Family Rosaceae is of exceptional interest from the phylogenetic point of view and is considered to be the most primitive group in Dicotyledons. It belongs to order Rosales (17 families and 20,000 species) which is a prolific group and spread mainly in temperate regions. It includes herbs, shrubs, and trees; the herbaceous members show a clear relationship to their woody ancestors. The order is derived from Dilleniales passing into amentiferous families and culminating in the Urticales (Hutchinson, 1959). They are linked with the primitive families of Saxifragales through the sub-family Spiraeoideae of Rosaceae and had a common origin with them, on the whole more advanced than the Saxifragales; seeds usually without endosperm, and vessels usually with simple perforations (Takhtajan, 1969). The family has been sufficiently related to Leguminales by Hutchinson (1959) and Dilleniales and Saxifragales by Takhtajan (1969). This proves an interesting problem and in order to assess the relationships of family on basis of anatomical studies and associated structures such as trichome and leaf venation the present investigation was undertaken.
The materials were collected locally and in few cases herbarium collections were also utilized. Routine methods employed in study of anatomy were followed.

In the present study the genera considered are: Spiraea, Sorbaria, Cotoneaster, Cydonia, Pyracantha, Pyrus, Malus, Grioebastra, Crataegus, Kerria, Rubus, Fragaria, Geum, Filipendula, Alchemilla, Agrimonia, Rosa, Neurada, Prunus, Padus, and Hirtella. In each case, anatomy of leaf, petiole, young stem and wood (where possible) were investigated; special emphasis was laid on structure of tricorne and leaf venation.

Leaf

The lamina is usually dorsiventral and hypostomatic; in Duchesnea indica, Geum urbanum, Alchemilla vulgaris, Prunus domestica and Pyrus pashia it is amphistomatic. The upper epidermis usually is single layered, except in Sorbaria tomentosa, Cotoneaster microphylla, Fragaria vesca, Prunus persica, Malus pumila were 2-3 layered condition also occurs. Cuticular striations occur in Pyrus, Cotoneaster, Prunus persica being strongly developed on the lower epidermis. The cuticle the is smooth, thin and straight on both surfaces in Spiraea, Cydonia oblonga, Pyracantha crenulata, Pyrus communis, Grioebastra japonica, Crataegus, Kerria japonica, Rubus niveus, R. antennifer Fragaria vesca, Duchesnea indica, Dryas ozyodonta, Filipendula vestita, Alchemilla vulgaris, Agrimonia pilosa, Rosa weubiana, A. moschata, Prunus domestica, P. persica, P. armenica, P. dulcis P. cerasicera, Padus carnuta, Malus pumila; straight or wavy on the upper epidermis and deeply wavy or denticulate on lower epidermis in Sorbaria tomentosa, Cotoneaster aitchisonii, Cotoneaster nummularia and Cotoneaster microphylla. On the lower
The epidermis is elevated to papillate in *Geum urbanum*, *Neurada procumbens*. Trichomes occur on both the surfaces, the cells of *Pyrus communis*, *Prunus cerasifera*, *Padus carnuta* are mucilaginous.

The mesophyll is differentiated into palisade and spongy parenchyma, the former is 2-3 layered; 3-4 in *Prunus domestica*, *Spiraea*, 1-2 in *Kerria japonica*, *Rubus antennifer*, *Fragaria vesca*, *Geum urbanum*, *Alchemilla vulgaris* 1-layered in *Dryas oxydonta* and *Agrimonia pilosa*; solitary prismatic and large sphaerocrystals of calcium oxalate are of common occurrence. Crystals contained in large crystalliferous cells replace the palisade cells in *Agrimonia pilosa*. Spongy tissue is of the usual structure, rarely in *Criopholus japonica* the air spaces are small and the spongy parenchyma cells approach palisade in appearance. Solitary and grouped sphaerocrystals are common. Mesophyll intrudes deep into the midrib region in some species.

The midrib in cross section is generally hemispherical in outline, reniform in *Crataegus*; *Pyriform* in *Prunus domestica*, semilunar in *Prunus cerasifera*. The epidermis is usually single layered, those of the dorsal region are comparatively larger. Trichomes are present. The cuticle is generally thin, and straight to slightly wavy; thick, slightly or strongly denticulate especially on the ventral surface in *Cotoneaster aitchsonii*, *C. microphylla*, *Crataegus*, *Rubus niveus*, *Agrimonia pilosa*, *Rosa moschata*, *Neurada procumbens*, *Prunus domestica*, *Prunus dulcis*. The lower epidermis is partly or wholly papillate in *Cotoneaster* ssp., *Kerria japonica*, *Agrimonia pilosa*, *Rosa*
webbiana, A. macrophylla Prunus dulcis, Padus carnuta, Malus pumila. Both surfaces are papillose in Crataegus and Prunus domestica.

The collenchyma is in several layers ventrally and few dorsally; angular, lacunate or lamellar; followed by several layered parenchymatous ground tissue with air spaces. Solitary prismatic or rhombohedral crystals or clustered sphacrocrystals are common.

The stele is horseshoe shaped, to roughly oval and situated in the upper half of the dorsal region. In Alchemilla xylem elements are irregularly distributed in the phloem tissue. The stele is ventrally bounded by sclerenchymatous fibres in P. crenulata, Eriobotrya japonica, Cotoneaster aitchisonii, C. microphylla, Rosa moschata. The phloem fibres when present are thick walled, the thickenings are of cellulose. Crystals, solitary prismatic and rhombohedral, occur in phloem parenchyma of Cydonia oblonga, Pyrus communis, Crataegus, sphaerocrystals in Rubus niveus, Prunus sps. and Malus pumila. Both solitary and sphaerocrystals occur in Padus carnuta.

The vascular elements of major veins are surrounded by 1-2 layers of parenchymatous bundle sheath cells; it may extend to the both epidermises, is parenchymatous or collenchymatous. The dorsal extension may be 1- many seriate of 1-6 cells, the ventral 1-3 layered of many cells wide. The epidermal cells over the sheath usually are invaginated dorsally and projected outwards ventrally. They may contain solitary rhombohedral or prismatic crystals in Spiraea, Sorbaria tomentosa, Pyracantha crenulata, Rubus niveus, Alchemilla vulgaris, Padus carnuta and Filipendula vestita. Both sphaero-
crystals and solitary crystals occur in Cotoneaster, Pyrus, Crataegus, Rosa, Prunus persica and Malus pumila, only sphaercrystals in Kerria japonica, Rubus antennifer, Prunus dulcis and P. cerasifera. Crystals are absent in Cotoneaster microphylla, Eriobotrya japonica, Fragaria vasca, Duchesnea indica, Geum urbanum, Dryas oxyodonata and Neurada procumbens. All the minor veins lack bundle sheath extensions and lie embedded in the mesophyll.

The petiole, like midrib, is varied in outline; + spherical with indistinct to distinct dorsal depression, to oval, triangular in Alchemilla vulgaris and Geum urbanum, spherical in Eriobotrya.

The epidermis is usually single layered, the cuticle is thin, straight or slightly wavy; or thick and denticulate either on one or both surfaces in Cotoneaster aitchisonii, C. nummularia, Crataegus, Geum urbanum, Neurada procumbens, Prunus domestica, and P. dulcis. Both epidermal surfaces are papillate in Cotoneaster aitchisonii, C. nummularia, Rosa macrophylla, Prunus armenica and Malus pumila, only ventral surface papillate in Rubus niveus. Trichomes are common. Subepidermal collenchyma is few to several layered, angular in Spiraea, Cotoneaster nummularia, C. microphylla, Cydonia oblonga, Pyracantha crassulata, Pyrus communis, Rubus niveus, Rubus antennifer, Fragaria vasca, Duchesnea indica, Dryas oxyodonata, Rosa macrophylla, Prunus domestica, Prunus persica, Prunus dulcis, Prunus cerasifera, Padus crenata, lacunate type in Sorbaria tomentosa, Cotoneaster aitchisonii, Crataegus, Kerria japonica, Geum urbanum, Alchemilla vulgaris, Agrimonia pilosa, Rosa webbiana, Neurada procumbens and Malus pumila. Lamellar type in Eriobotrya japonica, Filipendula vestita and Rosa moschata and lacking in Prunus armenica. The cortex is with intercellular spaces. Pith is
present in *Eriobotrya japonica*, *Jordaria tomentosa* and is homogenous.

The stele is in the form of an arc, the central bundle being largest in *Sorbaria tomentosa*, *Fragaria vesca*, *Duchesnea indica*, *Geum urbanum*, *Agrimonia pilosa*, *Filipendula vestita*, *Rosa moschata* and *Padus cunrult*. solitary crescent shaped in *Spiraea*, *Jordaria tomentosa*, *Cotoneaster aitchsonii*, *Cotoneaster nummularia*, *Crataegus*, *Rubus* spp., *Dryas obovata*, *Rosa webbiana*, *Rosa macrophylla*, *Prunus domestica*, *P. persica*, *P. dulcis* and *Malus pumila*; solitary horseshoe shaped in *Cotoneaster microphylla*, *Cydonia oblonga*, *Furus communis*; saucer shaped in *Pyracantha crenulata*; centric or hemicentric in *Eriobotrya japonica*; several centric bundles in *Alchemilla vulgaris* each consisting of a ring of xylem and phloem enclosing parenchyma.

In other genera, xylem occupies the dorsal position and has its vessel elements arranged in radial rows. Phloem fibers may or may not be present. Crystals either solitary or in sphaerocrystals or both are common in collenchyma, cortex and parenchyma.

**Trichomes**

The trichomes are glandular and non-glandular superficial in origin and occur on all vegetative parts. Occasionally trichomes are hypodermal as in *Crataegus monogyna* and *Rubus niveus*. They do not have restricted areas of development but may develop side by side.

The glandular trichomes are of four types: spherical oblong, elongated, and peltate. The spherical and oblong types
resemble in development, the only difference being the shape. 
In both the types the formation of 3 cell stage (foot, seta, head) is the rule. The typical spherical head is pluricellular in *Sorbaria tomentosa*, *Agrimonia pilosa*, *Duchesnea indica*, *Alchemilla vulgaris*, *Rubus*, *Rosa*, *Filipendula vestita*, *Dryas oxyodon* and *Neurada procumbens*. A head, with 3-4 (-5) cell long stalk, having a unicellular capitate head occurs in *Fragaria vesca*, *Geum urbanum*, *Alchemilla vulgaris*, the supression of stalk cell is observed in *Fragaria vesca* and *Geum urbanum*. The elongated head and spherical head occur together in these species.

The typical peltate head has multicellular disc shaped head in *Rosa* and *Rubus*. The head and stalk are both multicellular and multiseriate in *Rosa macrophylla*, *R. moschata*, *R. weissiana*, *Rubus antennifer*, *R. niveus* and *R. fruticosus*. They are of p.multiseriate and M.multiseriate types.

The non-glandular trichomes are bracket, acicular, filiform (and modifications) conical or spindle shaped. Two armed T-shaped in *Cotoneaster aitchisoni*; branched in *Rubus fruticosus*. They are normally unicellular, tending to be bicellular in *Geum urbanum*, *Sorbaria tomentosa*, *Eriobotrya japonica*, and two to many celled in *Pyracantha crenulata*. Great variety is observed in the structure of foot, being simple (in all species) bulbous, or with 1- to many pegs in *Geum urbanum*, *Prunus cerasifera*, *Rubus niveus*, *Alchemilla vulgaris*.

Development of a collar 1 cell high in *Agrimonia pilosa*, *S. rataeaeus mono-lynna*, *Alchemilla vulgaris* and *Eriobotrya japonica*; 2- many cells high with an elevated and dome shaped base in *Geum urbanum*. The trichomes have mostly smooth wall, except in *Kerria japonica* where it is warted.
Foliar venation

The number of primary veins which enter the base of the leaf is one in Prunus persica, P. dulcis, Rubus niveus, Pyracantha crenulata and Eriobotrya japonica; 2-3 in Fragaria vesca; 3 in Sorbaria tomentosa, Agrimonia pilosa, Geum urbanum, Crataegus oxyacantha, C. monogyna, Ducusnea indica, Padus curnuta, Prunus cerassifera, Rosa macrophylla, R. moschata, A. webbiana, Cotoneaster nummularia, C. aitchisonii, C. microphylla, Kerria japonica, Pyrus communis, Malus pumila, Prunus armenica, P. domestica, Rubus antennifer, R. fruticosus, Cydonia oblonga; 5 in Spiraea cantenensis, Filipendula vestita; and 7 in Alchemilla vulgaris. The midrib apex shows the following variation in its form.

1. Columnar

   a. Narrow, Padus curnuta, Cotoneaster microphylla, Malus pumila, Rubus fruticosus, Pyracantha crenulata, Alchemilla vulgaris.

   b. Broad, Kerria japonica, Cydonia oblonga, Eriobotrya japonica.

2. Felt head

   Sorbaria tomentosa, Spiraea cantonensis, Prunus cerassifera, Cotoneaster nummularia, Prunus dulcis, Rosa macrophylla, R. moschata, Rubus antennifer and Filipendula vestita.

3. Rotundate

   Geum urbanum, Crataegus oxyacantha, Crataegus monogyna.

4. Hemispherical

   Fragaria vesca, Agrimonia pilosa, Cotoneaster aitchisonii, Pyrus communis, and Rubus niveus.

5. Conical

   Prunus persica, P. armenica.
6. Knob-like

**Duchesnea indica, Prunus domestica.**

The polygons are differentiated into areoles, which are of three types:

- Supernumerary, additional and moyen areolae (formed by tertiary beins only). The polygons and areolae are fewer in the apical and marginal regions of the leaf, while in the central portion these are common. The areolae are with free included veinlets, the vein endings being simple or bifurcated.

The marginal tracheids are in abundance in *Sorbaria tomentosa, Aegrimonia pilosa, Seum urbanum, Crataegus, Spiraea cantonensis, Prunus cerasifera, Cotoneaster nummularia, Pyrus communis, Malus pumila, Prunus persica, P. armenica, Prunus dulcis, P. domestica, Rubus niveus, Cydonia oblonga, Eriobotrya japonica,* and fewer in other species. The accumulation of the tracheidal elements on the vein endings is present in *P. persica, P. armenica, P. dulcis, Eriobotrya japonica, Rubus niveus.*

The veins and veinlets are ornamented with a definite sheath of parenchymatous cells in *Spiraea cantonensis, Prunus domestica, Rubus fruticosus,* and *Filipendula vestita.* In case of *Prunus domestica* the same sheath cells get converted to tracheidal nodules. The sclereids occur on the veins and their endings of *Spiraea cantonensis, Prunus cerasifera, P. persica,* and *P. armenica,* *Rubus antennifer.*

The epidermis is usually single layered and trichotomous in the young stem. The cork originates in the epidermis or sub-epidermis or even in pericycle. The cells are mostly cubical
with thin walls. The cortex is differentiated into an angular collenchymatous hypodermis few to several layers, several layered parenchymatous cortex with rounded to oval cells and large or small air spaces. The cell walls are straight, or sinuous in Geum urbanum. Some cells bear blackish contents in Sorbaria tomentosa. Sphaerocrystals and solitary prismatic crystals are generally present. The endodermis is not well defined in Astrimia pilosa, Geum urbanum, Spiraea cantoniensis, Prunus cerasifera, Rosa macrophylla, R. webbiana, Cotoneaster spp., Rubus niveus, and Filipendula vestita. The pericycle forms a continuous zone of thick walled sclerenchyma cells arranged in few to several layers of cells in Sorbaria tomentosa. Fragaria vesca, Astrimia pilosa, Geum urbanum, Duchesnea indica, Spiraea cantoniensis, Alchemilla vulgaris, Filipendula vestita. It occurs in isolated strands with intervening un lignified parenchyma in Prunus cerasifera, Crataegus, Rosa macrophylla, R. webbiana, Cotoneaster spp., Pyracantha crenulata, Kerria japonica, Rubus niveus, R. antennifer; pericycle sclerenchyma is absent from Neurada procumbens.

Vascular bundles appear in a closed ring in Sorbaria tomentosa, Spiraea cantoniensis, Prunus cerasifera, Rosa webbiana, Cotoneaster sachlichenii, C. numularia, Kerria japonica, Alchemilla vulgaris, Pyracantha crenulata; but are visible as distinct units in Fragaria vesca, Astrimia pilosa, Geum urbanum, Duchesnea indica, Rubus niveus, Filipendula vestita.

In the intermediate types the bundles are separated by the primary rays in such a manner that at some places they appear as distinct units and at some places as a closed ring, e.g. Rosa macrophylla and Rubus antennifer.
Vessel elements are arranged in radial rows in *Sorbaria tomentosa, Fragaria vesca, Acrimonia pilosa, Duchesnea indica, Alchemilla vulgaris*; irregularly scattered in *Geum urbanum, Spiraea cantoniensis, Rubus* sps., *Filipendula vestita*, perforations are usually simple. Phloem may include fibres.

The pith is homogenous in *Sorbaria tomentosa, Fragaria vesca, Acrimonia pilosa, Geum urbanum, Duchesnea indica, Prunus cerasifera, Cotoneaster* sps., *Alchemilla vulgaris, Filipendula vestita, Neurada procumbens*; heterogeneous in *Spiraea cantoniensis, Rosa* sps., *Kerria japonica, Rubus* sps. The cells contain the crystals.

**Wood.**

Diffuse porous in *Prunus domestica, Malus pumila, Pyrus communis*; b. ring porous in *Prunus dulcis, P. armeniaca, Crataegus, Eriobotrya japonica*; c. semi-ring porous in *Cytisus oblonga, Padus carnuta*.

Growth rings (a) indistinct in *Prunus domestica, Malus pumila, Pyrus communis, Crataegus, Eriobotrya japonica*; (b) distinct demarcated by thick walled flattened tracheids in *Prunus armeniaca, Pyrus communis, Padus carnuta*; (c) distinct to indistinct demarcated by either darker bands of fibrous tissue as in *Prunus dulcis* or by thick walled tracheids as in *Cytisus oblonga*.

Vessels larger than fibres, (a) moderately larger in *Prunus domestica, P. armeniaca, Pyrus communis, Eriobotrya japonica*, (b) moderately small in *Malus pumila, Cytisus oblonga, Padus carnuta*; (c) typically small in *Prunus dulcis, Crataegus*. The number of pores ranges from 138-323/mm². They are either exclusively solitary as in *Cytisus oblonga, Crataegus* and *Eriobotrya japonica* or in radial or tangential pairs or in
multiples of up to 7 elements. Spherical - angular in shape. Mostly open or filled with deposits of gum or some times tyloses, numerous gum ducts present in Prunus dulcis, perforations usually simple but a few forminate perforation plates occur in Prunus domestica, P. dulcis, P. armenica, Malus pumila, Pyrus communis, Cydonia oblonca. In crataegus, Padus carnuta, both simple and forminate perforation plates are present. Vessels are usually spirally thickened and intervacular pitting is generally alternate.

Parenchyma apotracheal, diffuse either in the form of scattered cells or short uniseriate lines from ray to ray. Very sparse. Occasional diffuse paratracheal cells present in Prunus dulcis, Padus carnuta.

Parenchyma cells laid with large sphaerocrystals of calcium oxalate in Prunus armenica, Crataegus. Rays 1 to may seriate; (a) heterogeneous, composed of upright and procumbent cells in Prunus domestica, P. dulcis, P. armenica, Eriobotrya japonica; (b) homogeneous, composed of either procumbent or upright cells in Malus pumila, Pyrus communis, Cydonia oblonca, Crataegus, Padus carnuta. (d) with parenchymatous sheath cells present in Prunus domestica, P. dulcis.

Fibres usually with small simple pits, numerous on radial walls than on tangential walls in Prunus domestica, Malus pumila, Pyrus communis. Borded pits equally numerous on radial and tangential walls in Prunus dulcis, P. armenica, Cydonia oblonca, Crataegus, Padus carnuta, Eriobotrya japonica.

Fine septa and gum plates occur in fibres of Prunus domestica, Prunus dulcis, Malus pumila, Pyrus communis. Some traces of storied fibres present in Prunus domestica.
Concluding remarks

1. The leaves as a rule are hypostomatic excepting *Duchesnea indica*, *Geum urbanum*, *Alchemilla vulgaris*, *Prunus domestica*, *Pyrus pashia* and *Potentilla*, where a few stomata are present on upper epidermis also. In *Neurada procumbens* the stomata are present on the upper epidermis only.

The upper epidermis is single layered but 2 - 3 layered condition is also observed in some genera, such diversity of epidermis is also common in Urticales.

The lower epidermis is always single layered.

Occasionally the epidermis in either layer is mucilaginous as in *Hamamelidaceae*, *Ulmaceae*, *Connaraceae* and *Crassulaceae*. The mesophyll though of usual structure, shows often 3 - 4 layered palisade and some times elimination of spongy. However, it has a limited appeal as an evolutionary feature, unless enough data is available on developmental aspects of these leaves in similar habitats yet duplication of epidermis and the cuticular characters may provide taxonomic characters at the local level.

2. The stomata are of ranunculaceous type excepting in *Rubus rasaefolius* which resemble chrysobalanoidae with both having Rubaceous type of stomata, resembling *Hamamelidaceae* and differing in this respect from *Saxifragaceae* and *Dilleniaceae* which resemble other *Rosaceae*. In *Caesalpiniaceae* and *Papilionaceae* both ranunculaceous and rubiaceous types occur, though *Mimosaceae* show only rubiaceous type.
3. The cuticular striations are more common in Pomoideae but the detailed study in related families is not fully known. However such striations are quite common in members of Urticales, Hamamelidaceae and Platanaceae.

4. The petiole has been considered important in the anatomy of Rosaceae and within the genera studied it has shown some interesting features particularly in Spiraeoideae.

5. The trichomes offer an interesting exercise into the evolutionary trends in the various genera. The non-glandular trichome does not offer a valuable criterion but the glandular trichome which is of


The star hairs are common with Hamamelidaceae and Platanaceae, certain genera like Rubus and Potetilla have both star and typical spherical heads. The two-armed, I-shaped found in Cotoneaster come close to those in Saxifragaceae, and the uniseriate hairs found in Sorbaria, Erubotrya, and Pyracantha show relation with Platanaceae, Connaraceae and PitCtosporaceae, but they are never branched as in Platanaceae. In having pluriseriate hairs Rosaceae together with Chrysobalanoidaceae resemble saxifragaceae. The Capitate hairs with unicellular head of Rosaceae form a parallel in most of the angiosperms, but in the stellate hairs with pluricellular heads find a parallel in Juglandaceae only. The distribution of trichomes within the family shows that most of the subfamilies may not be monophy-
-letic and this has been supported by data on wood anatomy and observations on venation. The venation pattern in various genera show that whereas this feature does serve a taxonomic criterion, it incidentally reveals that such genera as Rubus, Cotoneaster, and even Prunus and Potentilla are "polymorphic", with respect to Rubus and Potentilla one could certainly say that they are still undergoing evolution due to their highly apomictic nature.

Anatomy of stem in herbaceous and young stem of woody genera has also revealed that whereas resemblances are with accepted relatives of Rosaceae, certain features of Neurada procumbens show affinities with Portulaceae, Pittosporaceae etc.

In the wood the affinity is clearly with other families of Rosales, Hamamelidae, and to the very limited extent with Urticales. Relationships with Caesalpiniaeae, Dilleniaceae, Connaraceae and Calycanthaceae are also indicated from wood.

The data available indicates that though taxonomically Rosales may be a well knit unit, phylogenetically it may be polyphyletic, and the Rosaceae itself might also be polyphyletic, in origin.


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Fig. XLVII. Epidermis in surface view. (1 - 3).

1. *Fragaria vesca* showing hair initials.

2. *Rubus fruticosus* showing stellate trichomes.

3. *Geum urbanum* showing non-glandular trichomes and sphaerocristals around the veins and veinlets.
Fig. XLVIII. (1 - 4).

1. *Sorbaria tomentosa* T.S. midrib showing glandular trichomes.

2,3. *Pyracantha crenulata* T.S. leaf showing uniseriate filiform trichome.

4. *Pyrus communis* T.S. midrib, showing prismatic and rhombohedral crystals.

5. *Crataegus oxyacantha* T.S. leaf showing bundle sheath extensions.
Fig. XLIX. (1-3).

1. **Rosa macrophylla** T.S. midrib showing intruding mesophyll and hypodermis on the dorsal surface.

2. **Prunus domestica** T.S. through a part of midrib, showing papillose epidermis.

3. **Prunus persica** T.S. midrib showing both solitary, prismatic and sphaeroocrystals.
Fig. L. Cleared leaf. (1-4).

1. *Spiraea cantoniensis* showing ornamented veins.
2. *Rubus fruticosus* showing ornamented veins and veinlets.
3. *Prunus domestica* showing tracheidal nodules.
4. *Prunus armenica* showing glandular leaf teeth.
Fig. LI. (1-2). T.S. Petiole-

1. *Rubus niveus* showing glandular and non-glandular trichomes.

2. *Prunus domestica* showing subepidermal collenchyma and crystals.