments. Flowers minute, whorled in terminal emergent spikes, sessile in axils of bracts (reduced aerial leaves), each flower subtended by 2 minute bracteoles; upper flower whorls male, middle bisexual, lower female. Male flowers: calyx minutely 4-lobed; corolla of 4 boat-shaped petals; stamens 8, epipetalous. Female and bisexual flowers: calyx lobes minute; petals minute or absent; ovary 4-celled; style absent, stigmas 4, sessile, recurved. Fruit a schizocarp, separating into 4, 1-seeded nutlets.

1. M. spicatum L. Eng: *Spiked Water Milfoil*. Fig. 38i - k.

Leafy stems 20 - 60(-250)cm. Leaves in whorls of 4, equalling or slightly longer than internodes, rounded or \pm obovate in outline, 1.5 - 4 x 1.5 - 4cm, pectinately divided into 25 - 35 filiform, parallel, spreading segments. Spikes reddish, 2 - 8cm, leafless, whorls 4-flowered. Bracts thick, ovate or lanceolate, c 1.5mm, lower ones longer, toothed or pectinate. Male calyx minute; petals elliptic, c 2mm. Female calyx absent; petals minute; ovary oblong, c 1.2mm. Fruit ovoid-globose, 4-lobed, 1.5 - 3mm.

Bhutan: N - Upper Pho Chu district (Gafoola); **Chumbi:** Dochen. In ponds, 3960 - 4420m. May - July.

Family 140. CORNACEAE

by R. A. Clement

Trees or shrubs. Leaves opposite or alternate, simple, entire, serrate or denticulate, petiolate; stipules absent, although bristles may be present at base of young petioles (*Helwingia*). Inflorescence a panicle, corymb or umbel, sometimes with showy bracts. Flowers actinomorphic, bisexual or unisexual (then plants dioecious). Calyx 4-5-lobed; tube adnate to ovary, persistent. Petals (3-)4-5, free. Stamens usually equal in number to petals. Ovary inferior, 1-4-celled. Style simple; stigma capitate or lobed. Fruit a drupe or berry, few-seeded.

1. Leaves entire; flowers bisexual 2
 + Leaves serrate, dentate or denticulate; flowers unisexual 4
2. Inflorescence a capitate head up to 1.5cm in diameter subtended by 4 showy white or yellow bracts **1. Benthamidia**
 + Inflorescence a corymb or small panicle without showy bracts 3
3. Flowers 4-merous; lateral veins at 35° - 45° to midrib **2. Swida**
 + Flowers 5-merous; lateral veins at 60° - 70° to midrib **3. Mastixia**
4. Leaves broadly ovate to orbicular, 8cm or more broad; male and female panicles 16cm or more, rarely less, pendent **6. Toricellia**
 + Leaves elliptic to oblong, less than 6cm broad; male and female inflorescences 14cm or less 5
5. Leaves mostly alternate; bristles often present at base of petioles; inflorescence a small umbel arising from middle of upper surface of leaf **5. Helwingia**
 + Leaves opposite; no bristles at base of petioles; inflorescence a panicle arising from stem **4. Aucuba**

1. BENTHAMIDIA Spach

Shrubs or trees. Leaves opposite, entire. Inflorescence a dense subglobose head, subtended by 4 large, showy, spreading bracts. Flowers bisexual. Calyx 4-toothed. Petals 4. Stamens 4. Style short; stigma capitate. Ovary 2-celled. Fruit a drupe, ovoid, 2-seeded.

1. B. capitata (Wall.) Hara; *Cornus capitata* Wall. Sha: *Phetsu Shing*; Nep: *Ramkattar* (34). Fig. 39a - d.

Shrub or tree, 2 - 10m. Leaves elliptic-oblong or elliptic, 5 - 11 x 2.1 - 4.1cm, acute or acuminate, base cuneate, ± densely appressed-hairy, hairs medifixed; petiole 0.7 - 1.1cm. Inflorescence 0.8 - 1.5cm diameter; bracts obovate to

suborbicular, 3.5–6.3 x 2.3–4.3cm, white to yellow. Calyces adnate in inflorescence. Petals yellowish, ± oblong, c 2mm. Stamens ± equalling petals. Fruiting heads 2–3cm in diameter, pendent, red, succulent.

Bhutan: S – Chukka and Deothang districts, C – Thimphu, Punakha, Tongsa, Bumthang, Mongar and Tashigang districts, N – Upper Mo Chu and Upper Kuru Chu districts; **Darjeeling; Chumbi.** Moist broad-leaved forest, occasionally on open hillsides, common, 1830–2900m. May – July, October.

Fruit pulp edible. An attractive species valued in horticulture.

2. SWIDA Opiz

Shrubs or trees. Leaves opposite or alternate, entire. Inflorescence a corymb. Flowers bisexual. Calyx 4-toothed. Petals 4. Stamens 4. Ovary 2-celled. Style simple, stigma capitate. Fruit a drupe, 2-seeded.

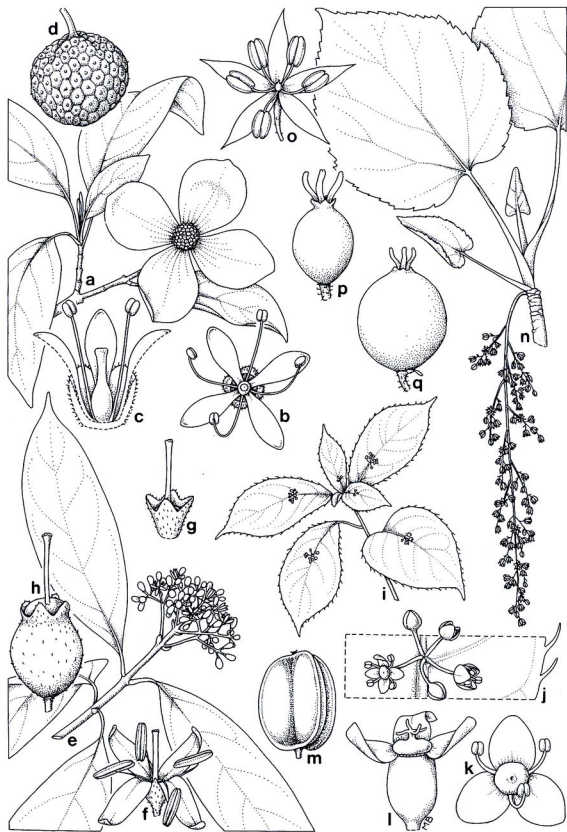
1. Leaves alternate **1. S. controversa**
 + Leaves opposite 2
2. Leaves 5cm or more broad **2. S. macrophylla**
 + Leaves 4.5cm or less broad **3. S. oblonga**

1. S. controversa (Hemsley) Sojak; *Cornus macrophylla* sensu Clarke p.p. non Wall.

Tree, 10–12(–18)m. Leaves alternate, elliptic to elliptic-oblong, 9–15 x 5.2–9cm, shortly acuminate, base broadly cuneate or cuneate, lower surface whitish puberulent, both surfaces with medifixed hairs; petiole 2.1–6.8cm. Inflorescence erect, c 8 x 7–11cm, youngest branches always alternate. Calyx 1.8–2mm, obscurely toothed, pubescent. Petals white, ± oblong, c 3.5mm, spreading. Stamens ± equal to petals; anthers cordate with recurved tip. Fruit subglobose, c 6.5 x 6.5mm, blackish.

Bhutan: locality unknown; **Darjeeling:** Lopchu, Sureil, Rungpo, Darjeeling. 915–1830m. April–June.

FIG. 39. *Cornaceae*. a–d, *Benthamidia capitata*: a, flowering branch; b, flower; c, l.s. flower; d, fruiting head. e–h, *Swida oblonga*: e, flowering branch; f, flower; g, calyx and ovary; h, young fruit. i–m, *Helwingia himalaica*: i, flowering shoot; j, inflorescence; k, male flower; l, female flower; m, fruit. n–q, *Toricellia tiliifolia*: n, flowering branch; o, male flower; p, female flower; q, fruit. Scale: i x ¼; n x ⅓; a x ½; e x ⅓; d x 1; m x 2½; q x 3; f, o x 4; h, j, p x 5; b, g x 6; k, l x 9; c x 10. Drawn by M. Bates.



2. *S. macrophylla* (Wall.) Sojak; *Cornus macrophylla* Wall. Nep: *Patmero* (34), *Bangi Kath* (34).

Similar to *S. controversa* but leaves opposite, ovate to ovate-elliptic, 11 – 18.4 x 5.2 – 10.1cm, usually acuminate, base truncate to rounded, sometimes slightly unequal; petiole 1 – 3.1cm; inflorescence with youngest branches always opposite; calyx teeth small but distinct, c 0.5mm; petals up to 4.5mm.

Bhutan: S – Deothang district, C – Tongsa and Tashigang districts, N – Upper Mo Chu district; **Darjeeling:** not common (34). Moist forest or among shrubs, 2130 – 2290m. June.

Leaves used as fodder (48).

3. *S. oblonga* (Wall.) Sojak; *Cornus oblonga* Wall., *C. oblonga* Wall. var. *griffithii* Clarke. Fig. 39e – h.

Tree 5 – 8m. Leaves opposite, oblong-elliptic, 8 – 12.5 x 2.3 – 4.2cm, acuminate, base cuneate, both surfaces with small medifixed hairs when young, upper surface often becoming glabrous, lower surface usually remaining hairy; petiole 0.8 – 1.2cm. Inflorescence up to 6 x 3 – 6cm; youngest branches opposite. Calyx 1.5 – 2mm, obscurely toothed, pubescent. Petals ± oblong, c 3.5mm, spreading. Stamens ± equalling petals. Fruit ellipsoid, c 5 x 3.5mm, green when young.

Bhutan: C – Punakha district (Mendegang and Wangdu Phodrang area). Warm broad-leaved forest, 1250 – 1580m. April.

3. MASTIXIA Blume

Trees. Leaves coriaceous, alternate or opposite and decussate, entire. Inflorescence a terminal panicle. Flowers bisexual, small. Calyx 5-lobed. Petals 5. Stamens 5. Ovary 1-celled. Fruit an ovoid drupe. Seed ellipsoid.

1. *M. pentandra* Blume subsp. ***chinensis*** (Merrill) Matthew; *M. arborea* auct. non (Wight) Beddome

Tree to 20m. Leaves oblong or elliptic, 13 – 14.5 x 5 – 5.8cm, acuminate, base cuneate, glabrous; petiole 2.5 – 3cm. Panicles c 9cm. Calyx c 3.5mm. Petals white, c 2mm. Fruit c 2.5 x 1cm.

Darjeeling: Mal Forest. Terai forest, 305 – 1070m. May.

Erroneously recorded from Bhutan on the basis of a collection from 'British Bootan' which is in fact part of West Bengal.

4. AUCUBA Thunberg

Shrubs. Leaves opposite, denticulate, coriaceous. Dioecious; inflorescences terminal panicles on short, lateral branches, pubescent. Male flowers small: calyx 4-toothed; petals 4; stamens 4; ovary absent. Female flowers similar except stamens absent: ovary 1-locular; style short. Fruit an ovoid, 1-seeded berry.

1. A. himalaica Hook.f. Nep: *Kali-kath* (34).

Large shrub, 2–4m, dichotomously branched. Leaves elliptic-oblong to oblong, 12–18.8 x 2.8–5.2cm, usually long acuminate, base cuneate, margin serrate in upper part to remotely denticulate, upper surface glabrous, lower surface tomentose at least when young; petiole 1.2–2.5cm. Male panicles 5–14cm; female panicles 3–4cm. Female flowers c 7mm long; petals ovate, c 3.5mm. Male flowers c 4mm; petals ovate, c 3.5mm; stamens subsessile. Fruit c 13 x 7mm, bright scarlet.

Bhutan: C – Tongsa district (Jirgang Chu valley); **Darjeeling:** common. Dense forest among *Rhododendron*, 1400–2740m. April – May.

5. HELWINGIA Willdenow

Undershrubs or shrubs. Leaves mostly alternate, serrate; bristly at base of young petioles. Dioecious; inflorescence a small umbel arising from middle of upper surface of leaf; female flowers 1–4; male flowers more numerous; flowers unisexual. Calyx minute. Petals 3–5. Male flowers with 3–5 stamens. Female flowers: ovary 3–4-locular; styles 3–4. Fruit subglobose or ellipsoid, 3–4-seeded.

1. H. himalaica Hook.f. & Thomson. Fig. 39i–m.

Glabrous shrub, 1–2.5m. Leaves ± elliptic, 5.5–13.2 x 2–5.8cm, finely acuminate, base cuneate, margin bristly-serrate; petiole 1–6.5cm. Umbel 0.3–0.5cm long. Male and female flowers c 1.5mm, greenish; pedicel c 1.5mm. Fruit c 7 x 7mm, red.

Bhutan: C – Thimphu, Tongsa and Mongar districts, N – Upper Mo Chu district; **Darjeeling:** Senchal, Goompahar, Darjeeling. In scrub with *Rhododendron arboreum* and in *Quercus* forest, 2130–3050m. May.

6. TORICELLIA DC.

Trees or shrubs. Leaves alternate, serrate-dentate. Dioecious; inflorescence a many-flowered, hanging panicle. Male flowers; calyx tube short, 5-lobed; petals 5; stamens 5; ovary reduced to pistillode. Female flowers; petals and stamens absent; styles 3. Fruit small, ovoid, few-seeded.

1. T. tiliifolia DC. Tongsa: *Ref*; Sha: *Dhengboor Laga*. Fig. 39n–q.

Tree or shrub, 2.5–5m. Leaves broadly ovate or orbicular, 9–19 x 8.4–18.5cm, usually acute, base cordate, margin conspicuously serrate-dentate, tomentose on margin and veins especially on upper surface, otherwise usually glabrous; petiole 3.5–13cm. Male and female panicles (12–)15–32cm. Male flowers reddish-green, c 3.5mm long; petals oblong, c 3mm; stamens shorter than petals. Female flowers c 2.5mm; styles c 1mm. Fruit c 6 x 5mm, glabrous, black when ripe.

Bhutan: S – Chukka district, C – Punakha, Tongsa and Mongar districts; **Darjeeling; Sikkim; Chumbi.** Warm broad-leaved forest, often in disturbed areas, 1000–2150m. April.

Family 141. ALANGIACEAE

by R. A. Clement

Trees or shrubs with characteristically horizontal branches. Leaves alternate, distichous, simple, entire or lobed, pinnately veined, petiolate; stipules absent. Flowers in axillary cymes, actinomorphic, bisexual. Calyx 4–10-lobed, persistent. Petals 4–10, linear. Stamens as many as or more than petals. Ovary usually 1-celled; style capitate; stigma 2–4-lobed. Fruit a drupe, usually 2-seeded.

1. ALANGIUM Lamarck

Description as for Alangiaceae.

A third species, *A. barbatum* (Clarke) Harms, has been recorded incorrectly from Bhutan on the basis of a wrongly labelled Griffith specimen.

1. Leaves cordate at base, rarely truncate, unlobed, without tufts of hair in vein axils; fruit 1.5–2 x 0.7–0.9cm, compressed 1. **A. alpinum**
- + Leaves truncate and often oblique at base, often lobed, tufts of hairs present in vein axils; fruit 1–1.4 x 0.5–0.6cm, not compressed 2. **A. chinense**

1. A. alpinum (Clarke) W.W. Smith & Cave; *Marlea begoniifolia* Roxb. var. *alpina* Clarke. Nep: *Galasune* (34).

Tree or shrub up to 15m. Leaves \pm ovate, 8.5–20 x 5.7–12.3cm, acuminate, base cordate, upper surface glabrous, lower surface pilose-tomentose; petiole 7–29mm. Cymes 1–4-flowered. Calyx c 4.5mm, teeth very small. Petals usually 7, c 18 x 2mm, creamy-white or yellow. Stamens usually 7, c 14mm. Fruit ellipsoid, 1–1.5 x 0.6–0.8cm, one-seeded.

Bhutan: S – Chukka district, C – Punakha district (Samtengang) and Mongar district (Latun La); **Darjeeling:** Siri Khola, Ryang, Sonada, Darjeeling. Moist forest, 610–2438m. May–June.

2. A. chinense (Loureiro) Harms; *Marlea begoniifolia* Roxb. Dz: *Luma Shing*; Sha: *Benthong Shing*; Nep: *Okane, Akhane, Singari* (34), *Bamanpati* (34). Fig. 381–o.

Similar to *A. alpinum* but differing in its leaves often with irregular, pointed lobes, \pm asymmetric and truncate at the base, and with tufts of hairs in vein axils of lower surface; inflorescence usually more than 4- and up to 23-flowered; fruit smaller, 1–1.4 x 0.5–0.6cm, and not laterally compressed.

Bhutan: S – Phuntsholing, Chukka and Gaylegphug districts, C – Punakha, Tongsa and Mongar districts; **Darjeeling:** foothills, e.g. Tista Valley, and terai. Subtropical and terai forests, 240–2134m. May–July.

Foliage used as fodder; timber sometimes used (48).

Family 142. NYSSACEAE

by R. A. Clement

Trees. Leaves alternate, simple, pinnately veined, entire or denticulate, petiolate; stipules absent. Monoecious; flowers actinomorphic, unisexual, in axillary, pedunculate, capitate heads, grouped near tips of branches; heads with flowers all of one sex or with a mixture of few female and many male flowers. Calyx (4–)5-lobed. Petals usually 5. Stamens 10. Style simple or bifid. Ovary inferior, 1-locular; ovule solitary, pendulous. Fruit a 1-seeded drupe.

1. NYSSA L.

Description as for Nyssaceae.

1. N. javanica Wengerin; *N. sessiliflora* Hook.f., *Daphniphylopsis capitata* Kurz, *Ilex daphniphyloides* Kurz. Nep: *Lekh Chilaune* (34). Fig. 43a–c.

Large tree to 20m. Leaves oblong-elliptic, 7–14 x 3.7–5.8cm, shortly acuminate, base cuneate or rounded-cuneate, subglabrous, usually punctate at least when dry; petiole 10–25mm. Heads subglobose, c 1cm diameter; peduncle 15–23mm. Male and female flowers similar. Calyx c 3mm, appressed-hairy; lobes c 0.5mm. Petals ± oblong, 3 x 1.3mm. Fruit ± obovoid, c 12 x 6mm.

Bhutan: S – Gaylephug district (117); **Darjeeling:** Senchal, Mahalderam, Dumsong; **Sikkim.** Warm broad-leaved forests, 1070–1980m. May.

Family 143. ARALIACEAE

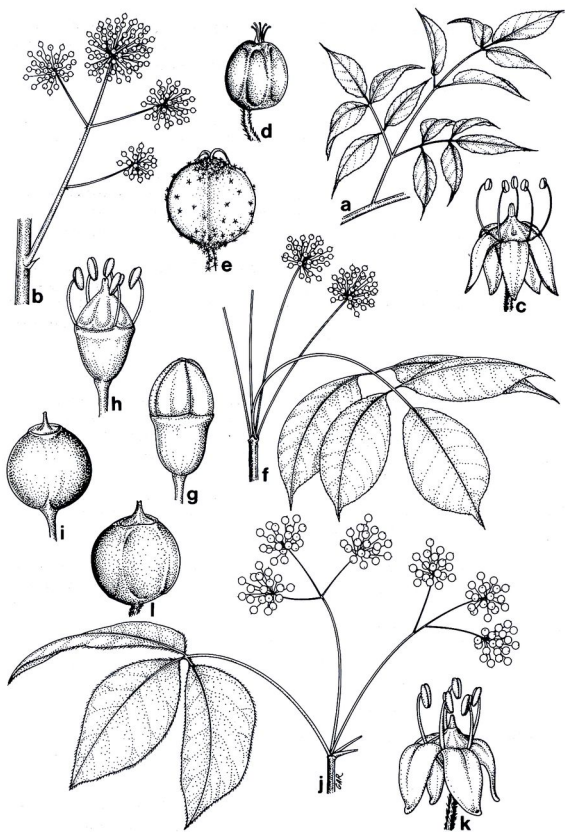
by A. J. C. Grierson

Trees or shrubs, sometimes climbing, rarely herbs; indumentum stellate, rarely simple. Leaves alternate or whorled, sometimes very large, pinnately or palmately compound, trifoliolate or simple sometimes palmately lobed. Flowers in umbels (seldom in racemes), umbels usually borne in panicles, perfect or unisexual, very often 5-merous, sometimes doubly so; pedicels often articulate at flower base. Calyx represented by small teeth around apex of ovary, sometimes obsolete. Petals mostly 5–10, sometimes coherent and falling together, valvate or sometimes imbricate. Stamens as many as and alternating with petals; anthers opening by slits. Ovary inferior 2–5- or 10-celled, each containing a solitary, pendulous ovule; styles as many as cells, distinct or connate, sometimes ± swollen at base to form a stylopodium. Fruit a drupe or berry.

1. Leaves 1–3 x pinnate or 3-foliolate 2
 + Leaves palmate with 3 or more leaflets, or simple, lobed or not 7

2. Leaves mostly 2 – 3 x pinnate 3
 + Leaves simply pinnate or 3-foliolate 4
3. Pedicels articulate at base of flowers; inflorescence glabrous; styles 5, free or shortly connate; fruit subglobose **1. Aralia**
 + Pedicels not articulate at base of flowers, inflorescence stellate-pubescent; styles 2, free; fruit compressed **2. Heteropanax**
4. Leaves simply pinnate with 5 or more leaflets; flowers in racemes or umbels **3. Pentapanax**
 + Leaves 3-foliolate 5
5. Leaflets sessile or with petiolules up to 1.5cm **4. Gamblea**
 + Petiolules longer than 1.5cm 6
6. Styles 5, connate almost to apex; leaves always 3-foliolate **3. Pentapanax** (*P. trifoliatum*)
 + Styles 2, connate almost to apex or sometimes truncated; leaves mostly palmately 5-foliolate **8. Macropanax**
7. Leaves palmate or digitate with more than 3 leaflets (but sometimes 3 in *Eleutherococcus*) 8
 + Leaves simple, lobed or not 12
8. Herbs, leaves whorled **5. Panax**
 + Shrubs, sometimes climbing, or trees; leaves alternate 9
9. Stems spiny 10
 + Stems unarmed 11
10. Shrubs; umbels solitary or few, not stellate-pubescent; styles 3 or 5, connate or free at apex **6. Eleutherococcus**
 + Trees; umbels numerous, paniced, sparsely stellate-pubescent when young; styles 2, connate to apex **7. Brassaiopsis**
11. Pedicels articulate at base of flowers; styles 2, connate almost to apex or sometimes truncated **8. Macropanax**
 + Pedicels not articulate at base of flower; styles 5, connate throughout, stigma obscurely 5-lobed **9. Schefflera**

FIG. 40. *Araliaceae*. a – d, *Aralia cachemirica*: a, leaf; b, fruiting inflorescence; c, flower; d, fruit. e, *Heteropanax fragrans*: fruit. f – i, *Pentapanax fragrans*: f, leaf and fruiting umbels; g, flower bud; h, flower at anthesis; i, fruit. j – l, *Gamblea ciliata*: j, leaf and fruiting panicles; k, flower; l, fruit. Scale: a x 1/6; f x 1/4; j x 1/3; b x 1; d, e x 2 1/2; g, h, i, l x 4; k x 6; c x 15. Drawn by G. Rodrigues.



12. Shrubs climbing by means of adhesive roots; leaves simple or sometimes lobed at base **10. Hedera**
 + Small trees; leaves usually deeply palmately lobed, sometimes shallowly lobed or unlobed 13
13. Stems unarmed; leaves shallowly 3 – 5-lobed or unlobed; styles 2 14
 + Stems prickly; leaves shallowly to deeply lobed; styles 2 or 10, connate . 15
14. Leaf margin serrate or serrulate; indumentum of stellate hairs; styles 2, free to base **11. Merrillioplanax**
 + Leaf margin entire; indumentum of simple hairs; styles 2, connate almost to apex **12. Cromapanax**
15. Leaves shallowly 3-lobed or deeply palmately 7 – 12-lobed; flowers 5-merous; styles 2, connate **7. Brassaiopsis**
 + Leaves deeply palmately 7 – 9-lobed; flowers 10-merous; styles 10, connate **13. Trevesia**

1. ARALIA L.

Shrub or small tree, unarmed or prickly. Leaves 2 – 3 x pinnate, exstipulate. Flowers bisexual and unisexual in paniculately or racemously arranged umbels; pedicels usually articulated at base of flower. Calyx minutely 5-toothed. Petals 5, imbricate. Styles 5, free or shortly connate. Fruit 5-celled, subglobose; seeds 5, compressed.

1. Shrub 2 – 3m, unarmed **1. A. cachemirica**
 + Small trees 3 – 5m, armed with short spines 2
2. Pedicels short, 1.5cm, pubescent; spines 5 – 15mm **2. A. armata**
 + Pedicels 1 – 5cm, glabrous; spines 1 – 3mm **3. A. foliolosa**

1. *A. cachemirica* Decaisne. Fig. 40a – d.

Shrub 2 – 3m, unarmed. Leaves 40 – 60cm, 2 – 3 x pinnate; leaflets ovate, 5 – 15 x 3 – 6cm, acuminate, base rounded or cordate, margins serrate, glabrous or pubescent with short, thick hairs. Panicles 30 – 40cm; bracts subulate, 3 – 5mm; umbels 1.5 – 2.5cm diameter; branches of panicle and pedicels pubescent; flowers cream-coloured. Fruit 4 – 5mm diameter, dark purple.

Bhutan: C – Ha, Thimphu and Bumthang districts, **N** – Upper Mo Chu and Upper Kuru Chu districts; **Sikkim.** On river banks, 2100 – 3350m. July – August.

2. *A. armata* Seemann

Spines 5 – 15mm, recurved. Leaves 2 – 3 x pinnate, 30 – 45(– 60)cm; leaflets ovate, 4 – 11 x 2 – 5cm, acuminate, base rounded, margin serrate, hirsute and with

scattered small prickles along midrib on both surfaces. Panicles c 50cm; rachises prickly; umbels 4cm diameter. Calyx teeth minute. Petals ovate, 2.5mm. Fruit 4 – 5mm diameter.

Darjeeling: Lebung, Mongpo, Kurseong, Pankabari. Subtropical forests, 760 – 1670m. July – August.

3. *A. foliolosa* Seemann. Nep: *Somri* (34).

Small tree up to 5m, shortly (1 – 3mm) prickly throughout. Leaves usually 3 x pinnate, up to 2.5 x 2m; leaflets ovate, 3 – 10 x 1 – 4cm, acuminate, base rounded, margin serrate, glabrous or sometimes spinulose along veins above; rachis jointed and bearing a pair of leaflets at each node. Panicles 40 – 100cm; bracts oblong-lanceolate, 5 – 10 x 3mm, glabrous or ciliate; umbels 1.5cm diameter. Petals whitish, oblong-ovate, 2.5mm. Fruit ovoid, 5mm.

Bhutan: S – Sarbhang district (Noonpani) and Gaylephug district (Betni Khola, 117); **Darjeeling:** Subtropical forest, 500 – 1500m. December.

2. HETEROPANAX Seemann

Small unarmed trees. Leaves 3 x pinnately compound, glabrous; leaflets entire; stipules not prominent. Flowers in umbels, borne in long racemose panicles, stellate-pubescent at first; pedicels not articulated at base of ovary; terminal umbels of panicle branches mostly with bisexual flowers; lateral umbels mostly with male flowers. Calyx teeth obsolete. Petals 5, valvate. Stamens 5, anthers ovoid. Ovary 2-celled, styles 2, free from base. Fruit laterally compressed, almost 2 x broader than long, 2-seeded.

1. *H. fragrans* Seemann. Sha: *Baha-boo-toh*; Nep: *Lal Totola* (34), *Bale Totola*, *Gykure*. Fig. 40e.

Tree 3 – 20m. Leaves 3 x pinnate, 0.5 – 1.2m; leaflets elliptic or ovate, 6 – 12 x 2.5 – 4.5cm, acuminate, base rounded or cuneate, rarely subcordate. Panicles 30 – 100cm, brownish stellate-tomentose; umbels many-flowered, 2cm diameter in flower, 3.5cm diameter in fruit. Petals whitish, ovate, c 2mm. Fruits rounded, laterally compressed, 0.5 – 0.8 x 1cm, sparsely stellate.

Bhutan: S – Samchi district (Dorokha, 117), Phuntsholing district (117) and Chukka district (Tabji Khola); **Darjeeling:** Farseng, Kurseong, Tista, etc. Subtropical and terai forests, 450 – 1200m. December – January.

3. PENTAPANAX Seemann

Trees or large scandent shrubs, sometimes epiphytic, unarmed. Leaves simply pinnate or trifoliolate; leaflets entire. Flowers bisexual or unisexual, in branched racemes or in umbels which are solitary or in panicles; pedicels articulated at base of flower. Calyx minutely 5-toothed. Petals usually 5, imbricate. Stamens as many

as petals. Ovary usually 5-celled; styles free or partially connate. Fruit subglobose; seeds laterally compressed.

1. Flowers in branched racemes **1. P. racemosus**
- + Flowers in umbels 2
2. Epiphytic shrub; umbels usually solitary **2. P. parasiticus**
- + Trees or woody climbers, sometimes epiphytic; umbels in panicles 3
3. Tree or shrub; leaflets usually 5, sometimes 3; umbels 4–5, arranged in whorls on inflorescence branches **3. P. fragrans**
- + Climber; leaflets always 3; umbels racemously arranged **4. P. trifoliatus**

1. *P. racemosus* Seemann

Tree 12m or large scrambler. Leaves pinnate, 5-foliolate, c 45cm; leaflets ovate or elliptic, 15–18 x 7–10cm, shortly acuminate, base rounded, serrate or denticulate, glabrous. Inflorescence to 40cm, pubescent. Petals yellowish, ovate, 3mm, Fruit c 2.5mm diameter.

Bhutan: S—Deothang district (Riserboo), C—Thimphu, Mongar and Tashigang districts; **Darjeeling:** Lebong, Darjeeling; **Sikkim:** Lachen. In moist warm broad-leaved forests, 1980–2730m. June–August.

2. *P. parasiticus* (D. Don) Seemann

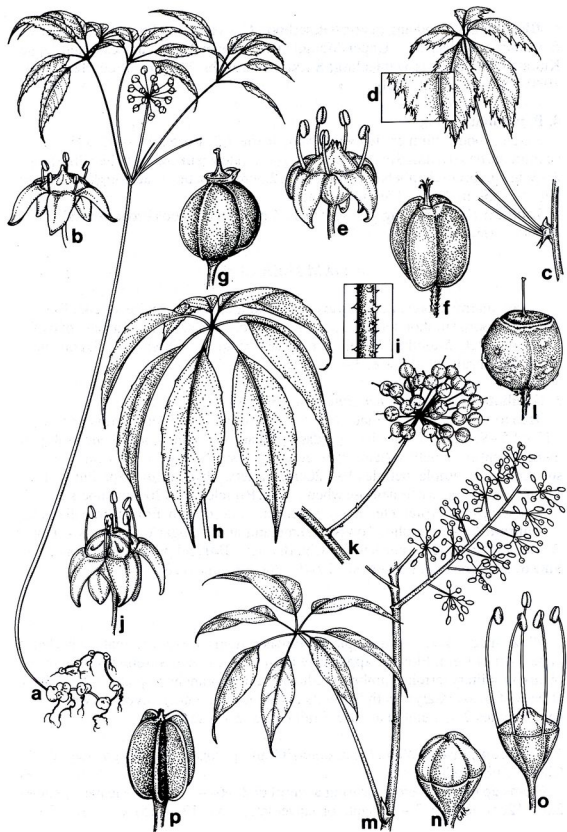
Epiphytic shrub 1.5–2m. Leaves 10–15cm, 5-foliolate; leaflets ovate, 4–6 x 2–2.5cm, acuminate, base cuneate, margins entire, glabrous, paler beneath. Umbels usually solitary, 3cm diameter; pedicels usually brownish pubescent. Petals ovate, 2mm. Fruits c 3.5mm diameter.

Bhutan: C—Thimphu district (Dotena). In mossy oak forest, 2560m. September.

3. *P. fragrans* (D. Don) Ha; *P. leschenaultii* (DC.) Seemann. Nep: *Chinde* (34). Fig. 40f–i.

Tree or shrub to 10m, sometimes epiphytic. Leaves 25–30cm; leaflets 3–5, ovate-elliptic, 7–15 x 2.5–8cm, acuminate, base rounded or cordate, finely serrate, glabrous above, pubescent on midribs and in vein axils beneath when young. Umbels 2–2.5(–5)cm diameter, arranged in whorls. Petals c 2mm, deciduous as a cap. Fruit 3.5mm diameter.

FIG. 41. *Araliaceae*. a & b, *Panax pseudo-ginseng* subsp. *himalaicus*: a, fruiting plant; b, flower. c–f, *Eleutherococcus cissifolius*: c, leaf; d, leaf prickles; e, flower; f, fruit. g, *Macropanax dispermus*: fruit. h–l, *Brassaiopsis glomerulata*: h, leaf; i, portion of stem; j, flower; k, fruiting umbel; l, fruit. m–p, *Schefflera bengalensis*: m, leaf and fruiting panicle; n, flower bud; o, flower at anthesis; p, fruit. Scale: m x 1/8; h x 1/4; a, c, i, k x 1/2; d x 1; b, f, j, l x 2 1/2; g x 3 1/2; e, n, o, p x 4. Drawn by G. Rodrigues.



Bhutan: S – Deothang district (Riserboo), C – Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling;** **Sikkim;** **Chumbi.** Margins of conifer forests, 1930 – 3650m. April – July.

4. *P. trifoliatum* Feng

Large woody climber. Leaves 30cm; leaflets 3, ovate, 13 – 15 x 5 – 8cm, acuminate, base rounded or truncate, margin serrate, teeth ending in hair-like points 2 – 3mm, glabrous. Umbels hemispherical, 2.5cm diameter, ± racemously arranged. Petals c 2.5mm. Fruits 3.5mm diameter.

Bhutan: S – Sarbhang district (Dara Chu). Shady cool broad-leaved forest, 1810m. February.

4. GAMBLEA Clarke

Small unarmed trees. Leaves mostly 3-foliolate; leaflets entire, ciliate. Flowers in umbels, borne in short terminal panicles; pedicels not articulated at base of ovary. Calyx minutely 5-toothed. Petals 5, reflexed. Stamens 5. Styles 3 – 5, connate in lower half. Fruit subglobose, 3 – 5-seeded.

1. *G. ciliata* Clarke. Nep: *Kursimla* (34). Fig. 40j – l.

Tree to 12m. Leaves palmate, (1 –)3(– 5)-foliolate; leaflets elliptic or ovate, 5 – 17 x 2.5 – 9cm, acuminate, base cordate, cuneate or rounded (lateral ones oblique), margins entire, finely ciliate, sparsely brownish pubescent on veins on both surfaces, hairs simple; petioles 10 – 20cm; leaflets subsessile or on petiolules up to 1.5cm, densely brown tomentose when young. Panicles up to 20cm; umbels 10 – 17-flowered, up to 6cm diameter. Petals greenish, ovate, c 3mm. Fruit c 8mm diameter.

Bhutan: C – Thimphu, Tongsa, Bumthang and Mongar districts, N – Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling:** Tonglu, Pankabari; **Sikkim:** Jongri. In mixed forests, 2740 – 3660m. June – July.

5. PANAX L.

Rhizomatous herbs with simple unbranched stems. Leaves palmate, whorled in upper part of stem. Flowers apparently unisexual, males and females on separate plants, in solitary terminal umbels (peduncles rarely branched); pedicels articulated at base of ovary. Calyx teeth 5. Petals 5. Stamens 5; anthers ovoid. Ovary 2 – 3-celled; styles 2 – 3, united at base. Fruit ovoid, 2 – 3-seeded.

1. *P. pseudo-ginseng* Wall.; *P. sikkimensis* Banerji, *Aralia pseudo-ginseng* (Wall.) Clarke. Fig. 41a&b.

Stems up to 75cm, erect, bearing a whorl of 3 – 6(– 7) palmate leaves; petioles 2.5 – 12cm; leaflets 3 – 6, ovate or lanceolate, 3.5 – 12(– 15) x 1 – 3(– 7)cm,

acuminate, base rounded or cuneate, margins serrate or deeply incised-pinnatifid, sparsely hirsute along veins on both surfaces. Male umbels 1.5cm diameter; female umbels 3cm diameter. Petals white, c 2mm. Fruits scarlet, 4mm diameter.

Bhutan: S – Gaylegphug and Deothang districts, C – Ha, Thimphu, Tongsa and Tashigang districts, N – Upper Kulong Chu district; **Darjeeling; Sikkim; Chumbi.** In coniferous forests, 1500 – 3650m. May – September.

An important species in traditional medicine. The typical subsp. *pseudo-ginseng* with short rhizomes and carrot-like roots, and flattish seeds 5 – 8mm long x 2 – 2.5mm thick, has not been recorded from this area; our plants have long, creeping, nodular rhizomes, and ovoid seeds 4 – 5 x 3 – 4mm, and have been segregated as subsp. **himalaicus** Hara. This has been further subdivided into two varieties: var. **bipinnatifidus** (Seemann) Li (*Aralia bipinnatifida* (Seemann) Clarke) with pinnatifid leaflets with sharply incised lobes, recorded from Thimphu district (Hinglai La to Tsalimaphe), Darjeeling district (Tonglo) and Sikkim (Samdong, Yakla and Bakkim); and var. **angustifolius** (Burkill) Li, with leaflets narrowly lanceolate up to 2.5cm broad, uniformly serrate, which is widespread in Bhutan, Darjeeling and Sikkim.

6. ELEUTHEROCOCCUS Maximowicz

Shrubs with prickly stems. Leaves digitate. Flowers bisexual and unisexual, in umbels; umbels solitary or few; pedicels not articulated at base of ovary. Calyx minutely 5-toothed. Petals 5. Stamens 5, anthers oblong. Ovary 3 – 5-celled; styles 5, free or connate throughout. Fruit suborbicular, 3 – 5-seeded; seeds compressed.

1. Styles connate **1. E. leucorrhizus**
 + Styles free in upper half **2. E. cissifolius**

1. E. leucorrhizus Oliver; *Acanthopanax leucorrhizus* (Oliver) Harms

Shrub to 4m, usually sparsely prickly at nodes. Leaves 10 – 15cm; leaflets usually 5, elliptic or oblanceolate, 4 – 9 x 1.5 – 3.5cm, acuminate, base cuneate, serrate in upper half, usually entire near base, glabrous. Umbels solitary or in 3's, c 5cm diameter, on peduncles 5 – 9cm. Petals c 1.5mm. Styles c 1mm, connate almost to apex. Fruit 7 – 8mm diameter.

Bhutan: C – Ha district (Sharithang), Thimphu district (Dotena and Taba) and Tongsa district (Rukubji). In forests, 2440 – 3660m. May – July.

2. E. cissifolius (Seemann) Nakai; *Aralia cissifolia* Seemann, *Acanthopanax cissifolius* (Seemann) Harms. Fig. 41c – f.

Shrub to 5m; branches sparsely prickly. Leaves 6 – 12cm; leaflets 3 – 5, obovate, 2 – 4 x 1.5 – 2cm, acuminate, base cuneate, margin doubly serrate with scattered, minute prickles on both surfaces. Umbels usually solitary, 2 – 3cm diameter, on peduncles up to 5cm. Petals 2.5cm. Styles c 2mm, free almost to base. Fruit 6.5mm diameter.

Bhutan: C – Ha district (Damthang), Thimphu district (Barshong, Paro), N – Upper Mo Chu district (Gasa) and Upper Kulong Chu district (Shingbe); **Sikkim:** Lachen; **Chumbi:** Gautsa to Yatung. In forests, 2285 – 3650m. June – July.

7. BRASSAIOPSIS Decaisne & Planchon

Small armed trees; indumentum stellate. Leaves palmately compound or palmately lobed; stipules not prominent. Flowers bisexual and unisexual, in umbels borne in panicles; bisexual flowers usually in terminal umbels of inflorescence branch; male umbels lateral and deciduous; pedicels not articulated at base of ovary. Calyx teeth minute. Petals 5, valvate. Stamens 5; anthers ovoid. Ovary 2-celled; styles 2, connate to apex. Fruit globose, 2-seeded; seeds scarcely compressed.

- | | |
|---|--------------------------|
| 1. Leaves palmately compound | 1. B. glomerulata |
| + Leaves palmately lobed | 2 |
| 2. Leaves 12 – 37cm, shallowly 3 – 7-lobed | 2. B. hainla |
| + Leaves 30 – 60cm, deeply 11 – 13-lobed | 3 |
| 3. Densely spiny on stems, leaves and panicles; leaves glabrous; umbels in a racemose panicle | 3. B. hispida |
| + Spiny on main stem; leaves pubescent beneath; umbels in a branching panicle | 4. B. mitis |

1. B. glomerulata (Blume) Regel; *B. speciosa* Clarke, *B. hookeri* Clarke. Fig. 41h – l.

Tree 3 – 6m, spiny on main stem and sometimes on panicles. Leaflets 6 – 7, ovate, 20 – 30(–48) x 10 – 15(–22)cm, acuminate, base cuneate, margin serrate, glabrous on both surfaces or brownish stellate-pubescent especially beneath; petiole 25 – 60cm; petiolules 1.5 – 10cm. Panicles up to 40cm; umbels many-flowered, 3.5 – 4cm diameter in flower, 6 – 7cm diameter in fruit. Petals greenish, ovate, 4mm. Ovary sparsely stellate; style 3 – 4mm. Fruit 7mm diameter.

Bhutan: S – Phuntsholing district (Jumudag), Gaylegphug district (Chabley Khola) and Deothang district (Chungkar), C – Punakha district (Mara Chu); **Darjeeling:** widespread. Subtropical, warm broad-leaved and evergreen oak forests, 900 – 2150m. May – November.

The typical variety has glabrous leaves but var. **rufo-stellata** (Clarke) Grierson has undersides of leaves and panicles densely brownish stellate-pubescent. This is known from Deothang district (Morong). The record of *B. aculeata* (D. Don) Seemann from Bhutan (117) may belong here.

2. B. hainla (D. Don) Seemann; *B. palmata* Kurz, *B. polyacantha* (Wall.) Banerjee, *Panax curcifolia* Griff. Nep: *Chuletro*.

Trees 3–8(–12)m; main stems and panicles spiny. Leaves ovate or suborbicular in outline, 12–37cm long and broad, ± shallowly, palmately 3–7-lobed, acuminate, base cordate, margins serrate, glabrous or sparsely stellate-pubescent beneath; petioles 10–30cm. Panicles c 20cm, brownish stellate-pubescent. Petals greenish, ovate, c 2.5mm. Styles c 1.5mm. Fruit 6.5mm diameter.

Bhutan: S – Chukka, Sarbhag and Gaylephug districts, C – Tongsa and Tashigang districts, N – Upper Kuru Chu district; **Darjeeling:** Pankabari, Kalimpong, Rongbè. Warm broad-leaved forests, 910 – 1980m. February – April.

3. B. hispida Seemann. Nep: *Phutta* (34).

Tree 3–5m, prickly on stems, panicle, petiole and leaf margins. Leaves deeply palmately 11-lobed, suborbicular in outline, to 30 x 55cm, lobes divided 2/3 to base, oblong, acute, margin prickly-serrate, base deeply cordate, glabrous above, appressed stellate-pubescent and main veins armed with small prickles beneath; petiole to 35cm, bearing short prickles. Panicles racemose, 40cm, main axis shortly prickly; peduncles 7–8cm; umbels 5.5cm diameter. Fruit unknown.

Bhutan: S – Gaylephug district (Chabley Khola), C – Tashigang (Dondi Chu, 117); **Darjeeling:** Little Rungit, Goompahar; **Sikkim** (80). Evergreen broad-leaved forests, 1500 – 2133m. October – November.

4. B. mitis Clarke. Nep: *Phutta* (34), *Chuletro* (34).

Tree to 6m, spiny on main stem. Leaves palmately 7–12-lobed, suborbicular in outline, to 60 x 60cm, lobes divided 2/3 to base, linear-lanceolate, acuminate, margins serrate, glabrous above, sparsely stellate beneath; petioles c 60cm, densely bristly at apex. Panicles c 50cm, bristly; peduncles 10–20cm; umbels c 5cm diameter. Flowers creamy; petals 3mm. Fruit unknown.

Bhutan: C – Tongsa district (near Tongsa) and Mongar district (above Mongar), N – Upper Mo Chu district (Khosa, – Tamji); **Darjeeling:** common around Darjeeling (34), Tonglo; **Sikkim.** In broad-leaved forests, 1830 – 2350m. May – July.

Foliage lopped for fodder (34).

8. MACROPANAX Miquel

Small unarmed trees. Leaves palmately 3–5-foliolate; stipules intrapetiolar or obsolete. Umbels borne in panicles; pedicels articulated under flower. Calyx minutely 5-dentate. Petals 5, valvate. Stamens 5. Ovary 2(–3)-celled; styles connate almost to apex (or sometimes truncate). Seeds compressed.

1. Leaflets serrate; inflorescence minutely brown stellate-tomentose

1. M. dispermus

+ Leaflets entire or obscurely serrulate; inflorescence glabrous

2. M. undulatus

1. M. dispermus (Blume) Kuntze; *M. oreophilus* Miquel. Sha: *Gu Shing*. Fig. 41g.

Tree to 10m. Leaflets 3–5(–7), ovate-elliptic, 7–20 x 3–7cm, acuminate, base rounded or cuneate, margins denticulate or serrate, glabrous; petioles 10–15cm; petiolules up to 5cm. Panicles up to 50cm, closely brown stellate-pubescent. Umbels 2.5cm diameter, 15–25-flowered. Petals ovate, 2.5mm. Fruit reddish, ovoid-ellipsoid, 6.5 x 5mm, slightly ribbed.

Bhutan: S – Phuntsholing and Chukka districts (near Chukka Dzong), C – Mongar district (Ngasamp); **Darjeeling:** In mixed broad-leaved forests, 1220–1980m. August–October.

2. M. undulatus (G. Don) Seemann. Nep: *Chinde* (34).

Tree to 15m. Leaflets 3–5, elliptic, 8–20 x 5–8.5cm, acuminate, base cuneate, margins entire or obscurely serrulate, glabrous; petioles 5–15cm; petiolules 0.5–6cm. Panicles up to 30cm, glabrous. Petals 3mm. Fruit ellipsoid, compressed, 6.5 x 5.5cm.

Bhutan: S – Chukka district (Marichong) and Sarbhang district (Dara Chu), C – Tongsa district (Shemgang, 117); **Darjeeling:** Mongpu, Kalimpong. In cool broad-leaved forests, 700–1810m. October–November.

9. SCHEFFLERA Forster

Unarmed trees or scrambling shrubs. Leaves digitate; leaflets entire, coriaceous; stipules connate, intrapetiolar, rounded. Flowers in umbels borne in panicles; pedicels not jointed. Calyx teeth minute or obsolete. Petals 5, valvate, sometimes cohering and falling as a cap. Stamens as many as petals. Ovary 5-celled; styles short, connate, or stigmas sessile. Fruit subglobose or ellipsoid; seeds laterally compressed.

This treatment of *Schefflera* is partly based on unpublished data kindly supplied by D. G. Frodin. Research is not yet complete and one or more additional taxa from Bhutan may result. The record of *S. khasiana* (Clarke) Harms from Bhutan (80), is based on a specimen from Assam.

1. Umbels 2.5–3.5cm diameter; styles united, short 2
+ Umbels 1–2(–2.5)cm diameter; styles absent 3

2. Leaflets densely stellate-pubescent beneath, veins impressed above

1. S. impressa

- + Leaflets glabrous or sparsely stellate-pubescent beneath, veins ± prominent above **2. S. elata**

3. Leaflets 2 – 3.5cm broad, caudate-acuminate; inflorescence densely stellate-pubescent at first **3. S. tenuis**
 + Leaflets 4 – 7cm broad, shortly acuminate; inflorescence sparsely pubescent or glabrous 4
4. Inflorescence sparsely stellate-pubescent at first; buds purplish, flowers white, petals cohering and falling as a cap **4. S. bengalensis**
 + Inflorescence ± glabrous; flowers greenish yellow, petals opening and falling separately **5. S. aff. roxburghii**

1. S. impressa (Clarke) Harms; *Heptapleurum impressum* Clarke. Nep: *Bhalu Chinde* (34), *Bhalu Phutta* (34).

Tree (4 –) 5 – 10(– 12)m. Leaflets 5 – 8, elliptic or oblanceolate, 15 – 30 x 4 – 8cm, acuminate, base cuneate, glabrous, with impressed veins above, densely whitish stellate-pubescent beneath; petiole 15 – 40cm, pubescent at first. Panicles 40 – 50cm, lateral branches 10 – 30cm; umbels 3 – 3.5cm diameter. Fruit subglobose, 4.5mm diameter; styles connate, 1.5mm, persistent.

Bhutan: S – Chukka district (Jumudag), C – Mongar district (Lhuntse); **Darjeeling:** Tonglo, Senchal. Evergreen oak forests, 2200 – 3050m. August – September.

Foliage used as fodder (34).

2. S. elata (D. Don) Harms; *S. bhutanica* Banerjee, *S. glauca* auct. non (Seemann) Harms, *Heptapleurum elatum* (D. Don) Clarke. Nep: *Gufila* (34).

Tree 6 – 12m. Leaflets 7, elliptic or lanceolate, 13 – 15 x 4 – 6cm, finely acuminate, base rounded, glabrous or with a few stellate hairs on both surfaces; petioles 25 – 30cm; petiolules 1.5 – 3.5cm. Panicles 15 – 25cm, minutely stellate-pubescent, lateral branches 5cm; umbels 2 – 3.5cm diameter, minutely stellate-pubescent. Petals pale greenish-white, 2.5mm. Styles connate c 1mm. Fruit broadly ellipsoid, 5 – 6mm diameter.

Bhutan: S – Chukka district (Chukka Dzong), Deothang district (Kheri Gompa); **Darjeeling; Sikkim.** In dense broad-leaved forests, 1525 – 2130m. September – November.

Wood used as planking (34).

3. S. tenuis Li

Shrub to 3m. Leaflets 3 – 5, narrowly elliptic, 7 – 10 x 2 – 3.5cm, caudate-acuminate, base cuneate, glabrous on both surfaces; petioles 5 – 10cm; petiolules 1 – 2cm. Panicle branches c 10cm, stellate-pubescent at first; umbels 5 – 8-flowered, 1 – 2cm diameter. Petals crimson, 2mm. Fruits globose, 3.5mm diameter, orange or red.

Bhutan: S – Gaylegphug district (near Sham Khara). On cliff face, 1150m. March.

4. *S. bengalensis* Gamble; *Heptapleurum venulosum* sensu F.B.I. p.p. non (Wight & Arnott) Seemann. Nep: *Kursimlo Lahara*. Fig. 41m – p.

Large climbing shrub. Leaflets 5 – 7, oblong-elliptic, 8 – 15 x 3.5 – 7cm, shortly acuminate, base rounded or cuneate, glabrous on both surfaces; petioles 10 – 18cm; petiolules 2.5 – 5cm. Panicles c 18cm, branches stellate-pubescent, 10 – 12(– 18)cm; umbels 1 – 2cm diameter, c 10-flowered. Petals purplish in bud, opening white, 2.5mm, cohering and falling as a cap. Fruit ellipsoid, 3.5mm diameter, strongly 5 angled, orange or crimson.

Bhutan: S – Chukka district (near Chukka) and Sarbhang district (near Loring Falls), C – Punakha district (Wangdu Phodrang) and Tashigang district (Gamri Chu); **Darjeeling; Sikkim.** In warm broad-leaved forests, 900 – 1675m. October – April.

The name *Schefflera venulosa* (Wight & Arnott) Harms applies to a South Indian plant.

5. *S. aff. roxburghii* Gamble

Similar to *S. bengalensis* but panicles up to 25cm, branches glabrous; umbels 1.5 – 2cm diameter, 7 – 12-flowered; petals greenish-yellow, 2mm, opening and falling separately; fruit globose, 4mm diameter, orange to dark red.

Bhutan: S – Gaylegphug district (Sarbhang Road) and Deothang district (near Samdrup Jongkhar); **Darjeeling:** Rongbe and Sivoke Terai. In dense subtropical jungle, often in river valleys, 300 – 600m. April – July.

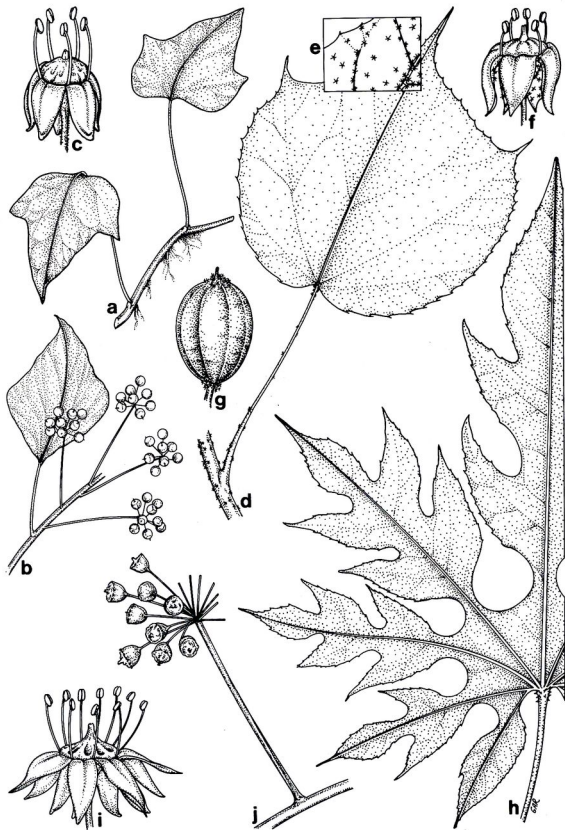
10. HEDERA L.

Unarmed climbing shrub, stems bearing adhesive rootlets. Leaves simple, sometimes lobed. Umbels few-flowered, borne in short panicles; pedicels not articulated at base of ovary. Calyx rim subentire. Petals 5. Stamens 5. Ovary 5-celled, stigmas connate. Fruit berry-like.

1. *H. nepalensis* K. Koch; *H. helix* sensu F.B.I. non L. Sha: *Paan-Roo*; Nep: *Lek Bori, Doode Lahara*; Eng: *Ivy*. Fig. 42a – c.

Leaves coriaceous, ovate-lanceolate, 5.5 – 11 x 3 – 6cm, acuminate, base rounded or cuneate, usually 3-lobed on prostrate rooting stems, unlobed on flowering stems, entire, glabrous. Umbels in terminal panicles 3 – 6cm, 3 – 10(– 24)-flowered, 2cm diameter; buds stellate-pubescent at first. Petals ovate, 3mm. Fruit subglobose, 6 – 8mm diameter, orange.

FIG. 42. Araliaceae. a – c, *Hedera nepalensis*: a, prostrate stem with adhesive rootlets; b, part of fruiting branch; c, flower. d – g, *Merrillioanax alpinus*: d, leaf; e, leaf indumentum; f, flower; g, fruit. h – j, *Trevesia palmata*: h, part of leaf; i, flower; j, part of fruiting umbel. Scale: d, h, x ¼; a, b, j x ½; e x 2; c, f, i x 4; g x 5. Drawn by G. Rodrigues.



Bhutan: S – Chukka district, C – Ha, Thimphu, Punakha, Tongsa and Tashigang districts; **Darjeeling:** rare in wild, cultivated at Darjeeling; **Sikkim:** Choongtam, Lachung. In moist forests, 1900 – 2600m. October – November.

11. MERRILLIOPANAX Li

Small unarmed trees with stellate indumentum. Leaves simple, 2 – 3-lobed or unlobed; stipules adnate to petioles, indistinct. Inflorescence a terminal panicle of umbels. Flowers small, pedicels not articulated at ovary base. Calyx teeth 5, minute. Petals 5, reflexed. Stamens 5. Ovary 2-celled, ovules 1 per cell. Styles 2, united at base. Fruit ellipsoid, 2-seeded.

1. M. alpinus (Clarke) Shang; *Brassaiopsis alpina* Clarke. Nep: *Bhote Phutta* (34). Fig. 42d – g.

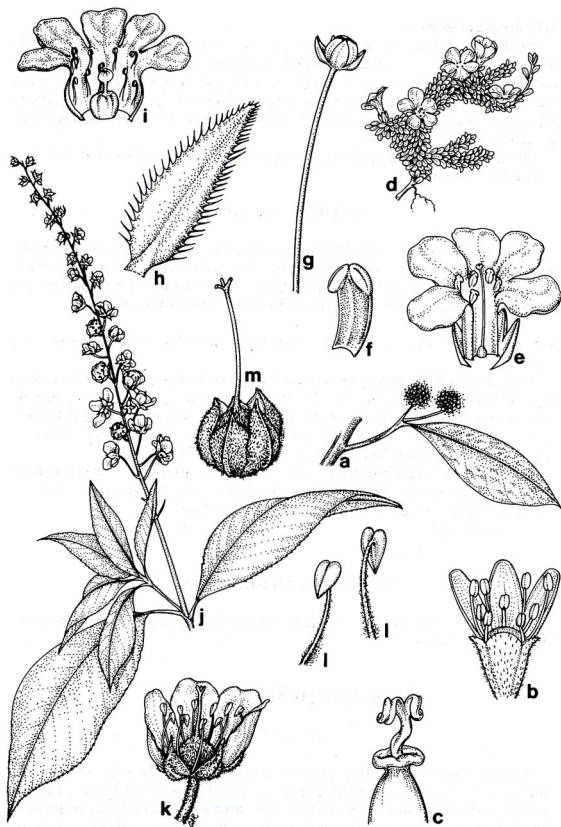
Tree 3 – 8m, pale brownish tomentose at first. Leaves broadly ovate or suborbicular, 15 – 25 (– 35) x 15 – 25 (– 36)cm, lobes up to 3, shallow, abruptly acuminate, base cordate, margin serrulate, stellate-pubescent on both surfaces at first, denser and pale brown beneath; petioles 10 – 20cm. Panicle branches up to 25cm, pale brownish stellate at first; umbels 1.5 – 2cm diameter, 7 – 15-flowered; pedicels 5 – 7mm. Petals greenish, narrowly ovate, 2mm. Stamens c 2mm. Fruit 5 x 3mm.

Bhutan: C – Tongsa, Mongar and Tashigang districts, N – Upper Kulung Chu district; **Darjeeling:** Senchal, Tonglo; **Sikkim:** Lachen. In wet broad-leaved forests, 1800 – 2800m. May – September.

12. CROMAPANAX Grierson

Unarmed tree; indumentum simple. Leaves palmately (3 –)5-lobed. Umbels in panicles. Flowers unknown, pedicels articulated at base of ovary. Fruit ellipsoid, weakly ribbed longitudinally. Styles 2, connate almost to apex, base slightly conical.

FIG 43. **Nyssaceae, Diapensiaceae and Clethraceae.** **Nyssaceae.** a – c *Nyssa javanica*: a, part of inflorescence; b, male flower with two petals and one stamen removed; c, ovary and style from female flower. **Diapensiaceae.** d – g, *Diapensia himalaica*: d, habit; e, dissected flower; f, stamen; g, fruit surrounded by persistent calyx. h & i, *Diplarche multiflora*: h, leaf; i, dissected flower. **Clethraceae.** j – m, *Clethra delavayi*: j, flowering branch; k, flower with one petal removed; l, stamens; m, fruit enclosed by persistent calyx. Scale: a, j x 1/2; d x 1; g x 1 1/2; k x 2 1/2; e x 3; m x 3 1/2; i, l x 4; f x 6; h x 7 1/2; b, c x 10. Drawn by G. Rodrigues.



I. C. lobatus Grierson

Small tree to 4m; young stems simply pubescent. Leaves broadly ovate in outline, 20 – 22 x 18 – 24cm, palmately lobed, lobes ovate-oblong, shortly and abruptly acuminate, base cordate, margin entire, sparsely pubescent above, paler and more densely pubescent beneath with simple hairs c 0.5mm; petioles 7 – 15cm, pubescent. Panicles c 15cm, umbels 10 or more flowered, 2.5 – 3cm diameter. Fruit 6 x 4mm, styles 1.5 – 1.7mm.

Bhutan: S – Gaylephug district (Lodrai Khola). In subtropical forest, 340m. Endemic to Bhutan.

13. TREVESIA Visiani

Small prickly trees with stellate indumentum. Leaves coriaceous, simple, palmately lobed; stipules intrapetiolar. Flowers in umbels borne in large panicles; pedicels not articulated at base of ovary. Calyx lobes 10, small. Petals 10. Stamens 10. Styles 10, connate, short. Capsule subglobose, up to 10-seeded.

I. T. palmata (Roxb.) Visiani. Sha: *Torma Laga Shing*; Nep: *Phutta* (34). Fig. 42h – j.

Trees 3 – 6m with strongly spiny bark. Leaves palmately 7 – 9-lobed to ¼ from base; lobes ovate-elliptic, 18 – 35 x 4 – 14cm, acuminate, coarsely serrate, sparsely stellate-pubescent at first; petioles 15 – 45cm, sparsely prickly or unarmed. Umbels up to 30-flowered, 5 – 10cm diameter. Calyx teeth c 1.5mm. Petals yellowish, narrowly ovate, 6.5mm. Styles c 4mm. Fruit 10 – 16mm diameter.

Bhutan: S – Chukka, Sarbhang and Gaylephug districts, C – Tongsa, Mongar and Tashigang districts; **Darjeeling:** terai and foothills; **Sikkim.** On subtropical broad-leaved forest slopes, 500 – 1675m. March – April.

Fruit edible (34).

Family 144. UMBELLIFERAE

The account of this family has been deferred to Volume 2 Part 2 due to unresolved taxonomic problems.

Family 145. DIAPENSIACEAE

by S. J. Rae

Small, prostrate or decumbent, glabrous, evergreen subshrubs. Leaves coriaceous, simple, alternate, often crowded, pinnately veined, sessile, exstipulate. Flowers solitary or in terminal clusters (condensed racemes), bisexual, actinomorphic. Sepals 5, free. Corolla tubular at base; lobes 5, spreading. Stamens 5 or 10, 350

epipetalous, dehiscent by slits. Ovary superior, 3- or 5-celled; ovules numerous, axile; style simple; stigma 4-lobed. Fruit a 3- or 5-celled capsule, borne on elongated pedicel; seeds many.

1. Leaves obovate-oblong, entire; flowers solitary; stamens 5 **1. Diapensia**
 + Leaves linear-lanceolate, serrulate; flowers in terminal clusters (condensed racemes); stamens 10 **2. Diplarche**

1. DIAPENSIA L.

Prostrate subshrubs. Leaves entire. Flowers solitary on a short peduncle. Stamens 5, opposite sepals. Ovary 3-celled. Fruit a 3-celled capsule.

1. *D. himalaica* Hook. f. & Thomson. Fig. 43d - g.

Leaves coriaceous, obovate-oblong, 2-5 x 1.5-2.5mm, apex acutely mucronate or obtuse, base sheathing, thin, midrib impressed above. Flowers subsessile. Sepals ovate-oblong, imbricate, leaf-like, 3-4 x 2-3mm. Corolla pale pinkish-red; tube 4-8mm; lobes suborbicular, 3-5mm. Capsule broadly ellipsoid, c 8mm, surrounded by persistent calyx, on greatly elongated pedicel 5-7cm.

Bhutan: C - Tongsa and Mongar districts, N - Upper Mo Chu, Upper Pho Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim; Chumbi.** Rocky hillsides, cliff ledges and damp rocks, 3050-4900m. May - August.

Two varieties are recognised: var. **himalaica**, the widespread plant in Sikkim and Bhutan, with leaves acute and mucronate, and var. **retusa** Evans with leaves obtuse or retuse, the more local of the two in Sikkim and Upper Mo Chu and Upper Kulong Chu districts of Bhutan.

2. DIPLARCHE Hook. f. & Thomson

Decumbent dwarf shrubs. Leaves crowded along branches, finely serrulate. Flowers in terminal clusters (condensed racemes), subtended by leaf-like, ciliate bracts. Stamens 10, in 2 whorls. Capsule 5-lobed.

1. Branches glandular-pubescent; leaves 3-6mm long; heads 10-30-flowered; lower 5 stamens attached above base of corolla tube **1. D. multiflora**
 + Branches glabrous or nearly so; leaves 2-3mm long; heads 2-8-flowered; lower 5 stamens free from corolla **2. D. pauciflora**

1. *D. multiflora* Hook.f. & Thomson. Fig. 43h&i.

Dwarf decumbent shrub, 4-10cm. Leaves crowded along branches, linear-lanceolate, 3-6 x 1-2mm, acute, margins with subulate teeth. Flowers 10-30 forming a globose head. Sepals oblanceolate, c 5mm. Corolla pink; tube c 2mm; limb c 4mm across. Upper 5 stamens attached near apex of corolla tube, lower 5 attached above base. Capsules c 3mm diameter.

Bhutan: C – Tongsa district (Omta Tso and Thita Tso), N – Upper Kulong Chu district (Me La); **Sikkim:** Lachen and Lhonak; **Chumbi:** Open hillsides and alpine screes, 3300 – 4700m. June – August.

2. *D. pauciflora* Hook.f. & Thomson

Similar to *D. multiflora* but a smaller plant; leaves smaller, 2 – 3 x 1mm; heads 2 – 8-flowered; sepals c 3mm; corolla limb c 3mm across; lower whorl of stamens free from corolla.

Bhutan: N – Upper Kulong Chu district (Me La); **Sikkim:** Zemu Valley, Cheumsangthang, Kankola and Thanka La. Alpine slopes, 4260 – 4500m. July – August.

Family 146. CLETHRACEAE

by S. J. Rae

Evergreen trees or large shrubs with stellate hairs. Leaves alternate, simple, pinnately veined, exstipulate. Flowers in simple terminal racemes, actinomorphic, bisexual. Calyx deeply 5-lobed, persistent. Petals 5, free. Stamens 10, in 2 whorls; anthers opening by pores. Ovary superior, 3-celled; style simple, shortly 3-lobed, persistent; ovules 20 – 40 per cell, axile. Fruit a subglobose capsule; seeds many.

1. CLETHRA L.

Description as for Clethraceae.

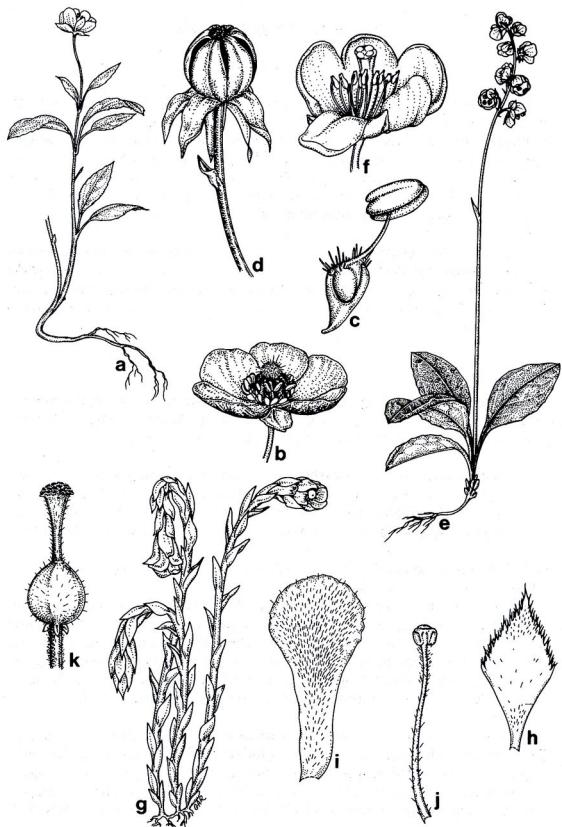
1. *C. delavayi* Franchet. Fig. 43j – m.

Tall shrub or small tree 3 – 5m; young branches red, stellate-pubescent. Leaves thinly coriaceous, elliptic, 8 – 15 x 4 – 6cm, acuminate, base cuneate, margins serrate, thinly tomentose beneath, becoming glabrous above; petioles 1 – 2.5cm, villous. Flowering racemes densely stellate, 10 – 21cm; pedicels 5 – 9mm. Calyx lobes pink, ovate-lanceolate, 5 – 6mm, pubescent. Petals white, obovate, 5 – 8mm, emarginate. Filaments hairy. Ovary pilose; style glabrous. Capsule subglobose, c 4mm diameter, surrounded by persistent calyx.

Bhutan: C – Mongar district (Rudo La); **Arunachal Pradesh:** Orka La, Bhutan frontier. Wet mixed forests, 2750 – 2900m. July.

An attractive ornamental shrub.

FIG. 44. **Pyrolaceae** and **Monotropaceae**. **Pyrolaceae.** a – d, *Chimaphila japonica*: a, plant in flower; b, flower; c, stamen in side view; d, fruit. e & f, *Pyrola corbieri*: e, plant in flower; f, flower. **Monotropaceae.** g – k, *Monotropa uniflora*: g, plant in flower; h, sepal; i, petal; j, stamen; k, ovary and style. Scale: a, e, g x ½; b, f, k x 3; d, i x 4; h, j x 5; c x 18. Drawn by G. Rodrigues.



Family 147. PYROLACEAE

by S. J. Rae

Rhizomatous, evergreen, perennial herbs or dwarf shrubs. Leaves alternate, opposite or subverticillate, pinnately veined, entire, subentire or toothed, petiolate, exstipulate. Flowers actinomorphic, bisexual, solitary or in racemes on bracteate scapes or peduncles. Calyx deeply 5-lobed, persistent. Petals 5, free, or shortly united, deciduous. Stamens 10 in 2 whorls; anthers opening by pores. Ovary superior, subglobose, 5-celled; ovules numerous, axile; style simple. Fruit a subglobose capsule; seeds minute, numerous.

1. Leaves \pm basal, alternate, ovate, ovate-elliptic or suborbicular, on long petioles 10 – 55mm; style filiform **1. *Pyrola***
 + Leaves cauline, opposite or subverticillate in 3's, lanceolate, on short petioles 4 – 8mm; style short, obconical **2. *Chimaphila***

1. PYROLA L.

Erect glabrous herbs; leafy stems short, scaly at base. Leaves alternate, entire or subentire, on long petioles. Flowers in racemes, on long bracteate scapes. Filaments glabrous. Style straight or curved; stigma capitate, shortly 5-lobed.

1. Leaves broadly ovate or suborbicular; petioles 3 – 5.5cm; racemes 6 – 10cm, 10 – 13-flowered; sepals 2 – 2.5mm; petals yellow-green. **1. *P. sikkimensis***
 + Leaves ovate-elliptic; petioles 1 – 3.5cm; racemes 1.5 – 2.5 (– 4)cm, 4 – 9-flowered; sepals c 4mm; petals white **2. *P. corbieri***

1. *P. sikkimensis* Krusa; *P. rotundifolia* L. var. *asarifolia* Clarke, *P. media* Swartz subsp. *sikkimensis* (Krusa) Sarvela

Plants 20 – 30cm; scales at stem base 4 – 8mm broad, sheathing. Leaves pale green, thinly coriaceous, broadly ovate or suborbicular, 2.5 – 5 x 2 – 4.5cm, rounded or subacute, base rounded, sometimes shortly attenuate, margins remotely serrulate; petioles 3 – 5.5cm. Racemes 6 – 10cm, 10 – 13-flowered. Sepals ovate-triangular, 2 – 2.5mm. Petals obovate-suborbicular, 6 – 7 x 5mm, yellowish-green. Anthers c 2mm. Style straight or becoming curved in upper half. Capsule 5-lobed, 8 – 10mm diameter.

Bhutan: C – Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Sikkim:** Lachen, Tankra etc.; **Chumbi.** Alpine meadows and clearings in Spruce forests, 1800 – 3500m. June – August.

The status of *P. sikkimensis* is disputed by different authorities: it has been variously treated as a species, a subspecies of *P. media* Swartz, a variety of *P.*

rotundifolia L., and as a hybrid between *P. minor* L. and *P. rotundifolia* L. One specimen from Sikkim (Tangu) has been determined as *P. sororia* Andrés, but is very close to *P. sikkimensis*.

2. *P. corbieri* Lévillé; *P. decorata* Andrés, *P. chlorantha* Swartz subsp. *fallax* Krisa. Fig. 44e&f.

Similar to *P. sikkimensis* but plants smaller, 11–30cm; scales at stem base 1–3mm broad, not or slightly sheathing; leaves ovate-elliptic, dark green with pale veins above, 3.5–7 x 1.5–3.5cm, subacute, base cuneate or attenuate, margins entire or shallowly crenate; petioles 1–3.5cm; racemes shorter, 1.5–2.5(–4)cm, 4–9-flowered; sepals c 4mm; petals white; anthers c 3mm; style distinctly curved.

Bhutan: C – Thimphu district (Kyapcha, Thimphu, Taba, Dotena and Dochong La) and Punakha district (between Samtengang and Tzarza La). Streamsides in Blue Pine forest, 2100–2700m. July – August.

A specimen from Tongsa district (Chendebi) has been described as *P. chlorantha* Swartz subsp. *fallax* Krisa; it appears to be a minor variant of this species, possibly of hybrid origin.

2. CHIMAPHILA Pursch

Erect dwarf shrubs; stems leafy throughout and often bearing persistent bud scales. Leaves opposite and subverticillate in 3's, serrate, on short petioles. Flowers terminal, 1–2 on simple or branched bracteate peduncles. Filaments pilose. Style very short, obconical. Capsules long-persistent.

1. *C. japonica* Miquel. Fig. 44a–d.

Leafy stems woody, 15–35cm. Leaves deep green, subcoriaceous, broadly lanceolate, 1.5–3 x 0.7–1cm, acute, base broadly cuneate or rounded, margins sharply serrulate; petioles 4–8mm. Peduncles 3–6cm long, papillose, with 1–3 distant, ovate, irregularly serrate bracts. Sepals obovate-rounded, 3–5 x 2–3mm, margins irregularly undulate-serrate, pale green. Petals white, oblong-rounded, 5–7 x 3mm. Filaments short, swollen and winged in lower half, pilose. Capsule 5-lobed, 4–6mm diameter.

Bhutan: C – Thimphu, Punakha, Tongsa and Bumthang districts. Scattered in shade of Pine forest and by forest streams, 2200–2700m. June – August.

Family 148. MONOTROPACEAE

by S. J. Rae

White saprophytic or partly parasitic, perennial herbs without chlorophyll; roots fleshy. Leaves on a simple erect stem, alternate, scale-like, entire. Flowers solitary or racemose, actinomorphic, bisexual. Sepals 3–5, free, imbricate, scale-like.

Petals 3 – 5, free, saccate at base. Stamens 6 – 10, usually twice the number of petals; anthers opening by slits or lids. Ovary superior, 1- or 5-celled; ovules numerous, parietal or axile; style simple, stigma broadly capitate. Fruit an indehiscent berry or capsule.

1. Anthers opening by slits; ovary 5-celled, style base not tapering into ovary, ovules axile; fruit a globose capsule; seeds spindle-shaped **1. *Monotropia***
 + Anthers opening by a lid; ovary 1-celled, style base tapering into ovary, ovules parietal; fruit an indehiscent berry; seeds ovoid **2. *Monotropastrum***

1. MONOTROPA L.

Flowers solitary or racemose. Sepals 3 – 5. Petals 3 – 5, entire or toothed. Anthers opening by slits. Ovary 5-celled; ovules axile; style base not thickened and tapering, sharply differentiated from ovary. Fruit a globose capsule; seeds spindle-shaped.

1. Flowers solitary **1. *M. uniflora***
 + Flowers racemose **2. *M. hypopithys***

1. *M. uniflora* L. Fig. 44g – k.

Stems 15 – 30cm. Leaves ovate, 10 – 12 x 5 – 6mm. Flowers brownish-white, solitary, pendent (becoming erect in fruit), subtended by leaf-like bracts. Sepals ovate-oblongeolate, 7 – 8mm, pubescent or glabrous. Petals obovate, 10 – 20 x 5 – 15mm, rounded, margin entire, inner surface pubescent, outer glabrous. Filaments pubescent; anthers dehiscing by a terminal slit on each cell. Style short and stout. Capsule globose, 7 – 11 x 5 – 12mm, grooved, many-seeded.

Bhutan: C – Punakha district (Wangdu Phodrang); **Darjeeling:** Lama Dhora. Warm broad-leaved and oak forests, 1830 – 2440m. September.

2. *M. hypopithys* L.; *M. lanuginosa* Michaux, *Hypopithys lanuginosa* (Michaux) Rafinesque

Similar to *M. uniflora*, but a more slender plant; flowers racemose.

Bhutan: C – Thimphu, Tongsa and Tashigang districts, N – Upper Mangde Chu district; **Chumbi.** Shady cool broad-leaved and moist coniferous forests, 2130 – 3280m. July – August.

2. MONOTROPASTRUM Andrés

Flowers solitary, terminal. Sepals usually 3. Petals 3 – 4. Anthers opening by lids. Ovary 1-celled; ovules parietal; style base thickened and tapering into ovary. Fruit an indehiscent smooth berry; seeds ovoid.

1. *M. humile* (D. Don) Hara; *M. clarkei* Andrés, *Monotropanthum ampullaceum* (Andrés) Andrés, *Cheilothecha humilis* (D. Don) Keng

Stems 5 – 15cm. Leaves ovate, 10 – 15 x 5 – 7mm. Flowers pendent, whitish or sometimes reddish, subtended by leaf-like bracts. Sepals elliptic-lanceolate, 10 – 18 x 4 – 11mm, glabrous. Petals obovate, 10 – 20 x 5 – 15mm, rounded, often incurved, margin entire, inner surface finely pubescent, outer surface glabrous. Filaments pubescent. Style short, stout. Berry 9 – 20 x 10 – 24mm, seeds numerous.

Bhutan: C – Thimphu district (Motithang and Jato La), Tongsa district (Yuto La) and Mongar district (Denchung); **Darjeeling:** Tonglo and Tiger Hill; **Chumbi:** Shady Hemlock and Fir forests, 2740 – 3050m. May – August.

Family 149. ERICACEAE

by D. G. Long & S. J. Rae

Trees, shrubs, or subshrubs, often evergreen, sometimes epiphytic. Leaves alternate, sometimes becoming aggregated into pseudo-whorls, simple, pinnately veined, exstipulate. Flowers in racemes, corymbs, panicles, clusters or solitary, actinomorphic or zygomorphic, bisexual. Calyx of 5(–8) sepals, free and borne on ovary, or united into tube at base. Corolla of 5(–10) petals united at base or almost to apex, tubular, barrel-shaped, urn-shaped, campanulate, funnel-shaped or salver-shaped. Stamens (5–)10(–18), free; anthers opening by apical pores, sometimes spurred. Ovary inferior or superior, 4–5(–20)-celled; style cylindrical; stigma simple; ovules numerous, axile. Fruit a berry or 5(–20)-valved capsule, sometimes enclosed by enlarged fleshy calyx (*Gaultheria*).

Members of the Ericaceae are of great horticultural importance in North temperate countries, particularly in Europe and North America where many genera are prized as ornamentals, including *Rhododendron* (by far the most important), *Enkianthus*, *Pieris*, *Gaultheria*, *Vaccinium* and *Agapetes*. Bhutan is particularly rich in Ericaceae, and there exists some economic potential for commercial production of the rarer species.

The family is treated here in a broad sense, including those genera sometimes placed separately in Vacciniaceae.

1. Ovary superior, floral parts borne below ovary; corolla campanulate, funnel-shaped, salver-shaped, cylindrical, barrel-shaped or urn-shaped; stamens often spurred but without tubular anther tips; fruit a dry capsule (in *Gaultheria* surrounded by fleshy calyx) (Subfamily Ericoideae) 2
- + Ovary inferior, floral parts borne on top of ovary; corolla tubular, barrel-shaped or urn-shaped; stamens spurred or not, with elongated tubular anther tips; fruit a fleshy berry (Subfamily Vaccinioideae) 8

2. Dwarf shrubs with imbricate, scale-like leaves **3. Cassiope**
 + Dwarf to large shrubs or trees, leaves neither imbricate nor scale-like 3
3. Leaves entire 4
 + Leaves serrate or serrulate (minutely so in *Leucothoe*) 5
4. Flowers in condensed racemes or corymbs, rarely solitary; corolla campanulate, funnel-shaped or salver-shaped (cylindric in *R. keysii*) 8 – 80mm; capsules cylindric **1. Rhododendron**
 + Flowers in simple axillary racemes; corolla cylindric or urn-shaped, 5.5 – 12mm; capsules globose **5. Lyonia**
5. Flowers clustered amongst leaves at branch-ends; corolla campanulate **4. Enkianthus**
 + Flowers in axillary racemes or panicles, rarely solitary in axils; corolla tubular, barrel-shaped or urn-shaped 6
6. Flowers in branched racemes; leaves clustered towards branch ends **6. Pieris**
 + Flowers in simple racemes (sometimes more than 1 per axil); leaves not clustered 7
7. Corolla barrel-shaped or urn-shaped; fruit becoming surrounded by fleshy, persistent calyx **2. Gaultheria**
 + Corolla cylindric; fruit a dry capsule **7. Leucothoe**
8. Corolla tube barrel-shaped or urn-shaped **8. Vaccinium**
 + Corolla tube cylindric **9. Agapetes**

1. RHODODENDRON L.

by D. G. Long

Evergreen shrubs or trees, often aromatic; indumentum of simple or compound hairs or peltate scales. Leaves alternate or clustered at branch ends, coriaceous, entire. Flowers in terminal condensed racemes, rarely solitary, weakly zygomorphic. Calyx 5(–8)-lobed, often reduced to a shallow cup. Corolla campanulate, funnel-shaped or salver-shaped, rarely cylindric, with 5 – 10 long or short lobes. Stamens (5 –)10(–18). Ovary 5 – 20-celled; stigma capitate. Capsule 4 – 20-valved.

Taxonomy. *Rhododendron* taxonomy has been the subject of considerable controversy due to different approaches taken by specialists over the past century. Much taxonomy was formerly based on cultivated plants, and vegetatively propagated clones were sometimes described as new species with little attempt to relate them to the natural (often wider) variation in wild populations. Hybridization in the wild

and in cultivation has, until recently, been underestimated. Recent revisions by Chamberlain (180) and Cullen (183) have attempted to give specific names only to those which formed discrete, recognisable entities in the wild. Thus many 'old' names have been relegated to synonymy or to subspecific or varietal rank. For example, some were considered to represent clones or hybrids with no clear identity in the wild, as in those species now treated as synonyms of *R. maddenii*.

This system has been broadly followed here, with minor amendments such as the recognition of *R. flinckii* and *R. aeruginosum*. Many taxonomic problems remain in Bhutanese species however, which require detailed study in the wild, such as *R. grande*, *R. thomsonii*, *R. campanulatum*, *R. maddenii* and their relatives.

A number of *Rhododendron* species not treated here, have been reported from Bhutan (80), such as *R. boothii* Nuttall, *R. formosum* Wall., *R. hookeri* Nuttall and *R. nuttallii* Booth. The record of *R. formosum* is probably based on a mis-labelled Griffith specimen from Khasia; the remainder refer to specimens collected by Booth and labelled as originating from 'Bootan', but were in fact collected in Arunachal Pradesh. Some of these species could, however, be discovered in eastern Bhutan in future.

The genus *Rhododendron* is of potential economic importance in Bhutan, because most of the species are greatly prized in horticulture in Europe and N America, and although a number are already widely grown in those continents, there is considerable demand for rhododendrons of known wild origin. One reason for this is the tendency for hybridization to occur in cultivation, so that wild seed is preferable to replenish stocks periodically. Species widely cultivated include *R. anthopogon*, *R. arboreum*, *R. barbatum*, *R. campanulatum*, *R. cinnabarinum*, *R. edgeworthii*, *R. falconeri*, *R. grande*, *R. hodgsonii*, *R. maddenii*, *R. lepidotum* and *R. thomsonii*. However, many others, such as *R. argipeplum*, *R. baileyi*, *R. bhutanense*, *R. ciliatum*, *R. flinckii*, *R. kesangiae*, *R. keysii*, *R. leptocarpum*, *R. neriiflorum*, *R. niveum*, *R. papillatum*, *R. pogonophyllum* and *R. succothii* are much less widely grown or even unknown in cultivation from Bhutanese origin. A very good treatment of the genus and its horticultural importance, as well as all the Sino-Himalayan species and their cultivation is given in the recent volumes by Cox (181, 182).

Terminology: the following special terms are used for compound hair types in *Rhododendron* (see 180):

dendroid: tree-like, with long stalk and flexuous arms arising at apex.

capitellate: dendroid but with a short broad stalk.

fasciculate: hairs clustered (dendroid with almost no stalk).

stellate: with short to long stalk and rigid spreading branches from apex.

1. Plants without disc-like scales; shrubs or trees mostly 2 – 15m (less than 1m only in *R. aeruginosum*); leaves mostly 5 – 35cm (less than 5cm only in *R. campylocarpum*, *R. flinckii*, *R. tsariense* and *R. thomsonii*) 2
- + Plants scaly (especially leaf undersides and inflorescences); scales disc-like, sessile or stalked (lacerate in *R. anthopogon* and *R. pogonophyllum*, obscured by tomentum in *R. edgeworthii* and *R. pendulum*); dwarf to tall shrubs, never trees (over 2m only in *R. edgeworthii*, *R. triflorum*, *R. cinnabarinum* and *R. keysii*); leaves mostly 0.4 – 8cm (over 8cm in *R. dalhousiae*, *R. lindleyi*, *R. maddenii*, *R. edgeworthii*, *R. camelliiflorum*, *R. cinnabarinum* and *R. keysii*) 45
2. Plants with flowers 3
- + Plants without flowers 23
3. Stamens 12 – 18, corolla lobes 5 – 10 4
- + Stamens 10, corolla lobes 5 5
4. Corolla 5-lobed, 6 – 8cm; calyx 12 – 15mm; racemes 3 – 5-flowered
1. R. griffithianum
- + Corolla 7 – 8(–10)-lobed, 3 – 7cm; calyx 1 – 2mm; racemes 15 – 25-flowered 24
5. Calyx conspicuous, 5 – 10mm, cup-shaped or saucer-shaped 6
- + Calyx inconspicuous, 0.5 – 3mm, cup-shaped or rim-like 8
6. Calyx saucer-shaped, shallowly lobed; ovary glabrous **24. R. thomsonii**
- + Calyx cup-shaped, deeply lobed; ovary tomentose 7
7. Corolla 3 – 3.5cm; leaves glabrous beneath, or with scattered glands
19. R. barbatum
- + Corolla 3.5 – 4.5cm; leaves thinly to thickly brown tomentose beneath
20. R. argipeplum
8. Corolla yellow, often red-spotted within 9
- + Corolla white, pink, red, lilac or purple 11
9. Leaves glabrous beneath; calyx 1.5 – 2mm, glandular; ovary glandular-hairy
6. R. campylocarpum
- + Leaves tomentose beneath; calyx 0.5 – 1mm, glabrous; ovary tomentose.....10
10. Petioles glabrous or thinly floccose; midrib glabrous above; racemes 12 – 20-flowered **11. R. wightii**
- + Petioles tomentose; midrib tomentose above; racemes 3 – 8-flowered 37

11. Racemes lax, 3 – 10-flowered; filaments pubescent or glabrous at base ... 12
 + Racemes moderately to very dense, 18 – 20-flowered; filaments always glabrous at base 16
12. Leaves narrowly elliptic, 3 – 5 x longer than broad, cuneate or narrowly rounded at base, glabrous or thinly tomentose beneath; filaments glabrous at base 13
 + Leaves broadly elliptic, 2 – 3 x longer than broad, broadly rounded or subcordate at base, thinly to densely tomentose beneath; filaments pubescent or glabrous at base 14
13. Corolla pink or creamy, 3.5 – 5cm; leaves 2.5 – 5cm broad, shortly acuminate
8. R. papillatum
 + Corolla blood red or scarlet, 3 – 3.5cm; leaves 1.5 – 2.5cm broad, rounded and apiculate at apex **22. R. neriiflorum**
14. Racemes 3 – 5-flowered; pedicels c 8mm; ovary densely tomentose; leaves 3 – 6cm, midrib tomentose above **15. R. tsariense**
 + Racemes 5 – 10(– 15)-flowered; pedicels 10 – 25mm; ovary ± glabrous; leaves 6 – 11cm; midrib glabrous above 15
15. Leaves sparsely tomentose beneath, slightly rough to touch **18. R. wallichii**
 + Leaves densely tomentose beneath, soft to touch 19
16. Leaves glabrous beneath, either sessile or with acuminate apex 17
 + Leaves floccose or tomentose beneath (sometimes finely matted), neither sessile nor acuminate at apex 18
17. Leaves 2 – 3cm broad, acuminate, on petioles 10 – 13mm . **7. R. kendrickii**
 + Leaves 3 – 5.5cm broad; rounded or minutely apiculate, sessile or on short petioles to 5mm **21. R. succothii**
18. Racemes moderately dense, 8 – 15-flowered; pedicels 15 – 25mm 19
 + Racemes very dense, 10 – 20-flowered; pedicels 5 – 13mm 20
19. Large shrub or small tree 1.5 – 4(– 6)m; leaf margins not or weakly reflexed when dry, lower surface with very short, fawn or pale brown indumentum
16. R. campanulatum
 + Low shrub 0.5 – 2m; leaf margin usually strongly reflexed when dry, lower surface with thick soft velvety red-brown or orange indumentum
17. R. aeruginosum

20. Leaf base rounded or shallowly cordate, ovary glabrous 21
 + Leaf base cuneate; ovary tomentose 22
21. Leaves elliptic or elliptic-obovate, acute or subacute; petioles floccose or tomentose; corolla pinkish **12. R. bhutanense**
 + Leaves broadly elliptic, rounded at apex or minutely apiculate; petioles glabrous; corolla scarlet or blood red **23. R. fulgens**
22. Leaves elliptic to oblanceolate, acute or shortly acuminate, matted-tomentose or floccose beneath **9. R. arboreum**
 + Leaves narrowly obovate or oblanceolate, rounded and apiculate, softly and thickly white or fawn tomentose beneath **10. R. niveum**
23. Petioles 20 – 45mm; leaves 14 – 35cm long (9 – 20cm in *R. griffithianum*) 24
 + Petioles 2 – 20mm or leaves sessile (15 – 30mm in *R. thomsonii*); leaves 4 – 17cm long 28
24. Leaves glabrous beneath, 9 – 20cm **1. R. griffithianum**
 + Leaves closely matted to loosely, silvery, white, yellowish or brown tomentose beneath 25
25. Lateral veins distinctly prominent beneath; indumentum of closely matted to loosely floccose white or silvery hairs; cup-shaped hairs absent; corolla with nectar pouches at base 26
 + Lateral veins not or weakly prominent beneath; indumentum tomentose with white, pale brown to red-brown cup-shaped sometimes fimbriate hairs; corolla without nectar pouches 27
26. Leaves elliptic-oblanceolate; lateral veins 18 – 24 pairs; corolla yellow **2. R. grande**
 + Leaves broadly elliptic to \pm obovate; lateral veins 12 – 15 pairs; corolla pink **3. R. kesangiae**
27. Leaves stiffly red-brown tomentose beneath, cup-shaped hairs long-fimbriate; corolla white, creamy or yellow **4. R. falconeri**
 + Leaves softly white or pale brown tomentose beneath; cup-shaped hairs not or weakly fimbriate; corolla pinkish-red or purple **5. R. hodgsonii**
28. Leaves narrowly oblong-elliptic to narrowly lanceolate, at least 4 x as long as broad, glabrous beneath 29
 + Leaves ovate, elliptic, oblanceolate or obovate, 1.5 – 3 x as long as broad, tomentose, pubescent or glabrous beneath 30

29. Leaves acuminate, green and not papillate beneath **7. R. kendrickii**
 + Leaves rounded and apiculate, often minutely whitish-papillate beneath
22. R. neriiflorum
30. Leaves glabrous on both surfaces (sometimes sparsely pubescent in *R. barbatum*) 31
 + Leaves thinly to thickly (sometimes closely matted) tomentose beneath .. 35
31. Leaves sessile or on very short petioles 2 – 5mm **21. R. succothii**
 + Leaves on petioles 10 – 20(–30)mm 32
32. Leaves elliptic or oblanceolate, 8 – 17cm; apex apiculate or shortly acuminate 33
 + Leaves ovate-elliptic to broadly elliptic or suborbicular, 4–9cm; apex rounded with a minute apiculus 34
33. Branchlets and petioles thinly tomentose at first, becoming glabrous; leaves apiculate, not glandular beneath **8. R. papillatum**
 + Branchlets and petioles stiffly bristly, rarely glabrous; leaves shortly acuminate, often glandular beneath and on margins **19. R. barbatum**
34. Leaves ovate-elliptic; branchlets and petioles with slender stalked glands at least when young **6. R. campylocarpum**
 + Leaves broadly elliptic or suborbicular; branchlets and petioles glabrous and eglandular **24. R. thomsonii**
35. Petioles and upper surface of leaf midrib (at least towards base) thickly and softly brown or whitish tomentose 36
 + Petioles glabrous, pubescent, floccose or bristly; midrib glabrous above (in *R. bhutanense* petiole thinly tomentose or floccose and midrib greyish floccose above) 38
36. Leaves 3 – 6 x 1.5 – 2.5cm, elliptic **15. R. tsariense**
 + Leaves 6 – 10 x 2 – 5cm, elliptic or obovate 37
37. Leaves obovate, base cuneate or rounded, thickly pale brown to chocolate brown tomentose beneath **13. R. lanatum**
 + Leaves elliptic, base rounded, thickly rusty-brown tomentose beneath
14. R. flinckii
38. Petioles and young branchlets bristly **20. R. argipeplum**
 + Petioles glabrous, pubescent or floccose 39

39. Leaves broadly elliptic, sometimes obovate-elliptic, 2 – 3 x longer than broad, base rounded or subcordate, brown tomentose beneath 40
 + Leaves narrowly elliptic, oblanceolate or narrowly obovate, mostly 3 – 3.5 x longer than broad, base cuneate or narrowly rounded; indumentum various, rarely brown tomentose 43
40. Petioles quite glabrous; leaves very soft to touch beneath with velvety tomentum
16. R. campanulatum, 17. R. aeruginosum and 23. R. fulgens
 + Petioles floccose, thinly tomentose, or sparsely pilose; leaves rough or moderately soft to touch, never velvety 41
41. Tomentum on lower leaf surface thin, rough to touch; petioles with a few pilose hairs **18. R. wallichii**
 + Tomentum on lower leaf surface close and matted, moderately soft to touch; petioles floccose above, sometimes thinly tomentose beneath 42
42. Leaf base rounded or \pm cuneate; petioles 10 – 20mm **11. R. wightii**
 + Leaf base cordate, sometimes shallowly; petioles 3 – 10mm
12. R. bhutanense
43. Leaves narrowly obovate or oblanceolate, softly and thickly white or fawn tomentose beneath **10. R. niveum**
 + Leaves elliptic to oblanceolate; indumentum various, never thickly white tomentose 44
44. Leaf base usually rounded; leaves brownish tomentose beneath
8. R. papillatum
 + Leaf base cuneate; leaves matted silvery or fawn tomentose or pale floccose beneath (sometimes with an additional outer brown tomentose layer)
9. R. arboreum
45. Flowers present 46
 + Flowers absent 68
46. Flowers in short axillary racemes 47
 + Flowers solitary to many in terminal racemes (sometimes corymbose or capitate and sometimes becoming overtopped by a leafy axillary shoot) .. 48
47. Corolla tubular, orange-red; calyx c 0.5mm **37. R. keysii**
 + Corolla funnel-shaped, pale pink; calyx 1.5 – 2mm **38. R. virgatum**
48. Corolla 5 – 11cm long 49
 + Corolla 0.8 – 4cm long 52

49. Calyx 3 – 5mm; stamens 17 – 25 **27. R. maddenii**
 + Calyx 11 – 18mm; stamens 10 50
50. Corolla 5 – 7cm; pedicels and leaf undersides with dense woolly tomentum
 obscuring scales beneath **25. R. edgeworthii**
 + Corolla 7.5 – 11cm; pedicels and leaf undersides glabrous or pubescent, but not
 obscuring scales 51
51. Pedicels pubescent and scaly; calyx lobes not ciliate on margins
28. R. dalhousiae
 + Pedicels scaly, otherwise glabrous; calyx lobes with white ciliate margins
29. R. lindleyi
52. Corolla 2 – 4cm (sometimes as short as 1.8cm in *R. pendulum* but then pedicels
 tomentose; as short as 1.6cm in *R. glaucophyllum* but then leaves white
 beneath) 53
 + Corolla 0.8 – 2cm 58
53. Young shoots, petioles and pedicels woolly tomentose or conspicuously bristly
 54
 + Young shoots, petioles and pedicels glabrous except for scales.....55
54. Corolla 1.8 – 2.2cm; young shoots, petioles and pedicels woolly tomentose
26. R. pendulum
 + Corolla 3 – 4cm; young shoots, petioles and pedicels conspicuously bristly
30. R. ciliatum
55. Calyx lobes 6 – 11mm; corolla pale to deep pink or red 56
 + Calyx lobes c 1mm; corolla creamy, yellow, orange or red 57
56. Leaves not white beneath; pedicels 5 – 10mm; stamens 12 – 16
40. R. camelliiflorum
 + Leaves white beneath; pedicels 10 – 20mm; stamens 10
41. R. glaucophyllum
57. Corolla creamy or pale yellow, open funnel-shaped **31. R. triflorum**
 + Corolla orange or red, campanulate or tubular-campanulate
36. R. cinnabarinum
58. Flowers solitary, on very short pedicel 0.5 – 1mm **33. R. nivale**
 + Flowers 2 – 10 (rarely solitary), on longer pedicels 2 – 25mm 59

59. Corolla salver-shaped; stamens 5 – 8; pedicels 2 – 4mm 60
 + Corolla funnel-shaped, campanulate or sub-rotate; stamens 10 – 16; pedicels 5 – 25mm (3 – 8mm but hairy in *R. setosum*) 61
60. Flowers 5 – 10, in dense heads; erect subshrub; leaves not pilose **44. *R. anthopogon***
 + Heads 2 – 4-flowered; prostrate subshrub, leaves white pilose **45. *R. pogonophyllum***
61. Pedicels 3 – 10mm; calyx lobes 4 – 7mm 62
 + Pedicels 9 – 25mm; calyx lobes 2 – 4mm 64
62. Stamens 12 – 16; leaves 5 – 8cm **40. *R. camelliiflorum***
 + Stamens 10; leaves 0.9 – 1.7cm 63
63. Stems bristly; pedicels 3 – 8mm, hairy **32. *R. setosum***
 + Stems minutely puberulous, pedicels 7 – 10mm, minutely puberulous **34. *R. fragariiflorum***
64. Corolla lemon-yellow; leaves 45 – 80mm **39. *R. leptocarpum***
 + Flowers purple, red, pink, white, rarely yellow; leaves 7 – 45mm 65
65. Flowers 3 – 9, in distinct racemes, deep red or purple; leaves 20 – 45mm **43. *R. baileyi***
 + Flowers 1 – 3, clustered, white, pink, or purple, rarely yellow; leaves 7 – 20mm 66
66. Corolla pubescent externally; leaves elliptic **35. *R. pumilum***
 + Corolla glabrous or scaly externally, never pubescent, leaves obovate or spatulate, rarely elliptic 67
67. Terrestrial shrub; pedicels 15 – 25mm; calyx 3 – 4mm; capsules 5 – 7mm, woody **42. *R. lepidotum***
 + Commonly epiphytic shrub; pedicels 9 – 14mm; calyx c 2mm; capsules 20 – 25mm, thin **46. *R. vaccinioides***
68. Branchlets and leaf undersides with dense, woolly tomentum, obscuring scales beneath 69
 + Branchlets and leaf undersides glabrous, pubescent or bristly, scales not obscured 70
69. Leaves ovate elliptic, acuminate; petioles 5 – 15mm **25. *R. edgeworthii***
 + Leaves oblong-elliptic, obtuse; petioles 2 – 4mm **26. *R. pendulum***

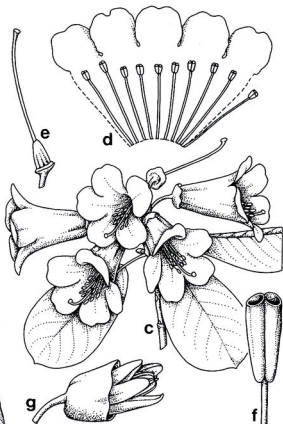
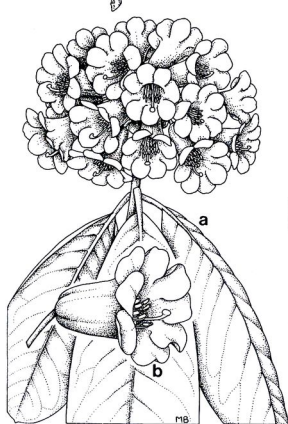
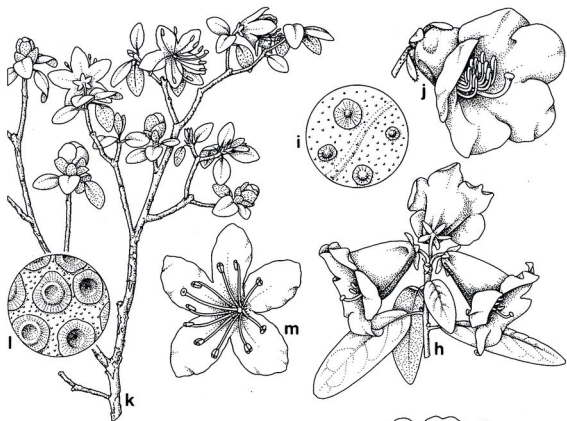
70. Small to large erect branched shrubs 0.4–5m; leaves mostly 3.5–17 x 1–7cm (as short as 2cm only in *R. virgatum* and *R. baileyi*), petioles mostly 5–20mm (as short as 2 or 3mm in *R. virgatum*, *R. leptocarpum*, *R. glaucophyllum* and *R. baileyi*) 71
- + Dwarf shrubs, often dense or compact, sometimes creeping, 5–60cm tall (up to 80cm in *R. vaccinioides*); leaves mostly 0.4–2 x 0.2–0.9cm (up to 3 x 1.5cm in *R. anthopogon*); petioles 0.5–3mm (sometimes up to 5mm in *R. anthopogon*) 78
71. Branchlets, petioles and leaves conspicuously stiffly bristly...**30. *R. ciliatum***
- + Branchlets, petioles and leaf margins not densely bristly (sometimes sparsely so in *R. dalhousiae*) 72
72. Leaves mostly 7–17cm 73
- + Leaves mostly 2–9cm (rarely to 10 or 11cm in *R. camelliiflorum* and *R. cinnabarinum*) 75
73. Leaves acute **27. *R. maddenii***
- + Leaves obtuse or rounded, sometimes apiculate 74
74. Branchlets, petioles and leaf bases with a few cilia or slender bristles
- 28. *R. dalhousiae***
- + Bristles and cilia absent **29. *R. lindleyi***
75. Leaves white beneath, with scattered brown and yellow scales
- 41. *R. glaucophyllum***
- + Leaves green or brown beneath, sometimes pale (rarely whitish in *R. triflorum*); scales scattered to dense 76
76. Leaves densely scaly beneath with scales closely overlapping; densely scaly above **43. *R. baileyi***
- + Leaves sparsely to densely scaly beneath but scales scarcely overlapping; glabrous to sparsely scaly above 77
77. Petioles 5–12mm; leaves ovate, lanceolate or elliptic
- 31. *R. triflorum*, 36. *R. cinnabarinum* and 37. *R. keysii***
- + Petioles mostly 2–6mm (up to 10mm in *R. camelliiflorum*); leaves oblong, elliptic to oblanceolate
- 38. *R. virgatum*, 39. *R. leptocarpum* and 40. *R. camelliiflorum***
78. Leaves bristly or pilose at least on margins and midrib beneath 79
- + Leaves glabrous except for scales 80

79. Compact but erect subshrub; branchlets densely bristly and scaly; leaves 9 – 13mm **32. R. setosum**
 + Prostrate subshrub; branchlets puberulous and scaly; leaves 6 – 10mm **45. R. pogonophyllum**
80. Leaves densely scaly beneath with closely overlapping lacerate scales **44. R. anthopogon**
 + Leaves sparsely to moderately scaly beneath, scales never closely overlapping 81
81. Leaves ovate to elliptic, mostly rounded at base 82
 + Leaves elliptic, oblanceolate, obovate or spatulate, cuneate to attenuate at base 83
82. Leaves 4 – 7 x 2 – 5mm; branchlets not puberulous **33. R. nivale**
 + Leaves 10 – 17 x 5 – 9mm; branchlets puberulous **34. R. fragariiflorum**
83. Creeping terrestrial subshrub; branchlets puberulous; leaves elliptic **35. R. pumilum**
 + Erect terrestrial subshrubs, or pendulous epiphyte; branchlets often warted but never puberulous; leaves elliptic-obovate, oblanceolate to spatulate 84
84. Leaves elliptic-obovate or oblanceolate, acute or rounded and apiculate; petioles 0 – 1mm **42. R. lepidotum**
 + Leaves obovate-spatulate, rounded and usually shallowly retuse without apiculus; petioles 1 – 3mm **46. R. vaccinioides**

1. R. griffithianum Wight; *R. aucklandii* Hook. f., *R. oblongum* Griff., *R. griffithianum* var. *aucklandii* (Hook. f.) Hook. f. Nep: *Seto Chimal* (34).

Shrub or tree, 2 – 10m; bark grey, papery; shoots glabrous. Leaves oblong-elliptic, 9 – 20 x 3 – 7cm, bluntly acute or mucronate, base rounded, glabrous beneath; petioles 2 – 4cm. Racemes 3 – 5-flowered, flowers fragrant; pedicels 1.5 – 4cm, sparsely glandular. Calyx saucer-shaped, spreading, 1.2 – 1.5cm diameter, not or very shallowly lobed, glabrous. Corolla broadly funnel-shaped, 6 – 8cm long, 5-lobed, pure white or tinged pinkish. Stamens 13 – 16; filaments glabrous. Ovary and style glandular throughout. Capsules stout, 2.5 – 3.5 x 1.2 – 1.7cm.

FIG. 45. Ericaceae. a & b, *Rhododendron kesangiae*: a, flowering branch; b, flower. c – g, *Rhododendron thomsonii*: c, flowering branch; d, corolla and stamens dissected; e, ovary and style; f, anther; g, capsule and persistent calyx. h – j, *Rhododendron lindleyi*: h, flowering branch; i, scales on leaf underside; j, flower. k – m, *Rhododendron nivale*: k, flowering branch; l, scales on leaf underside; m, flower. Scale: h x 1/4; a x 1/3; c x 2/3; d, e, j x 1/2; b, k x 2/3; g x 1; m x 1 1/2; f x 4; i, l x 35. Drawn by M. Bates.



Bhutan: S – Chukka district (Bunakha and Chukka), C – Ha, Thimphu, Punakha, Tongsa and Mongar districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Darjeeling; Sikkim.** River banks, ravines and cliffs in cool broad-leaved and evergreen oak forests, 1800 – 2590m. April – May.

2. **R. grande** Wight; *R. argenteum* Hook. f., *R. longifolium* Nuttall. Nep: *Patle Korlinga* (34).

Tree 8 – 15m; bark rough, young shoots glabrous. Leaves elliptic-oblongate, 15 – 26 x 6 – 9(– 12cm), acute, subacute or rounded and apiculate, base cuneate, silvery beneath with fine closely matted hairs, lateral veins 18 – 24 pairs, distinctly prominent; petioles 2 – 3.5cm. Racemes dense, 15 – 25-flowered; pedicels 1.5 – 2.5cm, glandular. Calyx a minute rim 1 – 2mm. Corolla campanulate, 5 – 7cm, 8-lobed, pale yellow or white (sometimes pink-tinged in bud), with dark reddish-purple nectar pouches. Stamens usually 16. Ovary glandular hairy at apex; style glabrous. Capsules stout, 3.5 – 4.5 x 1.4 – 1.7cm, weakly curved.

Bhutan: S – Chukka and Deothang districts, C – Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** Tonglo, Dumsong, Senchal etc; **Sikkim:** Karponang. Moist evergreen oak and Hemlock forests, 2100 – 3000m. February – April.

3. **R. kesangiae** Long & Rushforth. Dz: *Tala*. Fig. 45a&b.

Similar to *R. grande* but young shoots often closely white floccose, leaves broadly elliptic to almost obovate, 20 – 30 x 10 – 16cm, apex rounded, minutely mucronate, base cuneate or rounded, silvery white beneath with thicker (sometimes loosely floccose) indumentum, lateral veins stout, 12 – 15 pairs; corolla smaller, 3 – 4.7cm, pink; ovary densely glandular, sometimes also thinly tomentose; capsules narrower, 3.5 – 4 x 0.9 – 1cm, curved.

Bhutan: S – Chukka district; C – Thimphu, Punakha, Tongsa, Bumthang and Mongar districts, N – Upper Kuru Chu and Upper Kulong Chu districts. Amongst Rhododendrons and bamboos in Fir and Hemlock forests, 2890 – 3450m. April – May.

Endemic to Bhutan. Formerly confused with *R. hodgsonii* and often misidentified as a hybrid between *R. hodgsonii* x *R. falconeri*. It differs from both those taxa in its rounded bud-scales, very prominent lateral veins, white or silvery indumentum without cup-shaped hairs, pink flowers and presence of nectar-pouches.

A specimen from Takhtoo, Sakden district and two from adjacent Arunachal Pradesh, represent another taxon allied to *R. kesangiae* in indumentum and flower colour, but differ in their smaller, oblanceolate, acute or shortly acuminate leaves.

4. **R. falconeri** Hook.f. Dz : *Khangley Metog*; Nep: *Korlinga* (34).

Large shrub or tree 5 – 15m; bark smooth, branchlets thinly brown tomentose. Leaves broadly elliptic-obovate, 15 – 35 x 7 – 17cm, rounded with small blunt mucro, base rounded, dark green and rugose above, thickly red-brown tomentose beneath (rough to touch) with long-fimbriate cup-shaped hairs, obscuring lower fine white tomentum; lateral veins 12 – 17 pairs, weakly prominent beneath and

thinly tomentose; petioles stout, 3 – 4.5cm, ± tomentose with white and brown indumentum. Racemes dense, subglobose, 12 – 16cm diameter, 15 – 20-flowered; pedicels 3 – 5.5cm, glandular. Calyx a minute cup 1 – 2mm. Corolla fleshy, obliquely campanulate, 4 – 5cm, 8 – 10-lobed, white, creamy or yellow with purple blotch at base, rarely tinged pinkish (?hybrids); nectar-pouches absent. Stamens 12 – 16. Ovary densely glandular and thinly to thickly tomentose. Capsules straight, c 3.5 x 1.2cm.

Bhutan: C – Thimphu, Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** Tonglo, Sandakphu, Chowbhanjan, etc.; **Sikkim:** Dentam, Yak La. Hemlock/Rhododendron and cool broad-leaved forests, 2500 – 3200m. April – May.

The above description and records refer to the common subsp. **falconeri**. A specimen from Tongsa district (Jirgang Chu) belongs to subsp. **eximium** (Nuttall) Chamberlain (*R. eximium* Nuttall) which differs in having sub-persistent brown tomentum on the upper leaf surface, and in its red flowers.

R. decipiens Lacaita from alpine Darjeeling (Kalapokri, Singalila, Tonglu) is thought to be a hybrid between *R. falconeri* and *R. hodgsonii*. It has the foliage and indumentum of *R. falconeri* but pink flowers.

5. *R. hodgsonii* Hook. f. Nep: *Korlinga* (34).

Similar to *R. falconeri* but branchlets matted white tomentose; leaves usually more narrowly obovate-elliptic, 7 – 11cm broad, finely white to pale-brown tomentose beneath with shortly fimbriate cup-shaped hairs, soft to touch; lateral veins 12 – 15 pairs, slender, not prominent; corolla 3 – 4cm, 7 – 8-lobed, pinkish-red or purple; ovary tomentose; capsules narrow, curved, 3 – 4.5 x 0.6 – 0.8cm.

Bhutan: C – Ha, Thimphu, Tongsa, Bumthang, Mongar and Sakden districts, N – Upper Mo Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling;** **Sikkim;** **Chumbi.** Fir/Rhododendron and Hemlock forests, 2900 – 3690m. April – May.

Wood used to make saddles (48). Often confused with *R. kesangiae*; for differences see under that species.

6. *R. campylacarpum* Hook. f.

Aromatic shrub 2 – 4m or small tree to 6m; branchlets thinly covered with stalked glands. Leaves ovate-elliptic, 4 – 9 x 2.3 – 5cm, rounded or apiculate, base shallowly cordate, whitish and glabrous beneath; petioles 1 – 2cm, with stalked glands. Racemes 5 – 13-flowered; pedicels 1 – 4cm, with stalked glands. Calyx a 5-lobed glandular cup 1.5 – 2mm. Corolla campanulate, 3 – 4.5cm, 5-lobed, pale yellow, sometimes with a red basal blotch. Stamens 10. Ovary densely covered with stalked glands; style glandular at base, glabrous above. Capsules 2 – 3 x 0.5cm, strongly curved.

Bhutan: C – Ha, Thimphu, Punakha, Bumthang, Mongar and Sakden districts,

N – Upper Mo Chu and Upper Kulong Chu districts; **Sikkim**; **Chumbi**. Hemlock and Fir/Rhododendron forests, 3050 – 4200m. May – July.

The E Himalayan plants belong to subsp. **campylocarpum**.

7. R. kendrickii Nuttall

Shrub or small tree to 6m; branchlets glabrous. Leaves narrowly oblong-elliptic 8 – 14 x 2 – 3cm, acuminate, base rounded, margins undulate when dry, glabrous; petioles 1 – 1.3cm. Racemes dense, 10 – 20-flowered; pedicels 5 – 8mm, glandular-pubescent. Calyx 2 – 3mm, bluntly 5-lobed. Corolla campanulate, 3 – 3.5cm, 5-lobed, deep red or crimson with darker spots and basal nectar pouches. Stamens 10. Ovary almost glabrous, eglandular; style glabrous. Capsules slightly curved, c 2 x 0.4cm.

Bhutan: C – Ha, Bumthang, Mongar, Tashigang and Sakden districts, N – Upper Kulong Chu district; **Arunachal Pradesh**: Nyam Jang Chu. Spruce and Hemlock/Rhododendron forests, 2300 – 3000m. March – April.

8. R. papillatum Balfour f. & Cooper; *R. epapillatum* Balfour f. & Cooper

Similar to *R. kendrickii* but branchlets thinly tomentose at first; leaves elliptic or oblanceolate, 8 – 15 x 2.5 – 5cm, apiculate or very shortly acuminate, margins not undulate, lower surface minutely papillate, with or without stellate indumentum; racemes 5 – 10-flowered; pedicels 1 – 2cm, tomentose; corolla larger, 3.5 – 5cm, pink or cream with red spots; ovary densely tomentose and stalked-glandular.

Bhutan: S – Chukka district (Chukka), C – Ha district (Ha Dzong) and Thimphu district (Bela Dzong near Paro); **Arunachal Pradesh**: Nyam Jang Chu. Hemlock and Fir forests, 1830 – 3350m. March – April.

9. R. arboreum Smith. Dz: *Ito Metog*; Sha: *Zhu-dang Metog*; Nep: *Gurass, Gurans* (34).

Shrub 1 – 2m or tree up to 15m; young shoots puberulous to tomentose. Leaves elliptic-oblanceolate, 7 – 17 x 2 – 5cm, acute or very shortly acuminate, base cuneate, lower surface densely matted white, silvery or fawn tomentose, (sometimes obscured by loose red-brown tomentum) or loosely whitish or fawn floccose; petioles 8 – 15mm. Racemes compact, 10 – 20-flowered; pedicels 5 – 10mm, hairy and glandular. Calyx 1 – 2mm, shortly 5-lobed, glandular or glabrous. Corolla tubular-campanulate, 3 – 4.5cm, 5-lobed, bright red, pink or more rarely white, with darker spots and nectar pouches. Stamens 10. Ovary white tomentose; style glabrous. Capsules slightly curved, 1.5 – 2.5 x 0.7 – 0.9cm.

A very variable taxon; the E Himalayan plants belong to the following four infraspecific taxa:

subsp. **arboreum**; *R. windsorii* Nuttall

Leaves as described for *R. arboreum* but closely matted white or silvery tomentose beneath; flowers red.

Bhutan: S – Chukka and Gaylegphug districts, C – Thimphu, Punakha, Tongsa,

Bumthang, Mongar and Sakden districts, N – Upper Mo Chu district; **Darjeeling; Sikkim; Chumbi.** Evergreen oak and Blue Pine forests, 1200 – 3000m. March – June.

subsp. **cinnamomeum** (G. Don) Tagg; *Rhododendron cinnamomeum* G. Don, *R. campbelliae* Hook. f., *R. arboreum* subsp. *campbelliae* (Hook. f.) Tagg

Leaves with loose red-brown tomentum beneath, obscuring a close, matted creamy or fawn tomentum; flowers pink or red.

Darjeeling: Phallut, Tonglu and Sandakphu areas. Fir/Rhododendron forests, 2800-3400m. March – May.

var. **roseum** Lindley; *R. arboreum* var. *album* Wall., *R. album* (Wall.) Hamilton.

Very similar to subsp. *arboreum*, but leaves closely matted cream or fawn tomentose beneath; flowers pink or crimson, rarely white.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa, Mongar and Sakden districts, N – Upper Kulong Chu district; **Darjeeling; Sikkim; Chumbi.** Blue Pine, Hemlock and Fir forests, 1370 – 3960m. April – May.

subsp. **delavayi** (Franchet) Chamberlain; *R. delavayi* Franchet

Differs from the other varieties and subspecies of *R. arboreum* in having the leaf undersides with a loose, floccose (not matted), whitish to fawn indumentum; corolla deep crimson to carmine red.

Bhutan: S – Deothang district (Chungkar), C – Tongsa, Bumthang, Tashigang and Sakden districts. Chir Pine, evergreen oak and Hemlock forests, 1700 – 3390m. November – April.

Hybrids reputedly occur between *R. arboreum* and *R. barbatum*, *R. campanulatum* and *R. wallichii*. *R. arboreum* produces useful timber and is valuable for firewood.

10. *R. niveum* Hook. f.

Similar to *R. arboreum* but leaves narrowly obovate or oblanceolate, 10 – 17 x 3 – 5.5cm, rounded and apiculate; densely and softly white or fawn tomentose (not matted) beneath; pedicels 7 – 10mm, tomentose; corolla mauve or purple.

Bhutan: C – Thimphu district (Dochong La area), N – Upper Kulong Chu district (Lao); **Sikkim:** Lachung, Laghep, Cho La and Yumthang. Hemlock forests, 2900 – 4000m. May.

A rare species in Bhutan, with an anomalous distribution. A specimen from Byasu La, Punakha district has leaves similar to *R. niveum* but flowers similar to *R. lenatum*, and may be a hybrid or a new taxon.

11. *R. wightii* Hook. f.

Shrub 2 – 5m; branchlets glabrous or puberulous. Leaves broadly elliptic or obovate, 9 – 15 x 4 – 6cm, rounded or acute, base rounded or somewhat cuneate, densely appressed reddish brown tomentose beneath with compound hairs; petioles 1 – 2cm, stout, closely greyish floccose above. Racemes loose, with 12 – 20

pendulous flowers; pedicels 1.5 – 2.5cm, tomentose. Calyx minute, 5-lobed. Corolla campanulate or broadly campanulate, 3 – 3.5cm, mostly 5-lobed, pale or lemon-yellow with reddish or brownish spots. Stamens 10; filaments pubescent at base. Ovary brown tomentose; style glabrous. Capsules curved, 2.5 – 4 x 0.5 – 0.7cm.

Bhutan: C – Ha, Thimphu, Tongsa, Bumthang and Sakden districts, N – Upper Mo Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Fir forests and Juniper/Rhododendron scrub, 3660 – 4200m. May – July.

Vegetatively similar to *R. wallichii* which differs in its sparsely pilose (not closely floccose) petioles and thinly tomentose lower leaf surface which is rough to the touch, and in its lilac or pinkish-mauve flowers with glabrous ovaries.

12. *R. bhutanense* Long & Bowes Lyon

Similar to *R. wightii* but a smaller shrub 0.6 – 3m, leaves 6 – 12.5 x 3 – 5cm, base cordate, closely brown tomentose beneath, glabrous above except for greyish floccose hairs at base of impressed midrib; petioles 3 – 10mm, greyish floccose above, pale brown tomentose beneath; pedicels 8 – 13mm, glabrous or puberulous; corolla deep pink in bud, opening pale pink; filaments glabrous throughout; ovary glabrous.

Bhutan: C – Punakha, Tongsa, Bumthang/Mongar boundary and Sakden districts, N – Upper Mangde Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts. Open hillsides and in Fir/Juniper/Rhododendron scrub above tree line, 3810 – 4270m. May – August.

Endemic to Bhutan. Vegetatively similar to *R. wallichii*, which differs in its non-cordate leaves which are rough to the touch beneath, and in its longer sparsely pilose petioles.

13. *R. lanatum* Hook. f.

Shrub 1.5 – 4m. Leaves coriaceous, obovate, 6 – 10 x 2 – 5cm, obtuse with short mucro, base cuneate to rounded, glabrous above except for pale tomentum on midrib, thickly chocolate-brown or pale brown tomentose beneath; petioles stout, 0.8 – 1.5cm, densely whitish tomentose. Racemes short, 4 – 8-flowered; pedicels 1 – 2cm, tomentose. Calyx minute. Corolla campanulate, 5-lobed, 3 – 4.5cm, yellow, often red-spotted within. Stamens 10; filaments pubescent at base. Ovary red-brown tomentose. Capsules slightly curved, c 2.5 x 0.8cm.

Bhutan: C – Ha, Thimphu, Punakha and Tongsa districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Sikkim;** **Chumbi.** Fir/Rhododendron forest, 3500 – 4260m. May – June.

14. *R. flinckii* Davidian

Closely allied to *R. lanatum* but leaves thinly coriaceous, elliptic, 4 – 9 x 3.5cm, rounded at apex and base, thinly rusty-brown tomentose beneath.

Bhutan: C – Tongsa, Bumthang, Mongar and Sakden districts, N – Upper

Bumthang Chu and Upper Kulong Chu districts. Rhododendron forest, 3050 – 4100m. May.

Endemic to Bhutan, but possibly only subspecifically distinct from the more western *R. lanatum*. According to Cox (182), *R. poluninii* Davidian and *R. tsariense* Cowan var. *magnum* Davidian, from Waitang and Black Mountain, are probably pink-flowered forms of this species. Such plants are intermediate between *R. flinckii* and *R. tsariense* and may be of hybrid origin.

15. *R. tsariense* Cowan

Similar to *R. lanatum* and *R. flinckii*, but leaves elliptic, smaller, 3 – 6 x 1.5 – 2.5cm, acute or obtuse, base rounded, densely red-brown tomentose beneath; corolla rose pink, pale pink or rarely white, smaller, 2.5 – 3.5cm.

Bhutan: C – Bumthang district (Byakar); **S.E. Tibet:** Trimo, Nyam Jang Chu. Rhododendron and Hemlock forests, 3000 – 3260m. April – June.

The plants from Nyam Jang Chu differ in their paler indumentum and have been segregated as var. *trimoense* Davidian.

16. *R. campanulatum* D. Don. Nep: *Nilo Chimal* (34).

Large shrub 1.5 – 4m or small tree to 6m; branchlets glabrous. Leaves thinly coriaceous, elliptic, sometimes elliptic-obovate, 7 – 11 x 3 – 5cm, acute or subacute, base rounded or narrowly cordate, margins weakly or not reflexed when dry, glabrous and without metallic bloom above, with fine, very short, fawn or pale brown indumentum of capitate hairs closely appressed to lower surface (soft to touch); petioles glabrous 0.5 – 1.8cm. Racemes 8 – 15-flowered; pedicels 1.5 – 2.5cm, glabrous. Calyx c 1mm, glabrous. Corolla open-campanulate, 2.5 – 3.5cm, 5-lobed, white or pink, with reddish spots and large blotch at base within. Stamens 10; filaments glabrous or with a few hairs at base. Ovary glabrous. Capsules weakly curved, 2 – 2.5 x 0.5 – 0.7cm.

Sikkim: Jongri, Singalila, Changu, Minmoi Tso. Fir/Rhododendron and *Betula* forests, 3050 – 3800m. May – June.

Specimens from Bhutan labelled *R. campanulatum* are usually *R. wallichii*. The Sikkim plants of *R. campanulatum* have smaller leaves and flowers than the typical plants from Nepal and may be of hybrid origin; other atypical plants may be hybrids with *R. arboreum* and *R. wightii*.

17. *R. aeruginosum* Hook. f.; *R. campanulatum* subsp. *aeruginosum* (Hook. f.) Chamberlain

Differs from *R. campanulatum* in its smaller size, 0.5 – 2m; leaves mostly 5 – 8cm, with margins often strongly reflexed when dry, upper surface with bluish, metallic bloom when fresh, lower surface with thick, soft, velvety, red-brown or orange tomentum of dendroid hairs; corolla pink, purple or red.

Bhutan: C – Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo

Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim; Chumbi**. Open mountainsides and cliffs, 3500–4570m. May–July.

18. *R. wallichii* Hook. f.

Similar to *R. campanulatum* but leaves more sparsely, dirty-brown tomentose beneath with stiff, fasciculate hairs (rough to touch), becoming glabrous when older; racemes 5–10-flowered; pedicels 1–2cm; corolla lilac or pinkish-mauve, 3–4cm.

Bhutan: C–Ha, Thimphu, Punakha, Tongsa, Bumthang and Sakden districts, commoner in West, N–Upper Mo Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling; Sikkim; Chumbi**. Fir and Rhododendron forests and in Juniper/Rhododendron scrub, 2750–4260m. April–May.

Hybrids with *R. arboreum* are common in the Darjeeling district. Vegetatively similar to *R. wightii* and *R. bhutanense* (q.v.).

19. *R. barbatum* G. Don; *R. lancifolium* Hook. f. Nep: *Lal Chimal* (34).

Shrub or small tree 2–6m; young shoots with stiff spreading bristles. Leaves elliptic-oblongate, 9–17 x 2.5–4.5cm, shortly acuminate or almost mucronate, base cuneate or narrowly rounded, glabrous above, with a few dendroid hairs and stalked glands beneath (often almost glabrous); petioles 1–2cm, with stiff spreading bristles 6–10mm, more rarely glabrous. Racemes dense, 10–20-flowered; pedicels 8–15mm, glabrous or puberulous. Calyx cup-shaped, with deep rounded lobes 5–10mm long, rarely shorter. Corolla tubular-campanulate, 3–3.5cm long, crimson or blood-red, with darker blotches at base, 5-lobed. Stamens 10, glabrous. Ovary stiffly hairy; style glabrous. Capsules weakly curved, 1.5–2cm, bristly.

Bhutan: C–Ha, Thimphu, Punakha, Tongsa and Bumthang districts, N–Upper Mo Chu district; **Darjeeling:** Tonglo, Phalut, Sandakphu, Singalila; **Sikkim:** Yoksam. Spruce, Hemlock and Fir forests, 2100–3650m. April–May.

A specimen from Ha district (Sharithang Chu) named as *R. ramsdenianum* Cowan is probably a form of *R. barbatum*.

20. *R. argioplum* Balfour f. & Cooper; *R. smithii* Hook. f. non Sweet

Closely allied to *R. barbatum* but leaves usually proportionally broader, obovate-oblongate, 9–13 x 3–6cm, apiculate, usually thinly to thickly tomentose beneath with pale brown dendroid hairs which become whitish when dry; corolla often larger, 3.5–4.5cm long.

Bhutan: C–Punakha, Tongsa, Bumthang and Mongar districts; **Darjeeling:** doubtfully present (34); **Sikkim:** Changu, Juluk, Laghep and Kanglasi; **Arunachal Pradesh:** Nyam Jang Chu. Fir/Rhododendron forests, 2750–3500m. April–May.

Replaces *R. barbatum* in eastern Bhutan, but several intermediate plants occur with the narrower leaves of *R. barbatum* and indumentum of *R. argioplum*; these may result from hybridization.

21 *R. succothii* Davidian; *R. nishiokae* Hara.

Shrub 1–2m or small tree to 6m; branchlets glabrous. Leaves elliptic or narrowly obovate, 8–13 x 3–5.5cm, rounded or minutely apiculate, base rounded or shallowly cordate, glabrous on both surfaces, sessile or on very short, glabrous petioles 2–5mm. Racemes dense, 10–15-flowered; pedicels 4–13mm, glabrous. Calyx minute, lobes rounded, c 1mm. Corolla tubular-campanulate, crimson, 2.3–3.5cm, 5-lobed. Stamens 10; filaments glabrous throughout. Ovary and style glabrous. Capsules curved, up to 25 x 6mm.

Bhutan: C—Ha, Thimphu, Punakha, Tongsa, Bumthang, Mongar and Tashigang districts, N—Upper Kulung Chu district. Fir/Rhododendron forests, 3300–4100m. April–May.

Similar to *R. fulgens* and *R. thomsonii* which have petiolate leaves.

22. *R. neriiflorum* Franchet

Shrub or small tree to 6m. Leaves linear-oblong, or narrowly oblanceolate, 6–14 x 1.5–2.5cm, apiculate, base attenuate, glabrous on both surfaces, often minutely pale papillate beneath; petioles 5–15mm, glabrous or with spreading bristles 3–5mm. Racemes 5–10-flowered; pedicels 8–13mm, thinly stellate and glandular-pubescent. Calyx cup-shaped, with rounded, ciliate lobes c 2mm. Corolla tubular-campanulate, scarlet or blood-red, 3–3.5cm, 5-lobed. Stamens 10; filaments glabrous throughout. Ovary densely pubescent, sometimes glandular; style glabrous. Capsules curved, up to 25 x 4mm.

Bhutan: C—Tongsa district (Chendebi), N—Upper Kulung Chu district (Lao and Tobrang); **Arunachal Pradesh:** Nyam Jang Chu (Pangchen). Broad-leaved, Pine and Fir forests, 2200–3050m. March–May.

The E Himalayan plants described above belong to subsp. **phaedropum** (Balfour f. & Farrer) Tagg (*R. phaedropum* Balfour f. & Farrer, *R. tawangense* Sahnii & Naithani):

23. *R. fulgens* Hook. f. Nep: *Chimal* (34).

Shrub 1.5–5m. Leaves broadly elliptic, 8–12 x 3.5–7cm, rounded or minutely apiculate at apex, base rounded or shallowly cordate, glabrous above, densely and softly brown or red-brown tomentose beneath; petioles 1–2cm, glabrous. Racemes dense, 10–15-flowered; pedicels 5–10mm, glabrous. Calyx red, cup-shaped, with short, rounded lobes c 2mm. Corolla tubular-campanulate, 5-lobed, scarlet or blood-red, 2.5–3.5cm. Stamens 10; filaments glabrous throughout. Ovary and style glabrous. Capsule curved, c 2cm.

Bhutan: C—Punakha, Tongsa, Mongar, Tashigang and Sakden districts, N—Upper Mo Chu and Upper Kulung Chu districts; **Darjeeling:** Sandakphu; **Sikkim;** **Chumbi.** Fir/Rhododendron forests, 3350–4270m. April–June.

24. *R. thomsonii* Hook. f. Tongsa: *Khema*. Fig. 45c–g.

Similar to *R. fulgens* but leaves usually smaller, broadly elliptic or suborbicular, 4–8(–10) x 3.5–6cm, glabrous beneath but minutely papillate-puberulous and with a few stalked glands; petioles 1.5–3cm; racemes with fewer (3–8) flowers;

pedicels longer, 1.2 – 2cm; calyx larger, 6 – 10(–15)mm long, shallowly lobed; corolla 3.5 – 5cm, deep crimson.

Bhutan: C – Ha, Thimphu, Tongsa, Bumthang and Sakden districts, N – Upper Mo Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim.** Fir forests and open hillsides with secondary bamboo, 3050–4000m. April – July.

A variable species in Bhutan, Darjeeling and Sikkim. The typical subsp. **thomsonii** is characterised by its glabrous ovary, large shallowly lobed calyx 6 – 15mm and large blood red or deep magenta corolla 3.4 – 5cm long. However many specimens exist which differ in one or two of these characters and are possibly of hybrid origin:

Form A. (R. x candelabrum Hook. f.) Corolla pink; calyx shorter, 3 – 8mm and ovary sparsely to densely glandular. Known from Sikkim (apparently common) and Bhutan (Ha and Tongsa districts). This is considered to be a hybrid of *R. thomsonii* and *R. campylocarpum*.

Form B. Corolla deep red but often shorter, 3.5 – 4cm; calyx shorter, 3 – 5mm, deeply lobed, and ovary glabrous. Scattered throughout Sikkim and Bhutan (Upper Mo Chu district).

Form C. Leaves tomentose beneath, similar to *R. fulgens* but calyx large, deeply lobed; ovary glabrous. Sikkim (locality unknown). Possibly a hybrid between *R. thomsonii* and *R. fulgens*.

Form D. Leaves elliptic, much longer than broad, thinly whitish tomentose beneath; calyx 4–5mm; ovary glandular-pubescent. Sikkim (Phumi, N of Lachung). Possibly a new taxon but known from a single collection only.

Records of *R. hookeri* Nuttall from Bhutan (80) are based on the type specimen from Arunachal Pradesh. It differs from *R. thomsonii* in its oblanceolate leaves, 12 – 15 x 4 – 5cm.

25. R. edgeworthii Hook. f. Tongsa: *Poso Metog*; Nep: *Lahare Chimal* (34).

Shrub 1 – 4m. Branchlets thickly pale brown tomentose. Leaves ovate, or ovate-elliptic, 5 – 12 x 2.5 – 4.5cm, shortly acuminate, base rounded, upper surface strongly rugose, glabrous, lower surface softly and thickly pale brown tomentose, obscuring a close layer of minute, yellowish scales; petioles 5 – 15mm. Flowers terminal, solitary or 2–3, very fragrant; pedicels 1 – 2cm, thickly tomentose. Calyx cup-shaped, 12 – 15mm, lobed almost to base, pubescent and scaly. Corolla funnel-shaped, white, often tinged pink, 5 – 7cm long, 5-lobed to middle, scaly outside. Stamens 10, curved; filaments pilose in lower part. Ovary tomentose; style pilose and scaly in lower part. Capsules shortly cylindrical, c 2 x 1.3cm, tomentose.

Bhutan: S – Gayleghphug district (Gale Chu), C – Thimphu, Punakha and Tongsa

districts, **N** – Upper Mo Chu and Upper Kuru Chu districts; **Darjeeling**: Senchal; **Sikkim**: Lachen. Evergreen oak forests, often epiphytic or on rocks by rivers and on cliffs, 1830 – 3000m. April – May.

A much-prized ornamental species.

26. *R. pendulum* Hook. f.

Similar to *R. edgeworthii* but a smaller shrub up to 1m; leaves oblong-elliptic, 2.5 – 4.5 x 1.3 – 2.5cm, obtuse, base rounded, upper surface smooth, glabrous; lower surface pale tomentose and scaly; petioles 2 – 4mm; calyx deeply lobed, lobes 5 – 8mm, rounded, ciliate; corolla smaller, 1.8 – 2.3cm; capsules oblong, c 13mm.

Bhutan: **C** – Ha, Thimphu, Bumthang and Mongar districts, **N** – Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim**; **Chumbi**. Epiphytic and on cliffs and rocks in conifer and Rhododendron forests, 2300 – 3650m. April – June.

27. *R. maddenii* Hook. f.; *R. brachysiphon* Hutchinson, *R. brevityubum* Balfour f. & Cooper non Smith, *R. calophyllum* Nuttall, *R. jenkinsii* Nuttall, *R. macranthum* Griff., *R. polyandrum* Hutchinson.

Shrub 1 – 2(–4)m; branchlets scaly. Leaves elliptic, oblanceolate or obovate, 7 – 14 x 2.5 – 6cm, acute, base cuneate, red-brown scaly beneath, otherwise glabrous; petioles 5 – 15mm. Racemes umbel-like, 2 – 5-flowered, fragrant; pedicels 6 – 20mm, scaly. Calyx cup-shaped, divided nearly to base into 5 rounded fimbriate lobes 3 – 5mm, scaly at base. Corolla funnel-campanulate, 5-lobed, white, pinkish-white or pink throughout, and with a yellow blotch at base of tube, 6 – 8cm long, tube scaly on outside. Stamens mostly 17 – 25, filaments glabrous. Ovary 10 – 12-celled, densely scaly, tapering into style. Capsules cylindrical, 1.5 – 2.4cm, c 10-ribbed, scaly.

Bhutan: **S** – Chukka district, **C** – Thimphu, Punakha, Tongsa, Mongar and Tashigang districts, **N** – Upper Mo Chu district (Gasa); **Darjeeling**: Sandakphu; **Sikkim**: Choongtam. On rocks and cliffs in evergreen oak forests, and in *Rhododendron arboreum* scrub, 1800 – 3000m. May – July.

The Sikkim, Darjeeling and Bhutan plants belong to the widespread subsp. **maddenii**. The species was formerly subdivided into several very narrowly defined 'species' differing in variable characters such as stamen number. According to Cullen (183) these taxa have no distinct status in the wild, and are now treated as synonyms; further research in the field is desirable, however.

28. *R. dalhousiae* Hook. f.; ?*R. macrocarpos* Griff. Nep: Lahare Chimal (34).

Similar to *R. maddenii* but young shoots scaly and sparsely bristly; leaves 10 – 17 x 2.5 – 7cm, apex rounded or mucronate, densely reddish scaly beneath; petioles bristly; racemes 2 – 3-flowered; pedicels pubescent; calyx deeply divided into oblong obtuse lobes 10 – 15 x 5 – 10mm, thinly pubescent on outside; corolla 8 – 11cm white or creamy, with or without a red line from base to apex of each lobe;

stamens 10, filaments pubescent in lower part; ovary 5-celled; capsule 4 – 5cm, 5-ribbed.

Two varieties occur:

var. **dalhousiae**

Corolla 7.5 – 9cm, creamy, without red lines.

Bhutan: S – Phuntsholing and Chukka districts, C – Punakha, Tongsa, Tashigang and Sakden districts; **Darjeeling; Sikkim.** On cliffs and epiphytic on trees in warm broad-leaved forests, 1600 – 2100m. April – June.

var. **rhabdotum** (Balfour f. & Cooper) Cullen; *R. rhabdotum* Balfour f. & Cooper.

Corolla 9 – 11cm, creamy but with a red stripe from base to apex of each lobe.

Bhutan: S – Chukka and Gaylegphug districts, C – Punakha, Mongar and Sakden districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Arunachal Pradesh:** Nyam Jang Chu. On trees and rocks in warm and cool broad-leaved forests, 1500 – 2300m. April – July.

29. R. lindleyi Moore; *R. bhotanicum* Clarke, *R. grothausii* Davidian. Nep: *Lahare Chimal* (34). Fig. 45h – j.

Similar to *R. maddenii* and *R. dalhousiae* but shoots and petioles scaly, not bristly; leaves elliptic, rounded at apex, pale beneath with conspicuous scattered red scales; racemes 2 – 3-flowered, pedicels scaly; calyx lobes 11 – 18 x 5 – 8mm, with ciliate margins, otherwise glabrous; corolla 7.5 – 10cm, white, golden yellow at base within; stamens 10; filaments pubescent in lower part; ovary 5-celled; capsules c 4cm.

Bhutan: S – Chukka district, C – Thimphu, Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Mo Chu district; **Darjeeling; Sikkim.** Evergreen oak and Hemlock forests, 2100 – 2740m. April – May.

30. R. ciliatum Hook. f. Sha: *Baloo*.

Shrub 0.8 – 2m; branchlets densely spreading-bristly and scaly. Leaves elliptic, 4 – 7 x 2 – 3cm, acute or rounded and mucronate, base rounded, sometimes narrowly, upper surface dark green, bristly at base of midrib and on margins, lower surface pale green, scaly and thinly bristly; petioles 2 – 6mm. Racemes corymbose, 2 – 5-flowered; pedicels 7 – 12mm, bristly. Calyx unequally divided to base into ovate-elliptic lobes 6 – 10mm, base scaly, margins ciliate. Corolla campanulate, 3 – 4cm, white flushed pink. Stamens 10; filaments pubescent towards base. Ovary 5-celled, glabrous and without scales, apex impressed at base of style. Capsules shortly ovoid-oblong, c 1.5cm long.

Bhutan: C – Ha district (Ha and Saga La), Thimphu district (Dochong La), Punakha district (Tashi La) and Bumthang district (Kyi Kyi La), N – Upper Mo Chu district (Kohina); **Sikkim:** Lachen, Cho La, Dik Chu etc. Swampy ground at tree-line or in open dwarf Rhododendron scrub, 2900 – 3350m. April – May.

31. R. triflorum Hook. f.; *R. deflexum* Griff. Nep: *Pahenle Chimal* (34).

Evergreen or semi-deciduous shrub 1 – 5m; branchlets minutely scaly. Leaves ovate to lanceolate, 3.5 – 6.5 x 1.5 – 3cm, acute, base rounded, green and glabrous above, pale green or whitish beneath with minute scales; petioles 5 – 12mm. Racemes 2 – 3-flowered; pedicels 7 – 12mm, scaly. Calyx minute, obscurely 5-lobed, scaly. Corolla strongly zygomorphic, open funnel-shaped, 2 – 3cm, pale yellow, sometimes reddish blotched within. Stamens 10; filaments pubescent towards base. Ovary scaly. Capsules narrowly cylindrical, c 1.3cm.

Bhutan: C – Ha, Thimphu, Punakha, Bumthang and Mongar districts, N – Upper Kulong Chu district; **Darjeeling; Sikkim; Chumbi.** Blue Pine, Spruce and *Quercus griffithii* forest, 2300 – 3600m. April – June.

32. *R. setosum* D. Don

Compact, strongly aromatic subshrub 10 – 60cm; young shoots densely scaly and spreading-bristly. Leaves oblong-obovate, 9 – 13 x 3 – 6mm, rounded, truncate or shallowly retuse, base rounded, conspicuously scaly with yellowish scales above and red-brown scales beneath, apex, margins, and base of midrib beneath bristly; petioles c 1mm. Racemes dense, 2 – 5-flowered; pedicels 3 – 8mm, scaly and pubescent. Calyx deeply 5-lobed, lobes ovate-elliptic, 4 – 7mm, obtuse, scaly, sometimes ciliate. Corolla open funnel-shaped, 1.3 – 1.6cm, pale to deep purple, deeply 5-lobed, glabrous outside. Stamens 10, exerted; filaments pubescent towards base. Ovary pubescent and scaly. Capsules oblong-ovoid, c 5mm.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu and Upper Bumthang Chu districts; **Sikkim; Chumbi.** Open mountain slopes and valleys, 2770 – 4800m. June – August.

33. *R. nivale* Hook. f. Fig. 45k – m.

Compact dwarf shrub 10 – 30cm; shoots scaly otherwise glabrous. Leaves ovate or broadly elliptic, 4 – 7 x 2 – 5mm, rounded at apex and base, scaly on both surfaces with a mixture of yellow and dark brown scales; petioles 0.5 – 1mm. Flowers mostly solitary; pedicels 0.5 – 1mm. Calyx short, lobes ovate, 2 – 3mm, scaly. Corolla broadly funnel-shaped, 0.9 – 1.3cm, purple to lilac or pink, \pm glabrous outside. Stamens 10, shortly exerted; filaments hairy towards base. Ovary scaly. Capsules ovoid, 3 – 5mm.

Bhutan: C – Thimphu district (Pajoding and Tremo La), N – Upper Mo Chu district (Lingshi, Laya and Pangte La) and Upper Bumthang Chu district (Pangotang); **Sikkim; Chumbi.** Open mountain slopes and streamsides, 3960 – 4570m. May – June.

The E Himalayan plants belong to subsp. *nivale*.

34. *R. fragariiflorum* Kingdon Ward

Similar to *R. nivale* but shoots scaly and puberulous; leaves oblong-elliptic, larger, 10 – 17 x 5 – 9mm, apex rounded or subacute, margins crenulate, scaly on both surfaces with vesicular scales; petioles 1 – 2mm; racemes 2 – 3-flowered; pedicels 7 – 10mm; calyx lobes oblong, 6 – 7mm, sparsely scaly; corolla widely

open-campanulate, 1.4 – 1.7cm, red or dark purple.

Bhutan: C – Sakden district (Orka La), N – Upper Kulong Chu district (Shingbe, Me La). Open mountain slopes, 3960 – 4100m. June.

35. *R. pumilum* Hook. f.

Similar to *R. nivale* and *R. fragariiflorum* but a very low creeping subshrub; shoots scaly and puberulous; leaves elliptic, 7 – 16 x 3.5 – 8mm, acute, base cuneate, subglabrous above, brownish scaly beneath; petioles 1 – 2mm; flowers solitary or 2 – 3 together, on long, erect pedicels 1 – 2cm (up to 6cm in fruit); calyx lobes oblong, 2 – 3mm, scaly; corolla funnel-shaped, 1.2 – 1.6cm, pink, densely pilose outside.

Bhutan: N – Upper Kulong Chu district (Shingbe and Me La); **Sikkim:** Lhonak and Zemu valleys and Lachen. Open rocky slopes and screes, 3800 – 3960m. May – July.

36. *R. cinnabarinum* Hook. f. Nep: *Sanu Chimal* (34).

Shrub or small tree 2 – 6m, branchlets densely scaly. Leaves narrowly to broadly elliptic, 6 – 11 x 2.5 – 4cm, rounded or subacute with mucronate point, base rounded, densely scaly beneath, glabrous or scaly above; petioles 1 – 1.5cm, scaly. Racemes terminal, compact, 2 – 6-flowered; pedicels 6 – 13mm. Calyx small, cup-shaped with short rounded lobes up to 1mm, scaly. Corolla fleshy, tubular-campanulate or campanulate, 2.5 – 3.5cm, usually orange or orange-yellow, sometimes reddish or purple. Stamens 10; filaments hairy towards base. Ovary scaly. Fruit cylindrical, 8 – 12mm.

Two subspecies occur:

subsp. **cinnabarinum**; *R. blandfordiiflorum* Hooker, *R. roylei* Hook. f.

Leaves narrowly to broadly elliptic, glabrous above except when young; corolla 3 – 3.5cm, with narrow tube.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa, Mongar and Sakden districts, N – Upper Mo Chu district; **Darjeeling; Sikkim; Chumbi.** Fir/Rhododendron, Hemlock and Blue Pine forests, 2750 – 3200m. April – July.

subsp. **xanthocodon** (Hutchinson) Cullen; *R. xanthocodon* Hutchinson

Leaves broadly elliptic, often shorter than in subsp. *cinnabarinum*, distinctly persistently scaly on upper surface; corolla more broadly campanulate, 2.5 – 3cm.

Bhutan: C – Ha, Thimphu, Tongsa, Bumthang and Mongar districts, N – Upper Mo Chu, Upper Bumthang Chu and Upper Kulong Chu districts. Fir and Hemlock forests and in Juniper/Rhododendron scrub, 2900 – 4100m. May – July.

The leaves of *R. cinnabarinum* are reputed to be poisonous (48). In Bhutan subsp. *xanthocodon* is generally found at higher altitudes; in leaf shape the two subspecies overlap, but the differences in leaf indumentum and corolla shape correlate well. Red-flowered plants have been distinguished as var. *breviforme* Davidian. *R. basfordii* Davidian, described as a relative of *R. lindleyi*, must be regarded as a

synonym of *R. cinnabarinum* as the type specimen from the Rudong La belongs to that species. Cultivated plants referred to *R. basfordii* clearly do not originate from the type collection, and are close to or synonymous with *R. lindleyi*.

37. *R. keysii* Nuttall

Shrub 1.5 – 6m; shoots densely scaly. Leaves elliptic, 6 – 9 x 2 – 3cm, acute, subacute or rounded and finely mucronate, base rounded or cuneate, densely scaly beneath, sparsely scaly above; petioles 7 – 11mm. Racemes axillary, often several close together, each 2 – 5-flowered, flowers pendulous; pedicels slender, 5 – 8mm, scaly. Calyx minute, with short spreading lobes 0.5mm. Corolla tubular, 1.5 – 2.5cm, orange-red or crimson, becoming paler towards 5 short, weakly spreading, yellowish or greenish lobes. Stamens 10; filaments pubescent in lower half. Ovary scaly. Capsules cylindrical, c 1cm.

Bhutan: C – Thimphu, Punakha, Tongsa, Bumthang, Mongar, Tashigang and Sakden districts, N – Upper Mo Chu and Upper Kulong Chu districts. Spruce, Hemlock and Fir forests, and in Juniper/Rhododendron scrub, 2600 – 3500m. May – September.

Reports of this species from Sikkim have not been substantiated.

38. *R. virgatum* Hook. f.

Shrub 0.4 – 1.3m; young shoots scaly. Leaves oblong or oblong-elliptic, 2.5 – 7.5 x 1 – 2cm, acute or mucronate, base cuneate, glabrous above except for a few scales on midrib, red-brown scaly beneath; petioles 3 – 6mm. Flowers 1(–2) in upper leaf axils; pedicels 3 – 6mm. Calyx of 5 rounded lobes 1.5 – 2mm, sparsely scaly and ciliate. Corolla funnel-shaped, usually pale pink, 2.0 – 3.5cm, sparsely pubescent and scaly outside. Stamens 10; filaments pubescent towards base. Ovary densely scaly; style pubescent and with a few scales near base. Capsules c 1cm, scaly.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu district (Gasa); **Sikkim:** Lachen, Choongtam and Lachung; **Arunachal Pradesh:** Nyam Jang Chu. Blue Pine and evergreen oak forests, 1900 – 3000m. April – May.

The E Himalayan plants belong to subsp. *virgatum*.

39. *R. leptocarpum* Nuttall; *R. micromeres* Tagg

Straggling shrub 1 – 2m, usually epiphytic; young shoots sparsely scaly. Leaves elliptic-oblongate, 4.5 – 8 x 1.8 – 2.5cm, rounded and mucronate, base cuneate, papillose and densely scaly beneath, sparsely scaly or glabrous above; petioles 2 – 5mm. Racemes subumbellate, 3 – 7-flowered; flowers nodding; pedicels 2 – 2.5cm, slender, flexuous, scaly. Calyx of 5 spreading or reflexed lobes 2 – 4mm, scaly at base. Corolla open-campanulate, 9 – 12mm, lemon-yellow. Stamens 10; filaments pilose towards base. Ovary scaly. Capsule oblong, c 15mm, slightly curved, scaly.

Bhutan: C – Sakden district (Sakden), N – Upper Kulong Chu district (Lao);

Sikkim: above Choka. In wet shady Rhododendron forest, 2740 – 3400m. June – July.

40. *R. camelliiflorum* Hook. f.; *R. cooperi* Balfour f., *R. sparsiflorum* Nuttall

Shrub 1 – 2m, often epiphytic; young shoots scaly. Leaves elliptic or oblanceolate, 5 – 8(–10) x 1.5 – 3cm, acute, base rounded or broadly cuneate, subglabrous above, densely brown scaly beneath; petioles stout, 5 – 10mm. Flowers terminal, 1 – 2 together; pedicels 5 – 10mm, stout, scaly. Calyx deeply 5-lobed, lobes rounded, 5 – 7mm, scaly at base. Corolla open-campanulate, 16 – 24mm, fleshy, deeply 5-lobed, pale pink to deep wine-red, scaly on outside. Stamens 12 – 16; filaments hairy towards base. Ovary 5 – 10-locular, scaly; style glabrous. Capsules ovoid-oblong, 10 – 12mm, scaly, on short thick pedicels.

Bhutan: S – Chukka district (Jumudag), C – Thimphu, Punakha, Tongsa, Bumthang, Mongar and Sakden districts, N – Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Lachung, Choka and Chungthang. On trees and cliff ledges in evergreen oak and Hemlock forests, 2540 – 3400m. June – July.

Vegetatively very similar to *R. keysii* which differs in its axillary, 2 – 5-flowered inflorescences with slender pedicels and narrowly tubular corollas.

41. *R. glaucophyllum* Rehder; *R. glaucum* Hook. f. non Sweet

Similar to *R. camelliiflorum* but a smaller shrub up to 1m; leaves 4 – 6 x 1.3 – 2.2cm, white beneath and with a mixture of brown and yellow scales; flowers 4 – 8 in terminal subumbellate racemes; pedicels slender, 1 – 2cm; corolla campanulate or tubular-campanulate, 16 – 34mm, pale to deep pink, rarely white; stamens 10; ovary 5-locular.

Two subspecies occur:

subsp. ***glaucophyllum***

Calyx 6 – 9mm; corolla campanulate, 1.6 – 2(–2.5)cm long; style sharply deflexed.

Bhutan: C – Punakha district (Phobsika); **Sikkim:** Karponang, Lachung, Cho La, Thangu etc. Amongst Rhododendrons in Blue Pine and Fir forests, 3000 – 3600m. May – June.

subsp. ***tubiforme*** (Cowan & Davidian) Long; *R. glaucophyllum* var. *tubiforme* Cowan & Davidian, *R. tubiforme* (Cowan & Davidian) Davidian

Calyx 7 – 11mm; corolla tubular-campanulate, 2.3 – 3.4cm long; style strongly curved.

Bhutan: C – Mongar district (E side Rudong La), Tashigang district (Mindu La) and Sakden district (Nyuksang La), N – Upper Kulong Chu district (Lao). Fir forests, 3050 – 3600m. June.

42. *R. lepidotum* G. Don; *R. elaeagnoides* Hook. f., *R. obovatum* Hook. f., *R.*

salignum Hook. f. Med: *Dali Metog* (flower); Nep: *Balu Sun Pate*, *Bhale Sunpate* (34).

Aromatic rounded or mat-forming subshrub 15–60cm; branchlets scaly. Leaves obovate, oblanceolate or elliptic, 5–15(–20) x 3–5(–9)mm, acute or rounded, base cuneate, conspicuously scaly on both surfaces but scales not closely overlapping; petioles absent or up to 1mm. Flowers 1–2, terminal; pedicels slender, 1.5–2.5cm, scaly. Calyx 5-lobed; lobes rounded 3–4mm, scaly. Corolla campanulate, 1–1.5cm, red, pink, purple, white or yellow, often spotted, scaly but not pubescent outside. Stamens 10; filaments pubescent towards base. Ovary scaly; style very short, deflexed. Capsules shortly cylindrical, 5–7mm.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa, Bumthang, Mongar, Tashigang and Sakden districts, N – Upper Mo Chu, Upper Pho Chu, Upper Mangede Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling;** **Sikkim;** **Chumbi.** Open mountainsides, moraines, riverbanks, Juniper/Rhododendron scrub, and in open glades in Fir forests, common, 2400–4570m. May – July.

Probably the commonest dwarf *Rhododendron* in the area; similar to *R. nivale* which differs in its very short pedicels up to 1mm, *R. fragariiflorum* which differs in its 2–3-flowered racemes, pedicels 7–10mm and larger funnel-shaped corollas, and to *R. pumilum* which has leaves without scales above and funnel-shaped corollas externally pilose. White-flowered plants are common and have been segregated as var. **album** Davidian.

43. R. baileyi Balfour f.; *R. thyodocum* Balfour f. & Cooper

Similar to *R. lepidotum* but a taller shrub 50–150cm; leaves larger and broader, elliptic or obovate, 20–45 x 10–20mm, very densely, often brownish, scaly on lower surface with closely overlapping scales, upper surface thinly to densely scaly; petioles 2–7mm; flowers 3–9 in distinct terminal racemes; pedicels 1–2cm; corolla deep wine red or purple.

Bhutan: C – Punakha district (Tang Chu), N – Upper Mo Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim:** Yeumthang; **Arunachal Pradesh:** Nyam Jang Chu. Fir forests and Juniper/Rhododendron scrub, 3050–4000m. May – July.

44. R. anthopogon D. Don. Med: *Dali Metog*; Nep: *Dhupi* (34).

Small erect aromatic shrub 15–60cm, much branched; branchlets scaly with short and long-stalked lacerate scales, these later becoming bristles. Leaves ovate, 1–3 x 0.7–1.5cm, rounded, shortly mucronate, base rounded, sparsely scaly above, densely (usually brown) scaly beneath with closely overlapping, lacerate scales; petioles 2–5mm. Flowers 5–10 in dense subcapitate racemes; pedicels short, 2–4mm. Calyx deeply 5-lobed, lobes ovate 3–4mm, scaly and with ciliate margins. Corolla salver-shaped, 5-lobed, white, pink or yellow, tube 6–10mm, lobes 4–7mm, glabrous outside, densely white pilose in tube. Stamens usually 5–8. Ovary

scaly. Capsules 4 – 5mm, enclosed in calyx.

Two subspecies are recognized:

subsp. **anthopogon**; *R. haemonium* Balfour f. & Cooper, *R. anthopogon* D. Don var. *haemonium* (Balfour f. & Cooper) Cowan & Davidian.

Branches without persistent leaf bud scales; corolla (in Bhutan) usually pink or pinkish white sometimes (in Darjeeling and Sikkim) lemon-yellow.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa, Bumthang and Sakden districts, N – Upper Mo Chu and Upper Bumthang Chu districts; **Darjeeling; Sikkim; Chumbi.** A common plant, on open hillsides, rocky slopes and cliff ledges and in dwarf Rhododendron scrub above tree line, 3650 – 4700m. May – August.

subsp. **hypenanthum** (Balfour f.) Cullen; *R. hypenanthum* Balfour f.

Differs from subsp. *anthopogon* in its branchlets which bear persistent lanceolate leaf bud scales at nodes; corolla creamy-white or yellow, sometimes (only in Bhutan) pink.

Bhutan: C – Ha district (Ha Dzong), Thimphu district (Tremo La and between Shodug and Barshong) and Punakha district (Ritang), N – Upper Kulong Chu district (Me La); **Sikkim:** locality unknown. Open hillsides and rocky slopes, 3200 – 4570m. April – June.

Subsp. *anthopogon* is the common E Himalayan race; subsp. *hypenanthum*, the W Himalayan race is rare in Bhutan; the Ha and Thimphu plants of the latter are typically yellow-flowered, whilst the Ritang and Me La plants are white or pink-flowered. These white-flowered plants have been separated as var. **album** Davidian. The leaves are highly aromatic and used as incense.

45. **R. pogonophyllum** Cowan & Davidian

Similar to *R. anthopogon* but a creeping subshrub; leaves obovate, 6 – 10 x 3 – 6mm, rounded or retuse, base rounded, conspicuously white-pilose but without scales on upper surface and margins, thickly brown scaly beneath (appearing almost tomentose); petioles 1 – 2mm; flower heads 2 – 4-flowered; calyx lobes obovate, 5 – 6mm; corolla white to pink; fruit unknown.

Bhutan: C – Tongsa district (Chore, Rinchen Chu and Ritang, Tang Chu). Creeping on rocks and rocky soil on open hillsides, 4270 – 4720m. June – July.

A very rare species endemic to Bhutan.

46. **R. vaccinioides** Hook. f.

Small bushy shrub 15 – 80cm, pendulous when epiphytic, branchlets rough with stalked scales. Leaves clustered towards branch-ends, obovate-spathulate, 13 – 20 x 5 – 8mm, rounded or retuse, base attenuate, margins revolute when dry, sparsely scaly above, pale beneath with scattered scales; petioles 1 – 3mm. Flowers terminal, solitary or 2 – 3 in a cluster; pedicels 9 – 14mm, scaly. Calyx deeply lobed, lobes c 2mm, glandular. Corolla rotate-campanulate, pink; tube broadly cylindrical c 5mm; lobes spreading, 4 – 5mm. Stamens 10, exserted from mouth of corolla tube;

filaments densely hairy. Ovary scaly. Capsules linear, curved, 20 – 25 x 3 – 4mm; valves thin, with pale membranous margins, splitting and reflexing to base.

Bhutan: C – Punakha district (Dochong La) and Tongsa district (Tashiling and Tongsa), N – Upper Mo Chu district (Gasa Dzong); **Darjeeling:** Balasun, Pankabari etc; **Sikkim:** Lachen. Epiphytic or growing on rocks, cliffs and logs in evergreen oak forests, 2130 – 2740m. June – July.

2. GAULTHERIA L.

by S.J. Rae

Erect or prostrate evergreen shrubs. Leaves alternate, serrulate or ciliate, often glandular beneath. Flowers often functionally unisexual, in simple axillary racemes or solitary. Sepals 5, united at base, becoming enlarged, fleshy and surrounding capsule in fruit. Petals 5, united into a barrel- or urn-shaped tube; lobes short, recurved or spreading. Stamens 10, rarely 5, inserted at base of corolla, with 2 or 4 spurs at apex of anthers. Ovary superior or semi-inferior, 5-celled; style simple. Fruit a 5-lobed capsule surrounded by enlarged fleshy calyx; seeds many, angled.

- | | |
|--|-----------------------------|
| 1. Leaves 3 – 14 x 1.5 – 6cm | 2 |
| + Leaves 0.5 – 3 x 0.2 – 2.5cm | 6 |
| 2. Leaves white beneath | 2. G. discolor |
| + Leaves green (sometimes pale) beneath | 3 |
| 3. Shoots glabrous | 4 |
| + Young shoots spreading or appressed pilose or bristly | 5 |
| 4. Leaves with 2 – 4 pairs of lateral veins; margin distantly and bluntly serrulate; fruiting pedicels with bracteoles at or near apex | 1. G. fragrantissima |
| + Leaves with 4 – 6 pairs of lateral veins; margin closely and sharply serrulate; fruiting pedicels with bracteoles in lower half | 3. G. griffithiana |
| 5. Shoots with appressed bristles; bracts small, c 1mm, narrowly triangular; ovary semi-inferior; stamens 5 | 4. G. semi-infera |
| + Shoots with spreading bristles; bracts large, c 4mm, ovate; ovary superior; stamens 10 | 5. G. hookeri |
| 6. Leaves elliptic-obovate or ovate, 4 – 25mm broad | 7 |
| + Leaves narrowly elliptic or oblanceolate, rarely ovate or suborbicular, 2 – 3mm broad | 8 |
| 7. Leafy shoots short, glabrous; leaves elliptic-obovate 0.7 – 3 x 1 – 2.5cm; | |

- flowers in short racemes **6. *G. pyroloides***
 + Leafy shoots long and slender, bristly; leaves ovate, 0.6 – 1.5 x 0.4 – 1.2cm;
 flowers solitary **7. *G. nummularioides***
8. Anthers with 2 apical spurs; leaf margins ciliate (except var. *eciliata*)
8. *G. trichophylla*
 + Anthers with 4 apical spurs; leaf margin without cilia (except var. *layaensis*)
9. *G. sinensis*

1. *G. fragrantissima* Wall. Dz: *Chamze Kam*; Nep: *Machino* (34).

Shrub 2 – 3m; branches glabrous. Leaves ovate-lanceolate, 4 – 13 x 2.5 – 5cm, apex acute, base cuneate, lateral veins 2 – 4 pairs; petioles 5 – 9mm. Racemes 10 – 30-flowered, 3 – 7cm, pubescent; pedicels 2 – 5mm; bract at base c 3mm; bracteoles c 1mm, remaining near apex of fruiting pedicels. Sepals triangular, acute, c 1.5mm. Corolla barrel-shaped, constricted towards apex, 3 – 5 x 2 – 4mm, white, sometimes greenish-white, lobes minute. Stamens 10; anthers with 4 spurs c 0.5mm. Capsules 5 – 8 x 3 – 5mm, surrounded by enlarged fleshy calyx.

Bhutan: S – Gayleghpug and Deothang districts, C – Thimphu, Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling** (34). Roadside banks in warm broad-leaved and evergreen oak forests, 1700 – 2500m. March – June.

A plant from Sikkim/Darjeeling with narrower leaves and numerous, more slender racemes has been described as var. *racemosa* Clarke. This has been placed as a doubtful synonym of *G. stapfiana* Airy Shaw but differs from that species in its glabrous shoots.

2. *G. discolor* Nuttall

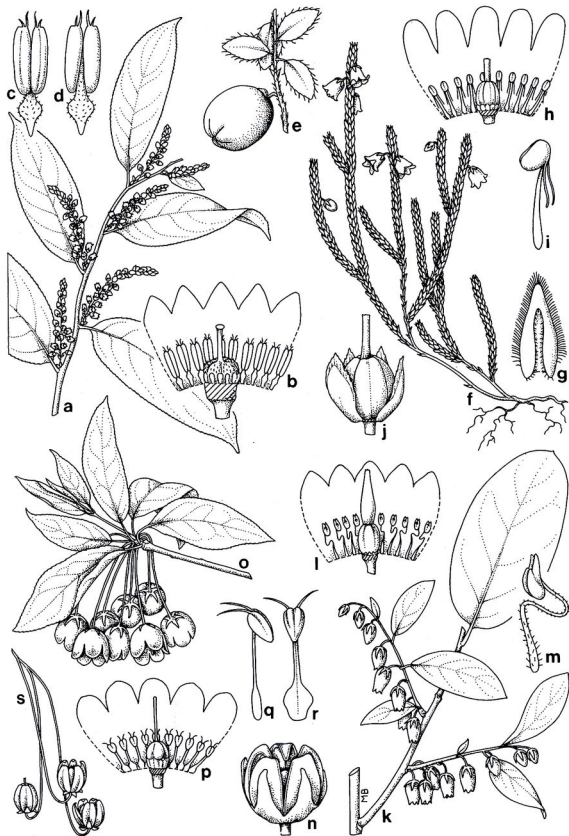
Similar to *G. fragrantissima* but branches sparsely setose; leaves white beneath, 4 – 8 x 1.5 – 3.5cm, lateral veins usually 2 pairs; petioles 3 – 6mm; pedicels 1 – 2mm; corolla ovoid, white, lobes tinged pink; capsules subglobose, bluish-white.

Bhutan/Arunachal Pradesh frontier: Orka La. Amongst shrubs, 1830 – 2130m. December – February.

Fruit edible.

3. *G. griffithiana* Wight. Fig. 46a – d.

FIG. 46. Ericaceae. a – d, *Gaultheria griffithiana*: a, flowering branch; b, dissected flower; c, stamen in front view; d, stamen in back view. e, *Gaultheria trichophylla*: part of shoot with fruit. f – j, *Cassiope fastigiata*: f, flowering plant; g, leaf; h, dissected flower; i, stamen in side view; j, fruit with one sepal removed. k – n, *Lyonia villosa*: k, flowering branch; l, dissected flower; m, stamen in side view; n, capsule. o – s, *Enkianthus deflexus*: o, flowering branch; p, dissected flower; q, stamen in side view; r, stamen in front view; s, capsules. Scale: a x 1/3; f, k, o, s x 2/3; e, p x 1/2; l x 2 1/2; h x 3; b, j, n x 4; q, r x 5; g, m x 6; i x 8; c, d x 10. Drawn by M. Bates.



Shrub 2–3m; branchlets glabrous. Leaves elliptic-oblong, 7–14 x 2.5–6cm, apex caudate-acuminate, base rounded, lateral veins 4–6 pairs; petioles 5–7mm. Racemes 15–25-flowered, 3–8cm, pubescent; pedicels c 2mm; bract at base 2–4mm; bracteoles c 2mm, remaining on lower half of fruiting pedicels. Sepals triangular, obtuse, c 2mm. Corolla open-campanulate, 3–5 x 3–5mm, pale greenish-white, lobes c 1mm. Stamens 10; anthers minutely 4-spurred. Capsule 5–7 x 4–6mm, surrounded by enlarged fleshy calyx.

Bhutan: S – Chukka district, C – Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Mo Chu district; **Darjeeling;** **Sikkim:** Choongtam, Karponang, Yak La. Moist evergreen oak and Hemlock/Rhododendron forests and scrub, 2000–3050m. April – June.

A collection from Choongtam, Sikkim, differs in having much smaller leaves 5–6 x 1–1.5cm.

4. *G. semi-infera* (Clarke) Airy Shaw; *Diplycosia semi-infera* Clarke. Sha: *Shagshingma Shing*.

Shrub 0.5–1.5m; young shoots with appressed bristly hairs. Leaves ovate-oblong, 3–9 x 1.5–3cm, apex mucronate, base cuneate or rounded, margins serrulate, lateral veins 3–4 pairs; petioles 3–5mm. Racemes 12–18-flowered, 1–2cm, pubescent; bract at base of pedicel c 1mm; bracteoles c 1mm, persisting near apex of fruiting pedicels. Sepals lanceolate, c 3mm, acute. Corolla barrel-shaped, constricted towards apex, 2–3 x 2mm, white sometimes tinged pink, lobes minute. Stamens 5; spurs 4 minute. Ovary semi-inferior. Capsule subglobose, 3–5 x 2–4mm, surrounded by enlarged, fleshy blue calyx with narrow erect teeth.

Bhutan: C – Thimphu, Punakha, Tongsa and Tashigang districts, N – Upper Mo Chu district (Gasa); **Darjeeling:** Jalapahar, Senchal; **Sikkim:** Lachung. Margins and clearings in evergreen oak and Blue Pine forests, 2100–3000m. May – June.

5. *G. hookeri* Clarke; *G. hookeri* var. *angustifolia* Clarke

Shrub 1–2m, branchlets with thin to dense, spreading, reddish bristles. Leaves ovate-elliptic, 3–9 x 1.5–4cm, apex acute, base rounded, margin serrulate, gland-dotted and bristly beneath; petioles 3–5mm. Racemes 10–15-flowered, 2–4cm, pubescent; bract at base of pedicel 4–5mm; bracteoles c 2mm, near apex of pedicels in bud, becoming ± basal in fruit. Sepals broadly triangular, 2mm. Corolla barrel-shaped, constricted towards apex, 3–4 x 2–3mm, white or greenish; lobes very short, pink. Stamens 10; spurs 4, c 0.5mm. Capsule c 5 x 4mm, surrounded by enlarged fleshy calyx.

Bhutan: S – Gaylegphug district (above Sham Khara), C – Mongar district (Pangkar) and Tashigang district (Chorten Kora); **Darjeeling;** **Sikkim:** Yumthang, Yak La, Lachen, Choongtam and Karponang. Moist forests, 2100–3270m. April – June.

Variable in leaf shape and in size and density of branchlet indumentum.

6. *G. pyroloides* Miquel; *G. pyrolifolia* Clarke

Mat-forming dwarf shrub with creeping rhizomes and short erect glabrous leafy shoots 4–10cm. Leaves elliptic-obovate, 0.7–3 x 1–2.5cm, apex obtuse, base cuneate, margins bluntly serrate, upper surface reticulate, lower surface glabrous or with a few minute bristles; petioles 1–2mm. Racemes 2–5-flowered, 0.8–1.5cm, pubescent; pedicels 2–8mm; bract at base c 5mm; bracteoles c 3mm, persisting at middle of pedicel. Sepals triangular, 3mm. Corolla ovoid, constricted towards apex, 3–5 x 3–4mm, white tinged pink, lobes minute. Stamens 10; anthers with 4 spurs 1mm. Capsules 0.5–1cm, surrounded by enlarged fleshy calyx, blue when ripe.

Bhutan: C – Tongsa district (Rinchen Chu and Pobjeka), Tashigang district (Preng La), and Sakden district (Orka La), N – Upper Kulong Chu district (Me La); **Sikkim:** Thanka La, Gocha La, Lachen. On open banks in Juniper/Rhododendron scrub and on rocky slopes and screes, 3650–4570m. May – August.

7. *G. nummularioides* D. Don. Tongsa: *Khwe Shokpa*.

Prostrate dwarf shrub with creeping, bristly leafy shoots 5–20cm long. Leaves ovate, 6–15 x 4–12mm, apex acute, base rounded or shallowly cordate, margins ciliate, cilia c 1mm, lower surface bristly; petioles 1–2.5mm. Flowers solitary, in upper leaf axils; pedicels 1–2mm, covered with 6–7 ovate bracts and bracteoles. Sepals triangular c 3mm. Corolla ovoid-urn-shaped, 5–7 x 2.5–5mm, white or pink, lobes short. Stamens 10; anthers with 4 short spurs. Capsule 5–8 x 4–7mm, surrounded by enlarged fleshy calyx, black when ripe.

Bhutan: S – Chukka and Gaylegphug districts, C – Thimphu, Tongsa and Tashigang districts; **Darjeeling; Sikkim; Chumbi.** Evergreen oak forests and on open rocky slopes, 1800–3500m. August – September.

A single collection from alpine Sikkim (above Toong) differs in its much larger, tubular corollas 10–11mm and may represent a distinct taxon.

8. *G. trichophylla* Royle. Laya: *Zum*. Fig. 46e.

Prostrate dwarf shrub with creeping leafless stems and short, erect, bristly leafy shoots 3–9cm. Leaves elliptic-oblongate, 5–10 x 2–3mm, apex subacute, base cuneate, margins ciliate, cilia c 0.5mm, otherwise glabrous; petioles 1mm. Flowers solitary, axillary; pedicels 2–4mm; bracteoles ovate, 1.5mm. Sepals triangular, 3mm. Corolla broadly campanulate, slightly constricted at apex, 3–5 x 2–4mm, whitish-pink, lobes 1mm. Stamens 10; anthers with 2 apical spurs. Capsule 6–9 x 5–8mm, surrounded by enlarged fleshy calyx, deep blue when ripe.

Bhutan: C – Thimphu, Tongsa, Mongar and Tashigang districts, N – Upper Mo Chu, Upper Pho Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim; Chumbi.** On cliffs, screes and rocky streamsides, 2900–4270m. May – June.

The above description refers to the common var. **trichophylla**; var. **eciliata** Rae & Long, from Pung La, Mongar district, differs in its smaller, ovate leaves 2.5–5 x 0.5–3mm, apex ciliate, margins serrulate but lacking cilia.

9. *G. sinensis* Anthony

Similar to *G. trichophylla* but leafy shoots sparsely hairy or glabrous, often longer, up to 15cm; leaf margins serrulate, not ciliate, midrib with a few hairs beneath; anthers with 4 apical spurs.

Bhutan: C—Mongar district (E side of Rudo La), N—Upper Kulong Chu district (Lao). Mossy rocks and by waterfalls, 2900—3650m. May.

The above description and records refer to var. **major** Airy Shaw, a slight variant with larger, somewhat more reticulate leaves than the typical Chinese plant. Another collection from Laya, Upper Mo Chu district, var. **layaensis** Rae & Long, differs in its smaller, ovate-suborbicular leaves, 3—4 x 2—3mm, apex subacute or obtuse and ciliate.

3. CASSIOPE D. Don

by S.J. Rae

Dwarf evergreen shrubs. Leaves scale-like, imbricate in 4 rows, margins ciliate. Flowers solitary, axillary, nodding. Sepals 5, free. Corolla campanulate, 5-lobed. Stamens 10, inserted at base of corolla; anthers with 2 slender spreading or deflexed horns. Ovary superior, 5-celled. Fruit a 5-lobed capsule.

1. Plants erect; young leafy shoots 3—5mm wide; flowers 2—8 per stem; pedicels as long as or shorter than flowers **1. C. fastigiata**
- + Plants decumbent; young leafy shoots 1—2mm wide; flowers 1—2 per stem; pedicels twice as long or more than flowers **2. C. selaginoides**

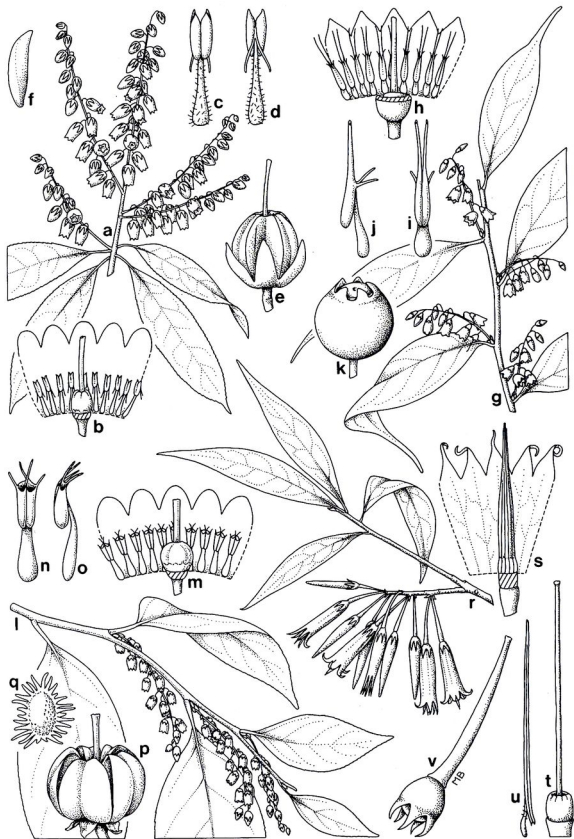
1. C. fastigiata (Wall.) D. Don; *Andromeda fastigiata* Wall., *A. cupressiformis* D. Don. Fig. 46f—j.

Erect shrub 15—30cm. Leaves ovate-oblong, 3—5 x 1—2mm, with membranous, white, ciliate margins. Pedicels 2—6mm, woolly. Sepals elliptic, tinged red, 2—4mm, margins papery and ciliate. Petals white. Filaments glabrous or pilose. Capsule globose 2—4 x 2—3mm.

Bhutan: C—Thimphu and Tongsa districts, N—Upper Mo Cho, Upper Pho Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim; Chumbi.** Grassy mountainsides, river banks and Juniper/Rhododendron scrub, 3650m—4570m. May—September.

2. C. selaginoides Hook. f. & Thomson

FIG. 47. *Ericaceae*. a—f, *Pieris formosa*: a, flowering branch; b, dissected flower; c, stamen in front view; d, stamen in back view; e, capsule; f, seed. g—k, *Vaccinium dunalianum*: g, flowering branch; h, dissected flower; i, stamen in front view; j, stamen in side view; k, fruit. l—q, *Leucothoe griffithiana*: l, flowering branch; m, dissected flower; n, stamen in front view; o, stamen in side view; p, capsule; q, seed. r—v, *Agapetes saligna*: r, flowering branch; s, dissected flower; t, ovary and style; u, stamen in side view; v, fruit and fleshy pedicel. Scale: a, g, r x 1/2; l x 2/3; s x 1; t, u, v x 1/2; b x 2; h x 2 1/2; e, m, p x 3; k x 4; c, d, i, j x 5; n, o x 8; f, q x 14. Drawn by M. Bates.



Similar to *C. fastigiata* but a more slender, decumbent subshrub to 25cm; leaves lanceolate, 2–3 x c 1mm, bristle-tipped; pedicels 5–20mm, pubescent.

Bhutan: C – Ha, Tongsa, Tashigang and Sakden districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Sikkim.** Mountain cliffs, screes and rocky river banks, 3350–4720m. May – August.

4. ENKIANTHUS Loureiro

by S.J. Rae

Deciduous shrubs or small trees. Leaves in terminal clusters on short lateral shoots, serrulate. Flowers pendulous, borne on long pedicels clustered amongst leaves. Sepals 5, united at base. Petals 5, united, campanulate, glabrous. Stamens 10, inserted at base of corolla, with two spurs at apex of filament. Ovary superior, 5-celled. Fruit a 5-lobed capsule; seeds many, ellipsoid.

I. E. deflexus (Griff.) Schneider; *E. himalaicus* Hook. f. & Thomson. Nep: *Sindure*, *Khorsane* (34). Fig, 460 – s.

Shrub or small tree 3–6m. Leaves ovate-elliptic, 3–5 x 1.5–2.5cm, apex acute to acuminate, base acute, pubescent beneath when young; petioles 5–10mm. Inflorescence 8–12-flowered; pedicels slender, 2–4cm. Sepals triangular, 2–3mm. Corolla 8–12 x 6–10mm, greenish, often tinged pink or orange, with red veins. Filaments and anthers hairy; spurs c 1mm. Capsule globose, 5–7 x 4–6mm.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Darjeeling; Sikkim; Chumbi.** Evergreen oak, Spruce and Hemlock forests, 2300–3660m. May – June.

5. LYONIA Nuttall

by S.J. Rae

Evergreen or deciduous shrubs or trees. Leaves alternate, entire. Flowers in simple axillary racemes. Sepals 5, united at base. Petals 5, united into cylindrical or urn-like tube, pubescent. Stamens 10, inserted at base of corolla, with or without 2 spurs at base of anthers. Ovary superior, 5-celled. Fruit a 5-lobed, globose capsule; seeds many, minute, linear, curved, not winged.

Foliage of both the species below is poisonous to cattle and goats and reputed to have insecticidal properties (16, 48).

1. Leaves ovate, acuminate; racemes c 40-flowered with 1–2 leaf-like bracts only

- at base; corolla cylindric, 8 – 12mm **1. L. ovalifolia**
 + Leaves elliptic, obovate or suborbicular, acute to rounded; racemes 6 – 12-
 flowered with scattered leaf-like bracts throughout; corolla urn-shaped, 5.5 –
 8mm **2. L. villosa**

1. L. ovalifolia (Wall.) Drude; *Andromeda elliptica* Siebold & Zuccarini, *Pieris ovalifolia* (Wall.) D. Don. Sha: *Shajula Shing*; Nep: *Angeri* (34).

Deciduous or semi-evergreen shrub or tree 2 – 10m. Leaves ovate, 4 – 15 x 1.5 – 6cm, apex acuminate, base rounded to cordate; petioles 5 – 15mm. Racemes c 40-flowered, 3 – 16cm with 1 – 2 leaf-like bracts 1.5 – 4cm at base. Sepals triangular, 1.5 – 2.5mm. Corolla cylindric, 8 – 12 x 2.5 – 5mm, white, sometimes tinged pink towards apex, pubescent. Filaments hairy towards base; anthers with 2 spreading, basal spurs c 0.5mm. Capsule globose 2.5 – 4.5 x 3.5 – 6mm; seeds c 1mm.

Bhutan: S – Chukka district, C – Thimphu, Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Mo Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Darjeeling:** common; **Sikkim.** Margins of and clearings in Oak and Blue Pine forests, 1500 – 2600m. May – August.

The above description and records apply to var. **ovalifolia**. The Bhutan record for var. *lanceolata* (Wall.) Handel-Mazzetti (117) which occurs from W. China to Khasia has not been substantiated.

2. L. villosa (Clarke) Handel-Mazzetti; *Andromeda villosa* (Clarke) Cowan & Cowan, *Pieris villosa* Clarke. Nep: *Lekh Angeri* (34). Fig. 46 k – n.

Similar to *L. ovalifolia* but leaves elliptic to obovate or suborbicular, 4 – 8 x 2 – 4cm, apex acute to rounded, base broadly cuneate to slightly cordate; racemes 2 – 7cm, 6 – 12(–18)-flowered; sepals 3 – 5mm; corolla urn-shaped 5.5 – 8 x 4 – 7mm; anthers without spurs.

Bhutan: C – Ha, Thimphu and Punakha districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Darjeeling;** **Sikkim;** **Chumbi.** Moist conifer/Rhododendron forests, 2440 – 3660m. June – August.

The above description and specimens refer to var. **villosa**; two collections from Upper Mo Chu district (Kohina) belong to var. **pubescens** (Franchet) Judd which differs in being more hairy throughout, and in its suborbicular or broadly elliptic leaves, and narrower corolla tube 3 – 4.5mm broad.

6. PIERIS D. Don

by S.J. Rae

Similar to *Lyonia* but leaves in pseudo-whorls, serrate; racemes aggregated into panicles; corolla glabrous; filaments with 2 spurs at apex; seeds not winged.

1. P. formosa (Wall.) D. Don; *Andromeda formosa* Wall. Nep: *Balu* (34). Fig. 47a

- f.

Small shrub or tree 1 – 5m. Leaves elliptic or oblanceolate, 5 – 12 x 1.5 – 3cm, coriaceous, apex acuminate, base cuneate, margins serrulate; petioles 3 – 15mm. Panicles 6 – 15cm. Sepals triangular, 3 – 5 x 1 – 2mm. Corolla urn-like to cylindric, 5 – 10 x 3 – 7mm, white, sometimes tinged pink. Stamens hairy especially towards base. Style slightly impressed into apex of ovary. Capsule ovoid to globose, 3 – 6 x 4 – 7mm; seeds c 3mm.

Bhutan: C – Ha, Thimphu and Tashigang districts; **Darjeeling; Sikkim; Chumbi.** River banks, scrub etc., in Blue Pine forests, 1830 – 3960m, February – June.

Poisonous (34).

7. LEUCOTHOE D. Don

by S.J. Rae

Similar to *Lyonia* and *Pieris* but leaves alternate, minutely serrulate; flowers in simple axillary racemes, 1(–2) per leaf axil; corolla cylindric, glabrous; anthers with 4 erect spurs at apex; seeds orbicular, compressed, narrowly winged, with scale-like papillae.

1. *L. griffithiana* Clarke. Fig. 471 – q.

Shrub 1 – 5m. Leaves coriaceous, elliptic-lanceolate, 10 – 15 x 3 – 5cm, apex caudate-acuminate, base cuneate; margins minutely serrulate; petioles 6 – 13mm. Racemes c 18-flowered, 3 – 9cm, solitary or paired. Sepals triangular 1 – 2mm. Corolla cylindric, 4 – 6 x 4mm, white. Stamens glabrous; anthers with 4 erect spurs c 0.5mm at apex. Capsule depressed-globose, 3 – 4 x 5mm; seeds c 1mm.

Bhutan: C – Mongar district (Bepa, 117) and Tashigang district (near Sana). 2070m. June – August.

8. VACCINIUM L.

by S.J. Rae

Evergreen shrubs, sometimes epiphytic. Leaves alternate, or \pm whorled, entire or serrulate, sometimes falsely whorled. Flowers in simple, axillary or terminal racemes, or solitary, bearing bracts (often deciduous) on rachis, and bracteoles on pedicels. Sepals 5, borne around top of ovary. Petals 5, united into a barrel-shaped or urn-shaped tube, lobes short often recurved. Stamens 10, free; anthers with 2 tubular tips (opening at apex) and 2 shorter dorsal spurs. Ovary inferior, terete, 5-celled; style simple. Fruit a 5-lobed globose fleshy berry, bearing persistent sepals; seeds numerous, ellipsoid.

1. Leaves 0.5 – 3 x 0.5 – 1.7cm 2

- + Leaves 3 – 10 x 1 – 6cm 4
2. Leaves obovate, entire **1. V. retusum**
- + Leaves ovate-elliptic, serrulate or ciliate 3
3. Leaves elliptic, often broadly so, 5 – 10mm broad, sparsely ciliate; young shoots bristly **2. V. nummularia**
- + Leaves ovate-elliptic, 10 – 17mm broad, serrate; young shoots pubescent **3. V. sikkimense**
4. Leaves entire, shallowly serrulate or finely ciliate; dorsal spurs on anthers prominent 5
- + Leaves crenate-serrate; dorsal spurs on anthers absent or minute 7
5. Leaves oblong-lanceolate, apex caudate, margins entire .. **4. V. dunalianum**
- + Leaves ovate-elliptic, apex acute, margins serrulate or finely ciliate 6
6. Leaves 6 – 10cm, margins serrulate; racemes 6 – 8-flowered, bracts caducous; fruit 6 – 10mm diameter **5. V. gaultheriifolium**
- + Leaves 4 – 6cm, margins finely ciliate; racemes 7 – 10-flowered, bracts persistent; fruit 4 – 5mm diameter **6. V. glauco-album**
7. Branchlets glabrous; leaves distinctly whorled at branchlet ends; corolla 5 – 9mm **7. V. vacciniaceum**
- + Branchlets spreading-pubescent; leaves \pm scattered along branchlets; corolla 3 – 5mm 8
8. Leaf base rounded; bracts at base of racemes often persistent; pedicels ascending, 7 – 10mm; corolla 3 – 4.5mm **8. V. subdissitifolium**
- + Leaf base cuneate; bracts at base of racemes deciduous; pedicels widely spreading, 9 – 15mm, corolla 4.5 – 5mm **9. V. scopulorum**

1. V. retusum (Griff.) Hook. f.; *Thibaudia retusa* Griff. Nep: *Rate* (34).

Epiphytic shrub 1 – 2m; young shoots pubescent. Leaves obovate, 15 – 25 x 7 – 10mm, shallowly retuse, base attenuate, margins recurved, entire, glabrous; petioles 1 – 3mm. Racemes 10 – 20-flowered, 3 – 5cm, pubescent; pedicels 2 – 5mm; bracts elliptic, 6 – 10mm deciduous; bracteoles 3 – 5mm. Sepals triangular, 0.5mm. Corolla barrel-shaped, constricted towards apex, 3 – 5 x 3 – 4mm, white sometimes pink; lobes deep pink, minute. Tubular anther tips c 1mm; dorsal spurs c 0.5mm; filaments hairy. Fruits c 3 x 4mm.

Bhutan: C – Tongsa district (Jirgang Chu and Tunle La) and Mongar district (Rudong La and near Sengor), N – Upper Mo Chu district (Gasa); **Darjeeling:** Senchal; **Sikkim:** Choongtam, Laghep, Lachung. Wet broad-leaved and coniferous forests, 2130 – 3050m. April – June.

2. V. nummularia Clarke

Similar to *V. retusum* but smaller, 0.5 – 1m; young shoots rough with bristly hairs; leaves elliptic often broadly so, 5 – 15 x 5 – 10mm, base rounded, margins sparsely ciliate, subsessile; racemes 8 – 15-flowered, condensed; pedicels 4 – 7mm; corolla 3 – 7 x 2 – 4mm; tubular anther tips 1 – 1.5mm.

Bhutan: C – Ha, Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling;** **Sikkim.** On wet rocks and trees in evergreen oak and Hemlock/Rhododendron forests, 2440 – 3200m. April – June.

Vegetatively similar to *Agapetes serpens* which differs in its more ovate leaves and much larger, solitary flowers.

3. *V. sikkimense* Clarke

Small shrub 0.5 – 1m; young shoots pubescent. Leaves ovate-elliptic, 1 – 3 x 1 – 1.7cm, acute, base rounded, margins serrulate, glandular, recurved, midrib and veins glandular beneath, subsessile. Racemes 6 – 8-flowered, 2 – 3cm; pedicels 2 – 3mm; bracts 0.7 – 1cm, deciduous; bracteoles 5 – 8mm. Sepals minute, triangular. Corolla urn-shaped, 4 – 6mm, pink, lobes darker, very small, recurved. Tubular anther tips c 1mm; dorsal spurs minute; filaments hairy. Fruit 5 – 10 x 5 – 8mm.

Sikkim: Lachen, Chiabanjan, Jongri and Singalila. Rocky slopes above tree-line, 3730 – 3960m. May – June.

4. *V. dunalianum* Wight; *Thibaudia revoluta* Griff. Fig. 47g – k.

Epiphytic shrub 1.5 – 5m, glabrous. Leaves oblong-lanceolate, 6 – 10 x 2 – 3.5cm, apex caudate, c 2cm, base broadly cuneate, margins entire, slightly recurved, glabrous and green beneath; petioles 4 – 7mm. Racemes 6 – 12-flowered, 2 – 5cm; pedicels 3 – 5mm; bracts ovate, 5 – 7mm, early caducous. Sepals triangular, 2mm. Corolla urn-shaped, 4 – 7 x 4 – 6mm, green, tinged crimson; lobes small, recurved. Tubular anther tips 2mm; dorsal spurs 1mm; filaments glabrous. Fruit globose, c 5 x 3mm.

Bhutan: C – Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Mo Chu and Upper Kuru Chu districts; **Darjeeling:** Rechi La, Darjeeling; **Sikkim:** Chiabanjan, Choongtam. In dry Oak/Rhododendron forest and scrub, 1700 – 2750m. April – May.

5. *V. gaultheriifolium* (Griff.) Clarke; *Thibaudia gaultheriifolia* Griff. Bumthang: *Kauli Marip*; Tongsa: *Shim*; Nep: *Chashi*.

Similar to *V. dunalianum* but leaves ovate-elliptic, 6 – 10 x 3 – 6cm, apex acute, base rounded, glandular on midrib beneath, margins serrulate; petioles 3 – 5mm; racemes condensed, 6 – 8-flowered, flowers unknown; pedicels 8 – 12mm; fruit globose, 0.6 – 1cm.

Bhutan: C – Tongsa district (Changkha) and Tashigang district (banks of

Kulong Chu, Tashi Yangtshi); **Sikkim**: Catsuperri Lake. Amongst shrubs in cool broad-leaved forests, 2130 – 2400m.

Fruit edible.

6. V. glauco-album Clarke. Dz: *Naylum*.

Similar to *V. dunalianum* and *V. gaultheriifolium* but leaves ovate-elliptic, 4 – 6 x 3cm, apex acute, base cuneate, margins finely ciliate, white beneath, midrib and veins sparsely glandular-hairy beneath; petioles c 3mm; racemes 7 – 10-flowered, 2 – 7mm; pedicels 5 – 10mm; bracts 10 – 20mm, leaf-like, persistent; bracteoles 7 – 10mm, persistent; corolla barrel-shaped, 5 – 8 x 2 – 4mm, white tinged pink; filaments densely hairy; fruit 4 – 5mm.

Bhutan: C – Punakha district (Sewla Gompa) and Tongsa district (Chendebe), N – Upper Mo Chu district (Gasa) and Upper Kulong Chu district (Lao); **Sikkim**: Lachen and Lachung. Rhododendron forests and scrub, 2280 – 2750m. May – July.

Fruit edible.

7. V. vacciniaceum (Roxb.) Sleumer; *V. serratum* (G. Don) Wight, *V. venosum* Wight

Shrub 1 – 2m, sometimes epiphytic; young shoots glabrous. Leaves whorled, elliptic, 4 – 9 x 1.5 – 3cm, apex acute, base rounded, margins crenate-serrate; petioles 2 – 3mm. Racemes 10 – 25-flowered, 2.5 – 9cm; pedicels 8 – 15mm, erect-spreading, slightly expanded at apex; bracts triangular, 4mm, caducous; bracteoles 1mm, subsistent. Sepals triangular, 1mm. Corolla urn-shaped, 5 – 9 x 3.5mm, greenish-white, lobes small. Tubular anther tips c 1mm; dorsal spurs absent or minute. Fruit 3 – 5mm, surrounded by calyx teeth.

Bhutan: S – Phuntsholing and Chukka districts, C – Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling**: Sureil, Lebong, Darjeeling, Kurseong. On rock faces and trees in Chir Pine, evergreen oak and warm broad-leaved forests, 1200 – 2100m. March – May.

The Bhutan and Darjeeling plants belong to subsp. **glabritubum** Stevens.

8. V. subdissitifolium Stevens; *V. venosum* Wight var. *hispidum* Clarke, *V. vacciniaceum* (Roxb.) Sleumer forma *hispidum* (Clarke) Hara

Similar to *V. vacciniaceum* but shoots spreading pubescent; leaves not whorled, oblong-obovate, 4 – 7.5 x 1 – 2.5cm; petioles c 1mm; racemes 10 – 15-flowered, 2 – 5.3cm; pedicels 7 – 10mm; bracts and bracteoles persistent; corolla 3 – 5mm; anther spurs absent; fruit c 1.5mm.

Bhutan: S – Deothang district (Raidong), C – Tongsa district (Changkha); **Darjeeling**: Pasheeting; **Sikkim**: Tumlong. Broad-leaved forests, 1675 – 1980m. January – June.

A specimen from Tschilingor, SE Bhutan may represent an undescribed taxon, differing from *V. subdissitifolium* in its small, whorled leaves 3 – 4cm, cuneate at base, and longer ascending pedicels 8 – 12mm.

9. V. scopulorum W. W. Smith

Similar to *V. vacciniaceum* and *V. subdissitifolium* but shoots spreading-pubescent; leaves not whorled, elliptic-lanceolate, 3–5 x 1–1.7cm, base cuneate, sessile; racemes 10–20-flowered, 4–9cm; pedicels widely spreading, 9–15mm (up to 2cm in fruit); bracts caducous; bracteoles subpersistent; corolla 3–5 x 2–3mm; tubular anther tips 2–3mm, spurs absent.

Bhutan: S – Phuntsholing district (Kamji) and Sarbhang district (Sarbhang – Chirang road). On rock faces in warm broad-leaved forests, 1000–1200m. May.

A distinct species, known elsewhere only from W China and N Burma. The Bhutan plants differ from the Chinese populations in having longer, more acute leaves, and may be subspecifically distinct.

9. AGAPETES L.

by D. G. Long and S. J. Rae

Evergreen shrubs, sometimes epiphytic; stems often thickened at base. Leaves alternate, sometimes pseudo-whorled, entire or toothed, often with glands at the apex of the petiole. Flowers in axillary corymbs or solitary; pedicels often thickened, cupped and articulate under ovary. Sepals 5, borne around top of ovary. Petals 5, united, often with transverse markings, tube cylindrical, 5-angled, shortly lobed, lobes often recurved. Stamens 10, free; filaments short; anthers elongated into 2 long tubes, opening at apex and often spurred dorsally. Ovary inferior, terete, 5-angled or winged, 5-celled; style simple. Fruit a 5-lobed, globose berry; seeds many, ellipsoid.

- | | |
|--|------------------------|
| 1. Leaves 1–3.5 x 0.5–1.8cm | 2 |
| + Leaves 6–25 x 1.5–8cm | 3 |
| 2. Leaves ovate-lanceolate, 1–1.5 x 0.5–0.7cm; flowers red | 1. A. serpens |
| + Leaves elliptic-obovate, 1.4–3.5 x 0.8–1.8cm; flowers yellow | 2. A. smithiana |
| 3. Leaves reticulate above with strongly impressed veins, margin distinctly serrate; ovary winged | 4 |
| + Leaves smooth or weakly reticulate above, veins not impressed (except in <i>A. saligna</i>), margin entire (shallowly crenate in <i>A. auriculata</i>); ovary not winged | 5 |
| 4. Corolla yellow, pubescent on ribs | 3. A. hookeri |
| + Corolla white or pink with red markings, pubescent only on lobes | 4. A. incurvata |
| 5. Leaves cordate or rounded at base, sessile | 6 |

- + Leaves attenuate or cuneate at base; petioles 2 – 5mm 7
6. Pedicels, calyx and corolla glabrous; sepals 3 – 5mm; corolla 15 – 20 x 3 – 4mm
5. A. auriculata
- + Pedicels, calyx and corolla finely pubescent; sepals 7 – 10mm; corolla 15 – 22 x 5 – 7mm **6. A. sikkimensis**
7. Flowers in fascicles ± sessile on branches 8
- + Flowers in racemes on peduncles 2 – 15cm 9
8. Sepals glabrous; corolla 5 – 5.5cm **7. A. variegata**
- + Sepals glandular-hairy; corolla 2.6 – 2.8cm **8. A. bhutanica**
9. Leaves lanceolate, 6 – 12 x 1.5 – 3.3cm; petioles 2 – 4mm **9. A. saligna**
- + Leaves elliptic-obovate, 13 – 17 x 5.5 – 8cm; petioles 7 – 10mm
10. A. nuttallii

1. A. serpens (Wight) Sleumer; *Pentapterygium serpens* (Wight) Klotzsch. Tongsa: Gerchu; Nep: Harchur (34), Banmakai

Pendulous epiphytic shrub, 0.5 – 1.5m; shoots covered with bristly hairs. Leaves leathery, borne in one plane, ovate-lanceolate, 1 – 1.5 x 0.5 – 0.7cm, apex subacute, base rounded, margins recurved, remotely serrulate or subentire, subsessile. Flowers solitary, axillary; pedicels 0.7 – 1.5cm, glandular-hairy. Sepals lanceolate, 0.8 – 1cm, glandular-hairy. Corolla tubular, 2 – 3 x 0.5 – 1cm, red with darker markings, lobes 3 – 5mm. Anthers 6 – 9mm; apical tubes 12 – 15mm, not spurred. Berries globose, 10 – 12mm, 5-winged; sepals persistent.

Bhutan: S – Phuntsholing, Chukka, Sarbhang, Gaylephug and Deothang districts, C – Punakha, Tongsa and Tashigang districts; **Darjeeling:** common; **Sikkim.** On trees and sometimes rocks in warm broad-leaved, evergreen oak, and *Quercus griffithii*/*Rhododendron arboreum* forests, 1720 – 2130m. February – May.

Valued in cultivation as an ornamental. Bhutanese plants are variable in leaf shape; plants with narrowly lanceolate leaves have been segregated as var. **stenophylla** Airy Shaw. A specimen from Kalimpong (var. **alba** Airy Shaw) has white flowers.

2. A. smithiana Sleumer; *Pentapterygium sikkimense* W. W. Smith, non *A. sikkimensis* Airy Shaw.

Similar to *A. serpens* but leaves elliptic-obovate, 1.4 – 3.5 x 0.8 – 1.8cm, apex rounded, base cuneate with marginal glands near base; flowers solitary or 2 – 4, corymbose; pedicels 3 – 5mm; sepals 3 – 5mm; corolla 12 – 15 x 3 – 5mm, yellow, lobes c 1mm; anthers 3 – 4mm; apical tubes 5mm; fruit not known.

Bhutan: S – Chukka district (N of Jumudag); **Sikkim:** Lachung and Tonglo.

Epiphyte in evergreen oak forest, 2100 – 2700m. February – April.

This description applies to var. **smithiana** which is endemic to Sikkim and Bhutan. In E Bhutan (Pimi, Mongar district, and Wamrong, Deothang district (117)) var. **major** Airy Shaw occurs which differs in its longer, more inflated corollas 17 – 21 x 6 – 9mm.

3. A. hookeri (Clarke) Sleumer; *A. incurvata* (Griff.) Sleumer var. *hookeri* (Clarke) Airy Shaw, *Pentapterygium hookeri* Clarke. Nep: *Gujuru Ganta*

Epiphytic shrub to 50cm, with tuberous stem-base; young shoots pubescent. Leaves rigidly coriaceous, ovate-lanceolate, 6 – 9.5 x 2.5 – 3.5cm, acuminate, base subcordate, margins crenate-serrate, pubescent on veins beneath, rugose above with impressed veins, sessile. Corymbs 2 – 8-flowered, pendulous. Peduncle short, 5 – 8mm. Pedicels 15 – 20mm, pubescent at apex. Calyx lobes ovate, c 7mm, green. Corolla tubular, yellow, c 2cm, ribs hairy throughout. Anthers c 5mm; tubular tips c 10mm, spurred dorsally. Ovary reddish-green, winged. Fruit unknown.

Bhutan: S – Chukka district (N of Jumudag); **Darjeeling:** Choongtam, Rungbul, Kurseong, Lal. Evergreen oak forests, 1830 – 2540m. June – October.

4. A. incurvata (Griff.) Sleumer; *Gaylussacia incurvata* Griff., *Pentapterygium rugosum* Hook. f.

Similar to *A. hookeri* but leaves glabrous; pedicels glabrous or with a few hairs at apex; corolla white, pink or red with darker red or purplish markings; anthers spurred or not.

Bhutan: S – Deothang district (between Tshilingor and Riserboo), C – Mongar district (Kuru Chu) and Tashigang district (Balfi, Tashigang and Yonpu La). Cool broad-leaved forests, 2400m. June.

A. flava (Hook. f.) Sleumer, described from Arunachal Pradesh, is closely allied to *A. hookeri* but differs in its triangular, sharply acute calyx lobes.

5. A. auriculata Hook. f.

Erect or epiphytic shrub 1 – 3m; shoots glabrous, often angular. Leaves whorled, narrowly ovate to elliptic-lanceolate, 9 – 25 x 4 – 8cm, apex acute, base cordate, margins entire or weakly serrate with a distinct, continuous intramarginal vein, glabrous, sessile. Racemes 6 – 11-flowered, 4 – 12cm; peduncle 2 – 5cm; pedicels 1.5 – 2.5cm, glabrous, cup-shaped at apex. Sepals lanceolate, 3 – 5mm, glabrous, narrowly tapering and distinctly separated at the base by rounded sinuses. Corolla tubular, constricted towards apex, 15 – 20 x 3 – 4mm, glabrous, pale crimson, lobes small, green. Tubular anther tips 10mm, dorsal spurs absent. Fruit (immature) subglobose, c 1cm; sepals persistent.

Bhutan: S – Deothang district (Chunkar), C – Mongar district (Ngasamp) and Tashigang district (Jiri Chu); **Darjeeling:** foothills. On rocks and trees in warm broad-leaved and evergreen oak forests, 1200 – 1520m. August – November.

The record of the Khasian *A. affinis* (Griff.) Airy Shaw (*A. glabra* (Griff.) Clarke)

from Bhutan (80) is based on a Griffith specimen, probably mis-labelled. *A. affinis* differs in its densely pubescent inflorescences, and smaller, ovate leaves.

6. *A. sikkimensis* Airy Shaw

Similar to *A. auriculata* but pedicels pubescent; sepals linear lanceolate, 7 – 10mm, pubescent; corolla 15 – 22 x 5 – 7mm, pubescent; fruit ovoid, 6 – 7mm.

Bhutan: S – Phuntsholing district (above Rinchening and below Kamji), Chukka district (Marichong) and Gayleghug district (Sarbhong to Gayleghug); **Darjeeling:** Yankeung and Tista Valley. Warm broad-leaved forests, 900 – 1520m. October – December.

Both *A. auriculata* and *A. sikkimensis* can have narrowly elliptic to broadly ovate-elliptic leaves; only the inflorescence differences seem reliable.

7. *A. variegata* (Roxb.) G. Don

Glabrous epiphytic shrub 1 – 2m. Leaves lanceolate or narrowly elliptic, 11 – 23 x 3 – 5.5cm, apex shortly acuminate, base cuneate, margins entire, with 2 glands near base; petioles 4 – 7mm. Fascicles 4 – 10-flowered; pedicels 2.5 – 3cm, cup-shaped at apex. Sepals triangular, c 2mm. Corolla tubular, 5 – 5.5 x 0.5cm, red with darker markings, lobes 1cm. Anthers c 1cm; apical tubes 4.5cm, spurred in upper half. Berries subglobose, c 10 x 8mm; sepals persistent as short, broad points 2 – 3mm.

Bhutan: S – Chukka district (Marichong) and Sarbhong district (between Tori Bari and Loring Falls), C – Tongsa district (Dakpai, 117). Warm broad-leaved forests, 1070 – 1650m. November.

The Bhutan plants belong to var. *variegata* (var. *glabrata* (Clarke) Airy Shaw).

8. *A. bhutanica* Balakrishnan & Chowdhury

Similar to *A. variegata* but leaves oblanceolate, smaller, 9 – 15 (– 20) x 1.5 – 4cm, base attenuate; petioles c 2mm; fascicles 7 – 15-flowered; sepals triangular, c 2mm, glandular-hairy; corolla 2.6 – 2.8cm, pale pink with red markings, sparsely glandular-pubescent; anthers c 4mm; apical tubes 18 – 19mm, spurred in lower half; fruit unknown.

Bhutan: S – Gayleghug district (Mao River) and Deothang district (Deothang); **W. Bengal Duars:** Buxa. Epiphyte in subtropical terai forests, 150 – 500m. March – May.

Endemic to S. Bhutan and adjacent W. Bengal.

9. *A. saligna* (Hook. f.) Bentham & Hook. f. Nep: *Amile* (34), *Ongarey*. Fig. 47r – v.

Epiphytic shrub 0.5 – 1.5m; young shoots puberulous. Leaves lanceolate, 6 – 12 x 1.5 – 3.3cm, apex acuminate, base cuneate, margins entire; petioles 2 – 4mm. Racemes 6 – 12-flowered, 6 – 9cm; peduncle 2 – 4cm, glabrous; pedicels 1.5 – 2cm, thickened and cup-shaped towards apex (red and fleshy in fruit). Sepals lanceolate, 3 – 5mm. Corolla tubular, widening towards apex, 2.5 – 3 x 0.6 – 0.8cm, crimson-

red with darker reticulations, lobes 8 – 10mm. Tubular anther tips c 15mm; dorsal spurs minute. Berries subglobose 5 – 8mm; sepals persistent.

Bhutan: S – Chukka district (Choosam, Marichong and Chukka), Sarbhang district (Chirang road) and Gaylegphug district (Gaylegphug and Betni bridge), C – Punakha district (SW of Wangdu Phodrang); **Darjeeling:** Tista valley and foothills. Subtropical forests, 460 – 2000m. November – May.

10. *A. nuttallii* Clarke

Similar to *A. saligna* but a larger shrub up to 5m; young shoots glabrous; leaves elliptic-obovate, 13 – 17 x 5.5 – 8cm; petioles 7 – 10mm; racemes 16 – 26-flowered, up to 11cm (to 18cm in fruit); pedicels 2.5 – 4cm; corolla straight, red, 3cm, including lobes c 6mm.

Bhutan: S – Sarbhang district (below Dara Chu). Epiphyte in cool broad-leaved forest, 2000m. October.

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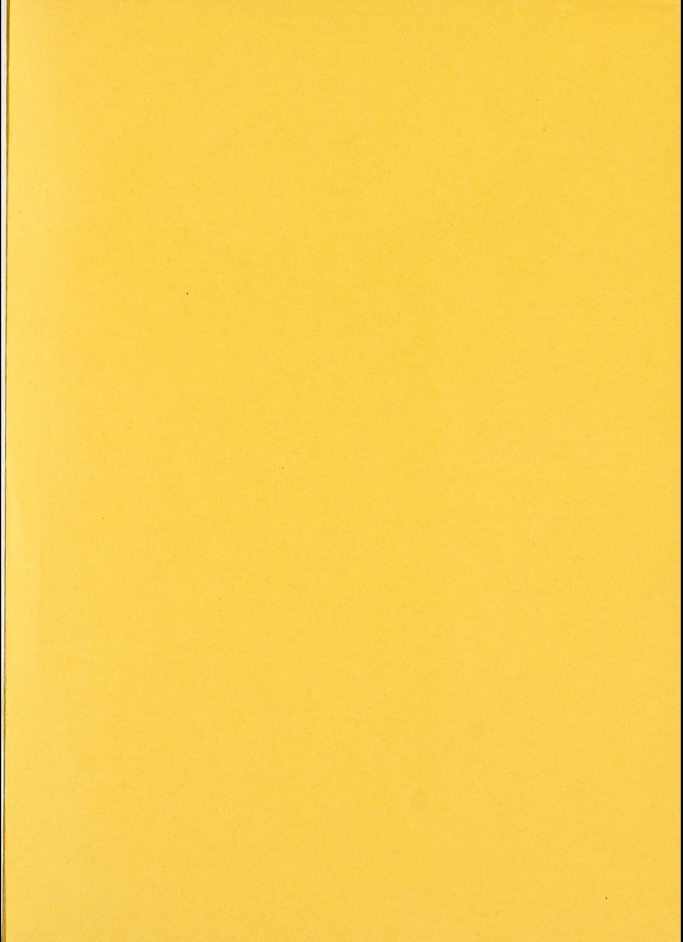
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The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry, no matter how small, should be recorded to ensure the integrity of the financial statements. This includes not only sales and purchases but also expenses and income. The text suggests that a systematic approach to record-keeping is essential for identifying trends and making informed decisions.

In the second section, the author explores various methods for organizing and analyzing financial data. It highlights the benefits of using spreadsheets and accounting software to streamline the process. The text also touches upon the importance of regular reconciliations to catch any discrepancies early on. Additionally, it discusses how to interpret the data to gain insights into the company's financial health.

The final part of the document provides practical advice on how to present the financial information to stakeholders. It stresses the need for clarity and transparency in reporting. The author suggests using clear language and visual aids like charts and graphs to make the data more accessible. It also mentions the importance of providing context and explanations for any significant fluctuations in the data.