

Elementary Biology: In a nutshell



भारतीय वन्यजीव संस्थान
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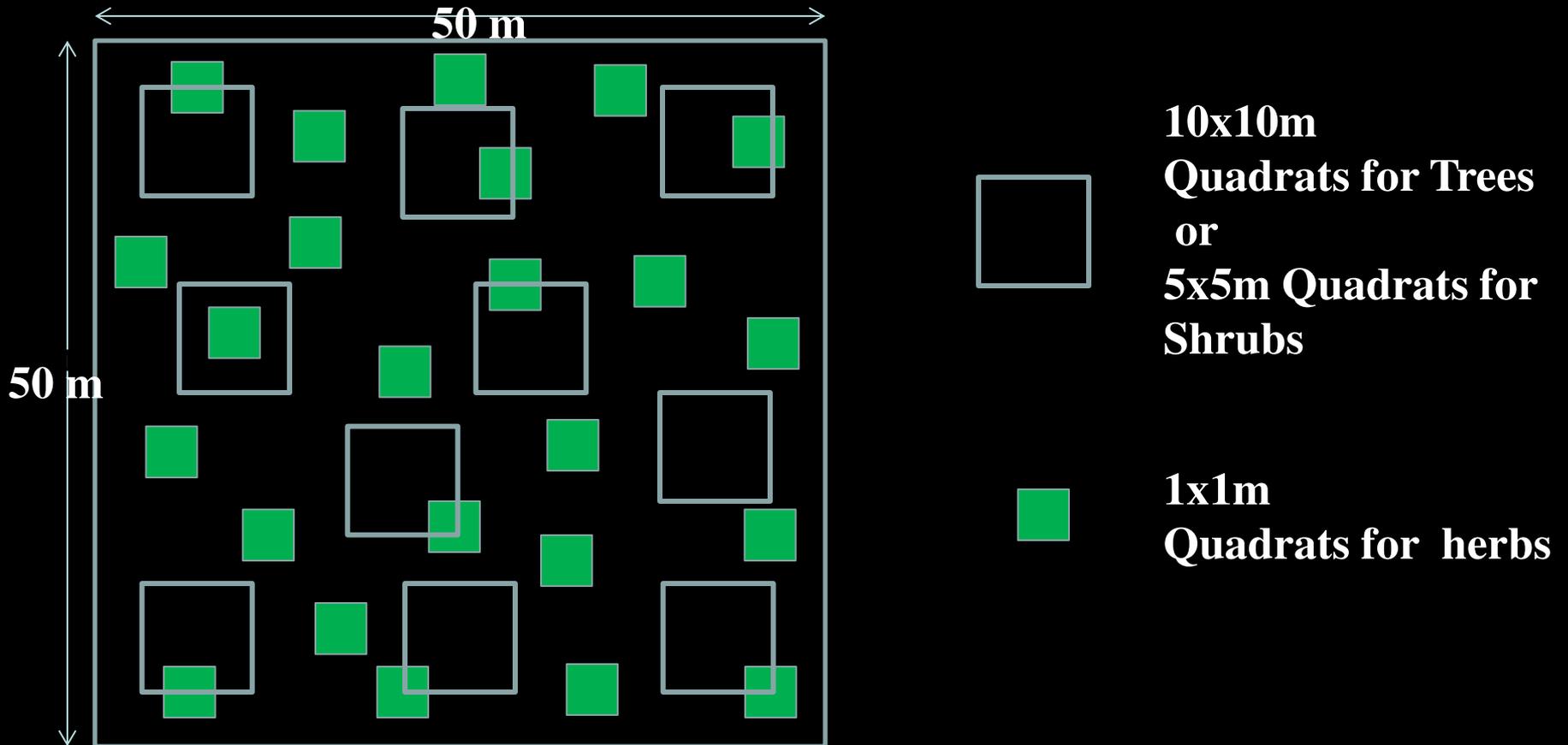
How can we know that a species is in need of conservation if we don't know the existence of the species?



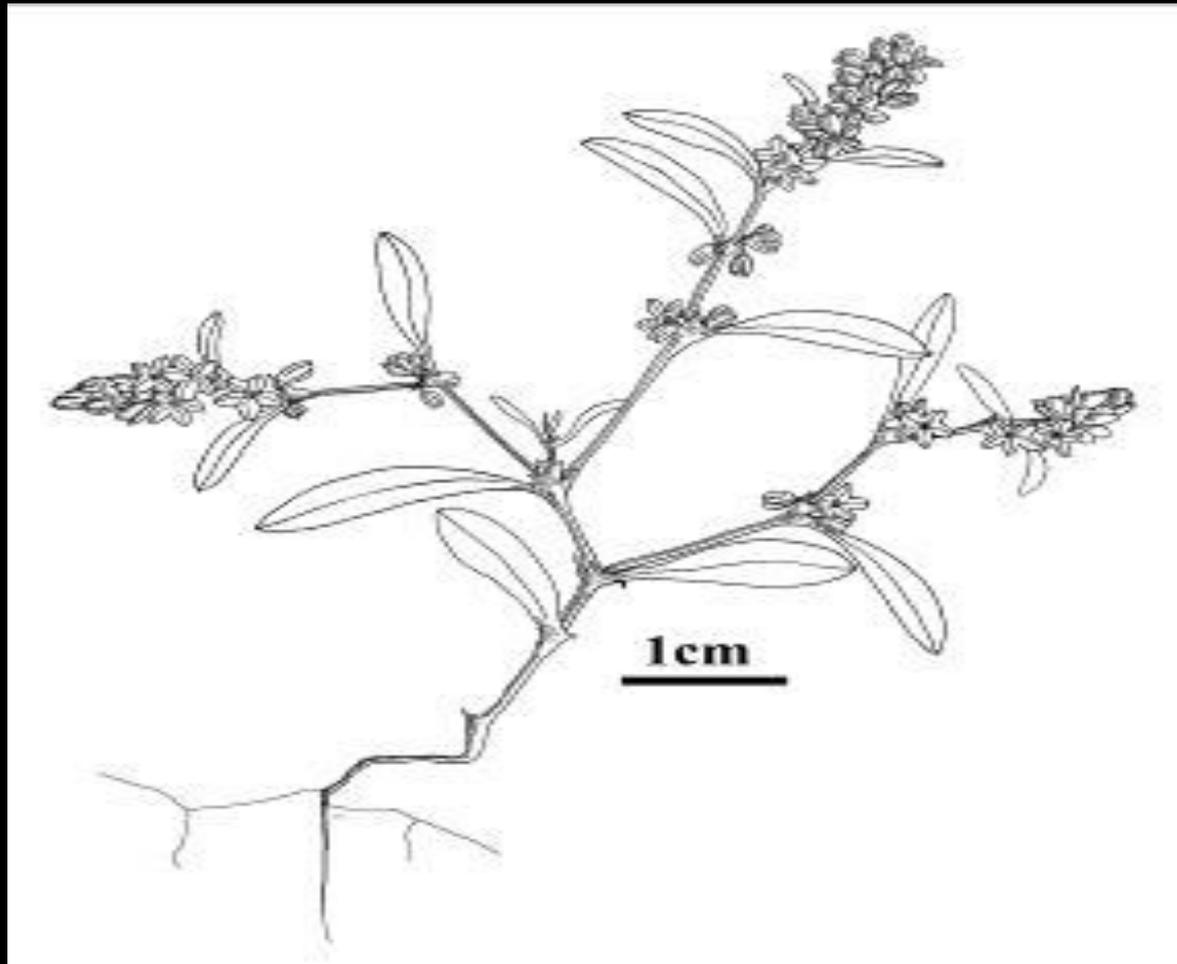
A new species (*Rhododendron rawatii* **I. D. Rai & B. S. Adhikari**)
from the Western Himalaya, *Phytotaxa*, 2012

Answer:

Through biodiversity surveys and monitoring



But how can we know that a species is in need of conservation if that species hasn't even been described??



Answer:

Studying Taxonomy/Systematic Botany



Rubus ellipticus,
Rosaceae

What is Taxonomy?

It is the science of identifying and classifying groups of biological organisms

1. Defining and Naming

2. Description

3. Classification



- *Best management practices*

- *Forest ecology concepts*

- *Phyto-taxonomy*

Who is doing taxonomy?

Common belief: Scientists and a few
other experts

Wrong!

Everyone is a taxonomist!!!!!!

How do we know them ??



How to recognize the plants??

Keen observer

Feel them, love them

Interest- madness

**Never try to mug up the
Botanical names !**

Where to start with ??

Start learning- **Trees-**

Tall trees

Small trees

Shrubs- Tall & small

Herbs- Medicinal plants

Grasses

Orchids

Ferns

**Herb- Annual, Biennial,
Herbaceous stem**



**Shrub- Perennial,
Multi-stemmed, woody**



**Tree- Perennial,
Single dominated woody Stem**



Identifying Plants

- Physical characteristics used to identify plants....
 - Life Cycle- annual, biennial, perennial
 - Plant Parts- flowers, leaves, fruit, roots
 - Growth Form- round, weeping, conical
 - Foliage Retention- Evergreen, deciduous

Monocots vs. Dicots

Monocots

- 1 seeded
- Parallel venation
- Flowers 3x
- Fibrous roots
- Scattered vascular system
- Example: Grass

Dicots

- 2 seeded
- Net venation
- Flowers 4x or 5x
- Tap roots
- Ringed vascular system
- Example: Buttercups

Dicots- mainly trees, shrubs etc



Reticulate veins



Monocots- grasses etc

Parallel veins



Monocot

- 3 petals
- 3 sepals
- 6 stamens
- Parallel veins
- Not woody



Dicot

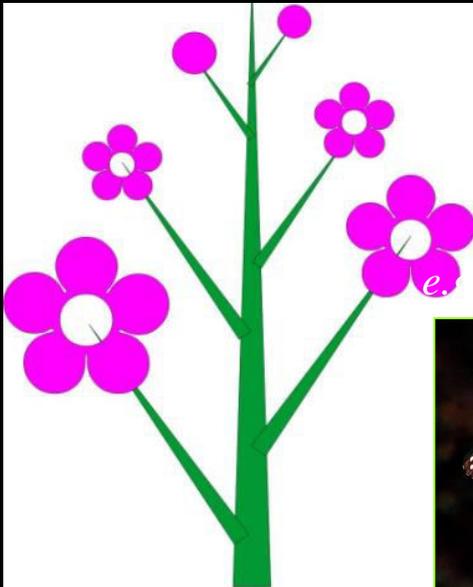
- 5 Petals
- Woody
- Fat leaves
- Tap roots

Plant ID Hints from Anatomy

- Monocot parts 3x, parallel leaf venation
- Dicots usually 5x or 4x, net leaf venation
- See if ovary is superior or inferior
 - above or below perianth
- Look for special flower structures

Types of Inflorescences

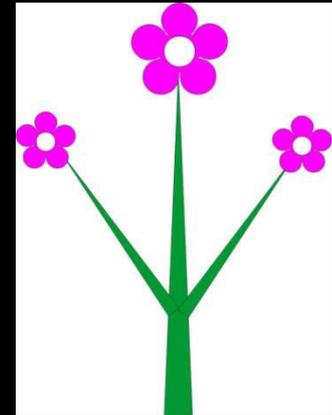
Racemose



e.g. *Crotalaria* sp



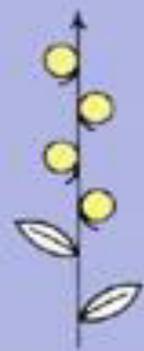
Cymose



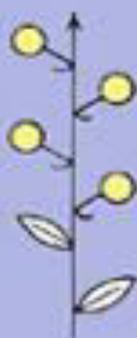
e.g. *Carissa* sp



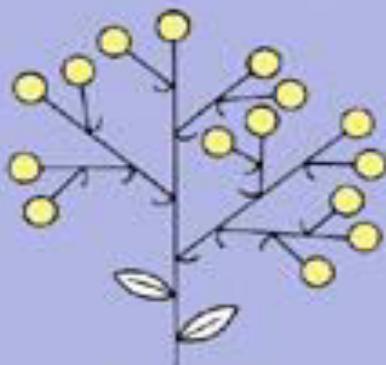
INFLORESCENCE TYPE



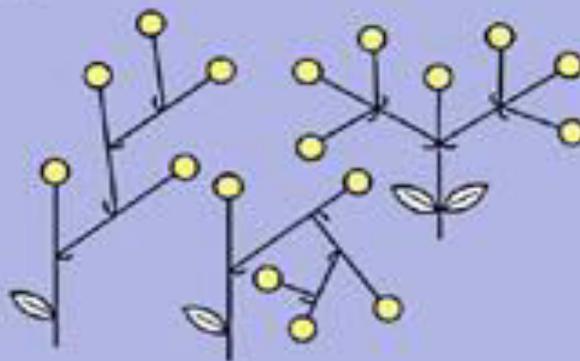
spike



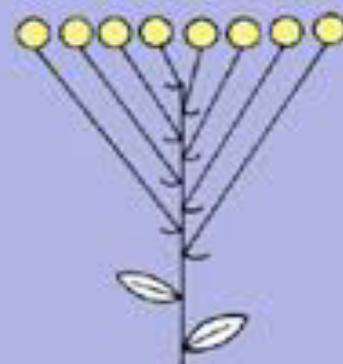
raceme



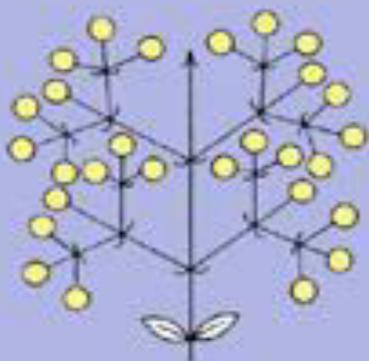
panicle



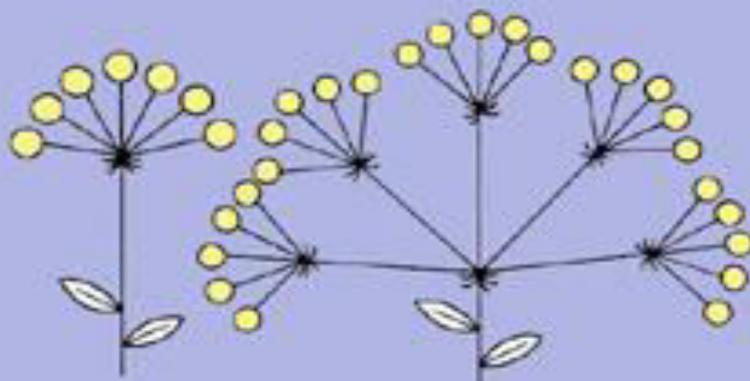
cymes



corymb

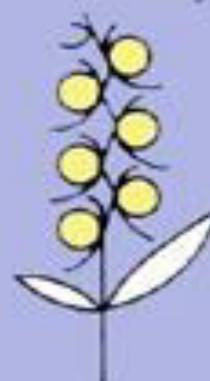


thyrsoid

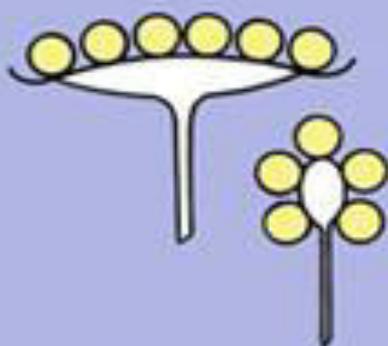


umbel

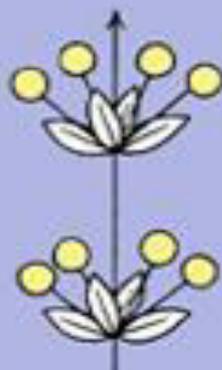
compound umbel



spikelet



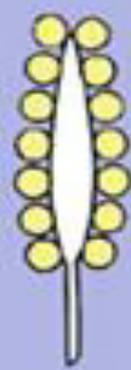
heads (capitula)



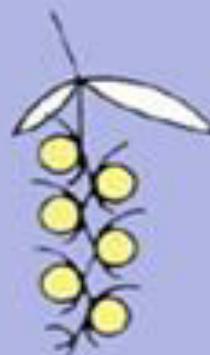
verticillaster



glomerule



spadix



catkin



syconium

Racemose

1. Raceme
2. Spike
3. Spikelet
4. Catkin
5. Spadix
6. Corymb
7. Umbel
8. Head / Capitulum

Raceme



Spike



Spikelet



Spadix



Umbel



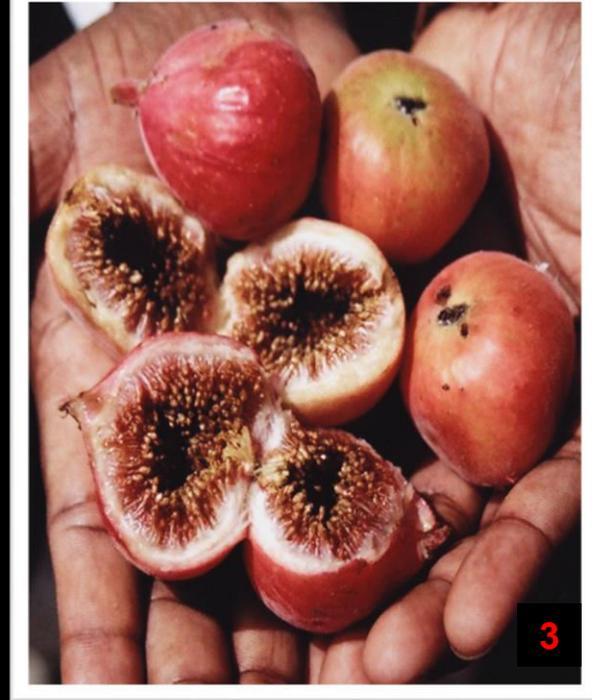
Head /Capitulum



Corymb

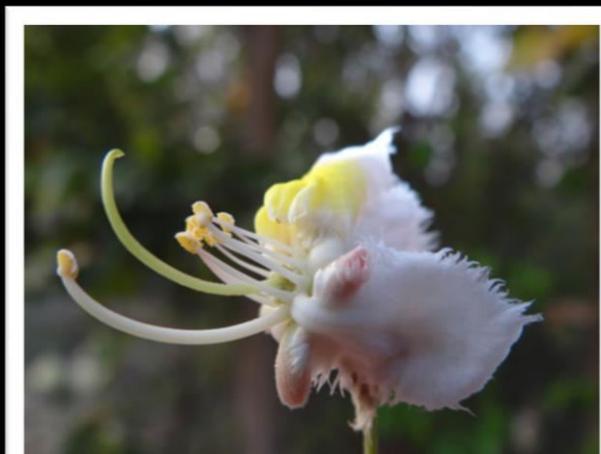
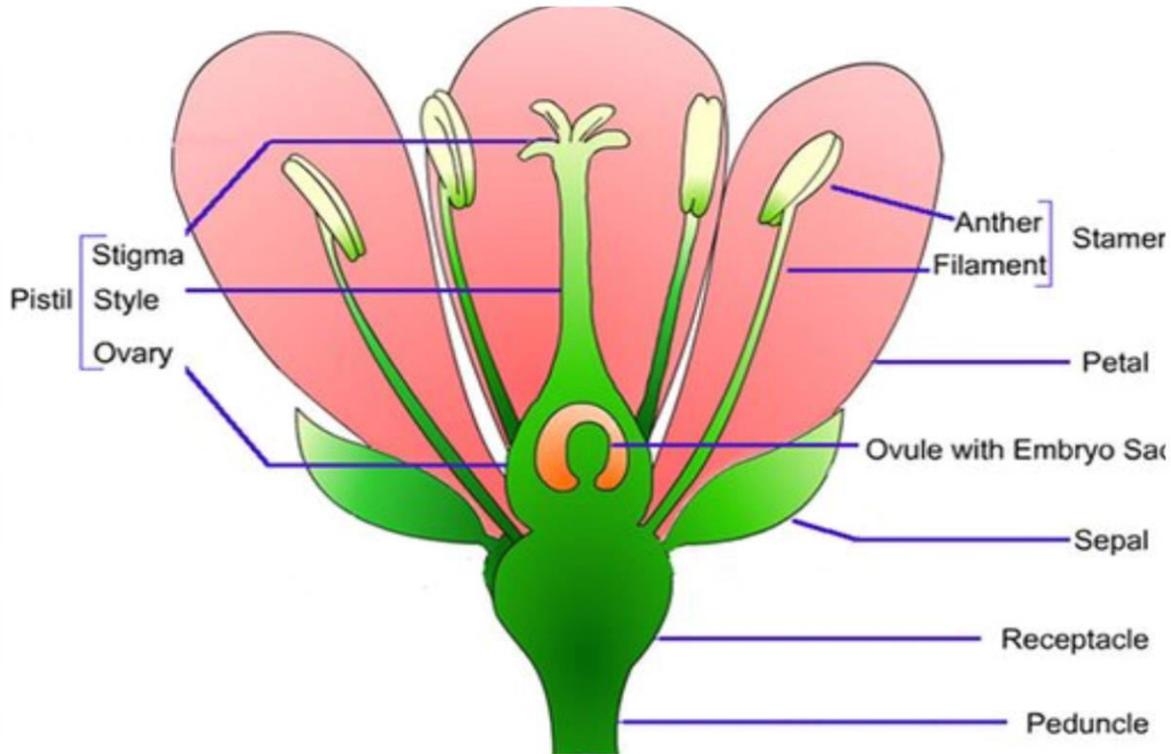


Special types



1. **Cyathium**
2. **Verticillaster**
3. **Hypanthodium**

Parts of a flower



Type of the flower

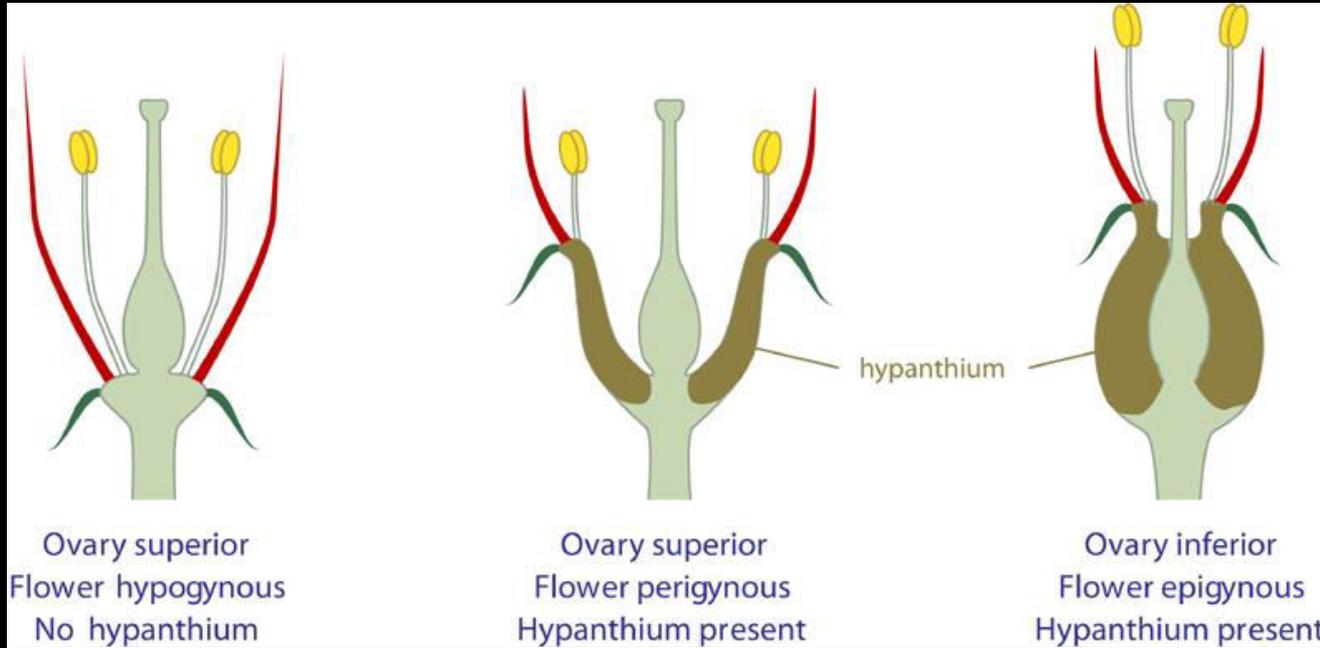
Unisexual: of one sex; having stamen and the pistil in **separate flowers**

Bisexual: of two sex; having both stamens and the pistil in the **same flower**

Monoecious: Unisexual with the male and female flowers on the **same individual**

Dioecious: Unisexual with the male and female flowers on the **separate individuals**

Position of ovary



Rosaceae



Primitive character

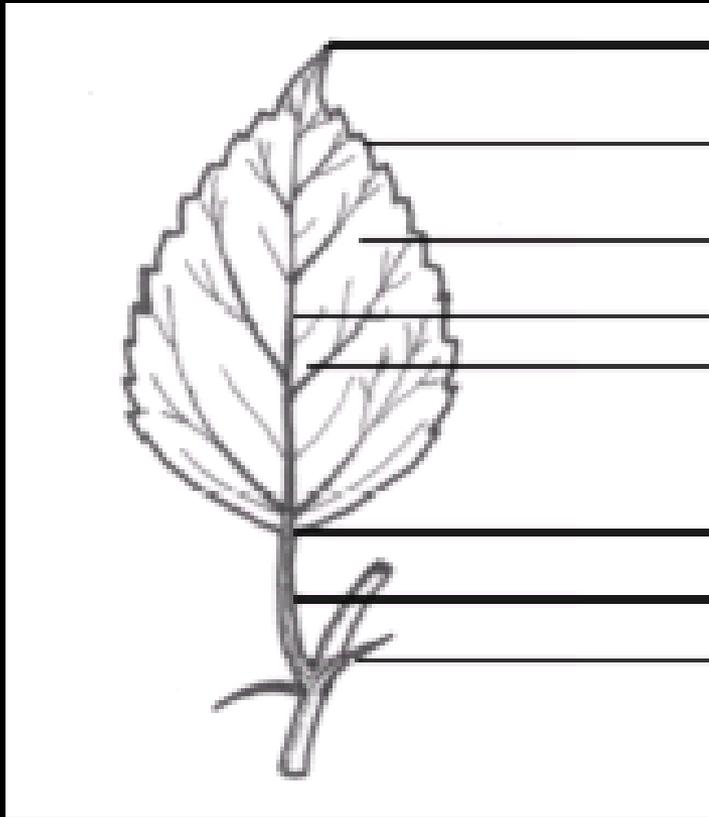
e.g.
Ranunculaceae,
Magnoliaceae,
Brassicaceae



Advanced character

e.g.
Cucurbitaceae,
Asteraceae

Parts of a leaf



Leaf tip

Leaf margin

Leaf blade/lamina

Mid nerve

Lateral nerve

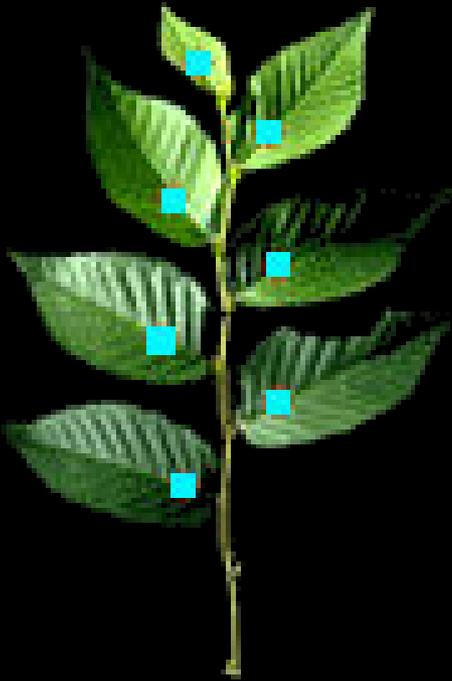
Leaf base

Petiole

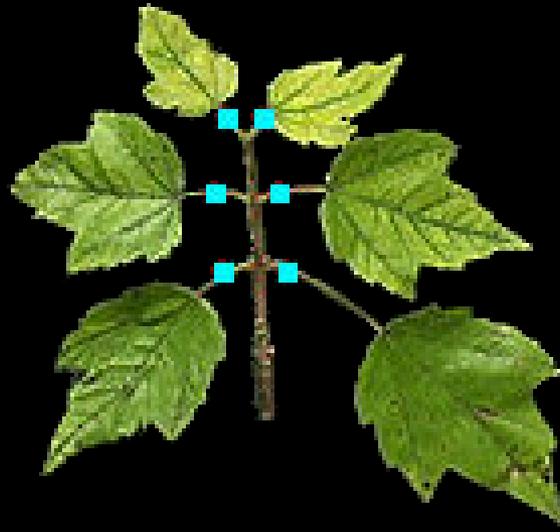
Stipule



Leaf Arrangement- Simple



Alternate



Opposite



Whorled

Alternate leaves

AMARANTHACEAE

ANNONACEAE

BERBERIDACEAE

BURSERACEAE

COMPOSITAE

CONVOLVULACEAE

GRAMINEAE

LINACEAE

ROSACEAE

RUTACEAE

SOLANACEAE

DIPTEROCARPACEAE

Opposite leaves

ASCLEPIADACEAE

APOCYNACEAE (rarely opp.)

CORIARIACEAE

EBENACEAE (rarely sub-opp.)

GNETACEAE

HYPERICACEAE

LOGANIACEAE

LYTHRACEAE

MALPIGHIACEAE

MELASTOMATACEAE

MYRTACEAE

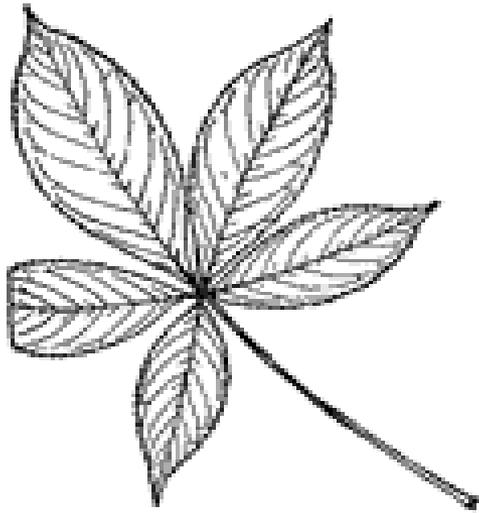
NYCTAGINACEAE

RHIZOPHORACEAE

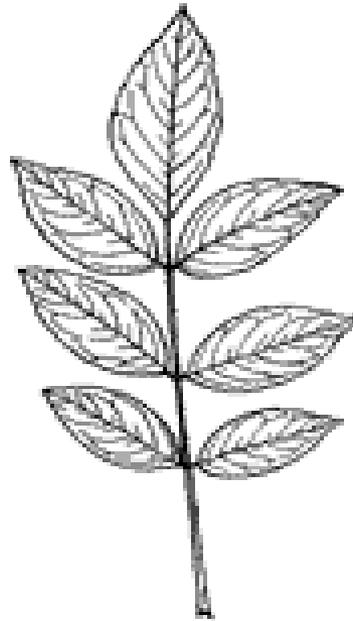
RUBIACEAE

SCROPHULARIACEAE

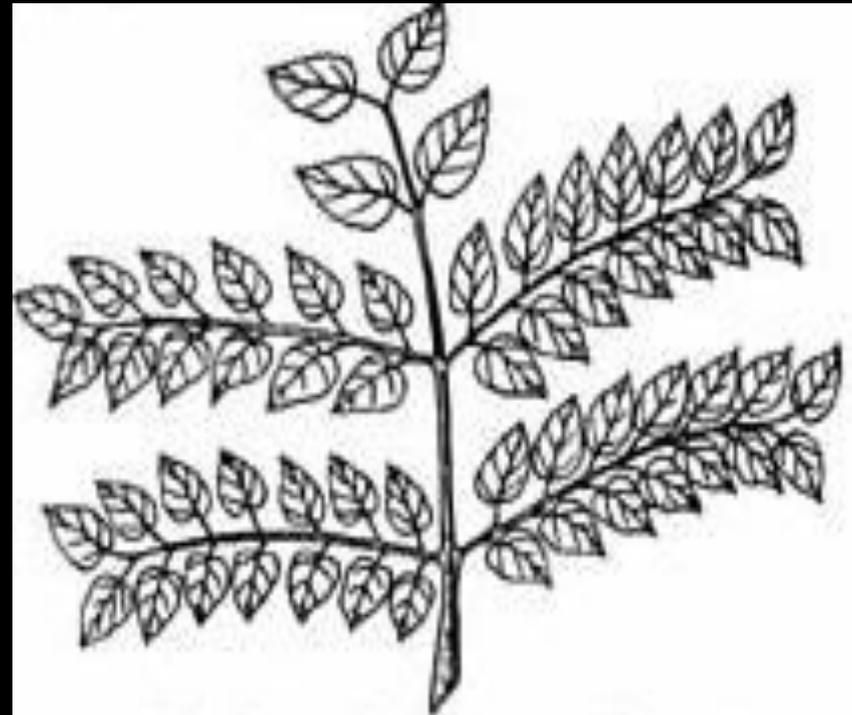
Leaf Arrangement- Compound



palmately
compound

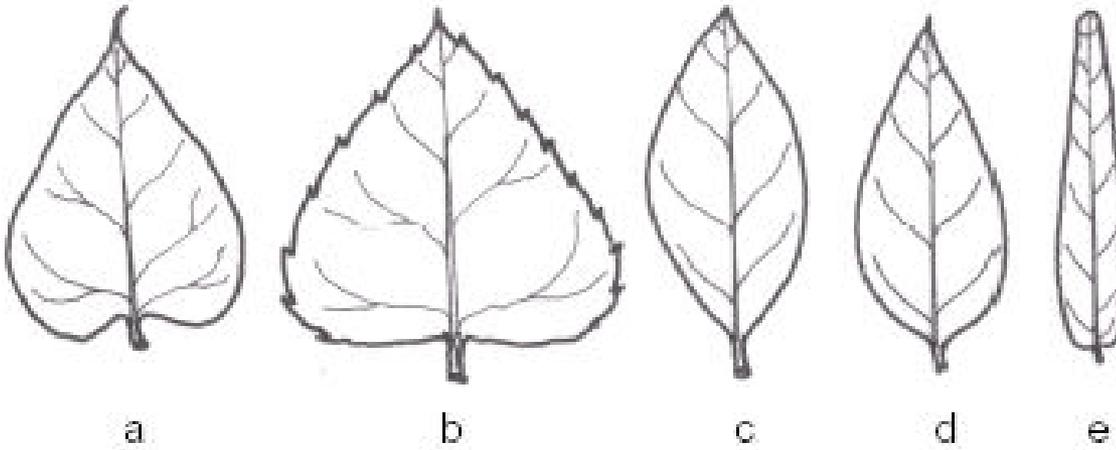


pinnately
compound

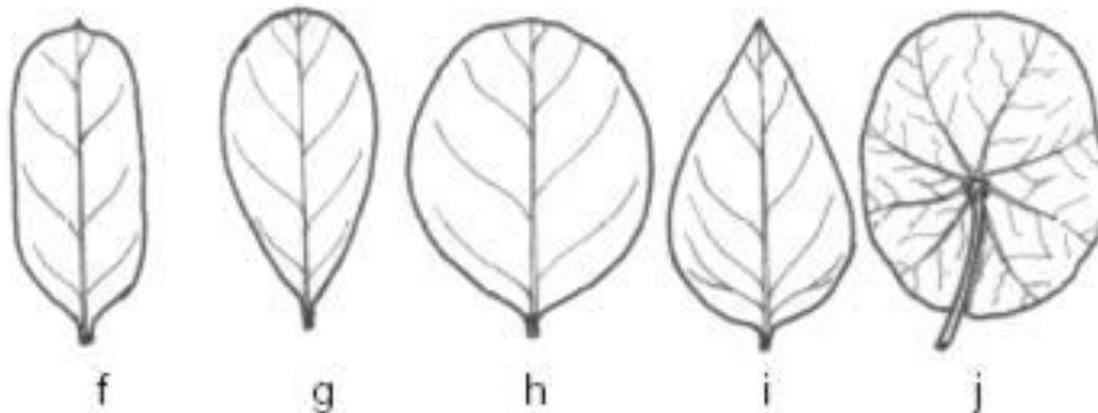


Bi-Pinnately Compound Leaf

Shapes of Leaves

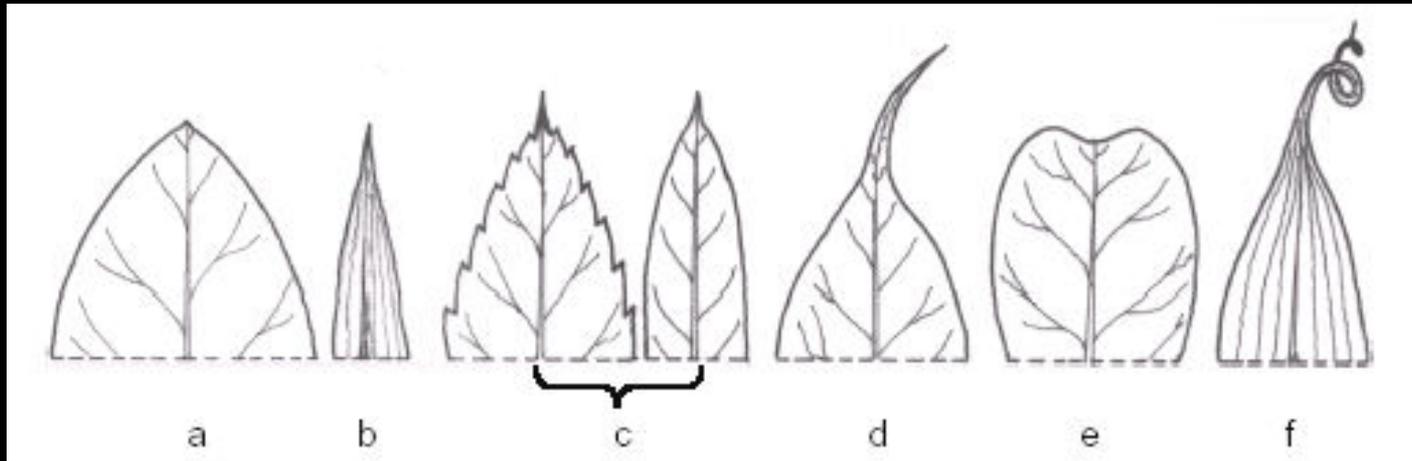


- a - **Cordate**
- b - **Triangular**
- c - **Elliptic**
- d - **Lanceolate**
- e - **Linear**

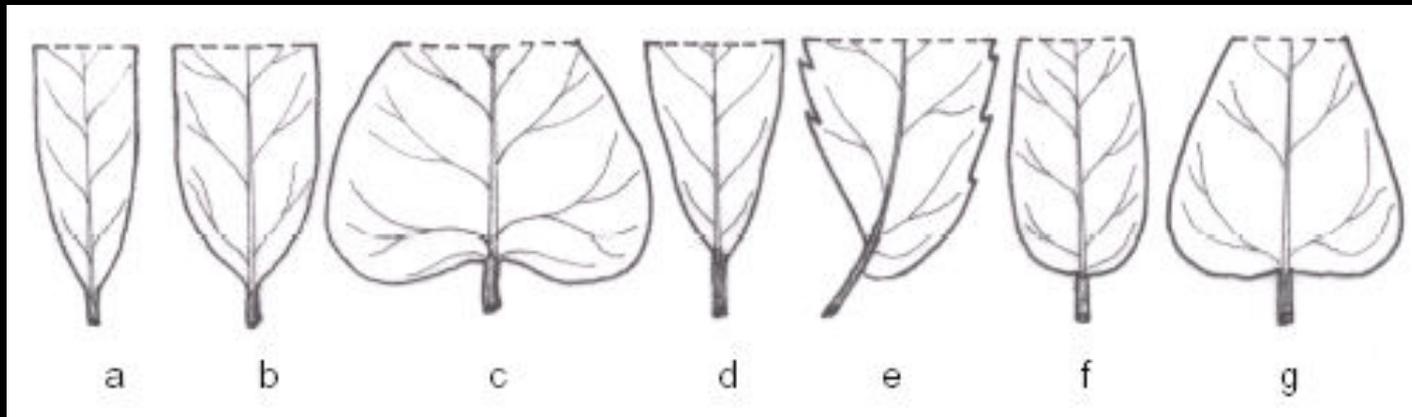


- f - **Oblong**
- g - **Obovate**
- h - **Circular**
- i - **Ovate**
- j - **Peltate**

Apices & bases of Leaves

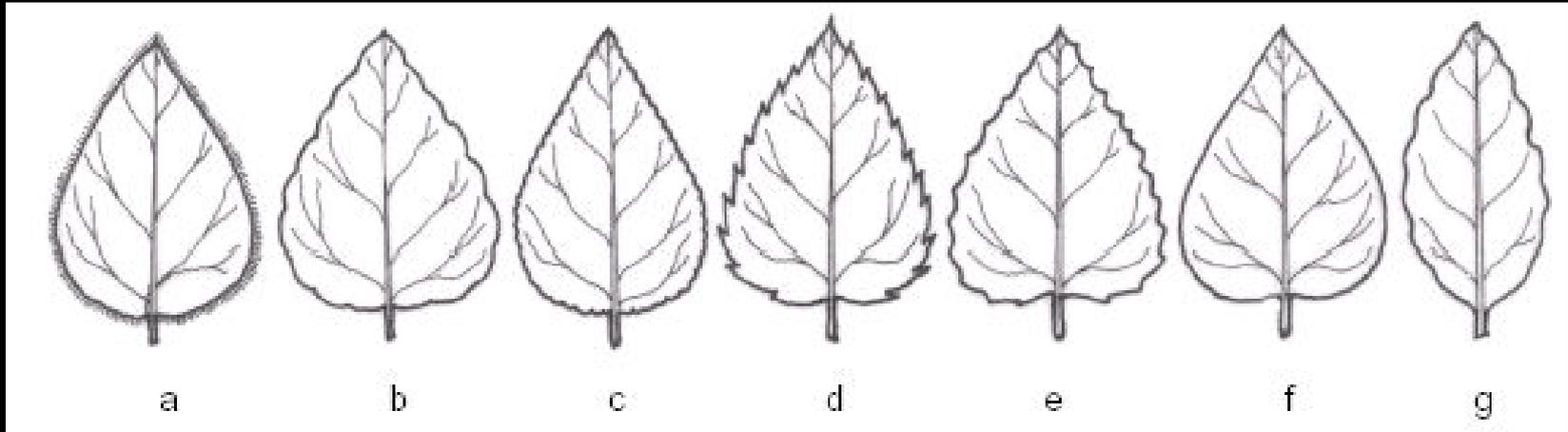


a – Acute; b – Acuminate; c – Cuspidate; d – Caudate; e – Emarginate; f - Cirrhose



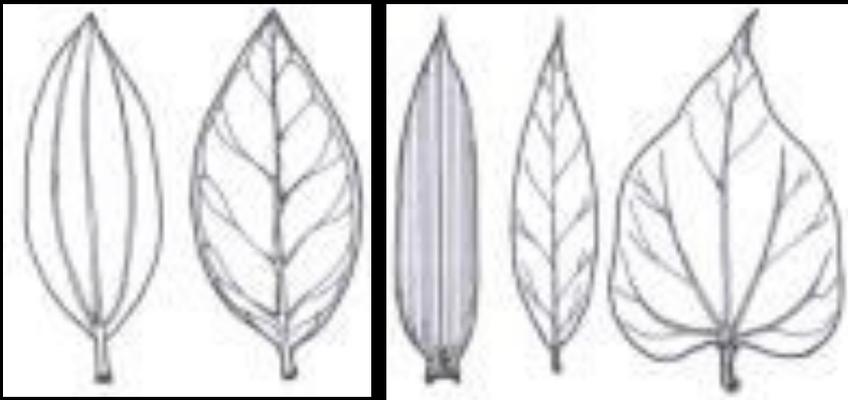
a - Acute; b - Acuminate; c - Cordate; d - Cuneate; e - Oblique; f - Obtuse; g - Truncate

Leaf margins



a – Ciliate; b – Crenate; c – Crenulate; d – Serrate; e – Dentate; f – Entire; g – Undulate

Venation of Leaves



a – 3-nerved; b – Joining along margin;
c – Parallel; d – Pinnately nerved;
e – Palmately nerved

Linnaeus' Classification System

Kingdom

Division

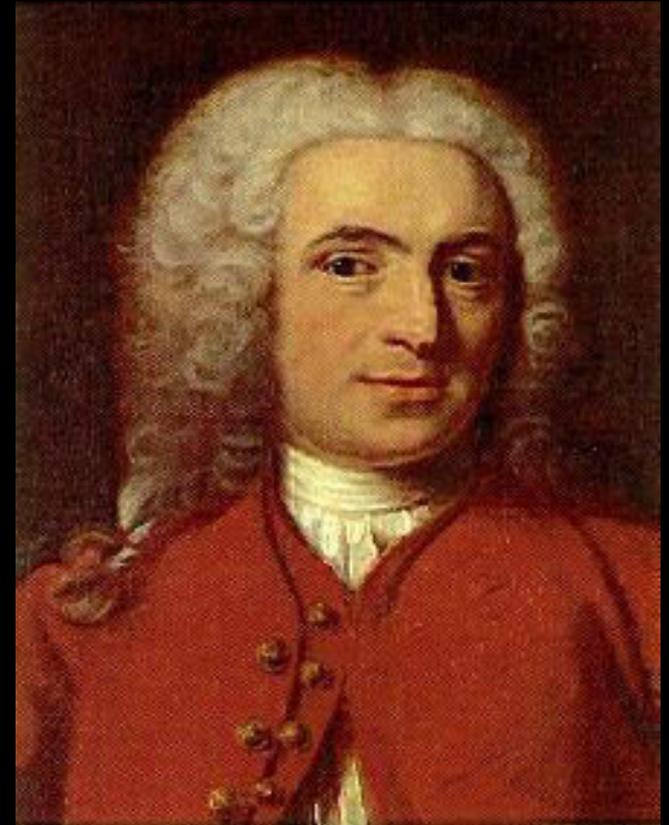
Class

Order

Family

Genus

Species



Carl von Linné
Carolus Linnaeus
(1707-1778)

Characters indicating species epithet

Large showy flowers – *grandiflora* e.g- *Magnolia grandiflora*

Red – *rubra, rubrum* e.g- *Plumeria rubra*

Snow white – *nivea, niveus* e.g- *Rubus niveus*

Black – *nigra, nigrum* e.g- *Solanum nigrum*

Heart-shaped leaves – *cordata* e.g- *Sida cordata*

Broad leaves – *latifolia* e.g- *Anogeissus latifolia*

Six petals – *hexapetala, hexapetalum*

Hairness – *pubescens, hirsuta, tomentosa, hirta, pilosa, ciliata*

Smell – *foetida; odoratissima, fragratissima, aromatica,*

Taste – *dulcis* (sweet), *amarus & picro* (bitter) e.g- *Picrorhiza kurroa*

Winged – *alata, ptero.....* e.g- *Cassia alata, Terminalia alata*

Inflorescence type – *paniculata, racemosa, cymosa, corymbosa*

Special characters : Latex\resin – *laticifera, resinifera, gummifera*

Spines – *spinosa;* e.g- *Lonicera spinosa*

Glands – *glandulifera*

Denoting the place of origin....

- Japan - *japonicum*
- America - *americana*
- India - *indica*
- Srilanka - *zeylanica, ceilanica*
- East - *orientalis*
- North - *borealis*
- South - *australis*
- West - *occidentalis*
- Abbysinia - *abbysinica, ethiopiaca*
- Mysore - *mysorensis*
- Peninsular India - *peninsularis*
- Western Ghats - *ghatensis*
- Silent Valley - *silentvalleyea*

Honouring Botanists

Ligustrum gamblei

Anisochillus henryii

Phyllanthus indo-fischerii

Decalepis hamiltonii

Cycas beddomei

Capparis cleghornii

Janakia arayalpathra

Urticularia nayarii

Buchanania lanzan

Cinnamomum wightii

Wrightia tinctoria

Bauhinia purpurea

Pogostemon gardneri

Kydia calycina

Cornus priceae



Rhododendron rawatii

Characteristics of plant families

Armed:

Capparaceae, Rhamnaceae,
Flacourtiaceae, Bombacaceae,
Balanitaceae, Celastraceae,
Rutaceae, Caesalpiniaceae,
Mimosaceae, Rosaceae, Rubiaceae,
Euphorbiaceae

Latex/Sap present:

Apocynaceae, Asclepiadaceae,
Sapotaceae, Euphorbiaceae,
Moraceae

Leaves aromatic (sweet/foetid smelling):

Rutaceae, Apiaceae, Asteraceae,
Lamiaceae, Lauraceae,
Zingiberaceae

Parasites:

Loranthaceae, Viscaceae,
Cuscutaceae, Santalaceae,
Orobanchaceae, Scrophulariaceae.

Epiphytes:

Orchidaceae,

Aquatics:

Nymphaeaceae, Nelumbonaceae,
Hydrocharitaceae, Trapaceae,
Aponogetonaceae, Lemnaceae,
Alismataceae

Climbers:

Cucurbitaceae, Convolvulaceae

Out with the Old, in with the New!

Old Name	New Name	Type Genus
Compositae	Asteraceae	<i>Aster</i>
Cruciferae	Brassicaceae	<i>Brassica</i>
Graminae	Poaceae	<i>Poa</i>
Guttiferae	Clusiaceae	<i>Clusia</i>
Labiatae	Lamiaceae	<i>Lamium</i>
Leguminosae	Fabaceae	<i>Faba</i>
Palmae	Arecaceae	<i>Areca</i>
Umbelliferae	Apiaceae	<i>Apium</i>

Floral wealth of India

Organisms	Species described		Estimated
	India	World	World
Virus & Bacteria	850	8,050	9,00,000
Algae	6,500	40,000	3,50,000
Fungi	14,500	70,000	10,00,000
Lichens	2,021	13,500	20,000
Liverworts	845	7,500	9,000
Mosses	1,980	7,000	9,000
Pteridophytes	1,200	10,000	12,000
Gymnosperms	48	650	650
Angiosperms	19,400	2,50,000	3,00,000
Total	47,344	4,06,700	26,00,650

Source: Botanical survey of India

India needs more plant taxonomists

(Ali and Chaudhary 2011, *Nature*)

India - rich and varied flora

Documentation and taxonomic enumeration ?

Country's dearth of plant taxonomists

India's many outstanding botanists, familiar with regional flora, must help plant taxonomists to advance molecular-systematics studies and improve the evolutionary understanding of the country's rich biodiversity.

Characters to note during field excursions

Habit: Tree, shrub, herb, grass

Habitat: Riverbed, steep slope,

Flower/Inflorescence: Flower colour,
Number, condition (free/fused)
Sepals: number, colour
Bracts: present/absent
Stamens: Numbers
Ovary: superior/inferior

Leaf: Simple, compound

Arrangement: alternate/opposite
margins, venation

Fruit: Type: Berry/pod/capsule/samara

Special characters: Thorns, Spine, Latex, Odour

TREES OF DELHI

Pradip Krishen



'Marvellous . . . it makes one feel more at home not only in Delhi but in the world at large'

—Vikram Seth

PRADIP KRISHEN

TREES OF DELHI

A FIELD GUIDE



A Personal Field Guide

Floral Gallery of Himalayan

Valley of Flowers

and Adjacent Areas.



K.R. Keshava Murthy

Books

A text book of Botany(Angiosperms)- Singh, Pandey & Jain

A handbook of Systematic Botany- M.P. Shiva

Taxonomy of Angiosperms- V. N. Naik

Forest Flora- Kanjilal

Local / regional floras

www.flowersofindia.in
www.theplantlist.org



Thank you...