Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third Year)

Subject: Botany

Course Code: BOC 105

Course Title: Classical Taxonomy & Phylogeny

Unit: 4

Module Name: Terms and concepts-monophyly, paraphyly, polyphyly & clades

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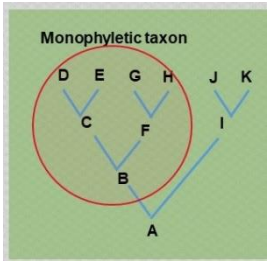
Notes

Introduction:

- Phylogeny is the history of evolution of a species, taxon or group, especially in relation to line of descent and relationship among broad groups
- A taxon is any group of organisms that is given a formal taxonomic name
- Monophyly, paraphyly, polyphyly and clades are the terms commonly used in taxonomy and evolutionary literature
- Knowledge of these terms is essential to understand phylogeny

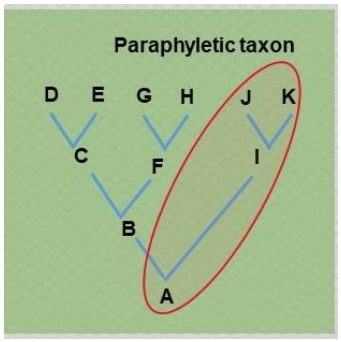
Monophyly:

- A monophyletic taxon is defined as one that includes the most recent common ancestor of a group of organisms, and all of its descendants
- Sometimes called holophyletic taxon
- In the figure, genus B evolved from genus A through one species of the latter
- Here, the genus B is monophyletic at the same rank as well as at the lower rank
- e.g. Angiosperms (as a group)



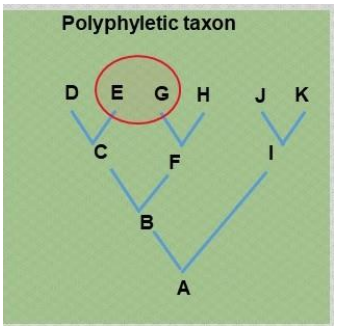
Paraphyly:

- A paraphyletic taxon is one that includes the most recent common ancestor, but not all of its descendants
- A group is paraphyletic if it consists of the group's last common ancestor and all descendants of that ancestor excluding a few monophyletic subgroups
- The group is said to be paraphyletic with respect to the excluded subgroups
- e.g. Bryophytes, Gymnosperms

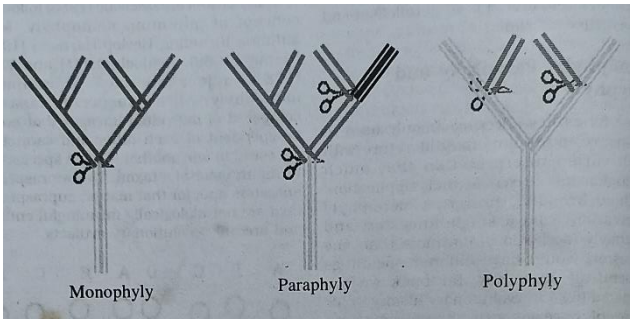


Polyphyly:

- A polyphyletic taxon is defined as one that does not include the common ancestor of all members of the taxon
- A polyphyletic group is a set of organisms, or other evolving elements, that have been grouped together but do not share an immediate common ancestor
- e.g. Algae, C4 photosynthetic plants



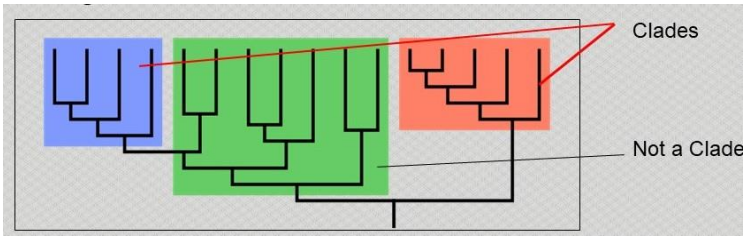
- Different systematists like Simpson (1961), Henning (1966), Dahlgren etc have tried to explain monophyly, paraphyly and polyphyly
- Cutting rule devised by Dahlgren and Rasmussen (1983) is an excellent way to represent the concept of monophyly, paraphyly and polyphyly
- The distinction is based on how the group is separated from a representative evolutionary tree



- A monophyletic group is separated by a single cut below the group; represents a complete branch
- A paraphyletic group is separated by one cut below the group and one or more cuts higher up; represents one piece of a branch
- A polyphyletic group is separated by more than one cut below the group; represents more than one piece of a branch

Clades:

- A clade is a group of species or organisms (used in a cladogram or tree) believed to comprise all the evolutionary descendants of a common ancestor



- A common ancestor may be an individual, a population or a species
- A clade is also known as monophyletic group or natural group
- It represents a single “branch” on the “tree of life”