

# **PHYLOGENY OF TUBIFLORAE**

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# INTRODUCTION

- Bentham and Hooker included these families in the series Bicarpeolatae under three orders:
- 1. Polemoniales

Families: Polemoniaceae, Hydrophyllaceae, Boraginaceae, Convolvulaceae and Solanaceae

- 2. Personales

Families: Scrophulariaceae, Orobanchaceae, Lentibulariaceae, Columelliaceae, Gesneriaceae, Bignoniaceae, Pedaliaceae and Acanthaceae

- 3. Lamiales

Families: Myoporineae, Selagineae, Verbenaceae and Labiatae

- Hutchinson(1969) kept some of these families in Lignosae and others in Herbaceae at the end of these groups

- Lignosae

Order 1. Bignoniales

2. Verbenales

- Herbaceae

Order 1. Solanales

2. Personales

3. Boraginales

4. Lamiales

- Cronquist (1981,1988) and Takhtajan (1980) kept these families in the subclass Asteridae.
- Cronquist kept them in three orders
  1. Solanales
  2. Lamiales
  3. Scrophulariales
- Takhtajan kept them in three orders
  1. Polemoniales
  2. Lamiales
  3. Scrophulariales

# General Characteristics of the Order

- Primarily herbaceous
- Gamopetalous corolla
- Floral parts usually in 4 isomeric whorls or with an oligomeric gynoecium and androecium
- Stamens epipetalous
- Hypogynous
- Ovules each with a single integument

# Convolvulaceae

- Herbs or shrubs, erect or twining, with usually milky latex
- Leaves alternate, simple, entire, lobed or pinnately divided, exstipulate
- Inflorescence solitary or in dichasium
- Flowers bisexual, actinomorphic, hypogynous, large showy, pentamerous
- Sepals 5, imbricate, persistent, free
- Petals 5, united, often funnelform or salverform
- Stamens 5, epipetalous, alternate with petals
- Ovary bicarpellary, syncarpous, bilocular with two ovules in each locule
- Axile placentation
- Fruit 4-6 valved capsule or berry
- Seed with cartilaginous endosperm and folded cotyledons
- Family consist of 55 genera, 1650 species
- Distributed mostly in tropics but extended to the temperate regions
- Example: *Ipomoea*, *Convolvulus*, *Argyreia*, *Evolvulus*
- *Ipomoea batatas* (sweet potato) are edible
- *Cuscuta* was included by Bentham and Hooker and Engler and Prantl in Convolvulaceae but Hutchinson, Cronquist and Takhtajan placed it in separate family Cuscutaceae

# Boraginaceae

- Mostly herbs, sometimes shrubs and climbing, usually scabrous or hispid hairy
- Leaves usually alternate, simple, usually entire, exstipulate
- Inflorescence scorpioid or helicoid cyme
- Flowers mostly bisexual, usually actinomorphic, hypogynous, usually pentamerous
- Sepals 5, distinct or basally connate
- Petals 5, united, funnel-shaped or tubular
- Stamens 5, epipetalous, alternate with petals
- Ovary superior, bicarpellary syncarpous, bilocular with two ovules in each locule
- Axile placentation
- Style gynobasic or terminal
- Fruit of 4 nutlets or drupe
- Seeds usually with slight endosperm
- Family consist of 100 genera, 2000 species
- Distributed in tropical and temperate regions
- Example: *Borago*, *Helitropium*, *Trichodesma*, *Cordia*
- Hutchinson separated the woody members *Cordia*, *Ehretia* etc. into a separate family Ehretiaceae

# Solanaceae

- Mostly herbs or twiners
- Leaves in nonflowering part usually alternate but in inflorescence portion becoming opposite. Leaves are simple or rarely pinnatisect, exstipulate
- Flowers solitary or in cymes, bisexual, actinomorphic or slightly zygomorphic, hypogynous
- Sepals 5, persistent
- Petals 5, gamopetalous, tubular or campanulate
- Stamens 5, epipetalous, alternating with corolla lobes
- Ovary oblique, bicarpellary syncarpous, bilocular with numerous ovules
- Axile placentation
- Fruit a berry or septicidal capsule.
- Seeds with endosperm
- Family consist of 90 genera, 2000 species
- Distributed in tropical and temperate regions
- Economically very important examples: Potato (*Solanum tuberosum*), tomato (*Lycopersicon esculentum*), egg plant (*Solanum melongena*), red pepper (*Capsicum frutescens*), tobacco (*Nicotiana tabacum*), Atropa, Hyoscyamus



# Bignoniaceae

- Trees and shrubs, most commonly lianas
- Leaves opposite decussate, simple or pinnately compound, exstipulate
- Inflorescence of usually dichasial cymes
- Flowers bisexual, zygomorphic, hypogynous, showy
- Sepals 5, fused
- Petals 5, gamopetalous, usually bell or funnel-shaped, sometimes bilabiate
- Stamens 4, didynamous, posterior staminode always present
- Ovary bicarpellary, syncarpous, bilocular with numerous ovules
- Axile placentation
- Fruit septicidal or loculicidal capsule or berry
- Seeds winged, without endosperm
- Family consist of 120 genera, 650 species
- Distributed in tropical regions
- Example: *Kigelia*, *Tecoma*, *Bignonia*, *Millingtonia*
- Economically important for lumber and as ornamentals

# Scrophulariaceae

- Mostly herbs or small shrubs. A few are chlorophyll-less parasites, and others chlorophyll containing parasites (Striga) or saprophytes
- Leaves alternate or opposite, simple, entire or pinnately lobed or incised, exstipulate
- Inflorescence racemose, spike, cymose clusters or solitary
- Bracts and bracteoles usually present
- Flowers bisexual, zygomorphic
- Sepals 5
- Petals 5, gamopetalous, often bilabiate
- Stamens 4, didynamous, epipetalous, the posterior stamen sometimes represented by a staminode
- Honey secreting disc below the ovary
- Ovary bicarpellary, syncarpous, bilocular with numerous ovules
- Axile Placentation
- Fruit usually a capsule or a berry
- Seeds with endosperm
- Family consist of 220 genera, 3000 species
- Cosmopolitan in distribution
- Example: *Bacopa*, *Scrophularia*, *Verbascum*, *Veronica*

# Acanthaceae

- Herbs or shrubs, xerophytes, aquatics or mesophytes
- Leaves opposite decussate, simple, exstipulate, cystoliths visible as streaks or protuberances
- Inflorescence a dichasial cyme or racemose.
- Flowers bisexual, hypogynous, zygomorphic, usually with a nectariferous disk below ovary
- Bracts and bracteoles usually present, often coloured
- Sepals 4-5, united
- Petals 5, gamopetalous, bilabiate
- Stamens 4 and didynamous or 2, epipetalous, staminode sometimes present
- Ovary bicarpellary, syncarpous, bilocular with 2-many ovules
- Axile placentation
- Fruit a loculicidal capsule
- Seeds usually exalbuminous
- Family consist of 250 genera, 2500 species
- Distributed in tropical regions
- Little economic importance except as ornamentals
- Example: *Andrographis*, *Crossandra*, *Barleria*, *Acanthus*, *Blepharis*

# Martyniaceae

- Herbs, viscid-pubescent
- Leaves opposite becoming alternate towards the tip, simple
- Flowers in terminal raceme, bisexual, zygomorphic
- Sepals 5
- Petals 5, gamopetalous, basally cylindrical and campanulate or infundibuliform above, bilabiate
- Stamens 4, didynamous, posterior staminode
- Ovary bicarpellary, syncarpous, unilocular with many ovules on parietal placentation.
- Fruit loculicidal capsule, the outer pericarp is soft and falling off, the inner woody
- Seeds with no endosperm
- Family consist of 3 genera, 70 species
- No economic importance
- Example: *Martynia*, *Proboscidea*, *Craniolaria*
- The family was included under Pedaliaceae by Bentham and Hooker while Bessey, Engler and Prantl, Hutchinson, Cronquist and Takhtajan treated it as a separate family

# Pedaliaceae

- Herbs or rarely shrubs
- Leaves opposite, simple, entire or lobed
- Flowers solitary or in cymes, bisexual, zygomorphic
- Sepals 5, basally connate
- Petals 5, tubular, bilabiate
- Stamens 4, didynamous, epipetalous, posterior represented by staminode
- Ovary superior, bicarpellary, syncarpous, bilocular with 1-many ovules per locule
- Fruit loculicidal capsule or nut often with hooks
- Seeds with thin fleshy endosperm.
- Family consist of 12 genera, 50 species
- Distributed in tropics and subtropics
- Example: *Sesamum orientale*, *Pedaliium*
- *Sesamum orientale*( Sesame oil) is an important oilseed plant.

# Orobanchaceae

- Parasitic herbs with little or no chlorophyll, root parasites
- Leaves alternate, scale like
- Inflorescence terminal raceme or spike
- Flowers bisexual, zygomorphic, hypogynous
- Sepals 2-5
- Petals 5, gamopetalous, bilabiate
- Stamens 4, didynamous, epipetalous
- Ovary bicarpellary (rarely tricarpellary), syncarpous, unilocular with numerous ovules
- Parietal placentation
- Fruit loculicidal capsule
- Seeds small, with minute undifferentiated embryo in oily endosperm
- Family consist of 13 genera, 180 species
- Distributed in North temperate regions
- Example: *Orobanche*, *Aeginetia*, *Cistanchae*

# Lentibulariceae

- Insectivorous herbs, aquatics
- Leaves alternate or in basal rosettes, often dimorphic in aquatic members with submerged leaves usually finely divided, bearing insectivorous bladders
- Inflorescence racemose or spike or flowers solitary
- Flowers bisexual, zygomorphic
- Sepals 2-5, united, bilabiate
- Petals 5, gamopetalous, bilabiate, the lower lip saccate or spurred
- Stamens 2, epipetalous, monothecous
- Ovary bicarpellary, syncarpous, unilocular with numerous ovules
- Free central placentation
- Fruit a capsule
- Seeds minute, exalbuminous
- Family consist of 4 genera, 170 species
- Cosmopolitan in distribution
- Example: *Lentibularia*, *Untricularia*, *Pinguicularia*

# Lamiaceae( Labiatae)

- Herbs or under shrubs, aromatic ,stem quadrangular
- Leaves opposite or whorled, simple, exstipulate
- Inflorescence a Verticillaster (a condensed cyme)
- Flowers bisexual, zygomorphic, hypogynous
- Sepals 5, united, persistent, sometimes bilabiate
- Petals 5, gamopetalous, bilabiate
- Stamens 4 or 2, epipetalous
- Ovary bicarpellary, syncarpous, bilocular, with 2 ovules in each locule
- Axile placentation, style gynobasic
- Fruit a group of 4 nutlets
- seeds with little or no endosperm
- Family consist of 180 genera, 3500 species
- Cosmopolitan in distribution
- Example: *Leucas*, *Ocimum*, *Mentha*, *Lavendula*, *Salvia*
- Family is important as source of volatile aromatic essential oils



# Verbenaceae

- Herbs , shrubs or trees
- Leaves simple or palmately or pinnately compound, usually opposite, rarely alternate, exstipulate
- Inflorescence simple raceme, spike or dichasial cyme
- Flowers bisexual, zygomorphic, hypogynous
- Sepals 5, united, persistent
- Petals 5, gamopetalous, usually with narrow tube, rarely campanulate, often bilipped
- Stamens 4, didynamous, epipetalous
- Ovary usually bicarpellary, syncarpous, bilocular or becoming tetralocular by the formation of false septa with two ovules per carpel
- Axile placentation, style terminal
- Fruit drupe or capsule
- Seeds exalbuminous
- Family consist of 75 genera, 3000 species
- Distributed in tropical and subtropical regions
- Example: *Tectona grandis*(Teak), *Lantana*, *Clerodendron*, *Duranta*
- Useful source of timber eg. *Tectona grandis*(Teak)
- Family Verbenaceae and Lamiaceae closely related. Two are differentiated on the basis of style: style terminal in Verbenaceae and gynobasic in Lamiaceae



THANK YOU