



Course Title: Flowering Plants Identification & Aesthetic Characteristics

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Course Title: Flowering Plants Identification & Aesthetic Characteristics

Topic: Principles and Rules of Botanical Nomenclature according to ICN [Ranks and Names; Principles of priority, Binomial System; type method, Author citation, Valid publication]

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UNIT-IB

An universal system of plant nomenclature has always been a demand in living world. Men in different parts of the world have been interested in plants and plant products since early part of human civilization as plants were the source of food, shelter and cloth. As a result, plants were named by different people in different languages as a common name. The common names are quite confusing and restricted region wise. No uniform rules ever available for naming the plants. Thus, it is correct to conclude that no plant can be identified on the basis of common/local names and it is must to assign scientific names to the plants according to rule, and there must be a rule for the Plant Nomenclature.

Name is the means of reference to all living and non-living thing. Any object known to human being is given a name to describe and communicate ideas about the object. The name may be different in different languages and at different places.

The art of naming the object is known as **NOMENCLATURE**. And when it comes to naming of plants it is called **Botanical Nomenclature**.

Definition: *The process of naming plants based on international rules proposed by botanists to ensure a stable and universal, uniform system is called BOTANICAL NOMENCLATURE.*

A plant's name is the key to its literature -Van Steenis (1957)

ICBN {International Code of Botanical Nomenclature}

The ICBN is a set of rules on the basis of which plants are given their scientific/botanical names. The code specifies the standards and forms of names to be applied to each taxon of plants.

The foundation of ICBN was laid down by **Linnaeus** when he proposed the elementary rules of naming plants in *Philosophia Botanica* in 1751, wherein he proposed certain principles of nomenclature. Then in 1813, A.P. de Candolle [**Augustin Pyrame de Candolle**] set forth a detailed set of rules regarding plant nomenclature in his *Theorie Elémentaire de la Botanique*. However, the first organised effort to develop a precise and simple system of nomenclature to be used by botanists all over the world were made by **Alphonse- Louis-Pierre Pyrame de Candolle** [son of A.P. de Candolle]. In 1867, Candolle called the **first International Botanical Congress** in Paris, in which a systematic attempt to standardize and decide nomenclatural practices in botany has been made. At this congress, rules proposed by him were adopted with some modifications as guide for nomenclature in the vegetable kingdom [**Regles de la Nomenclature Botanique or Laws of Botanical Nomenclature**]. These rules are known as **de Candolle Rules or Paris Code (1867)**. The subsequent International Botanical Congresses and Codes like **Rochester Code (1907)**, **Vienna Code (1905)**, **American Code (1907)** suggested many modifications and amendments in the rules. But it was only at the Cambridge in 1930 that, for the first time in botanical history, a code of nomenclature came into being that was international in function as well as in name".

International Botanical Congress is held at an interval of 5-6 years and the code is named after the name of the place where the Congress is held. Subsequently, **Amsterdam Code (1947)**, **Stockholm Code (1952)**, **Paris Code (1956)**, **Montreal Code (1961)**, **Edinburg Code (1966)**, **Seattle Code (1972)**, **Leningrad Code (1978)**, **Sydney Code (1983)**, **Berlin Code (1988)**, **Tokyo Code (1994)** and **St. Louis Code (1999)** came into operation. Several changes have been made in the code during previous years and now the rules of nomenclature are almost stabilized. International Botanical Congress held Vienna in 2005 and **Vienna Code (2005)** was adopted by 18th International Botanical Congress held at Melbourne in 2011 [**Melbourne Code**]. The 19th International Botanical Congress was held in Shenzhen in 2017 [**Shenzhen Code 2018**]. The 20th International Botanical Congress was to be held at Rio de Janeiro, in 2023 but has been postponed due to pandemic. It is scheduled to be held at **Madrid (2024)**.

The **ICNafp** (International Code of Nomenclature for Algae, Fungi and Plants [Shenzhen Code] 2018, is the set of rules and recommendations that govern the scientific names of all organisms traditionally treated

as algae, fungi, or plants, whether fossil or non fossil, including blue-green algae (Cyanobacteria), Chytrids, Oomycetes, Slime moulds, and photosynthetic protists with their taxonomically related non-photosynthetic groups (but excluding *Microsporidia*). Before 2011 it was called the *International Code of Botanical Nomenclature* [ICBN]. It is published by IAPT [International Association of Plant Taxonomists].

Significance of Code:

(Definition of Code: A set of rules or principles or laws [especially written ones])

- It ensures and controls that each and every plant possess one valid, legitimate and correct name.
- It is functional all over the botanical world, so it maintains uniformity.
- It is universally accepted and provides a stage as Botanical Congress after a limited period of few years for discussion and make solutions required for botanical nomenclature.

The scientific names are formulated in Latin.

PRINCIPLES OF NOMENCLATURE

The principles of ICNafp are detailed below:

1. Botanical nomenclature is **independent** of zoological and bacteriological 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**.

1 May 1753: Nomenclatural starting-point (*Species Plantarum*, ed. 1 : Linnaeus, 1753). No names published before this date are considered to be validly published.

4. Each taxonomic group (e.g. family or genus or species) can bear only **one correct name: the earliest** that is in accordance with the Rules, except in specified cases.

Each correct specific epithet must be unique within a genus. The same specific epithet is permitted within a different genus.

Apiaceae *Cryptotaenia canadensis* (L.) DC.

Apiaceae *Sanicula canadensis* L.

Asteraceae *Conyza canadensis* (L.) Cronquist

Cornaceae *Conus canadensis* L.

5. Scientific names of taxonomic groups are **treated as Latin** regardless of their derivation.
6. The Rules of nomenclature are **retroactive** unless expressly limited.

RULES OF NOMENCLATURE

1. Related to Taxa and their Ranks

Taxon(plural: taxa): A group of organisms that is given a formal taxonomic name.

It was Linnaeus who for the first time introduced hierarchical classification by placing each organism to a layered hierarchy of taxonomic categories or groups. Every individual plant is treated as belonging to a number of categories or taxa of consecutively subordinate rank, among which, the rank of species is basic.

The **principal ranks** of taxa in descending order are:

Kingdom (Latin 'regnum'),

Division or Phylum (Latin 'divisio or phylu'),

Class (Latin 'classis'),

Order (Latin 'ordo'),

Family (Latin 'familia'),

* **Tribe** (Latin 'tribus'),

Genus (Latin 'genus'),

* **Section** (Latin 'sectio'),

* **Series** (Latin 'series')

Species (Latin 'species'),

* **Variety** (Latin 'varieties'), and

* **Form** (Latin 'form')

Thus, each species is assigned to a genus, each genus to a family and so on.

[***Secondary ranks**]

A large number of ranks of taxa can also be formed by adding the prefix "sub" to the terms denoting the principal or secondary ranks. However, the sequence and order of these ranks is fixed and cannot be changed. The ranks can be easily recognized by specific case ending or prefix.

The smaller botanical differences that are used to divide the tribe into subtribes are often only recognizable to botanists. The plants in a Genus are often only recognizable as belonging to the same group. For every large genera, which may have hundreds of species, Sections are typically used to help organize them. A Section is a taxonomic rank below the Genus, but above the species. The subgenus, if present, is higher than the Section, and the rank of series, if present, is below the Section, Sections mainly in turn divided into Subsections

which are good and helpful when a genus has a large number of species, e.g. *Senecio* (Asteraceae).

Rank of taxa

Kingdom	(various)	Plantae
Phylum (Division)	-phyta	Magnoliophyta
Subphylum	-phytina	Magnoliophytina
Class	-opsida	Magnoliopsida
Subclass	-idae	Asteridae
Superorder	-anae (-iflore)	Asteranae
Order	-ales	Solanales
Suborder	-ineae	Solanineae
Family	-aceae	Solanaceae
Subfamily	-oideae	Solanoideae
Tribe	-eae	Solaneae
Subtribe	-inae	Solaninae
Genus	(various)	<i>Solanum</i>
Subgenus	(various)	<i>Solanum</i> subgen. <i>Solanum</i>
Section	(various)	<i>Solanum</i> sect. <i>Solanum</i>
Subsection	(various)	<i>Solanum</i> subsect. <i>Solanum</i>
Series	(various)	<i>Solanum</i> ser. <i>Solanum</i>
Subseries	(various)	<i>Solanum</i> subser. <i>Solanum</i>
Species	(various)	<i>Solanum nigrum</i>
Subspecies	(various)	<i>Solanum nigrum</i> ssp. <i>nigrum</i>
Variety	(various)	<i>Solanum nigrum</i> var. <i>nigrum</i>
Subvariety	(various)	<i>Solanum nigrum</i> subvar. <i>nigrum</i>
Forma	(various)	<i>Solanum nigrum</i> f. <i>nigrum</i>

- Names of taxon above the rank of family is treated as plural noun and written with an initial capital letter.
- Each rank has a distinctive ending that is attached to the stem of type genus.

Principles of priority

The earliest date of publication of a legitimate name or type designation establishes priority resulting in a correct name and typification for a taxon. For example,

Cannabis sativa L. 1753

Cannabis indica Lam. 1785

*Cannabis ruderalis*Junischevsky 1924

If above three names refer to a single species, or if three species are lumped into a comprehensive single entity, the entity must bear the earliest name – *Cannabis sativa* L. in this case.

Grewia multiflora Juss. (1804)

Grewia disperma Rottler ex Spreng. (1825)

Grewia diplocarpa Thwaites (1858)

K. C. Kishore & Mayur Nandikar (2019) synonymised *Grewia diplocarpa* and *Grewia disperma* under *Grewia multiflora*.

Just like the rule of nomenclatural type, the principle of priority also does not apply above the rank of family.

2. Binomial system

Scientific names are given to avoid confusion, indicate relationships, such as genetic, ecologic, and physiologic, and act as reference sources in scientific communication and literature.

The names have been derived from Latin and Greek languages. As per the ICNafp, the scientific names may be uninomials, binomials, or trinomials.

The binomials are also known as binary combinations. The Binomial names were first used by **Casper Bauhin** (1623) in his book *PinaxTheatriBotanici*. It was the Swedish botanist Carolus Linnaeus (1707-1778) who established and employed the binomial and trinomial systems of plant nomenclature. In the first edition of his book, *Species Plantarum* (1753), Linnaeus first used the Binomial System of Nomenclature.

According to the Binomial System of Nomenclature, the botanical consists of two Latin or latinized words, the first representing a **genus name**, and the second, the **specific epithet**. The specific name and specific epithet is not the same thing.

The specific epithet when combined with a genus name, constitutes the name of a species.

Generic name/Generic epithet (Genus name) + Specific epithet = Name of a species

The generic name starts with a capital letter and species name with a small letter.

In *Pisumsativum* (Pea), *Pisum* is the genus and *sativum* is the specific epithet;

In *Cucurbita maxima*, ‘*Cucurbita*’ is the Generic epithet and ‘*maxima*’ is the specific epithet.

Occasionally, scientific names may be long, e.g., *Saccharoperbutylaceticum* (26 letters; yeast),

Myxococcus Hlanfairpwllgwyngyllgogerychwyrndrobwlllantysiliogogochensis (73 letters; Bacteria). [This is the longest scientific name of any living or fossil organism, applied to a soil bacterium collected at Llanfairpwllgwyngyllgogerychwyrndrobwlllantysiliogogoch, Anglesey, Wales, one of the longest place names in the world. [Chambers, James; Sparks, Natalie; Sydney, Natasha; Livingstone, Paul G.; Cookson, Alan R.; Whitworth, David E. (2020). *Genome Biology and Evolution* 12 (12): 2289-2302.]

The term ‘species’ may be singular or plural and is abbreviated as ‘sp.’, (singular) or ‘spp.’ (plural), but the spelling remain same.

- ❖ Word “species” is used for singular [sp.] and plural [spp.] both, but spelling and pronunciation remain same.
- ❖ Genus (singular) and Genera (plural); never Generas

The generic name and specific epithet should be in italics or in bold when in print, and underlined separately when typed or handwritten.

- (i). **Honour of Person:** e.g. *Caesalpinia* from Caesalpino; *Linnaea* from Linnaeus; *Bauhinia* from Bauhin, (
- ii). **Special feature of Plant:** e.g. *Xanthoxylum*-for yellow wood of the plant; *Lencadendron*-for silver tree from silvery leaves,
- (iii). **Place of discovery:** e.g. *Ravenala*-from Madagascar; *Tsuga*- from Japan; *Nelumbo*-from Ceylon,
- (iv). **Mythological origin:** *Theobroma*-refers to God's food; *Nymphaea*-refers to water nymphs.

Generic names come in various sizes. For example, *Aa*, a genus name given by Reichenbach to an Orchid, is the **shortest generic name**, *Hydrogenoanaerobacterium* (24 letters; Bacterium) are long.

SPECIES NAMES are generally descriptive adjective, describing some specific features of the plant, e.g.

-alba: refers to white colour; *-rubra*: refers to red colour; *-nigra* refers to black colour; *-flava*: refers to yellow colour; *-alta*: refers to tall; *-tenuis*: refers to thin; *-repens*: refers to creeping; *-bignonioides*: resembling *Bignonia*; *-roxburghii* in honour of Roxburgh; *-vulgaris*: common; *-arvensis*: in fields; *-aquatica*: in water; *-esculentus*: edible; *-sativus*: sown for crops; *-spinosa*: spiny; *-tomentosa*: woolly; *-religiosa*: religious; *-chinensis*: China; *-japonica*: Japan; *-indica*: India; *-nepalensis*: Nepal.

There is only one scientific name for a plant which is known as its legitimate name.

(**POLYNOMIALS:** Concept given by PULKONAT. The earliest scientific names. They were composed of several words which gave more or less a complete description of plants. For example, the botanical name of *Sida acuta* is, "*Chrysophyllumfoliis ovalis, superneglalbris, parallele striates, subtustomentosonitidis*". It is very difficult to remember such a long name.)

Advantages of Binomial Nomenclature:

1. Binomial names are in Latin, hence universally accepted.
2. These names represent generic relationship and descent of individual plant.
3. The binomial names are scientific, definite and precise.
4. The binomial names are comprehensive, descriptive and easy to use.
5. The binomial names are independent.

3. Type method Typification

The ICNafp mandates that the **names of all plant taxa at the rank of family and below must be based on nomenclatural types.**

A nomenclatural type is that component with which the name of a taxon is permanently associated.

The type of a species or infraspecific taxon is an individual specimen.

Note: While designating a type, it is important to use the term 'designated here' and specify the herbarium where the specimen is preserved.

If a specimen cannot be preserved, the type may be a description or figure.

The type of a genus is a species, that of family a genus.

The principle of typification does not apply to names of taxa above the rank of family.

Following terms are used in nomenclature of Types:

Holotype/Nomenclatural Type: A single specimen or other element to which a plant name is permanently attached; for a species or an infraspecies, it is a single specimen or an illustration (before 2007); for a genus or infragenus, it is the name of a species, and for suprageneric names, it is the name of a genus.

Isotype: A duplicate of the holotype specimen, which is collected at the same time from the same place and by the same author. For example, if several branches of a tree are collected at the same time or several herbaceous plants (mounted on separate sheets), one is designated as type and others become isotypes.

Lectotype: A lectotype is a specimen or illustration that is selected from the original material to serve as the type when the holotype was not designated by the author at the time of publication or as long as it is missing. If a holotype is lost or destroyed, the lectotype is chosen from the isotypes or paratypes, if available.

Paratype or "co-type": If a new taxon is based on more than one gathering made at different times, one gathering is selected to serve as holotype and isotype(s). The rest of the gathering bearing different field numbers(s) constitutes the paratypes. [If two or more specimens have been cited as types by the author, the remaining cited specimens are called "co-types" or paratypes].

Neotype: A neotype is a specimen or an illustration designated from a non-original collection to serve as the type when all the originally cited material is lost or missing. [It is a specimen or other element selected to serve as nomenclatural type as long as all of the material on which the description of the new species was based is missing.]

Syntype: A syntype is any one of the specimens from the two or more gatherings or from the two or more specimens of a single gathering cited by the author in the original publication when no holotype was designated.

Topotype:A “topotype” is **not** a type, but a general term to indicate specimens of a taxon collected, usually later, from its original type locality. [It is a specimen collected from the same locality from where the holotype was collected].

Epitype:An epitype is a specimen or an illustration selected to complement the holotype, lectotype, or neotype, if any of these is inadequate and/or ambiguous with respect to the identification.

[A specimen or illustration selected to serve as an interpretative type when the holotype, lectotype or previously designated neotype, or all original material associated with a validly published name, is demonstrably ambiguous and cannot be critically identified for purpose of the precise application of the name of the taxon.]

TYPE SPECIMEN

Generally, species are described by taxonomists based on a type specimen and the details published in a scientifically recognised publication. The published scientific name and the official description which defines the characteristics of the species are then permanently associated with this type specimen.

A type specimen is a specimen selected to serve as reference point when a plant species is first named.

As a result these specimens are extremely important to taxonomist who are attempting to determine the correct application of a name.

Type specimens form part of biological collections maintained by Research Institutes and Universities where they can be accessed by other taxonomists.

4. Author Citation

The name of a taxon is incomplete unless it is affixed with the name of the author or authors who first validly published the name.

Without Author/Authority name, the Botanical/Scientific name is called incomplete name.

This helps to verify the dates of publication and impart precision in biological nomenclature.

For example, *Argemonmexicana* was identified, described and named by Carolus Linnaeus. Hence, should be cited as *Argemonmexicana*L.

An author’s name may be cited as the complete surname (Gamble, Duthie) or in abbreviated form (e.g., Benth. for Bentham; L. for Linnaeus; Hook. For Hooker)

Hook. Stands for William Jackson Hooker and Hook. f. for Joseph Dalton Hooker (**f.** stands for **filius**, the son).

It is important to have in mind that each valid Botanical/Scientific name has three Parts (not two parts):

- i. Generic epithet/Genus name
 - ii. Specific epithet/Species name
 - iii. Author/Authority name. [Author name never italicised/underlined/bold]
- OR

Valid Botanical Name=Generic epithet + Specific epithet + Author name

In a scientific name, there may be a single author, e.g., *Argemone mexicana* L. or multiple authors, e.g. *Millettia auriculata* Wight et Arn.

Use of et: When two or more authors publish a new species or propose a new name, their names are linked by et or an ampersand (&):

Tricholepistibetica Hook. f. et Thomson

Instead of et, ampersand (&) may be used:

Indigofera himachalensis Chauhan & A.K. Pandey

Use of et al. : When more than two authors are involved in naming a taxon, citation is normally restricted to the first author and is followed by et al. (“et alia,” et=and + alia=others; =et aliorum = and others. This is an abbreviation of the Latin phrase “et cetera”, which means “and the rest.” It is used in place of names for the purpose of saving time and space.), e.g., *Amomum meghalaysis* V.P. Thomas et al. (the species was published by V.P. Thomas, M. Sabu, and E. Sanoj)

Use of in: If an Author publishes a new species in the publication of another author, the name of the authors are linked by in, e.g. *Nepeta ciliaris* Benth. in Wall.

Use of parenthesis and Basionym:

A Basionym is the original name given to a species or taxon when it was first described in botanical nomenclature. It is an important concept in the naming and classification of plants. When a species is later reclassified or renamed, the original name is referred to as the basionym, and the new name is called the valid name or *nomen novum* if it has been changed due to taxonomic revisions. This practice helps maintain a historical record of the naming and classification of organisms.

[In Botanical world Basionym means the original name on which a new name is based: the author citation of the new name should include the authors of the basionym in parenthesis.]

Authors in parenthesis denote a change in the name of a taxon by transfer or by upgrading or downgrading the level of taxon. When a species is changed from one genus to another, whose specific epithet is being used in the changed name, is placed within parenthesis, and the author who made the change is mentioned outside the parenthesis, e.g., *Lucas nutans* (Roth.) Spreng, based on the basionym *Phlomis nutans* Roth. Here *L. nutans* (Roth.) Spreng based on **Basionym** *P. nutans* Roth.

When a genus or taxon of lower rank is altered in rank or position but retains its name or epithet, the name of the author who first published the name or epithet (basionym) must be cited in parenthesis followed by the name of the author who effected the change. This is known as **DOUBLE CITATION**.

Basionym: *Aucklandiacostus* Falc. (1841)

Aucklandiacostus was published by Falconer. Later, Shruti Kasana & A.K. Pandey transferred this species to the genus *Dolomiaea*. While transferring the specific epithet *costus* was retained and the name of Falconer was kept in parenthesis. Here, *Aucklandiacostus* is basionym of the new combination *Dolomiaeacostus* (Falc.) Kasana & Pandey.

Tricholepis glaberrima var. *angustifolia* (D.C.) L.B. Chaudhary & A.K. Pandey (1994)

Basionym: *Tricholepis angustifolia* DC. (1838)

De Candolle published *Tricholepis angustifolia*. Later, L.B. Chaudhary and A.K. Pandey transferred this species as a variety under *T. glaberrima*. On its transfer, the varietal epithet *angustifolia* was retained and the basionym author's name De Candolle (D.C.) was cited in parenthesis. Here, *T. angustifolia* is the basionym of *T. glaberrima* var. *angustifolia*, the new combination at a new rank (*combination nova et status nova*).

When a name was already suggested but it is before 1753, i.e., the starting of binomial system, the name of the author will be put in **Square brackets/Box brackets** ([]), e.g. *Lupinus* [Tourne.] Linn. Here Tournefort suggested the name in 1719, i.e., before 1753 (*Species plantarum*).

Use of ex: The meaning of 'ex' is "according to" or "from". When a name is proposed by one author but validly proposed by second author, the name of the former author is followed by the second author. The word ex is inserted between the name of two authors.

Berberis asiatica Roxb. ex DC.

In this botanical name, Roxberg proposed the name but the species was validly published by de Candolle.

Use of in: When a new name is proposed and published in the work of another author, the name of two authors are linked together by the word in.

Andrographis beddomei C.B. Clarke in J.D. Hooker, Fl. Brit. India 4: 506 (1884).

C.B. Clarke authored the new species *Andrographis beddomei* in the book Fl. Brit. India vol. 4, edited by J.D. Hooker.

Use of emend.: If an original description of a taxon is less-detailed and subsequently elaborated, or the circumscription of a taxon is altered retaining the same type, the citation of the original author is retained but followed by a word emend after the name of the author who changes the circumscription.

Phyllanthus L. emend. Mull. Arg.

["Emend" is a verb that means to make corrections or improvements to something, especially by editing or revising. It's often used in the context of editing written or printed material to correct errors, clarify meaning, or improve overall quality.]

5. Valid Publication:

Valid Publication means names must be published in accordance with the provisions of the Code. The name of the taxon must be effectively published and must have a reference to an effectively published description (1935-2011 in Latin; from 2012 in English/Latin).

(Authors publishing names of a new taxon on or after 1 January 2012 should give or cite a full description or diagnosis in Latin or English).

From 1958, a new taxon's name at the rank of family and below must be typified.

The name below the rank of genus is not validly published if the name of the genus or species to which it is assigned is not validly published at the same time or previously.

A name of a taxon has no status under the CODE unless it is validly published.

He who first validly published the name of a taxon is the author of that name. It is necessary to cite the name of the author after the name of the taxon.

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