PHYLOGENETIC SYSTEM [4.3 (b) Classification of Takhtajan]

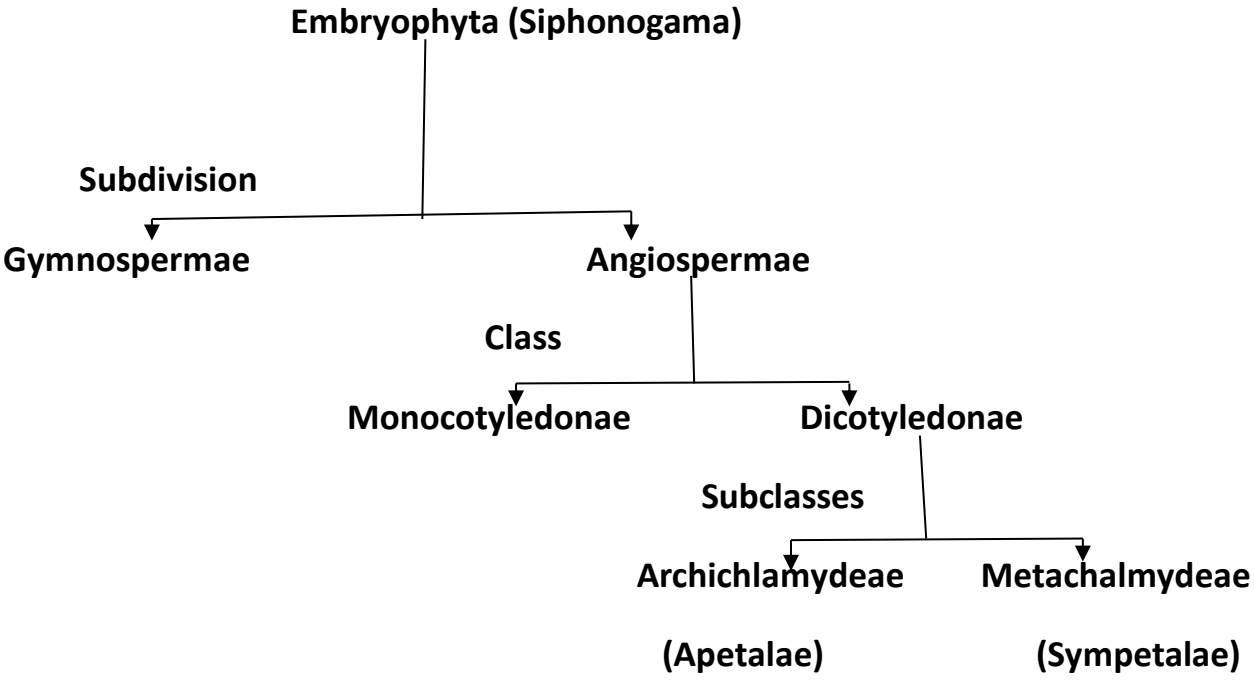
The outlook of taxonomy was changed with the publication of "Origin of Species" by Darwin in 1859. After that, there was more and more interest in classifying organisms with the incorporation of the evolutionary relationships of the evolutionary history, including the genetic relationships of the organisms.

The evolutionary history of a group of genetically related organisms is called a phylogeny. It includes ancestor species and descendent species. A phylogeny is usually represented by a tree diagram called a phylogenetic tree.

The various botanists who adopted phylogenetic systems are:

1. **A.W. Eichler: He modified Bentham and Hooker's system of classification by placing gymnosperms in the beginning. He is also called as the pioneer in phylogenetic system of classification.**
2. **Adolph Engler and Karl A.E. Prantl, the two German botanists published a twenty three volume work in "Die Naturlichen pflanzenfamilien" (1887-1915). It was a German work which was later translated in English.**

AN OUTLINE OF ENGLER AND PRANTL'S SYSTEM OF CLASSIFICATION:



Corolla- polypetalous gamopetalous

Perianth-single/double/absent in two whorls

MERIT:

Families were arranged according to increasing complexity of flowers.

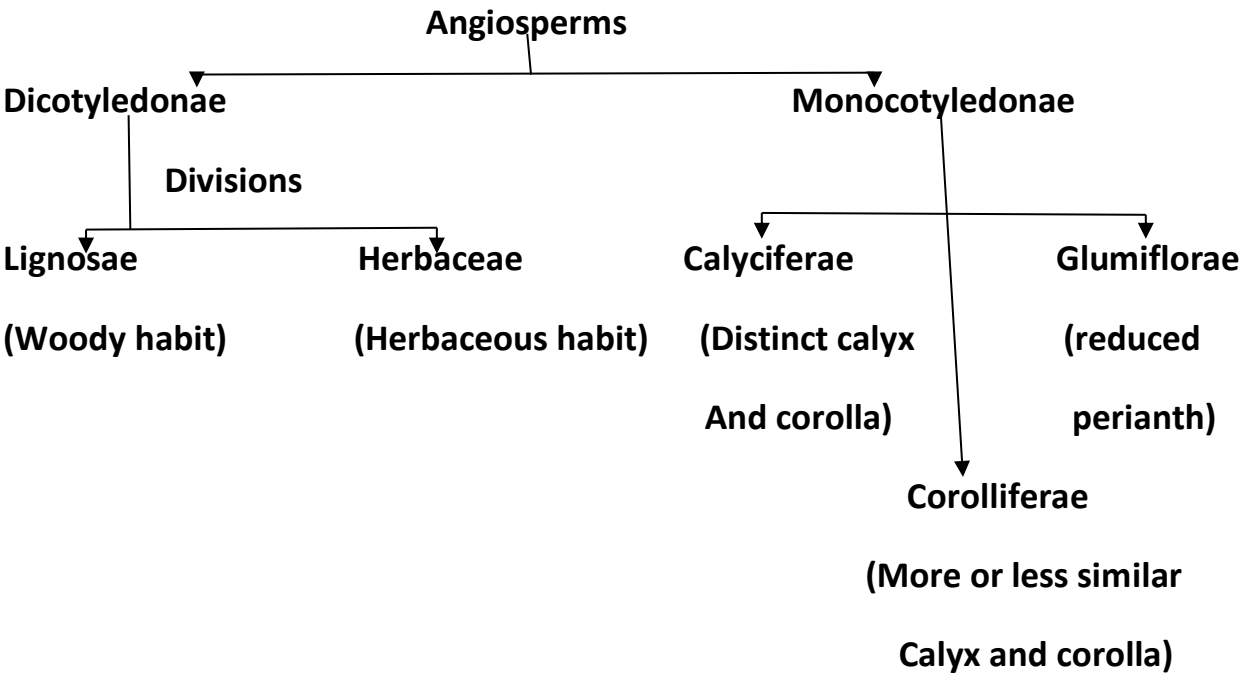
DEMERIT:

Monocots were considered primitive to dicots.

According to this system, primitive forms having naked flowers were kept in the beginning. The more advanced families have distinct perianth while the highly evolved families have fused perianth.

3. John Hutchinson, an English botanist, proposed his phylogenetic classification in his famous book "Families of Flowering Plants" in 1959.

An outline of Hutchinson's classification:



General principles were:

1. **Evolution in both upwards and downwards.**
2. **Trees and shrubs are considered to be more primitive than shrubs.**
3. **Dicots have been considered more primitive than monocots.**
4. **Polypetalous, actinomorphic and solitary flowers are considered more primitive than gamopetalous, zygomorphic and inflorescence respectively.**

4. Armen Takhtajan:

- **He was one of the most influential botanists and systematists of 20th century.**
- **In 1942, he developed a classification scheme for flowering plants. After 12 years i.e. in 1954, the actual system of classification was published in his "Die Evolution Der Angiosperm" i.e. The Origin of Angiospermous plants in Russian language.**

The classification was published in "Flowering plants: Origin and Dispersal" (1969) in English. Later on in 1980, a new revision of his system was published.

- **He classified angiosperms as Division: Magnoliophyta and subdivided them into the dicotyledons (Class: Magnoliopsida) and monocotyledons (Class: Liliopsida).**
- **OUTLINE OF CLASSIFICATION:**

DIVISION	CLASS	SUB-CLASS	ORDER
Magnoliophyta (Angiosperms)	Magnoliopsida (Dicotyledons)	Magnoliidae	**7**
		Hamamelididae	**8**
		Ranunculidae	**3**
		Caryophyllidae	**3**
		Dillendae	**12**
		Rosidae	**16**
		Asteridae	**7**
	Liliopsida (Monocotyledons)	Alismalidae	**3**
		Lilidae	**3**
		Arecidae	**5**
		Commelinidae	**6**

- **Most primitive order of class Magnoliopsida (Dicot) is Magnoliales, while most advanced order is Asterales (monocot).**
- **While in class Liliopsida, most primitive order is Alismatales and most advanced order is Arales.The main characters used by Takhtajan in his classification are as follows:**

CHARACTERS	PRIMITIVE	ADVANCED
Growth habit	Woody habit	Herbaceous
	Small	Large
	Evergreen	Deciduous
Leaves	Simple leaves	Compound leaves
	Reticulate venation	Parallel venation
	Alternate leaves	Opposite leaves
Stomata	Mesogenous type with subsidiary cells	Perigenous type, lack subsidiary
Nodal structure	Tri to pentalacunar	Unilacunar
Inflorescence	Cymose	Racemose
Floral structure	Indefinite number of floral parts arranged spirally	Fixed number of floral parts arranged in cyclic pattern
Pollen grains	Monocolpate	Tricolpate
Gynoceium	Apocarpus	Syncarpous
Ovules	Crassinucellate	Teninucellate
Pollination	Entomophily	Anemophily
Seeds	Abundant endosperm with a minute an undifferentiated embryo	Endosperm is reduced or wanting and embryo is well developed
Fruits	Many seeded follicular fruit	Coenocarpus fruit

According to him, the angiosperms are of monophyletic origin and evolved from some ancient group of gymnosperms called Phyllosperminae.

MERITS OF TAKHTAJAN'S CLASSIFICATION:

1. **It is more phylogenetic than that of earlier systems.**
2. **The classification is in general agreement with the major contemporary system of Cronquist, Dahlgren, Thorne and others.**
3. **The treatment of Magnolidae as a primitive group and the placement of Dicots before Monocots is in agreement with the other contemporary system.**
4. **The nomenclature of various groups is in accordance with ICBN.**

DEMERITS:

1. **This system provides classification only up to family level**
2. **Takhtajan considers Degeneriaceae as the most primitive angiosperm but many present day taxonomists consider Winteraceae to be most primitive family in angiosperms.**

3. **The classification incorporates data from a number of branches but greater emphasis is given to <u>Cladistic information</u> than <u>Phenetic information</u>.**