

CHAPTER – 7

WINTER BUD

7.1. INTRODUCTION

With the exception of a few species of *Acer*, chiefly native to Southeast Asia and the Himalayan region like, *A. coriaceifolium* Léveillé, *A. fabri* Hance, *A. levigatum* Wallich, *A. oblongum* Wallich ex. DC, *A. laurinum* Hasskarl etc. that are nearly evergreen or semi-deciduous, most other species are deciduous. The shoots are preformed and overwinter in the bud as embryonic leaves and leaf primordia (Kozlowshi and Clausen 1966; Critchfield 1971; Marks 1975; Bormann and Likens 1979; Steingraeber 1982; Sakai 1987, 1989, 1990). The buds develop at the axils of the petiole and in many species newly formed buds remain hidden within the pulvinus. The buds remain enclosed by bud scales and are indistinguishable from the leaf primordia in the early stages of development however, when fully developed they have fewer parts than the leaves. Their ontogeny is marked by an early promotion of the lower parts of the leaf primodium (anlage) in relation to the upper part, after which all development ceases (Strassburger 1976).

The scale leaves enclose the preformed leaves along with preformed inflorescence in a large number of species. The scale leaves expand along with the leaves and inflorescence with the innermost pair becoming the largest. They are usually caduceous falling off after the emergence of leaves and inflorescence. However, they often become related to the leaves by intermediate forms. Small leaves often develop at the tips of some of the inner bud scales that have a morphological form more or less like the true leaves. These scales remain attached longer than the normal scales being present even after the emergence of the leaves and inflorescence and can carry out photosynthesis

Two distinct types of the arrangements of the bud scales can be observed in *Acer* viz. the valvate and the imbricate. Along with these arrangements different species of *Acer* show differences with respect to the number of the pairs of bud scales that range from 2 to 15 pairs. Ogata (1967) considered the number of bud scales as important distinguishing characteristics of *Acer* species and he somewhat arbitrarily distinguished five categories. However, it has been observed that though some sections have more or less a fixed number of two, three or five pairs of bud scales, the variation becomes wider and more frequent with increase in the numbers of the bud scales.

In the present study the resting buds of the different species of *Acer* of the Darjiling–Sikkim Himalayas were collected during the month of January after leaves had been shed except in case of *A. thomsonii* which was collected in the month of September after its leaf fall and morphological studies made after dissection under the dissecting microscope. The number and size of terminal buds, the number, arrangement, shape, size and colouration of the bud scales were studied which have been described below.

7.2 KEY TO THE DIFFERENT SPECIES OF ACER OF THE DARJILING SIKKIM HIMALAYA BASED UPON THE WINTER BUD.

1. Buds stalked.....2
- 1a. Buds sessile.....6
2. Number of bud at the tip 1.....*A. hookeri*
- 2a. Number of bud usually 2 or 3.....3
3. Buds with two pairs of scales;4
- 3a. Buds with three pairs of bud scales.....*A. acuminatum*
4. Buds curved towards ones side tips often apiculate.....5
- 4a. Buds not curved, tips acute*A. stachyophyllum*
5. Outer surface pubescent , especially the margins of scales.....*A. pectinatum*
- 5a. Outer surface glabrous, buds usually green sometimes red.....*A. sikkimense*
6. Buds glabrous.....7
- 6a. Buds pubescent.....9
7. Tips of buds pointed.....*A. campbellii*
- 7a. Tips of bud rounded.....8
8. Scales 4 pairs; terminal buds 0.4-0.45 x 0.2-0.3cm.....*A. laevigatum*
- 8a. Scales 5 pairs, terminal buds 0.55-0.6 x 0.3-0.4 cm*A. osmastonii*
9. Buds tetrahedral; bracts 10 pairs.....*A. sterculiaceum*
- 9a. Buds elliptic or oval.....10
10. Scales imbricate.....11
- 10a. Scales valvate.....*A. caudatum*
11. No. of terminal buds 2; reddish brown; scales 4 pairs.....*A. palmatum*
- 11a. No. of terminal buds 1.....9
12. Scales 6 pairs;)4-0.45 x 0.2-0.23 cm.....*A. oblongum*
- 12a. Scales 10 pairs, 1.1-1.2-0.6-0.7 cm.....*A. thomsonii*

7.3. SYSTEMATIC ENNUMERATION OF THE WINTER BUDS OF THE DIFFERENT SPECIES OF *Acer* L. OF THE DARJILING-SIKKIM HIMALAYA

Acer acuminatum Wallich ex D. Don.

Terminal bud usually single, sometimes in pairs, sessile, larger than the lateral bud pairs below, elliptic, brownish green, larger 0.5-0.6 x 0.25-0.35 cm; lateral buds smaller, usually similar in size, elliptic, larger ca. 0.15-0.2 x 0.1-0.15 cm; bud scales 3 pairs, valvate, outermost pair brownish to purplish brown, broadly ovate, concave, outer surface reddish green, margin entire, apex acute slightly pubescent in the outer surface, partially covering the inner pairs, ca. 0.15-0.2 x 0.2-0.25 cm, middle pair largest, ovate, concave margin entire, apex acute, inner surface with fine silvery hairs, ca. 0.12-0.18 x 0.18-0.2 cm, innermost small, yellowish green, ovate, densely pubescent, margin entire, apex acute, ca. 0.1 x 0.15 cm; enclosing very young leaves which are densely pubescent.

Acer campbellii Hook. f. & Thomson ex Hiern.

Terminal bud usually in single or with two small lateral buds at base at the end of shoots, sessile, larger than the lateral bud pairs below, wide elliptic, apex acute, reddish with greenish tips, larger ca. 0.6-1 x 0.4-0.5 cm; lateral buds smaller, usually one larger or sometimes more or less equal, elliptic, larger ca. 0.3-0.4 x 0.2-0.25 cm, smaller ca. 0.2-0.25 x 0.1-0.15 cm; bud scales 5 pairs, imbricate, outermost pair smallest, reddish, broadly ovate, unequal larger concave, outer surface reddish, entire, more or less glabrous, partially covering the inner pair ca. 0.15-0.2 x 0.2-0.25, smaller ca. 0.1 x 0.15 cm; second pair, unequal, ovate, concave margin entire undulate, exposed outer surface reddish, basal portion yellowish green, slightly unequal, pubescent towards inner surface, 0.3-0.4 x 0.3-0.4 cm; third pair, largest, ovate, enclosing the fourth and fifth pair more densely pubescent on both surfaces, exposed apex reddish basal portion yellowish green, ca. 0.4-0.5 x 0.35-0.4 cm; fourth pair ovate, entire, concave, acute densely covered with silky silvery white hairs, yellowish green, innermost pair ovate more densely pubescent, yellowish green, entire, acute, 0.2-0.35 x 0.2-0.25 respectively enclosing very young leaves which are densely pubescent.

Acer caudatum Wallich

Terminal bud usually solitary, brown, sometimes in pair with the presence of two small lateral buds at its base at the end of the shoot, terminal bud more or less sessile, ovate, covered with dense brown hairs on the outer surface, tip pointed; 0.8-0.9 x 0.45-0.5 cm with the basal buds >

0.1 cm; lateral buds smaller with a short stalk c.a. 0.1 cm adpressed onto the stem, more or less equal 0.25 x 0.2 cm slightly curved inwards with outer surface convex covered with brownish hairs, bud scales in 2 pairs, valvate; outer pair of scales larger, more or less ovate, concave, entire, acute, pubescent on both surfaces 0.8-0.9 x 0.35 cm; inner pair small ovate, margin entire, apex acute, base broad slightly curved, concave, inner surface more or less glabrous, outer surface pubescent, 0.7 x 0.35 cm, enclosing preformed leaves (Fig. , Plate)

Acer hookeri Miquel

Terminal buds usually in pairs borne by a long shoot with ill developed lateral buds which are more or less equal or one is slightly larger, laterally compressed, stalked, stalk ca 0.2-0.35cm greenish to reddish in colour ; buds oval slightly curved to one side, tip pointed, outer surface glabrous; ca. 0.4-0.5 x 0.3-0.4 cm; bud scales 2 pairs, opposite valvate, outer enclosing the inner pair, outer pair thick leathery, elliptic, deeply concave, unequal, laterally adressed without overlapping, with broad margin; margin thick, thickest towards the apex, apex acute to apiculate, outer surface greenish with reddish streaks, inner surface reddish to orange with whitish hairs predominantly distributed towards the inner edge of the margins ; larger bud scale 0.4-0.5x 0.2-0.25 cm, smaller 0.3-0.35 x 0.2-0.25 cm ; inner pair orbiculate to ovate, slightly unequal, greenish to reddish, base yellowish green, pubescent on both surfaces more towards the inner edge of the thick margin, smaller ca. 0.25-0.3 x 0.25-0.3 cm; larger ca. 0.3-0.4 x 0.3-0.35 cm; inner pair inclosing preformed leaves.

Acer laevigatum Wallich

Terminal bud either solitary or in pairs with one of the buds larger than the other, at the tip of shoots, sessile, more or less elliptic with rounded apex more or less glabrous reddish green, 0.3-0.4 x 0.2-0.3 cm; lateral buds smaller more with apex directed to the tip, reddish green c.a. 0.2-0.25 x 0.2 cm; bud scales 4 pairs, imbricate, outermost small, hard scaly basal portion greenish upper portion reddish, wide ovate, slightly concave, entire, acute, base rounded, glabrous, 0.2-0.25 x 0.3 cm, partially covering the inner pair; second pair largest ovate, glabrous, deeply concave, entire, basal portion green, upper exposed portion reddish, rounded, 0.35-0.4 x 0.25 cm; third pair more or less orbicular, yellowish green acute, outer surface pubescent, inner surface glabrous, margins slightly incurved, entire, 0.25-0.3 x 0.4 cm; innermost pair ovate small, acute, pubescent on outer surface, 0.2 x 0.25 cm; enclosing preformed leaves along with inflorescence.

Acer oblongum Wallich ex DC.

Terminal bud solitary at the shoot tips, sessile, with two small buds at base, sessile more or less elliptic, apex pointed, with brownish covered with light brownish hairs, ca. 0.4-0.45 x .02-0.23 cm; lateral pairs of buds smaller, oblong, usually more or less equal, sometimes one larger with apex directed outwards ca. 0.25-0.5 x 0.18-0.2 cm; bud scales 6 pairs, imbricate, outermost pair small, scaly hard, light brown, wide ovate, slightly concave entire, pubescent ; acute, base deltoid, ca. 0.1 x 0.15 cm; second pair larger and partially covered by the first pair, cordate, entire, undulate, acute ca. 0.15 x 0.2 cm ; third pair ovate entire apex acute, ca. 0.15 x 0.2 cm; fourth pair ovate, concave, outer surface light brown, inner surface yellowish green, both surface slightly pubescent, encloses the fifth, acute 0.3-0.35 x 0.2-0.25 cm; fifth pair widely ovate, concave, outer surface light brown, 0.3-0.35 x 0.25-0.3 cm with fine light brown hairs; innermost pair elliptic yellowish green with brownish apex , entire, acute ca 0.1 x 0.15 cm.

Acer osmastonii Gamble

Terminal buds usually in pairs, rarely solitary, more or less equal, sessile, elliptic with apex slightly rounded, green with reddish tinge on margins ca. 0.55-0.6 x 0.35-0.4 cm; lateral bud pairs smaller, more or less equal, elliptic, slightly adpressed to the shoot 0.3-0.35 x 0.2-0.25 cm; bud scales 5 pairs, imbricate, lowermost pair smallest, unequal, hard, ovate, acute, slightly concave, entire, glabrous, slightly sticky ca 0.15-0.2 cm; second pair larger thin membranous with white hairs on the margins, ovate, slightly concave, entire pubescent, acute 0.2-0.3 x 0.15-0.2 cm; third pair elliptic ,slightly unequal, concave, outer surface greenish with reddish tinge on margins, entire undulate, pubescent, apex apiculate, ca. 0.4-0.5 x 0.25-0.3 cm smaller smaller; fourth pair largest, slightly unequal, elliptic, light green, densely pubescent on outer surface and at margin enclosing the fifth pair, ca. 0.55-0.6 x 0.4-0.5 cm; fifth pair elliptic, slightly unequal; densely pubescent on outer surface and at margins, less pubescent towards inner surface, ca. 0.5-0.55-0.3-0.5 cm; bud encloses preformed leaves, yellowish green , densely covered with whitish hairs

Acer palmatum Thunberg ex. Murray

Terminal buds always in pairs more or less equal or one slightly larger borne by the long shoots with lateral buds more or less equal in size being more or less triangular with pointed apex ca. 0.2-0.25x 0.15-0.2 cm; buds sessile more or less oval, pointed , outer surface glabrous greenish with reddish streaks; ca 0.3-0.5 x 0.2-0.25 cm; bud scales 4 pairs, opposite decussate with overlapping margins. Outermost pair largest enclosing the others, ovate, margin entire,

acute, basal portion greenish, upper portion reddish, inner surface greenish-yellow, glabrous, 0.3-0.35 x 0.25 cm, inner pair reddish glabrous, 0.3 x 0.2 cm, third pair yellowish green ovate, entire, acute, 0.3 x 0.2 cm, third pair yellowish covered on both surfaces by dense white silky hairs, ovate, entire, acute, 0.25- 0.3 x 0.2 cm, innermost pair sub orbicular small with dense white silky hairs on both surfaces 0.2 x 0.15 cm , apex acute, enclosing preformed leaves and inflorescence.

***Acer pectinatum* Wallich ex. Nicholson**

Terminal buds usually three with the median largest than two lateral buds or in pairs if apices bear inflorescence; born by a long shoot with ill developed lateral buds, one of the bud of the pair larger than the other; buds stalked; stalk ca 0.3-0.5cm reddish; buds oval, slightly curved to one side, pointed reddish, outer surface glabrous; ca. 0.4-0.7 x 0.3-0.5 cm; bud scales 2 pairs, opposite decussate, outer enclosing the inner pair, outer pair thick leathery, elliptic, deeply concave, unequal, laterally adpressed without overlapping, with broad margin, margin thick, thickest towards the apex, apex apiculate, outer surface reddish, inner surface reddish to maroon with whitish hairs predominantly distributed towards the inner edge of the margins ; larger bud scale 0.4-0.5 x 0.2-0.25cm, smaller 0.3-0.35 x 0.2-0.25 cm; inner pair suborbiculate to orbiculate, slightly unequal, reddish, base yellowish green, pubescent on both surfaces more towards the inner edge of the thick margin, smaller ca. 0.25-0.3 x 0.3-0.35 cm; larger ca. 0.4-0.45 x 0.3-0.35 cm enclosing preformed leaves.

***Acer sikkimense* Miquel**

Terminal buds usually three with the median largest than two lateral buds or in pairs if apices bear inflorescence, born by an elongated shoot; lateral buds equal or one slightly larger than the other, buds stalked, stalk ca 0.4-0.5cm reddish or green ; buds oval slightly curved to one side, laterally compressed, tip pointed reddish or greenish, outer surface glabrous; ca. 0.45-0.9 x 0.4-0.5 cm; bud scales 2 pairs, opposite decussate, outer enclosing the inner pair, outer pair thick leathery, elliptic, deeply concave, unequal, laterally adpressed without overlapping, with broad margin, margins thickest towards the apiculate, apex; outer surface reddish, inner surface reddish to maroon with whitish hairs predominantly distributed towards the inner edge of the margins ; larger bud scale 0.45-0.9 x 0.3-0.45, smaller 0.4-0.8 x 0.2-0.25; inner pair suborbiculate to orbiculate, slightly unequal, reddish, base yellowish green, pubescent on both surfaces more towards the inner edge of the thick margin smaller ca. 0.4-0.5 x 0.3-0.35 cm; larger ca. 0.5-0.55 x 0.3-0.35 cm, enclosing preformed leaves along with inflorescence.

Acer stachyophyllum

Terminal buds in pairs sometimes solitary; when paired one of the pairs larger than the other; bud shortly stalked; stalk ca 0.2-0.3 cm; reddish, pubescent; buds oval, pointed outer surface finely pubescent, ca 0.35-0.45 x 0.3-0.35 cm; bud scales in 2 pairs, valvate, outer pair enclosing the inner pair, outer pair thick, elliptical, concave, two pairs slightly unequal, adpressed with no overlapping, margin broad thicker towards the apex, apex acute, outer surface reddish green inner surface yellowish green with dense silvery white hairs; larger bud scales 0.35-0.45 x 0.3-0.35 cm, smaller 0.3-0.35 x 0.3-0.35 cm; inner pair orbiculate, slightly unequal, base yellowish green, pubescent on both surfaces; 0.2-0.25 x 0.2-0.25 cm, enclosing preformed leaves.

***Acer sterculiaceum* Wallich**

Terminal bud solitary at the shoot tips with two small lateral buds at base, sessile more or less tetrahedral with four edges and four faces, covered with light brownish hairs, 1-1.3 cm x 0.7-0.9 cm; lateral pairs of lateral buds smaller towards the lower portion of the shoot ca. 0.1-0.2 cm long, lightly adpressed to the shoot, light brown; bud scales 10 pairs, imbricate; outermost pair small, brittle, light brown, more or less triangular, slightly concave, acute, with brown hairs on the outer surface, c.a. 0.2-0.25 x 0.3 cm, second and third pair also triangular, acute concave, slightly larger than the first, covered with brownish hairs 0.3 x 0.4 and 0.4 x 0.45 cm respectively, fourth pair more or less ovate with basal portion yellowish green and upper portion brownish with brownish hairs on outer surface, margin entire apex acute 0.7 x 0.4 cm; fifth, sixth, seventh, eighth and ninth pairs more or less obovate with upper exposed portions brownish and enclosed basal portions yellowish green having sizes of 1-1.1 x 0.5, 0.9-1 x 0.4-0.45, 1.1 x 0.3, 0.9 x 0.3 cm respectively, ninth pair fully enclosed yellowish green with fine white hairs on inner surface 0.8-0.9 x 0.3 cm; innermost bud scales ovate entire, acute 0.7 x 0.4 cm enclosing preformed leaves.

***Acer thomsonii* Miquel**

Terminal bud solitary at the shoot tips sessile elongated, brown, covered with light brownish hairs, ca. 1.1-1.2 cm x 0.6-0.7 cm; lateral pairs of lateral buds becoming smaller towards the basal end of the shoot ca. 0.5 x 0.2 cm lightly adpressed to the shoot at the basal portion, bud scales 10 pairs, imbricate; outermost pair smallest, light brown, ovate, slightly concave, acute, with whitish hairs on the outer surface, c.a. 0.3-0.35 x 0.2 cm, second and third pair similar being slightly larger being 0.4 x 0.45 and 0.5 x 0.55 cm respectively, fourth pair more or less ovate with basal portion yellowish green and upper portion brownish with brownish hairs on outer surface,

margin entire apex acute 0.8 x 0.6 cm; fifth, sixth seventh, eighth and ninth pairs more or less obovate with upper exposed portions brownish and enclosed basal portions yellowish green showing sizes of 0.9-1x0.5-0.6, 1x0.45-0.5, 1 x 0.4, 0.7 x 0.3 cm respectively, ninth pair fully enclosed yellowish green with fine white hairs on inner surface 0.6-0.65 x 0.3cm, innermost bud ovate with entire margin with acute apex 0.5 x0.3 cm enclosing preformed leaves and inflorescence.

7.3. RESULTS AND DISCUSSION:

Studies of the winter bud in different species of *Acer* show that there are differences with respect to the number of the scale leaves enclosing the winter bud. The bud scales exhibit two types of arrangement being either imbricate or valvate. The major characteristics exhibited by the buds of the different species are tabulated below in Table (7)

It was observed that of the thirteen species under study, 10 species that included *A. acuminatum* Wall, *A. campbellii*, *A. caudatum*, *A. laevigatum*, *A. oblongum*, *A. palmatum*, *A. stachyophyllum*, *A. sterculiaceum* and *A. thomsonii* possessed sessile buds whereas the others possessed buds that are stalked. While the largest buds were observed in *A. sterculiaceum* and *A. thomsonii* being 1-1.3 x 0.7-0.9 and 1.1-1.2 x 0.6-0.7 cm respectively the smallest was observed in *A. palmatum* which was 0.2-0.25 x 0.15-0.2 cm with the others showing intermediate sizes between the two.

The buds of most of the species were elliptic with their surface being convex. However, the buds of *A. hookeri*, *A. sikkimense* and *A. pectinatum* were more or less oval being laterally compressed with the apical portion slightly curved towards one side with one of the scale leaves being slightly longer than the other, and morphologically the buds of these three species were difficult to differentiate except with respect to their sizes, being largest in case of *A. sikkimense* and smallest in *A. hookeri*. However, the difference in the size may be due to the earlier break in the dormancy of the buds of *A. sikkimense* in which the leaves and the inflorescence emerge earlier than the other two species. *A. sterculiaceum* exhibited a distinct type of the bud which is more or less tetrahedral with four flat faces and four edges which can very much differ from those of the other species including *A. thomsonii* to which it is closely related.

While, the buds of most of the species had pointed apices those of *A. laevigatum* and *A. osmastonii* were rounded. The buds in most species were reddish green, with the exposed

portions of the scales being reddish whereas the covered portions being green to yellowish green those of *A.sterculiaceum* and *A.caudatum* were brown and those of *A. thomsonii* being greenish brown. The outer surface of the buds were either pubescent as in *A.caudatum*, *A. palmatum*, *A. acuminatum*, *A. stachyophyllum*, *A. sterculiaceum* and *A. oblongum* or glabrous in the others.

The different species also exhibited a variation in the number of the scale leaves and the manner of their arrangement. The number ranged from 2 pairs as in *A. caudatum*, *A. hookeri*, *A. pectinatum*, *A.sikkimense* and *A. stachyophyllum*; 3 pairs in *A.acumintum*; 4 pairs in *A.laevigatum* and *A.palmatum* ; five pairs in *A.campbellii* and *A. osmastonii* ; six pairs in *A. oblongum* ; and 10 pairs in *A. thomsoni* and *A. sterculiaceum* which were the highest number. These were in conformity with the range of the numbers for the different sections and series that species belong to.

Two types of the arrangement of the buds could be observed in the different species valvate and imbricate. In the valvate arrangement there is no overlapping of the scales and the outermost remains the largest completing enclosing the smaller scales along with the leaf and or the inflorescence primordia. Such valvate arrangements were exhibited by *A.acuminatum*, *A.caudatum*, *A. hookeri*, *A.pectinaum*, *A.sikkimense* and *A. stachyophyllum*. In the other species viz. *A. campbellii*, *A.laevigatum*, *A.oblongum*, *A. osmastonii*, *A.sterculiaceum* and *A. thomsonii* the scales exhibit an imbricate type of arrangement where the scales show overlapping.

Sakai (1987,1989) made extensive studies of the growth pattern of the shoot, different species of Japanese *Acer* and has classified into two broad groups: one exhibiting indeterminate growth where the flush of preformed leaves in buds is followed by subsequent development of newly formed leaves which were not present in the buds and the other showing determinate growth in which case fully preformed leaves in a bud flush at once with no leaf being added after the flush. He has concluded that in species of *Acer* with indeterminate growth enables the seedlings to start rapid height growth in response to light conditions, earlier than those showing determinate growth (Sakai 1987). The annual extension growth is thus, greater in indeterminate species as compared to determinate species as in most other temperate and tropical trees (Marks 1975; Bhoojh and Ramakrishnan 1982; Sakai 1987, 1989,1990). These characteristics are related to regeneration, while the indeterminate species are adapted to regeneration in more competitive, less shady sites as compared to the determinate species that grow in shady places.

Sakai (1990) took an extensive studies utilizing light and scanning electron microscopy on the development pattern of the buds in the Japanese species of *Acer* along with paleobotanical studies including the extant forms. He concluded that the species that exhibited indeterminate branching arose earlier than the determinate species and has proposed an evolutionary trend of bud scales in Aceraceae. While the terminal bud of the more primitive genus of Aceraceae, *Dipteronia* lack bud scales and consists of young leaves only the terminal buds of indeterminate species have bud scales with the outermost having a small laminae which wither in the developmental stage and the inner pairs showing distinctly three lobed very small laminae. The determinate species also show terminal buds with bud scales with the outermost scales with small lamina, which wither during development and in the inner pairs no such laminae, develop. (Fig. 7.1.). From these observations Sakai (1990) concluded that the genus originated in the early successional forests and that a part of the group subsequently invaded late successional forest during the expansion of broadleaved deciduous forests, following the decline in temperature near the end of the Eocene.

**TABLE 7. 1. MAJOR CHARACTERISTICS OF THE WINTER BUDS OF THE DIFFERENT SPECIES OF
Acer L. OF THE DARJILING-SIKKIM HIMALAYA**

NAME OF THE SPECIES	CHARACTERISTICS OF THE TERMINAL BUD						CHARACTERISTICS OF THE BUD SCALES		
	NUMBER	NATURE	SHAPE	COLOUR	SIZE IN cm		NO. OF PAIRS	ARRANGEMENT	LARGEST PAIR
					LENGTH	BREADTH			
<i>Acer acuminatum</i>	2 or 1	Sub sessile pubescent	Elliptic Apex pointed	Brownish red	0.5-0.6	0.25-0.35	3	Valvate	Middle pair
<i>A. campbellii</i>	1 or 2	Sessile, Glabrous	Elliptic, Apex pointed	Reddish Green	0.6-1	0.4-0.5	5	Imbricate	Inner 3 rd pair
<i>Acer caudatum</i>	1 or 2	Sessile Pubescent	Ovate, Apex pointed	Brown	0.8-0.9	0.45-0.5	2	Valvate	Outermost pair
<i>A. hookeri</i>	1 or 2	Stalked Glabrous	Oval, Apex pointed curved	Green Or Red	0.4-0.5	0.3-0.4	2	Valvate	Outer most
<i>A. laevigatum</i>	1 or 2	Sessile Glabrous	Elliptic, Apex round	Reddish Green	0.3-0.4	0.2-0.3	4	Imbricate	Inner 2 nd pair
<i>A. oblongum</i>	1	Sessile Pubescent	Elliptic, Apex pointed	Green Brown	0.4-0.45	0.2-0.23	6	Imbricate	Inner 4 th pair
<i>A. osmastonii</i>	2 or 1	Sessile, Glabrous	Elliptic, Apex round	Reddish Green	0.55-0.6	0.3-0.4	5	Imbricate	Inner 4 th pair
<i>A. palmatum</i>	2	Sessile Pubescent	Elliptic, Apex pointed	Reddish Green	0.2- 0.25	0.15-0.2	4	Imbricate	Outermost
<i>A. pectinatum</i>	3	Stalked Glabrous	Oval Apex pointed curved	Red Green	0.4-0.7	0.3-0.5	2	Valvate	Outermost
<i>A. sikkimense</i>	3 or 2	Stalked, Glabrous	Oval Apex pointed curved	Red Green	0.45-0.9	0.4-0.5	2	Valvate	Outermost
<i>A. stachyophyllum</i>	1 Or 2	Sessile pubescent	Oval Apex pointed	Reddish Green	0.35-0.45	0.3-0.35	2	Valvate	Outermost
<i>A. sterculiaceum</i>	1	Sessile, Pubescent	Tetrahedral Apex pointed	Brown	1-1.3	0.7-0.9	10	Imbricate	Inner 6 th pair
<i>A. thomsonii</i>	1	Sessile Pubescent	Elliptic, Elongate, Apex pointed	Greenish Brown	1.1-1.2	0.6-0.7	10	Imbricate	Inner 8 th pair.