SOLANACEAE

Systematic Position:

- Kingdom: Plantae
    - Class: Dicotyledonae
        - Subclass: Gamopetalae
            - Series: Bicarpellatae
                - Order: Polemoniales
                    - Family: Solanaceae

Distribution:

A large family, primarily distributed in the tropics and extends to the temperate regions.

90 genera and 3000 species.

Habitat:

Members of this family are mostly mesophytes and some are xerophytes (*Solanum suratense*)

Habit:

Herbs, shrubs, sometimes creepers or climbers, very rarely trees. They're usually herbs or climbing vines in the tropics many shrubby forms are found and a few small trees.

Examples:

Herbs - *Solanum nigrum, Solanum tuberosum, Lycopersicum esculentum, Capsicum sps., Datura sps., Physalis sps., Petunia hybrida, Withania somnifera.*

Shrubs - *Solanum torvum*

Creepers/Climbers - *Solanum dulcamara*

Trees - *Solanum verbascifolia*

VEGETATIVE CHARACTERS:

Root:

Branched taproot system is exclusively seen.

Stem:

Aerial, erect and mostly herbaceous (*Solanum torvum and Solanum verbascifolia* are exceptions.)

Branched, pubescent (*Petunia hybrida, Nictotiana alata*) or prickly (either covered by pricles as in case of a few *Solanum* sps. or spines like in *Lycium* sps and *Solanum xanthocarpum* these spines are modified branches.)

The production of underground tubers, such as those of potatoes is exceptional.

Leaves:

Simple or pinnately lobed, entire (*Petunia hybrida*). Exstipulate and petiolate. Petiole shows adnation with stem.

Phyllotaxy- Alternate in the vegetative part and opposite or whorled in the floral region.

Unicostate reticulate venation. In *Solanum xanthocarpum*, the midrib and veins are found with yellowish spines.

REPRODUCTIVE CHARACTERS

Inflorescence:

It is usually Cymose type, terminal or axillary (*Datura stramonium*) in position. Monochasial cyme is evidently observed, scorpioid (*Petunia*, *Solanum*) or helicoid (*Solanum tuberosum*). Rarely solitary.

In some species is extra-axillary in position, appearing to arise from middle of an internode due to the adnation of peduncle with the internode.

In *Solanum nigrum*, the inflorescence is called as "rhipidia". It is a modified scorpioid cyme with shortened main axis so that the flowers appear to rise in one plane (Fan shaped cyme).

In *Withania somnifera*, umbellate cyme is observed.

Flower:

Bracteate (Petunia hybrida) or ebracteate (Solanum nigrum). Ebracteolate, pedicellate, bisexual (unisexual flowers are rare or absent). Generally actinomorphic, rarely zygomorphic (*Hyoscyamus*, *Schizanthus pinnatus*). Pentamerous, hypogynous.

Calyx:

Five, gamosepalous, green. Persistent calyx as in *Withania somnifera*, *Physalis peruviana* and *Solanum melangena*. In *Physalis peruviana* and *Withania somnifera*, the persistant calyx develops a bladdery husk about the fruit. Tubular and showing valvate aestivation (*Datura metel*) or imbricate aestivation (*Petunia hybrida*), bell shaped in *Solanum melangena.*

Corolla:

Five, gamosepalous sometimes of unequal lengths as in Petunia. Rotate or infundibuliform or lobed or tubular, usually plicate (folded like a fan blade) showing twisted or valvate or imbricate aestivation.

Androecium:

Five or sometimes four and didynamous or only 2 (*Schizanthus*). Polyandrous, alternating with petals, anthers fusing around style to form a cone. Dehiscence is through pores (*Solanum*) or longitudinal slits (*Petunia*). Epipetalous condition is significantly seen.

Gynoecium:

Bicarpellary, syncarpous, usually bilocular becoming multi locular by false septa (*Datura*). Ovary placed obliquely and not in the median plane, superior. Unilocular with single ovule is also observed in some (*Henoonia*). Style single, stigma simple or lobed.

Fruit:

Capsule (Datura), Berry (Lycopersicum, Solanum nigrum).

Seed:

Minute with abundant endosperm.

Pollination:

The flowers are usually large, the corolla more or less tubular and the nectaries are found at the base of the stamens. So, the pollination is affected by long legged insects like moths and butterflies. Nicotiana is pollinated by moths at night or in the evening.

Bees are also common pollinators.

Important Genera:

Atropa- *Atropa belladona* – Poisonous, contains an alkaloid called atropine. It is used as sedative, antispasmodic and mydriatic diseases. Berries are poisonous, roots and leaves are narcotic, diuretic.

Capsicum – *Capsicum annuum*, *C. frutescens* and *C. fastigatum*.

Cestrum – *Cestrum nocturnum* (lady of the night), cultivated shrub, strongly scented.

Datura – *Datura alba* syn *D. metel* – drug called stramonium – Narcotic

Hysocyamus – *Hysocynamus niger* – eye diseases, poisonous.

Lycopersicum - *Lycopersicum esculentum*

Nicotiana – *Nicotiana tabacum*

Petunia – Cultivated ornamental herb

Physalis – cultivated for fruits (Rasbhari)

Solanum

Withania – *Withania somnifera* – Ashwagandha nervine tonic.

Brunfelsia – cultivated ornamental – Pale violet fragrant flowers turn white.

Economic Importance:

Ornamental – *Petunia, Lycium, Cestrum, Schizanthus, Nicotiana, Solandra, Browaelia, Brunfelsia, Salpiglosis* etc.

Drug-yeilding – *Atropa belladona*, *Hyoscyamus niger*, *Withania somnifera*, *Nicotiana tabacum*, *Datura stramonium*.

Food – *Solanum tuberosum, S. melangena, Lycopersicum esculentum, Capsicum frutescens, Physalis*

Distinguishing Characters:

Flowers – Pentamerous, Bisexual, Actinomorphic, Hypgynous, Calyx and corolla fused, stamens epipetalous, sometimes syngenesious, Pistil- Bicarpellary, syncarpous, ovary oblique, axile placentation, Fruit- Capsule or berry.

Adnation and Plicate corolla

Adnation in Solanaceae:

Adnation of vegetative parts is a very common feature, in many members of Solanaceae. Three importanat variations in adnation are noticed. These are exemplified by a) Datura, b) Atropa and c) *Solanum nigrum*

A) *Datura* – The branching is aparantly dichotomous. Each shoot in the flowering region has two leaves. It is terminated by flower. The two leaves have axillary buds which later develop into an opposing pair of branches (Dichasium). The leaves are adnate to the stem. At maturity, the leaves are displaced.

B) *Atropa* and other members – Unlike Datura, the branching is sympodial. Each shoot ends in a terminal flower or inflorescence. At its node, there are both small and large leaves. Small leaves do not have axillary bud in them therefore, they do not get displaced. The bigger leaf has an axillary bud. Since the shoot end with inflorescence, further growth is taken up by the axillary bud of the bigger leaf.

C) *Solanum* and others – Flowering shoots are sympodial. As in Atropa, there are two unequal leaves and a terminal flower or inflorescence. Here the inflorescence is adnate to the shoot of next generation.

References:

1. Sambamurty, A. V. S. S. (2013). *Taxonomy of angiosperms*. IK International Pvt Ltd.
2. https://www.biologydiscussion.com/angiosperm/dicotyledons/solanaceae-characters-distribution-and-types/48409

Verbenaceae

Systematic Position:

- Class – Dicotyledonae
    - Subclass – Gamopetalae
        - Series – Bicarpellatae
            - Order – Lamiales
                - Family – Verbenaceae

Distribution:

Verbenaceae or the verbena family includes about 98 genera and nearly 2614 species, widely dispersed in nearly all warm and temperate region.

Habitat:

Generally, mesophytes, rarely halophytes (*Avicennia officinalis*)

Habit:

Shrubs or trees (*Tectona*), Rarely herbs (*Lippia nodiflora*) or climbers (*Petrea*).

VEGETATIVE CHARACTERS:

Root:

Tap root and branched.

Stem:

Erect, herbaceous or woody, young branches quadrangular, in some branches spiny.

Leaves:

Simple or palmately or pinnately (*Peronema, Vitex*) compound, opposite (*Stachytarpheta indica*) or whorled, exstipulate, entire or divided.

REPRODUCTIVE CHARACTERS:

Inflorescence:

Cyme or racemose spikes often with an involucre of coloured bracts, often compound or paniculate; cymose is usually dichasial (*Clerodendron*).

Flower:

Zygomorphic, hermaphrodite, rarely unisexual by abortion (*Aegiphila*), hypogynous, pentamerous or tetramerous (*Physopsis*), rarely actinomorphic (*Physopsis*) complete.

Calyx:

Sepals 5 lobed, gamosepalous, persistent, bell shaped or tubular, rarely 4 to 8 valvate.

Corolla:

Petals 5 or 4 lobed, gamopetalous petals unequal, tubular or cylindrical, bi-lipped, imbricate.

Androecium:

Stamens 4, didynamous, fifth stamen may be staminode or absent rarely 5 present (Tectona), epipetalous, bithecous, filaments free, dorsifixed, introrse, dehiscence longitudinal.

Gynoecium:

Bicarpellary, syncarpous, rarely carpels 4 (*Duranta*) or 5 (*Geunsia*) superior in early stage bilocular but soon divided into 4 or many loculed by false septa, axile placentation or free central in *Avicennia*; style terminal, stigma entire or bilobed.

Fruit:

Drupe rarely schizocarpic capsule enclosed by persistent calyx (*Glandularis* spp.).

Seed:

Non-endospermic with a straight embryo.

Pollination:

Entomophilous

Important Genera:

Verbena: *Verbena officinalis* – Perennial herb.

Lippia: *Lippia nodiflora* – Perennial herb.

Duranta: *Duranta plumieri* –Common hedge plant.

Clerodendron: *Clerodendron inerme* – A seashore plant

Callicarpa: *Callicarpa macrophylla*

Avicennia: *Avicennia officinalis* – mangrove shrub

Tectona: *Tectona grandis* – Deciduous tree

Premna: *Premna cariacea* – Strong smelling climber – yeild fuel and produce fire by friction (Himalayas)

Phryma: *Phryma leptostachya*

Holmskioldia: *Holmskioldia sanguinea*

Caryopteris: *Caryopteris wallchiana*

Lantana: *Lantana camara* – Invasive alien species.

Vitex: *Vitex negundo*

Economic Importance:

1. Timber - The wood of *Tectona grandis* (Teak, H. Sagwan) is extremely hard and lasting. The wood is largely used in manufacturing of ships and good quality furniture. Teak is grown in forests of Burma, Madhya Pradesh and Assam. The wood of *Gmelina arborea* is used in making drums, sitars and other musical instruments.

2. Medicinal - The roots of Clerodendron are used in asthma and cough. The decoction of leaves of *Lantana camara* is given in tetanus and rheumatism. The leave's juice of *Gmelina arborea* is used in gonorrhoea, cough and ulcers.
3. Oils - *Lippia alba* produces a valuable oil
4. Tanning - The bark of *Avicennia* is used in tanning.
5. Febrifuge - The leaves of *Vitex negundo* serve as febrifuge. The branches of this plant are kept over stored grains to keep off insects.
6. Ornamental - *Lantana, Verbena officinalis, Duranta, Congea tomentosa*, *Callicarpa*, *Clerodendron*, *Petrea* are cultivated in gardens.

Distinguishing Characters:

- Plants herbs, shrubs or trees
- Leaves simple, usually exstipulate, opposite or whorled; sometimes pinnately or palmately compound.
- Inflorescence variable; cymose, raceme or spike.
- Flowers bisexual; zygomorphic, hypogynous;
- Calyx 4-5 persistant.
- Corolla 4-5 lobed, gamopetalous, sometimes bilipped.
- Stamens 4, didynamous, epipetalous.
- Carpels 2, syncarpous, superior.
- Fruit drupaceous – nutlets
- Seed exalbuminous.