INTRODUCTION TO PLANT TAXONOMY

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Plant Taxonomy (Bio 204)

PLANT TAXONOMY

QUIZ 1st and 2nd	10 *points*
Field Collection	*5 Points*
MIRDTERM	*20 points*
PRACTICAL	*20 points*
FINAL	40 *points*

LEARNING OBJECTIVES

STUDENTS WILL BE ABLE TO LEARN ABOUT;

1. What the course is all about.

2. Fact about plants taxonomy

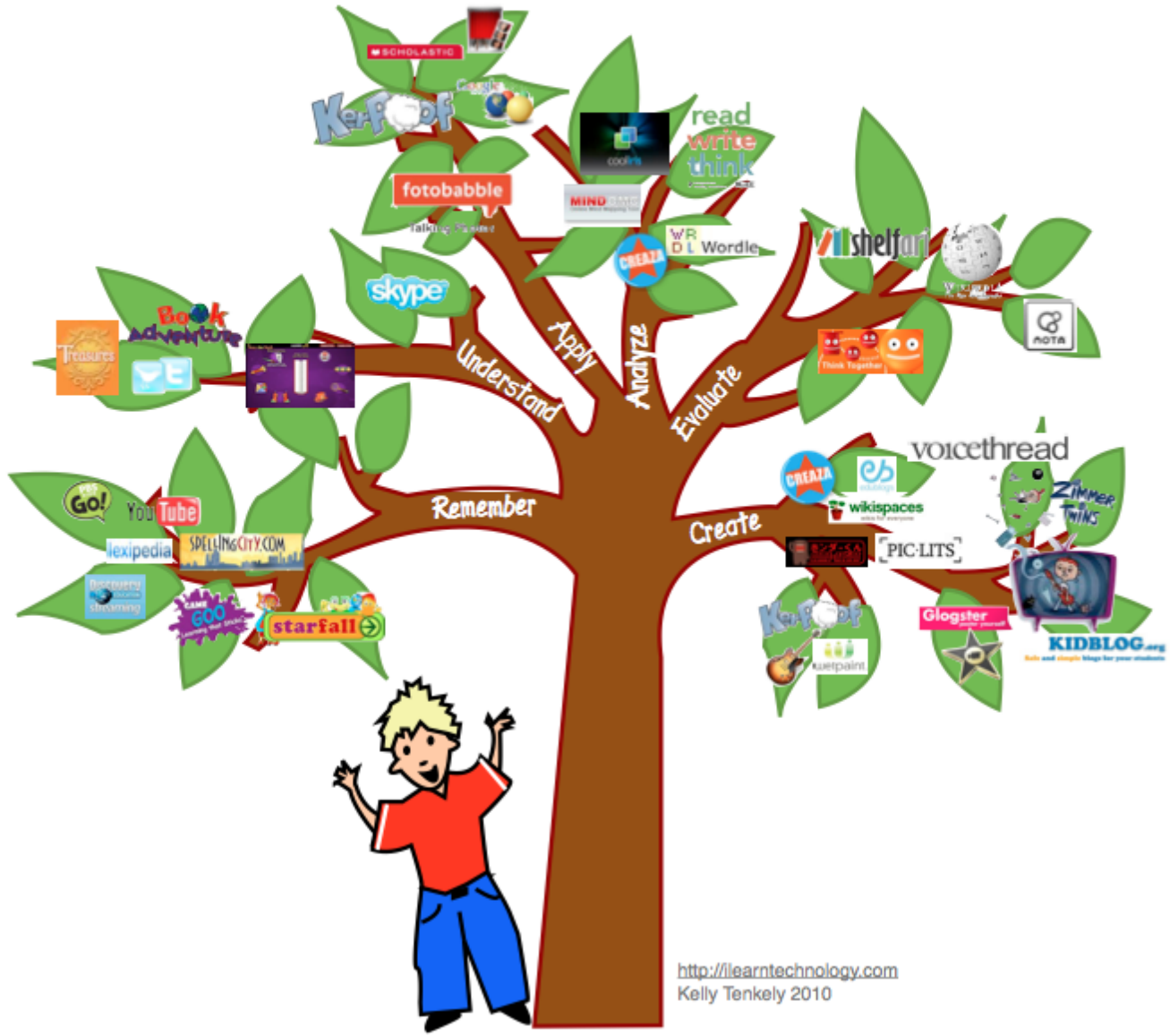
3. Taxonomy and Systematic

4. Basic components of plant taxonomy / plant systematics

5. Types of taxonomy

5. Role and Importance of Taxonomy and taxo

Can you...


Remember
Understand
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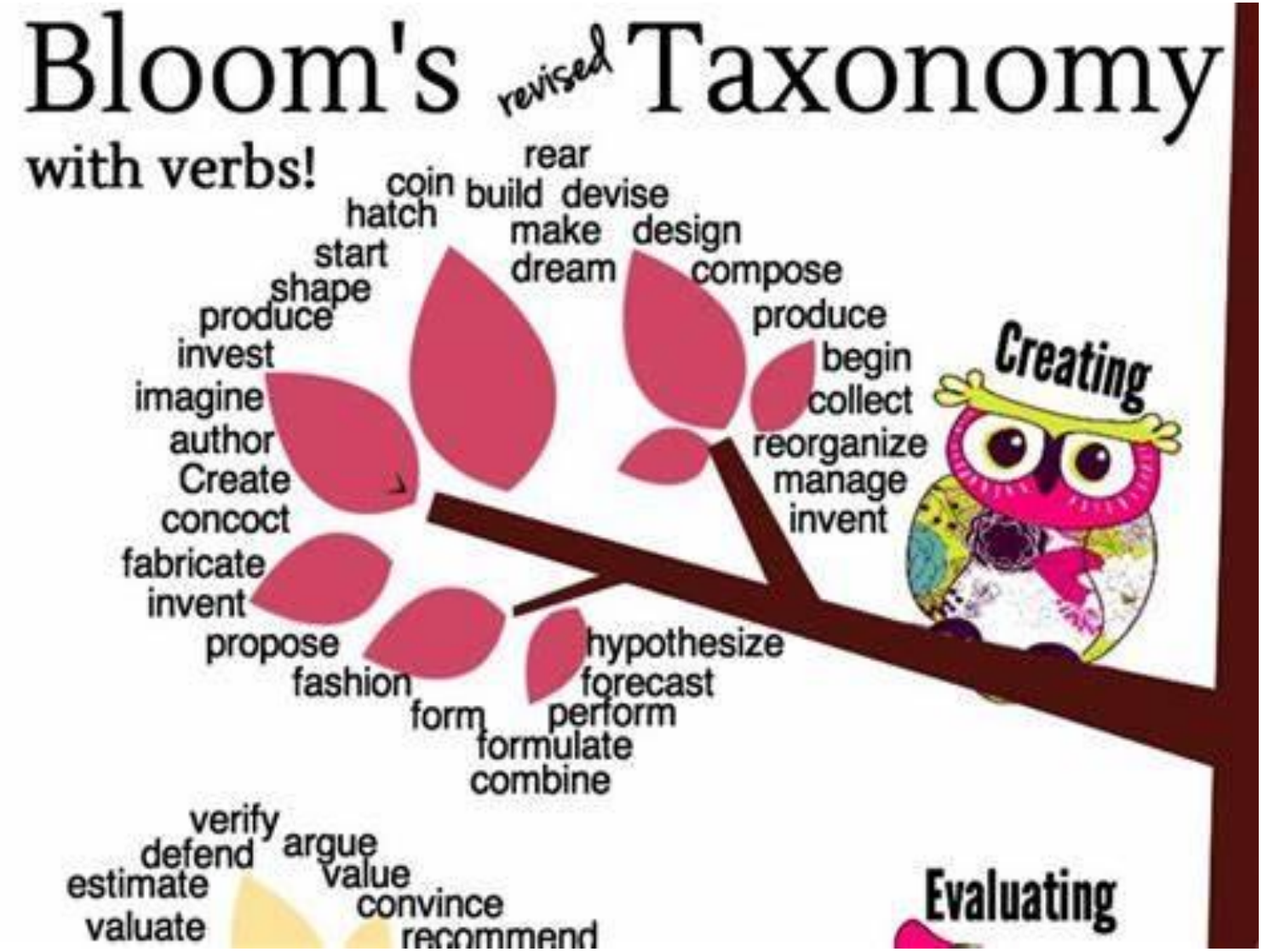
Kelly Tenkely 2010


Bloom's revised Taxonomy
with verbs!
rear
coin
build
devise
hatch
make
design
start
dream
compose
shape
produce
produce
invest
begin
imagine
collect
author
reorganize
Create
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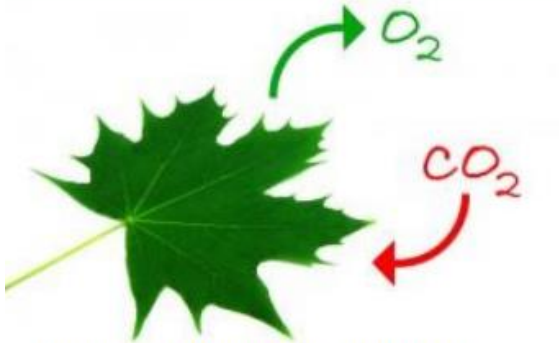
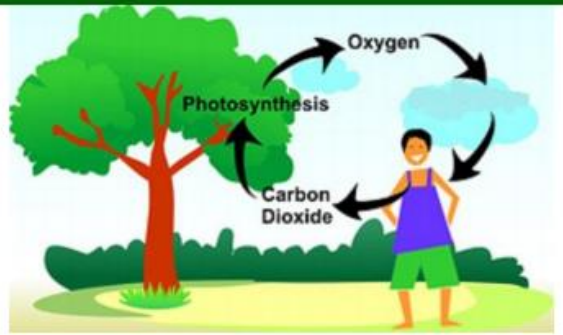
Evaluating

We study plants because:



- Plants produce oxygen. We breathe oxygen. We cannot live without oxygen.



- Plants convert Carbon dioxide gas into sugars through the process of photosynthesis.

- Every things we eat comes directly or indirectly from plants.

- Plants provide fibres for paper or fabric.

- Many chemicals produced by the plants used as medicine.

- Study of plants science helps to conserve endangered plants.

- Study of plants science helps to learn more about the natural world

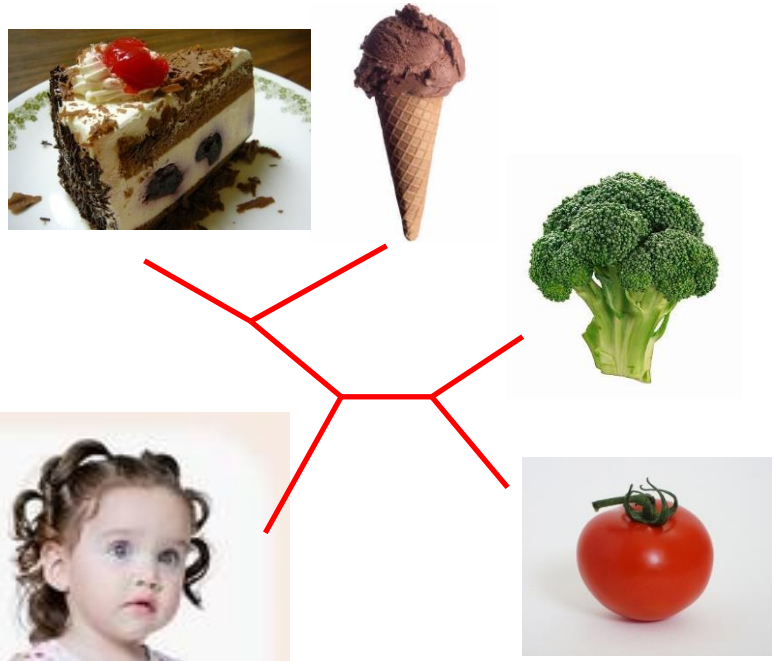
- Plants can be a source of biofuels. Sugars, starches and cellulose can be fermented into ethanol. Ethanol is used as fuel.

- We have millions of different kind of plants, animals and microorganism. We need to scientifically identify, name and classify all the living organism

Common misconception

Taxonomy is very difficult and specialized

FACT: Taxonomy is part of the cognitive process.



Txonomy (or systematics) is basically concerned with the classification of organisms. Living organisms are placed in groups on the basis of similarities and differences at the organismic, cellular, and molecular levels.

Why we need Latin names?

Common names ??

NOT UNIVERSAL!!

Problems:

1. They are too many!!!

Nymphaea alba L. has:

15 in English
44 in French
105 in German
81 in Dutch
221 in Russian

…over 5000 common names worldwide!

2 Many common names may exist for the same species in the same language in the same or different localities.

e.g. Cornflower, bluebottle, bachelor‘s button and ragged robin all refer to the same species *Centaurea cyanus* L.

Centaurea cyanus L.

3. Latin Names are Understood by all Taxonomists

4. Different plants may have the same common name

Often, two or more unrelated species are known by the same common name.

e.g. Bachelor‘s button, may thus be *Tanacetum vulgare* L., *Knautia arvensis* Coult. *or Centaurea cyanus* L.

Tanacetum vulgare L.

Knautia arvensis Coult.

Centaurea cyanus L.

What is a Plant? A Traditional View

A. *Plants are characterized by their features or characters & character states*

- *Any observable attribute*

- *Chemical, anatomical, morphological*

Plant character states

- *Green*
- *Non-motile*
- *Eukaryotic*
- *Multi-cellular*
- *Walls of cellulose*
- *Alternation of generations*

BACKGROUND

Variation is the rule of nature. The most impressive aspect of the world of life is its diversity and the uniqueness of its components.

No two sexually reproducing populations are the same, nor are any two populations, species, or higher taxa.

THERE ARE FOUR MAIN TYPES OF RELATIONSHIP BETWEEN PLANTS

- ✓ *Phyllogenetic relationship or relationship of decent which indicates the degree to which two individuals are related to a common ancestor.*

- ✓ *Relationship of similarities or phenetics relationship, this indicate the degree to which two individuals look alike not only in their external morphology but in all their other facts e.g. anatomy.*

- ✓ *Special geographic relationship which indicate how closely to which two individuals are situated to each other.*

- ✓ Tropic relationship; Are those that link two or more organisms where one acts as a predator or entity that feeds on another, and another functions as a food or entity on which they feed.

TERMINOLOGIES

Taxonomy: Derived from the Greek words

taxis (=arrangement)

and *nomos* (=law).

The term ‘taxonomy’ was coined by A.P. de Candolle in 1813.

Augustin Pyramus de Candolle in 1813

Taxonomy: May be define as the study and description of variation plants, the investigation of the causes and the consequences of variation and the manipulation of data obtain to produce a system of classification

Classification: Is define as the production of logical system of categories each containing a number of plants which allows easier identification .

Identification: *Is the naming of plants by reference to an existing classification.*

Taxon (Pl taxa): Is any taxonomic grouping such as phylum, family or a species.

Description is a statement of characterestics.

A flora: *Is the plant life of any giving area.*

A Flora: Is a book describing the flora of a given area.

Floristics: Is the study of floras including the preparation of Flora.

***Deme**: A group of related plants of a particular taxon.*

***Tepodeme:** A deme occurring withing a specified geographical area.*

***Ecodeme:** A deme occurring withing a specified kind of habitat.*

***Phenodeme:** A deme different from others phenotypically*

***Plastodeme:** A deme different from others phenotypically but not genotypically*

Experimental taxonomy: Is the study of plants from the stand points of population not only individual.

Biosystematics: is the study of diversification and relationships of plant forms of extinct extant.

The word systematics is derived from the Latinized Greek word ‘systema’ applied to the system of classification developed by Linnaeus in the 4th edition of his historical book ***Systema Nature*** in 1735

Different workers have tried to define taxonomy from their view point. Some of the accepted definitions of taxonomy are as follows:

According to **Mason** (1950) taxonomy is the synthesis of all the facts about the organisms into a concept and expression of the interrelationship of organisms.

Harrison (1959) defined taxonomy as the study of principles and practices of classification, in particular in methods, the principles and even in part, the result of biological classification.

Simpson (1961) defines taxonomy as the theoretical study of classification, including its bases, principles, procedures, and rules.

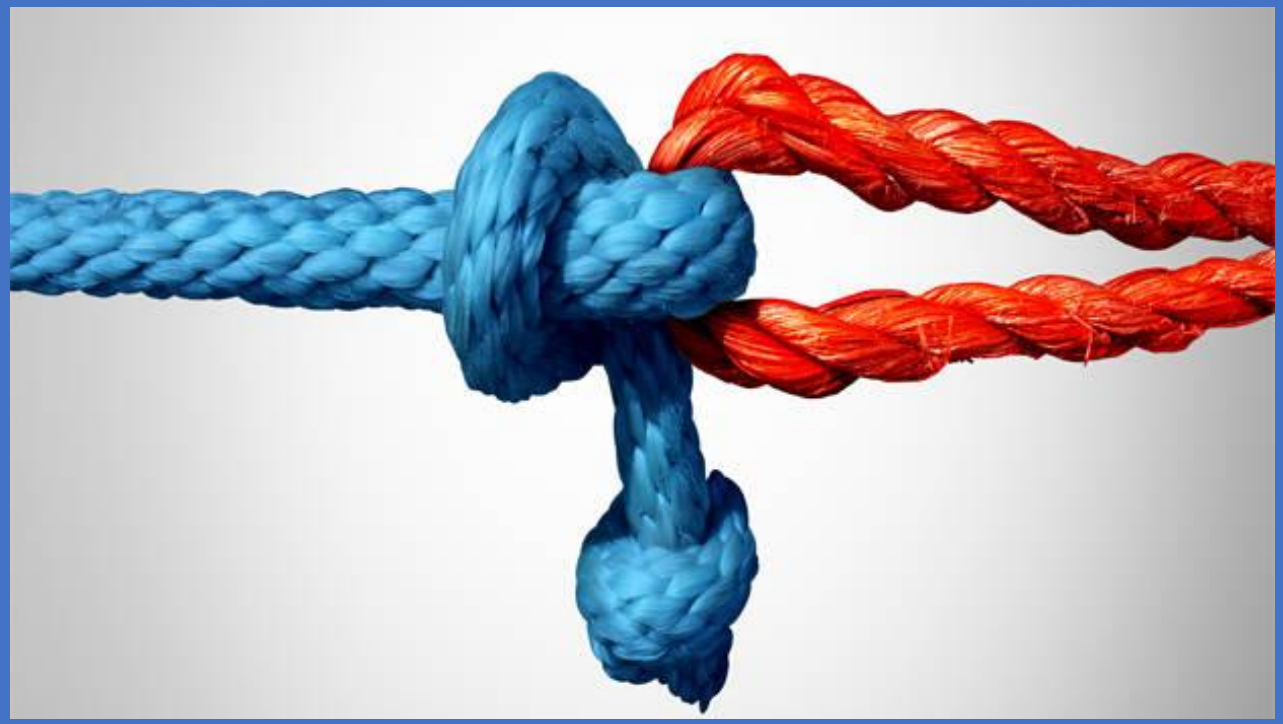
Heywoods (1967) defined taxonomy as the way of arranging and interpreting information.

Blackwelder (1967) explains it as the day to day practice of handling different kinds of organisms. It includes collection and identification of specimens, the publication of data, the study of literature and the analysis of variations shown by the specimens.

According to Johnson (1979), taxonomy is the science of placing biological form in order.

Christoffersen (1995) defines taxonomy as the practice of recognizing, naming and ordering taxa into a system of words consistent with any kind of relationships among taxa that the investigator has discovered in nature.

TAXONOMY AND BIOSYSTEMATIC



- ✓ *Kapoor (1998) considered that the relationship of taxonomy to systematics is somewhat like that of theoretical physics to the whole field of physics.*

- ✓ *Taxonomy includes classification and nomenclature but systematics includes both taxonomy and evolution. In simple terms, actually there are two parts of systematic.*

- ✓ *The first part, taxonomy, is concerned with describing and naming the different kinds of organisms, whether exist or extinct. This science is supported by institutions holding collection of organisms which are curated with relevant data.*

- ✓ *The second part of systematics, evolution, is concerned with understanding just how all these kinds of animals arose in the first place and what processes are at work today to maintain or change them.*

- ✓ *Systematics uses taxonomy as a means to understand organisms.*

- ✓ *Systematics elucidate the new methods and theories that can be used to classify species based on similarities of traits and possible mechanisms of evolution, a change in gene pool of a population over time.*

- ✓ *According to Wagele (2005), although theoretically the term taxonomy and systematic could be synonyms, in practice, however, differences in uses are obvious and a systematist and a taxonomist can conduct different analyses.*

Modern Taxonomy (New Systematics)

The term new systematic was coined by Julian Huxley (1940). New systematic is systematic study which takes into consideration all types of characters.

Besides classical morphology, it includes anatomy, cytology, physiology, biochemistry, ecology, genetics, embryology, behaviour etc. of the whole population instead of a few typological specimens.

- ✓ *In contrast classical taxonomy is based on the study of mainly morphological traits of one or a few specimens with supporting evidences from other fields. New systematics is also called population systematics and biosystematics*

- ✓ *It strives to bring out evolutionary relationship amongst organisms*

1. *New systematic is based on the all types of variation in the species.*

2. *Along with morphological variations, other investigations are also carried out to know the variety of traits.*

3. *Delimitation of species is carried out on the basis of all types of biological traits. It is also called biological delimitation.*

4. *Traits indicating primitiveness and advancement are found out.*

5. *Inter-relationships are brought out.*

6. *Species are considered as dynamic unit*

TAXONOMY AND SYSTEMATIC

1. Taxonomy is the most important branch of systematic and thus systematics is a broader area than taxonomy.

2. Taxonomy is concerned with nomenclature, description, classification and identification of a species, but systematics is important to provide layout for all those taxonomic functions.

3. Evolutionary history of a species is studied under systematics but not in taxonomy.

4. The environmental factors are directly related with systematics but in taxonomy it is indirectly related.

5. Taxonomy is subjected to change in course of time, but systematics is not changed if it was properly done.

TAXONOMY

The taxonomy is based on observable morphological characters with normal individuals considered to be expression of the same while their variations are believed to be imperfect expressions.

Classical taxonomy originated with Plato followed by Aristotle (Father of Zoology), Theophrastus (Father of Botany) up to Linnaeus (Father of Taxonomy) and his contemporaries.

1. *Species are delimited on the basis of morphological characteristics.*

2. *Only a few characters are employed for classification.*

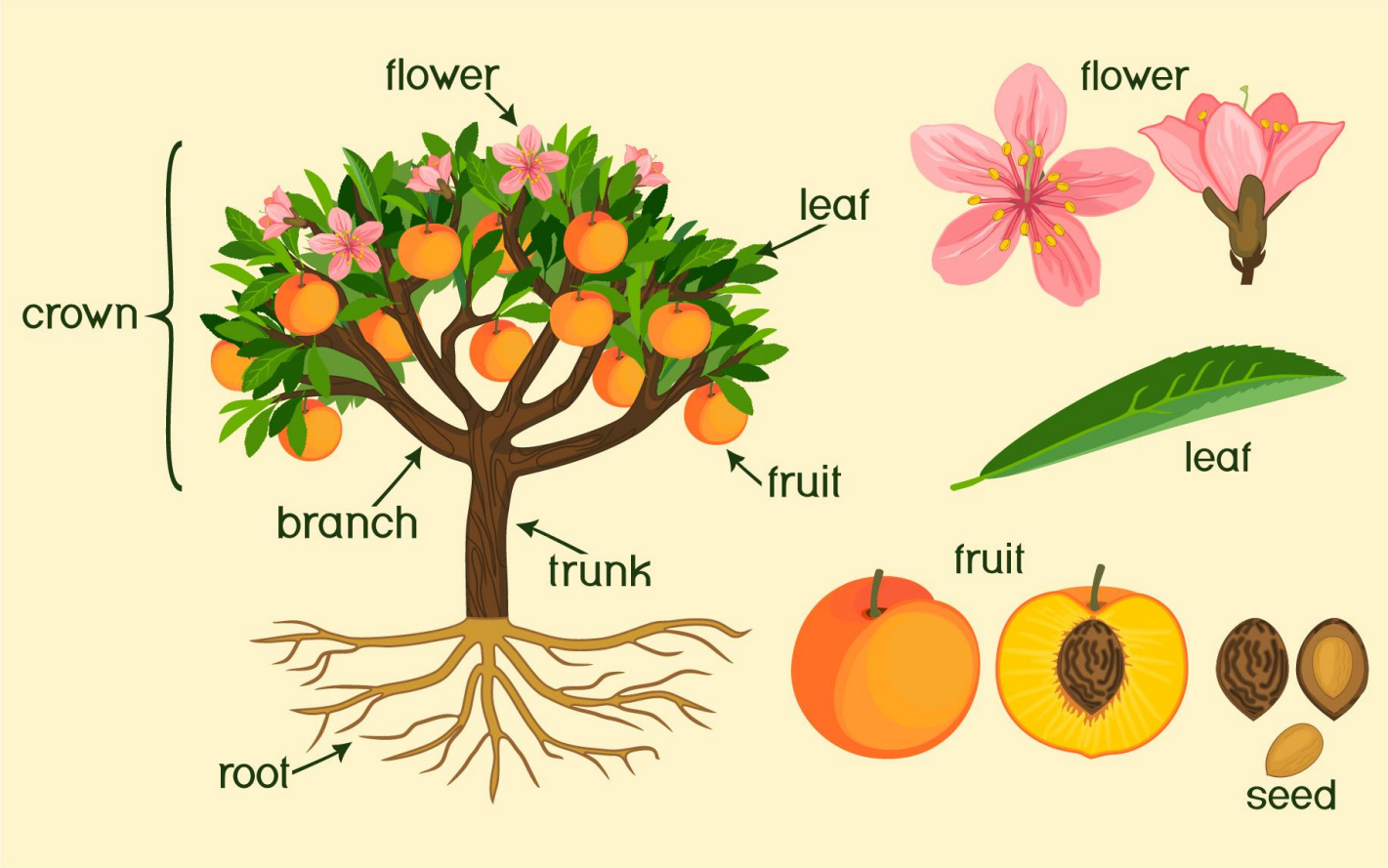
3. *A few individuals or their preserved specimens are used for study. It is called typological concept.*

4. *Species are believed to be static.*

5. *Species is the centre stage of study. Its subunits are not important*

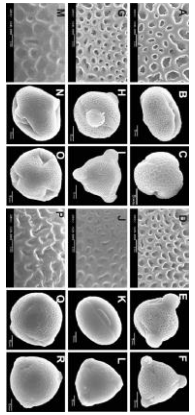
TAXONOMIC CHARACTERS

1.Morphology
2.Plant growth
3.habit, 4.leaf arrangement 5. shape, 6. flower
7. fruit characteristics.

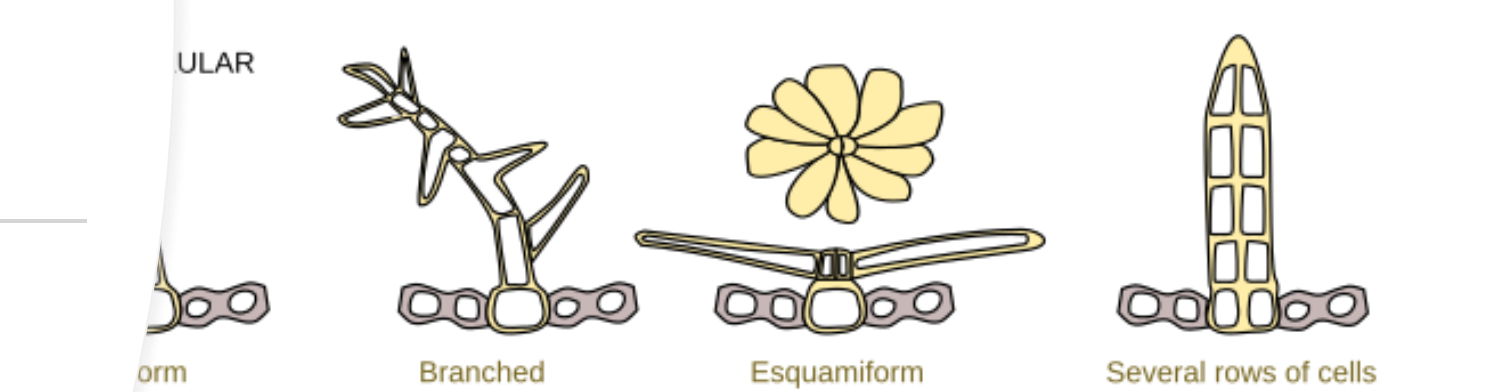


SYSTEMATICS CHARACTERS

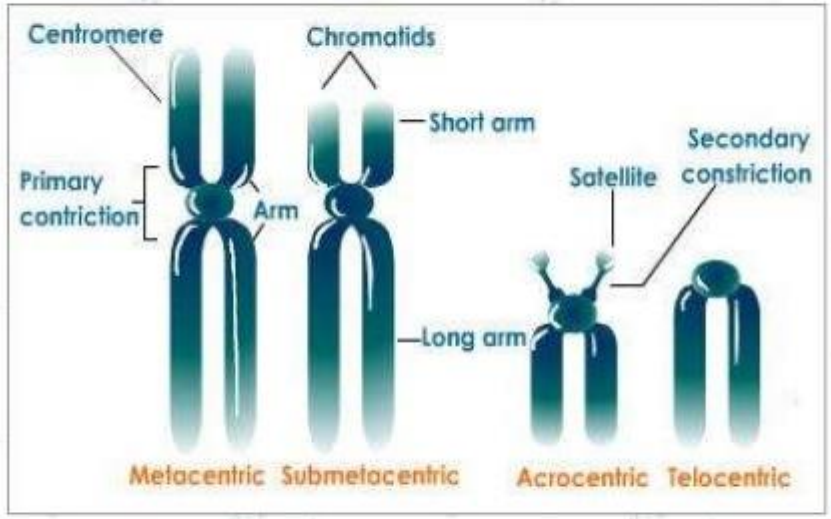
Palinology Pollen characteristics including size, shape, aperture and exine sculpture



1. Plant Anatomy Eg Vascular bundle, epidermis including trichomes and stomata.



2. Cytology The chromosome number, structure and habit



3. Chemical contents of plants

AIMS AND TASKS OF TAXONOMIST

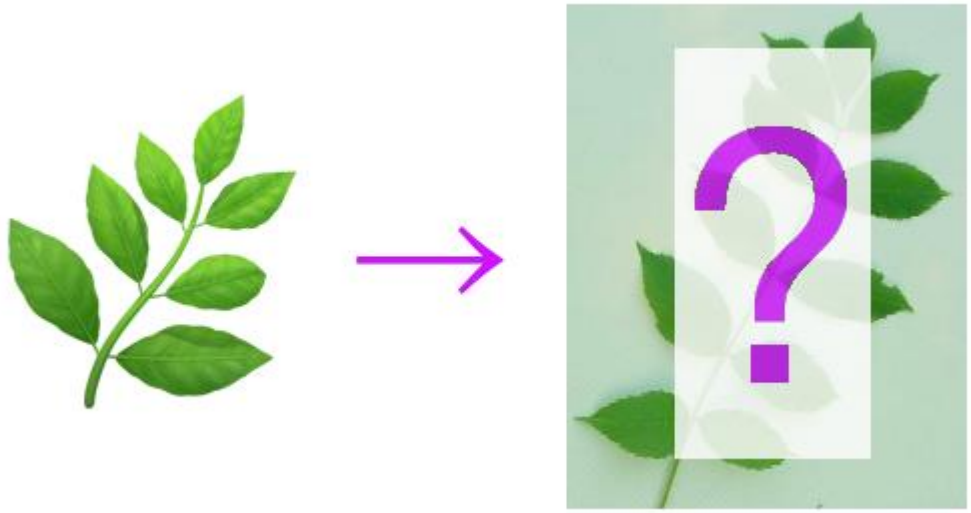
1. *To catalogue and preserve the biodiversity collected from different sources.*

2. *To provide scientific name to the taxa, so that one can recorded, store and retrieved when needed.*

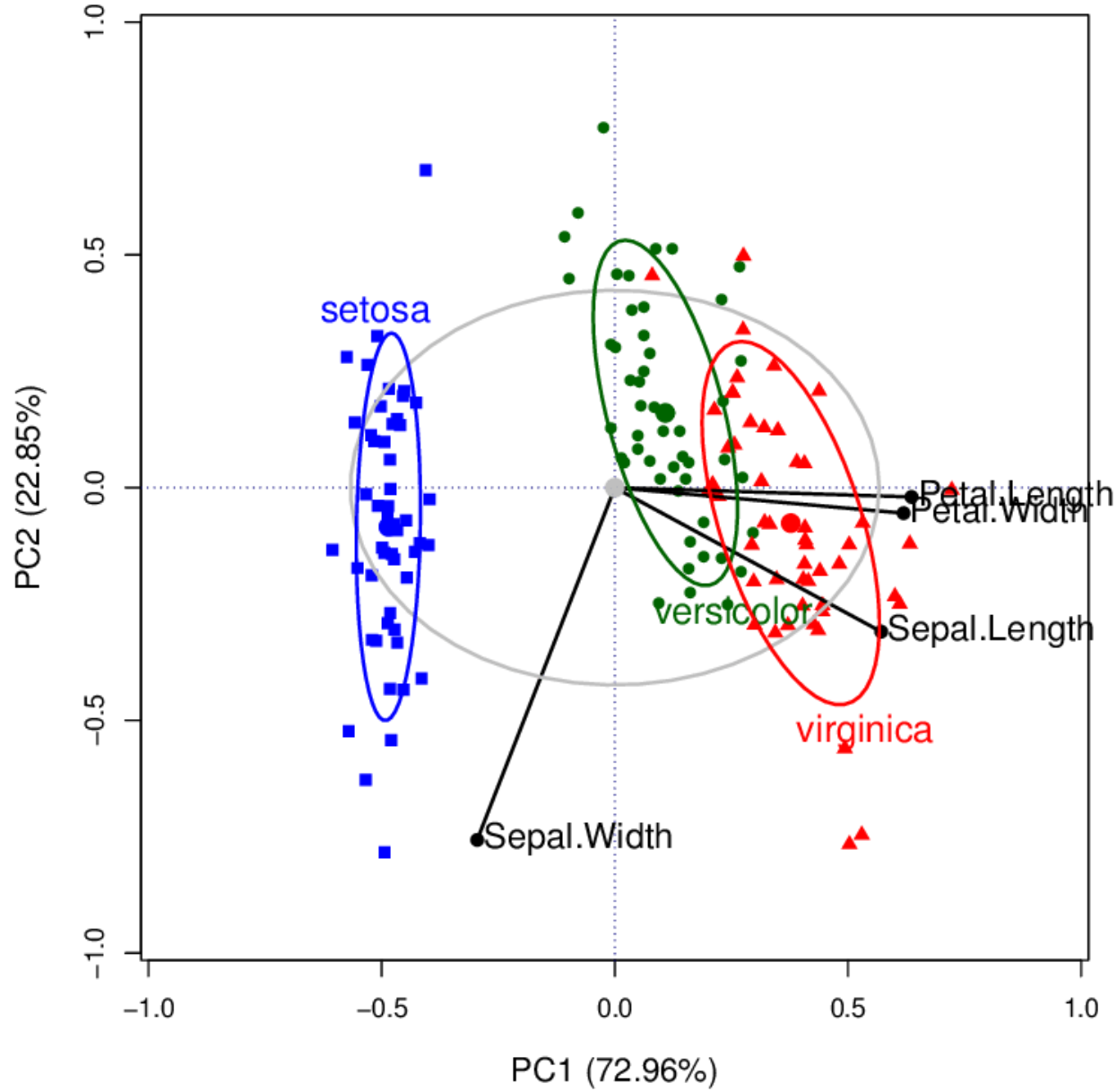
3. *To establish a set of rules to choose characters for arranging species into hierarchic classification.*

4. *To study the genetic and phylogenetic relationships among life forms.*

5. *To differentiate the variations among plants and arranged them on the basis of their relationships or associations.*



6. *To make extensive use of computer to analyze and differentiate the intra and interspecific relationships among organisms.*


setosa
versicolor
virginica
Petal.Length
Petal.Width
Sepal.Length
Sepal.Width
PC1 (72.96%)
PC2 (22.85%)
1.0
0.5
0.0
−0.5
−1.0
−1.0
−0.5
0.0
0.5
1.0

What kinds of questions do plant taxonomists study?

They study questions such as:

- What plant is this? What is its name? How should it be classified?
- What are some similar plants?
- What kinds of plants grow on Earth (biodiversity)?

- How many different kinds (species) of plants are there?
- Which plants grow in this area, and why (distribution)?
- Does this plant have any special/unique properties (i.e., is it edible, poisonous)?
- How did this plant evolve? To what other plants is it related?

IMPORTANCE OF TAXONOMY

1. It gives us a vivid picture of the existing organic biodiversity of our earth.

2.It provides much of the information permitting a reconstruction of the phylogeny of the life.

3.It reveals numerous evolutionary phenomena and thus makes them available for casual study by the other branches of biology.

4.It supplies, almost exclusively, the information needed for entire branches of biology.

5. It is indispensable in the study of ecologically and medically important organisms.

6. It supplies classifications which are of great heuristic and explanatory value in most branches of biology like evolutionary biology, biochemistry, immunology, ecology.

BASIC PRINCIPLES OF PLANT TAXONOMY / PLANT SYSTEMATICS

- ✓ Plant collection, Preservation and Documentation
- ✓ Plant Structure (Taxonomic Terminology, Taxonomic description of external and internal morphology
- ✓ Taxonomic Identification
- ✓ Scientific Nomenclature / Botanical nomenclate : Nomenclature deals with the application of a correct name to a plant or a taxonomic group. Scientific names are necessary because the same common name is used for different plants in different areas of the world.
- ✓ Taxonomic Classification (History and Systems of Plant Classification)

- ✓ Taxonomic evidences / Source of data (Morphology, Anatomy, Embryology, palynology, Micromorphology, Chemistry, DNA etc.) in plant taxonomy

TYPES OF TAXONOMY

- ✓ Alpha (α) Taxonomy / classical taxonomy:- It involves description and naming of organisms. It is the parent of other types of taxonomy. Plant collection, Preservation and Documentation.

- ✓ Beta (β) Taxonomy: - In addition to morphological description, it also involves consideration of affinities and their inter-relationship between separate group of species.

- ✓ Gama (ɣ) Taxonomy: - It is concerned with description, inter-relationship, and evolution of one species from the other.

- ✓ Omega (Ω) Taxonomy: - It is the modern experimental taxonomy in which the taxonomic activities have been enriched with data from ecology, phyto-chemistry, phyto-geography, cyto-genetics, and physiology coupled with adequate computation.

References

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