

**EVOLUTION, MERITS AND DEMERITS OF FIVE KINGDOM SYSTEM**

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**ABSTRACT**

Five kingdom system of biological classification was proposed. These kingdoms were: Monera, Protista, Fungi, Plantae and Animalia. The history of kingdom system started, laid the foundation of modern biological classification by classifying the organisms into two kingdoms *namely* Plantae and Animalia. The two kingdom system were followed by three, four and five kingdom systems respectively. In present discussion, author tried to discuss the evolution, merits, demerits and relevancy of "five kingdom system" in modern context.

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**Introduction**

The living organisms are quite enormous in number with great diversity in their characters. The living organisms may be alike in their general appearance but differ in detailed characteristics because of specialization mainly in their form, structure, metabolism and life cycle. It is nearly impossible to study all the living organisms, hence it is necessary to devise some means to make this possible. This means is classification. The classification and study of these organisms on the basis of their similarities and dissimilarities are concerned with taxonomy. By studying a given type; a good basic knowledge of the group concerned can be achieved. Besides, phylogenetic relationship can also be understood through classification.

**Systematics** branch of Biology deals with the study of identification, naming (nomenclature) and orderly grouping (classification) of organisms on the basis of their relationships. A worker<sup>8</sup> described the principles of systematics in detail. The systematics includes evolutionary relationships among the organisms. systematist<sup>6</sup> gave the term 'systematics' in 1735 while later on it was given the term 'taxonomy' in 1813. **Taxonomy** is basically the

process of classification of all living organisms based on different characteristics.

**HISTORICAL BACKGROUND**

The history of kingdom system started with a Swedish Naturalist<sup>6,7</sup>, who laid the foundation of modern biological classification by classifying the organisms into two kingdoms *namely* Plantae and Animalia. He for the first time classified the living organisms in a systematic way, introduced the hierarchic system both in plants and animals. He laid the foundation of modern biological classification by classifying the organisms into two said kingdoms. His classification is now popularly known as Two Kingdom System. He also propagated 'binomial nomenclature' for all the species of organisms in 10th edition of his book 'Systema Naturae'<sup>7</sup>. This book is now known as dictionary of classification and he is honoured as father of binomial nomenclature and founder of modern taxonomy.

The Kingdom Plantae included chlorophyll containing green plants, mosses, ferns, many colourless and coloured unicellular organisms, moulds, fungi, lichens, bacteria and multicellular seaweeds while Kingdom Animalia included many other unicellular protozoans and multicellular

organisms without having chlorophyll and photosynthetic ability. The two kingdom system of classification of Linnaeus was not found suitable due to huge diversity among the organisms and many other limitations. There is a brief account of diversity, evolution, taxonomy and various kingdoms in classification<sup>9</sup>.

A German biologist<sup>5</sup> proposed a third kingdom of life, the Protista, for unicellular eukaryotes such as protozoans in 1866. An American biologist<sup>4</sup> created the fourth kingdom, Monera, to include bacteria and blue green algae in 1956. Other workers<sup>1,2,3</sup> worked a lot on different kingdom systems and also suggested as well as proposed some ideas about new kingdoms. Their historical development of different kingdom systems.

#### FIVE KINGDOM SYSTEM

An American Ecologist<sup>10</sup> proposed the five kingdom systems of classification. Through his "five kingdom system", he succeeded to overcome the difficulties as well as demerits of two, three and four kingdom systems and to represent the living organisms according to the evolutionary relationship among themselves.

Five kingdom system of classification<sup>10</sup> is based on:

1. Mode of nutrition (main)
2. Cell structure and complexity
3. Phylogenetic relationship
4. Body organization
5. Reproduction

In the five kingdom system different kingdoms are as following:

1. **Monera** : Prokaryotes e.g. bacteria and cyanobacteria.
2. **Protista** : Unicellular eukaryotes e.g. unicellular algae, diatoms and protozoans.
3. **Fungi** : Multicellular decomposers e.g. fungi and moulds.
4. **Plantae** : Multicellular producers, e.g. plants.
5. **Animalia** : Multicellular consumers, e.g. animals.

Worker<sup>10</sup> also defined the kingdoms by a number of special characteristics such as whether the organisms possessed a true nucleus or not. Since, Monera are prokaryotic and virtually all are unicellular, they differ from the other four eukaryotic

kingdoms. The eukaryotic unicellular organisms were kept into the kingdom Protista. The unicellular organisms show several types of modes of nutrition. The three multicellular eukaryotic kingdoms distinguish themselves by the general manner in which they acquire food. Fungi are heterotrophs, generally break down large organic molecules in their environment by secreting enzymes. Plants are autotrophs and use photosynthetic systems to capture energy from sunlight. Animals are heterotrophs and acquire nutrients by ingesting plants or other animals and then digesting those materials.

#### Merits of five kingdom system:

- Better relationship among organisms with reference to levels of organization
- Clear cut representation of mode of nutrition.
- Better evolutionary trend reflecting gradual evolution of complex organisms from simpler ones.
- Better placement of certain controversial groups like cyanobacteria, fungi and euglenoids.
- Separation of kingdom Fungi from Plantae is justified as the fungi have their own type of structural, physiological as well as biochemical properties.

#### Demerits of five kingdom system:

- Dilemma regarding the position of virus.
- Poor understanding about microbial biodiversity, as the archaebacteria and bacteria are kept under the same single kingdom Monera.
- Improper grouping of kingdom Protista, as it includes organisms with diverse form, structure and life cycle.
- Inclusion of dinoflagellates under Protista is not logical, as they are not eukaryotic rather mesokaryotic.
- Slime moulds placed under Protista differ considerably from the rest of protists.

#### Discussion and Conclusion

Five kingdom system, despite of having several demerits, has been increasingly accepted globally by the biologists since its inception till now and is representing the standard paradigm.

When five kingdom system was proposed, microbial biodiversity was poorly understood. Now, microbial biologists have discovered the unicellular organisms that look-like prokaryotes but were

extremely distinct in ultrastructure and other characteristics from the traditional bacteria then updation of five kingdom system seems necessary.

Position of some unusual prokaryotes like thermophiles, halophiles and methanogens must have to be clearly decided. DNA sequencing data also increasingly suggested that these prokaryotes were most unlike the traditional bacteria and have some novel features that do not occur in bacteria and eukarya. With these new discoveries, it is required that five kingdoms should be reorganized to meet the current scenario.

However, American Ecologist<sup>11</sup> have developed three domain schem with six kingdom systems. This system adds 'domain' as a 'superkingdom' above the level of kingdom. Three domain system organizes biodiversity by evolutionary relationships<sup>11</sup>. As far as the relevancy is concerned, three domain system seems to more logical, ethical, justified and appropriate from evolutionary, microbial diversity and modern nucleic acid sequencing point of views but it is still waiting for its global and universal acceptance.

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