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* Identification

Identification is the basic process of classification. But it is not the same as naming of an individual.

Identification means the determination of the group to which a specimen belongs.

- The process of identification usually includes a direct comparison of an unknown specimen with the already classified and named taxa.
- The process also includes the use of various types of keys.

Identification may be defined as,

"The determination of similarities or differences bet^n two specimans."

or

"The determination of a name for a particular specimen in relation to an already established system of identification."

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* Nomenclature

Any object that becomes known to human after giving a name.
"The art of naming an object is known as nomenclature."
or
"Assignment of definite names to plants is called plant nomenclature."

- Nomenclature has two main purposes,
  (a) As an aid to communicate
  (b) To indicate relationship.

- In the present botanical world, the nomenclature involves the principles governed by rules formulated and adopted by International Botanical Congresses (IBC).
- The rules developed by IBC are listed formally in a code called International code of Botanical Nomenclature (ICBN).
- The major goal of ICBN is to provide one correct name for each taxon.
- Taxa (singular, taxon) are the taxonomic groups of any rank. The ascending hierarchy of taxa include species, genus, family, order, class and division.

- Nomenclature consists of vernacular or common names and scientific names.

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* Vernacular or common names :-
These are the local or common names given by local people of particular region or language.
These names are easy, short and familier to follow.
Plants are known by different common names in different parts of the world.
Within the same country, people of different states and regions use different common names to a single plant.
e.g. In India Mangifera indica known by different names such as,
In Marathi → Amba
In English → Mango
In Hindi → Aam

Ipomea batata
In Marathi → Ratala
In English → sweet potato
In Hindi → Sakharkand
In Bengali → Meetha Alu
In Telgu → Kandamul

* Scientific Names

These names are based on some criteria and principles which are accepted all over the world.
Such type of names are long which are difficult to remember.
Hence, to make it easy and meaningful binomial system of nomenclature was introduced.

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* Binomial Nomenclature

A swedish botanist "carolus Linnaeus" gave the binomial system in his book "species plantarum."

- "system of nomenclature of plant in which the scientific names consist of two words is called as binomial nomenclature.
- According to this system the plants have two words - Generic and specific word i.e. Genus and species.
  e.g. Mangifera indica, Helianthus annus etc.
  Mangifera is genus and indica is species.

- Binomial nomenclature system follows certain rules such as name of organism is composed of two latin or latinised Greek words.

- Generic name is simple noun which should be come first and start with capital letter
  e.g. Canna

- specific name is descriptive adjective which should come later and start with small letter e.g. indica.

- If generic as well as specific names are hand-written, they must be single underlined seperately. If they are printed must be Italics.

- Both the generic as well as specific names generally does not have less than 3 letters and more than 13 letters.

- Usually the name of author who gave the name to plant is also written in full or abbreviated form after species name of plant.
e.g. Mangifera indica L. (L. stands for Linnaeus).
- Mentioning of authors name after species name is called as citation.

- To avoid the confusion, two generic names are doesn't same from any kingdom where species name can be same when genera are different.
e.g. Mangifera indica, Azadirachta indica, Canna indica, Rosa indica, etc.
- When a single species is described under different authors, then these names are called 'synonyms'.

* Advantages of Binomial Nomenclature
- These names are simple, meaningful, precise and standard as they accepted universely.
- Due to this system confusion and uncertainity created by local or vernacular names is avoided.
- The binomial names are easy to understand and remember, indicate phylogeny of organisms and help to understand relationship bet organisms and group of organisms.

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* classification

→ classification is defined as "the naming of species and their grouping into families, orders, divisions, etc."

or

"classification is the arrangement of groups of plants with particular circumscriptions by rank and position according to artificial criteria, phenetic similarities or phylogenetic relationships."

→ In the simple words, classification is the placement of plants into groups and categories for proper study and effective organization.

Ranks of plant classification

- species, genus, family, order, class and division are the six main ranks of plant classification in an ascending order.
- Each rank has its subcategories, i.e. towards the higher ranks, subform, form, subvarieties, varieties, and subspecies are the subcategories of species.
- subsection, section, and subgenus are the subcategories of genus.
- subtribe, tribe, and subfamily are the subcategories of family.
- suborder is the subcategory of order.
- subclass is the subcategory of class.
- subdivision is the subcategory of division.

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* Principles of and Rules of ICBN (International code of Botanical Nomenclature).

- The ICBN is the set of rules and recommendations dealing with the botanical names that are given to plants.
- Its main aim is that each taxon or taxonomic group of plants has only one correct botanical name and that is accepted throughout the world.

History of ICBN

- Linnaeus in 1737 and again in 1751 (1751) proposed the rules of naming plants in his philosophia Botanica.
- Then in 1813, A.P. de candolle set forth a detailed set of rules regarding plant nomenclature in his Theorie elementaire de la Bbotanique.
- The same rules of Linnaeus, A.P. de candolle and his son Alphonse de candolle were later evolved into present International code of Botanical Nomenclature (ICBN).
- Alphonse de candolle convened the First International Botanical congress in 1867 in Paris. It was attended by the botanists of several countries.
- They adopted a set of rules of plant nomenclature, most of which were proposed by A. de candolle.

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- Subsequent meetings of the International Botanical congress were held in 1982, 1905, 19 and 1910, but a general agreement, regarding the internationally acceptable rules of plant nomenclature, was reached in the meeting of the IBC at cambridge in 1930.
- Lawrence (1951) has discussed the detailed history of the code and quoted that in 1930 at the Cambridge Congress for the first time and a code of nomenclature came into existance that was international in function as well as in name.
- This code is called the International code of Botanical Nomenclature.
- Scientists in the International Botanical Congresses suggest the amendments or modifications which are incorporated in the ICBN on a regular basis.

** Principles of ICBN :-

Following are the six principles of ICBN

1. Botanical nomenclature is independent of Zoological nomenclature.
2. The application of names of taxonomic groups is determined by means of nomenclatural types.
3. The nomenclature of a taxonomic group is based upon priority of publication.

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④ Each taxonomic group with a particular circumscription, position, and rank can bear only one correct name, the earliest that is in accordance with the rules, except in specific cases.

⑤ Scientific names of taxonomic groups are treated as Latin regardless of their derivation.

⑥ The rules of nomenclature are retroactive (पूर्वगामी) unless expressly limited.

* Rules of ICBN about Nomenclature

① Ranks and Endings of Taxa :-

In an accepted system of classification each individual plant is treated as belonging to a number of taxa of different ranks. Generally, the species is considered as the basic unit of classification.

other main ranks in the flowering plants in an ascending order are genus, family, order, subclass and class.

However, ICBN has mentioned 22 different ranks and some standardized grammatical ending (suffixes) for the ranks from division down to the level of genus.

② principle of priority :-

one plant might have been described under different botanical names by various plant

nomenclaturists in different parts of the world. But according to the principles of priority, "ea taxon is to be known by its earliest name." For ex, Cleome gynandra Linn. was first described and named by Linnaeus in 1753. Then he himself changed its name as cleome pentaphylla Linn. In 1824 de Candolle recognized three separate genera (cleome, polanisia and gynandropsis) and named the Linnean genus as Gynandropsis pentaphylla (Linn.).
So according to the 'principle of priority' the oldest name (Cleome gynandra) is the correct valid name.

③ Type method :-
The type method is a legal device to provide the correct name for a taxon.
A type speciman is a herbarium sheet of a specimen which was used by the author to provide its authentic description.
According to Article 9 of ICBN the type of a genus is a species and the type of a family is a genus.

④ Synonyms and Related definations :-

A name rejected due to misuse or difference in taxonomic judgement is called synonym.
A specific or intraspecific name which has priority and is retained when transferred to a new taxon, is called a basionym.

A case in which two or more identical names are based on different types, of which only one can be a legitimate name, is called a homonym.

(5) Citation of Author :-
some of the rules related to author citation are mentioned below,

(i) Original Author :-
The name of a taxon is complete and accurate only when it is followed by a full or abbreviated form of the author(s) who first validly published the concerned name, e.g. Liliaceae and Lilium superbum are incomplete. The complete names are Liliaceae Adans. and Lilium superbum Linn.

(ii) Joint Author :-
If two authors have jointly published the name of a taxon, the names of both the authors should be cited and linked by the words. et or ~~eg.~~ & e.g. Illicium griffithi Hook and Thoms (or Hook et Thoms).

(iii) Rank Alteration :-
When a taxon of a lower rank is upgraded in a higher rank but retains its name, the author's name who published it first should be cited in the bracket. It is to be followed by the name of the author who made the alteration.

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(iv) Name proposal :-
When the name of a taxon is proposed but not validly published by one author, and is later on validly published by another, the word ex should be used as a connecting link bet^n the name of the former author and the name of the subsequent author, e.g. Gossypium tomentosum Nutt ex Seem.

(6) Names of cultivated plants :-
Wild plants brought under cultivation retain their original names.

(7) Effective and valid publication :-
The publication of new names and description are effective and considered valid only when they are distributed in a printed form to the general public or to at least 10 well-established botanical institutions.

(8) Latin diagnosis :-
The diagnosis, details and description of new taxa published before 1st January, 1955 were accepted by ICBN as valid, irrespective of language. After this date the description of any new taxa would be considered valid only if accompanied by Latin diagnosis.

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* Herbarium

→ A collection of dried and pressed plants arranged according to a classification system and available for study or reference is known as herbarium (plural, herbaria).
The name first applied by Linnaeus.
- plant specimens are usually mounted on a sheet of high quality paper.
- properly dried, pressed and identified plant specimens are placed in thin paper folders which are kept together in thicker paper folders and finally are incorporated into the herbarium cupboards in their proper position.
- A herbarium may contain a few hundred locally collected plant specimens kept in a small place, or it may contain millions of them collected from different parts of the world and housed in a very big building.
- The world's largest herbarium is at Royal Botanic Garden, England containing over 5 millian specimens.
- The biggest Indian herbatium is of Botanical survey of India at Kolkata holding over 1.3 million specimens.

Importance of Herbarium (Functions)

some of the general functions of herbaria are mentioned below,

① plant specimens are permanently stored in

herbaria, and therefore they are the maior sources of information about plants and vegetation.

(2) Preserved specimens of herbaria are used in almost all types of taxonomic research.

(3) A picture of all species of a genus, or all the genera of a family may be gathered only in the herbarium.

(4) The classification of the world's flora is based mainly on the herbarium material.

(5) List of the endangered species of any region may be prepared only by herbarium specimens.

(6) Monograph of genera or families are prepared only by the herbarium specimens.

(7) Our knowledge of the distribution of plants, evolution, and several taxonomic problems etc. is based mainly on the herbarium specimens.

(8) Big herberia provide training to young students in herbarium practices.

(9) Exact area, region or location of the occurrence of important plants may be gathered from the herbarium specimens.

(10) Herberia preserve the national plant wealth, and provide scientific information to the public regarding the plants.

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* Important Herbaria of India.

Undermentioned is the list of some major herbaria, alongwith the approximate number of their specimen holdings as mentioned by Naik (1984), and Tiagi and Kshetrapal (1988).

The central National Herbarium, Kolkata ——— 25,00,000 specimens.

2) Herbarium of Forest Research Institute, Dehradun ——— 3,00,000 specimens.

3) Botanical survey of India
i) Eastern circle Herbarium, Shilong ——— 10,00,000
ii) Southern circle Herbarium, Coimbatore ——— 1,75,000.
iii) Western circle Herbarium, Pune ——— 50,000
iv) Northern circle Herbarium, Dehradun ——— 42,000.
v) Central circle Herbarium, Allahabad ——— 45,000.

4) Blatter Herbarium, Mumbai ——— 1,00,000.
5) National Botanical Garden Herbarium, Lucknow ——— 80,000
6) Herbarium of Industrial section, Indian Museum, Kolkata ——— 50,000.
7) Herbarium of Rajasthan Univer., Jaipur ——— 30,000.
8) Herbarium of School of plant Morphology, Meerut College, Meerut ——— 25000.
9) Herbarium of Delhi University, Delhi ——— 15,000.
10) Herbarium of Gwalior ——— 15000

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* Botanical Gardens of India

Botanical Gardens are the institutions that maintain the living plant collections of different varieties of plants.
Following are some of the major Botanical Gardens of India.

① Lalbagh or The Mysore state Botanical Garden, Banglore :-

- This famous botanical garden is considered to be the best in south India for its layout, maintenance and scenic beauty.
- It was named as 'Lalbagh' by Hyder Ali in 1760 because of roses and other red-coloured flowers
- Major Waugh was its director during 1799-1819. He introduced a number of foreign exotic plants in this garden.
- This garden is now a big centre of horticultural activities. It now has well-equipped laboratories for seed-testing and soil-testing and also a grape orchard, tree nursery, fruit ~~he~~ nursery, pot garden, economic garden and a herbal garden.

② Lloyd Botanic Garden, Darjeeling :-

- It was started as a branch of the Royal Botanic Garden Kolkata on a 40 acre land piece in Darjeeling.
- This land was donated by Mr. Willium Lloyd. Therefore it was named as Lloyd B. Garden.

- Since 1910, this garden has become a major institution for the distribution of seeds, bulbs and plants of temparate Himalayas to different parts of the world.
- It has a vast collection of plants from Myanmar, China and Japan.
- ~~Orchi~~
- Orchidarium, Bulbous section, a Rock Garden, succulent section, seed section, Herbarium of over 30,000 specimens and Rosery are its major attractions.

③ National Botanic Garden, Lucknow:-

- This famous Indian Botanical institution was established in new form 1946. It is now known as National Botanical Research Institute, Lucknow.
- It is popularly known as Sikander Bagh, a name given by Nawab Wajid Ali shah after his beloved Begum Sikandar Mahal.
- The present garden and its laboratories are spread over 27 acres of land on the bank of river Gomti.
- popular attractions of this garden are its Rosarium, palm house, cactus house, fern house and orchards of mango, citrus and guava.
- It has well-equipped laboratories of plant morphology, cytogenetics, plant breeding, tissue culture, palynology, plant physiology etc.

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(4) Botanical Garden of Forest Research Institu Dehradun :-

- This garden was established in 1934 under the leadership of C.E. Parkinson.
- It covers an area of about 20 acres in New forest Estate, Dehradun.
- There are about 700 species of plants belonging to about 400 genera and about 100 families in this garden.
- The garden has a greenhouse, a cactus house and a nursery. Its biggest attraction is a big herbarium holding over 30,00,00 plant specimens from all over the world.

(5) Largest Botanical Garden of India :-

- Indian Botanical Garden, Kolkata is the largest and oldest botanical garden of India.
- Formerly it was named as Royal Botanic Garden or Kolkata Botanic Garden.
- It was established in 1787.
- The garden covers an area of about 273 acres of land.
- The Great Banyan tree which is one of the largest trees in size in the world and mentioned also in the Guinees Book of world Records, is the main centre of attraction of this garden. It appears like a miniature forest in itself. over 2880 of its prop roots are actually rooted in the ground.

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- The garden is noted for potato cultivation and introduction of jute, sugarcane, tea, cultivation of ~~tea~~ Aloe, coffee, rubber are some of the achievements of this garden.
- There are over 15000 species of plants in this garden from several countries.

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Introduction

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* Def^n of Taxonomy :-

"Taxonomy is the branch of botany which deals with study of collection, identification, nomenclature, description and classification of plants."

or

"It is defined as the science of the classificati of organisms according to their resemblance and differences.

- However, according to Andrew Sugden (1986) the two terms taxonomy and systematics are synonyms of each other.
- According to them taxonomy is 'the science of classification and relationships of organisms,' and systematics as 'the part of classificatio that involves the arrangement of organisms into related groups."

- A.P. de candolle was the first taxonomist who introduced the term taxonomy.
- Taxonomy helps to man to identify the plants and also classify them into different groups such as medicinal plants, food plants, etc.

* Aims and objectives of Taxonomy

Following are the objectives of taxonomy,

① To know various types of plants on earth with their names, affinities, geographical

distribution, habitat, characteristics and their economic importance.

(2) To demonstrate the diversities of plants and their phylogenetic relationship.

(3) To establish a suitable method for identification, nomenclature and description of plant taxa.

(4) To create an understanding of evolutionary processes.

(5) To train the students of plant sciences in regard to the diversity of plants and their relationship with other biological branches.

* Principles of Taxonomy

- principles of taxonomy is an interesting tool, need to understand concept and meaning bet^n taxonomy, systematic and international code of nomenclature.

- ~~Taxonomy or systematic; two~~
It teaches the qualitative and quantitative techniques that are today used to describe/ identify species and higher level taxa based on the analysis of morphological and DNA sequence evidence.