M.Sc. II sem, paper II - UNIT II
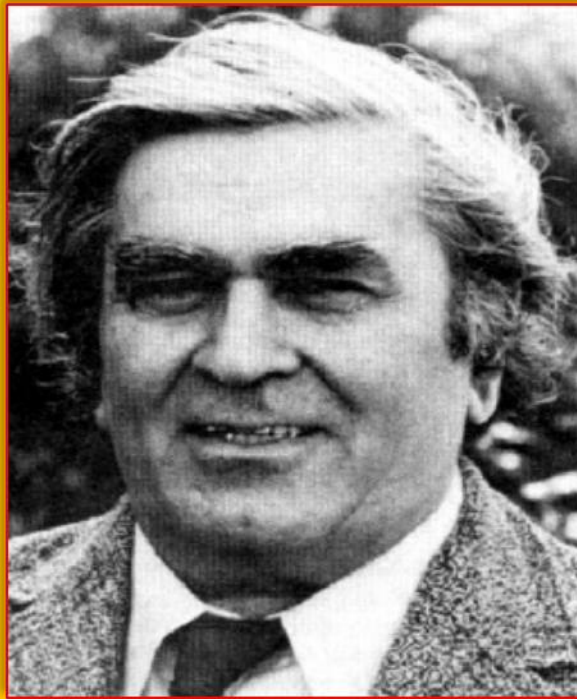# Classification of Angiosperms proposed by Takhtajan (1910-2009)

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Armen Takhtajan (1910–2009) was a leading Russian plant taxonomist and chief of the Department of higher plants in V. L. Komarov Botanic Institute, USSR Academy of Sciences, Leningrad (now named St. Petersburg). He was an international authority on phytogeography, origin and phylogeny of flowering plants. He was the President of the 12th International Botanical Congress held in Leningrad in 1975.

The contributions of Armen Takhtajan-

- His classification was first published in 1954 in Russian, but came to be known outside the Soviet Union only after its English translation *Origin of Angiospermous Plants* was published in 1958.

- The classification was elaborated in 1959 and1966 and was published in a revised form in *Botanical Review* in 1980. A more elaborate revision of this classification appeared in the Russian work *Sistema Magnoliophytov* in 1987.

- **His final comprehensive system of classification was published in 1997 (*Diversity and Classification of Flowering Plants*), incorporating several modifications in his system.**

Takhtajan believes in the **monophyletic origin** of Angiosperms, the group having evolved from seed ferns **Lyginopteridophyta.** He divided the *Magnoliophyta* (Angiosperms) into two classes *Magnoliopsida* **(**dicots) and *Liliopsida* (monocots) of which *Magnoliopsida* is considered primitive and *Liliopsida* to have been derived from *Magnonlales* under *Magnoliopsida***.**

While deciding the placement of various groups, Takhtajan has used a number of criteria based on his understanding of the available information i.e. Growth habit, Leaves, Stomata, Nodal structure, Inflorescence, Floral structure, Pollen grains, Gynoecium, Ovules, Pollination, Gametophyte & fertilization, Seeds and Fruits etc of flowering plants.

His major conclusions are summarized below:

Principles of Classification

Characters	Primitive	Advanced
Growth habit	Woody habit	Herbaceous habit
	Small woody angiosperm	Large trees of tropical rain forests
	Sparingly branched trees	Trees with numerous slender branches
	Evergreen plants	Deciduous woody plants

Leaves	Simple leaves	Compound leaves
	Reticulate venation	Parallel venation
	Alternate leaves	Opposite leaves
Stomata	Misogynous type	Perigynous type
	With subsidiary cells	Lacking subsidiary cells
Nodal structure	Tri to pentalacunar type	Unilacunar type

Inflorescence	Cymose	Racemose
Floral structure	Indefinite and variable number of floral parts arranged spirally on an elongated axis.	Fixed number of floral parts arranged in cyclic pattern on a short axis
Pollen grains	Exine devoid of external sculpturing	Sculpturing is of various types
	Monocolpate (dicots)	Tricolpate (dicots)
Gynoecium	Apocarpous	Syncarpous

Ovules	Anatropous ovule	Other types
	Crassinucellate ovules	Tenuinucellate ovules
Pollination	Entomophily	Anemophily
Gametophyte & fertilization	monosporic Polygonum type	Tetrasporic type
Seeds	Abundant endosperm with a minute and undifferentiated embryo	Endosperm is reduced and the embryo is large and well differentiated
Fruits	Many seeded follicular fruit develop from multicarpellary apocarpous gynoecia.	syncarpous fruits

The outline of the Takhtajan's system of classification (1997)

Takhtajan's classification approaches more closely that of Cronquist (1981, 1988) in naming angiosperms as division **Magnoliophyta**. Dicots and monocots are given the rank of a class and named **Magnoliopsida** and **Liliopsida,** respectively.

The suffixes used for designation of taxa in the classification are :
   a)   Division – 'phyta'
   b)   Class – 'opsida'
   c)   Subclass – 'idae'
   d)   Superorder – 'anae'
   e)   Order – 'ales'
   f)   Family – 'aceae'

Key characters of some important taxa-

Division –*Magnoliophyta* - Include all Angiospermic plants

Class – *Magnoliopsida* - Include all dicotyledons

Class –*Liliopsida* - Include all monocotyledons

Division	Class	Sub-class	Super-Order	Order	Family
Magnoliophyta (Angiosperms)	*1. Magnoliopsida* (Dicotyledons)	*1. Magnoliidae**	6	18	39
		2. Nymphaeidae	2	3	6
		3. Nelumbonidae	1	1	1
		4. Ranunculidae	1	9	17
		5.Caryophyllidae	4	4	24
		6.Hamamelididae	9	17	23
		7. Dilleniidae	10	39	108
		8. Rosidae	16	45	130
		9. Cornidae	3	17	42
		10. Asteridae	2	6	14
		11. Lamiidae	4	15	54
	Total	*11*	55	175	458
	2. Liliopsida (Monocotyledons)	*1. Liliidae**	2	18	73
		2. Commelinidae	7	21	30
		*3. Arecidae**	1	1	1
		*4. Alismatidae**	1	10	17
		5. Triurididae	1	2	2
		6. Aridae	4	5	8
	Total	*6*	16	57	131

Division. Magnoliophyta *(*Angiosperms)

2 classes, 17 subclasses, 71 superorders, 232 orders, 589 families

estimated genera-13,000, species- 2,50,000

Class 1. Magnoliopsida (Dicotyledons)-
11 subclasses, 55 superorders, 175 orders, 458 families estimated genera- 10,000, species- 1,90,000

Class 2. Liliopsida (Monocotyledons)-

6 subclasses, 16 superorders, 57 orders and 131 families estimated

genera-3,000, species- 60,000

Class 1. Magnoliopsida (Dicotyledons)- (*11 subclasses*)

*1. Magnoliidae ***

    2. Nymphaeidae

       3. Nelumbonidae

          4. Ranunculidae

             5. Caryophyllidae

                6. Hamamelididae

                   7. Dilleniidae

                      8. Rosidae

                         9. Cornidae

                            10. Asteridae

                               11. Lamiidae

Class 2. Liliopsida (Monocotyledons) *(6 subclasses)*

1. *Liliidae**

   2. *Commelinidae*

      3. *Arecidae**

         4. *Alismatidae**

            5. *Triurididae*

               6. *Aridae*

- Among the subclasses Takhtajan considered *Magnoliidae* to be the most primitive, forming basal group from which all other subclasses have been derived. Among *Magnoliopsida ,* he considered the *Lamiidae* is most advanced.

- Among Takhtajan system 3 subclasses under *Liliopsida* (*Alismatidae, Liliidae* and *Arecidae)* are consider to the primitive than the other subclasses of *Magnoliopsida* and have been derived from *Magnoliidae .*

Merits of Takhtajan System of Classification

1. The classification is phylogenetic as it is based on well established phylogenetic principles.

2. The nomenclature of various groups is in according to the rules of International Code of Botanical Nomenclature.

3. The earlier grouping of the angiosperms (Polypetalae, Gamopetalae and Monochlamydeae of Bentham and Hooker as well as Archichlamydeae and Metachlamydeae of Engler and Prantl) has been replaced with definite "subclasses". Thus, the division of the dicotyledons (*Magnoliopsida*) and monocotyledons *(Liliopsida)* into defined "subclasses" has been considered a 'major advancement' in understanding the phylogeny of the angiosperms (*Magnoliophyta*). The introduction of the rank of "super order" in the classification has provided an important link between the large 'subclass' and the smaller 'order".

4. The system follows a natural assemblage of families, based on a synthesis of information obtained from various disciplines. Thus, families *Lamiaceae* and *Verbenaceae* are positioned together in the order *Lamiales; Caryophyllaceae*, *Chenopodiaceae* and *Portulacaceae* are put together in the order *Caryophyllales*.

5. Dicots begin with Magnoliales as the most primitive angiosperm is universally accepted.

6. The position of Magnoliales at the start of Magnoliopsida is in accordance with evolutionary progression.

7. Monocots are derived from an extinct hypothetical terrestrial group of *Magnoliidae* and *Nymphaeales* and *Alismatales* are lateral side branches is also accepted fact.

8. The concept of primitive flower in the classification is in accordance with modern taxonomists

Demerits of Takhtajan System of Classification

1. The taxa are too narrowly defined which has resulted in the unwanted splitting of related taxa. For example *Papaveraceae* is separated from order *Capparales.*

2. The classification is only till the family level and key for identification are also not given. Hence the classification is not useful for practical identification.

3. Takhatajan considers *Degeneriaceae* as the most primitive family but many present day taxonomists consider *Winteraceae* to be most primitive family in angiosperms.

4. The classification incorporates data from a number of branches but greater emphasis is given to cladistic information than phenetic information.