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GENERAL INFORMATION ABOUT THE LEGUME FAMILY (FABACEAE)

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Annotation: This article discusses the general morphological, ecological, and phylogenetic characteristics of the legume (Fabaceae) family. Fabaceae is a large family of plants with diverse forms and species distributed worldwide. It includes trees, shrubs, subshrubs, and herbaceous plants. Their leaves are often compound, palmate or pinnate, and the flowers are bisexual and zygomorphic. The article analyzes the division of the Fabaceae family into three main subfamilies — Mimosoideae, Caesalpinioideae, and Faboideae — as well as the morphology of their flowers, pollination features, and biological diversity. It also provides information on the ecological significance of family representatives, their role in human nutrition, and their place in molecular-based phylogenetic studies. The distribution of this family in tropical, subtropical, and temperate zones of the Earth and its evolutionary connection to related families is also reviewed.

Keywords: Fabaceae, legumes, Faboideae, Mimosoideae, Caesalpinioideae, zygomorphic flower, leguminous plants, phylogeny, morphology, agrobiodiversity, plant systematics, pollination, nutritional value, molecular taxonomy.

The legume family (Fabaceae, Leguminosae) is considered one of the largest and most biologically diverse plant families in the world. It is widely distributed across the globe, particularly in tropical, subtropical, and temperate climate zones, and includes over 700 genera and more than 19,000 species. Legumes play a significant role not only in maintaining ecological balance but also in human life. Many plants in this family are widely used for food (e.g., beans, peas, lentils), medicine, fodder, industrial, and reclamation purposes.

The Fabaceae family is distinguished by its unique morphological and physiological features. It includes trees, shrubs, subshrubs, and herbaceous plants, most of which have compound leaves, zygomorphic (bilaterally symmetrical) flowers, and produce legumes as fruit. Their root systems live in symbiosis with nitrogen-fixing bacteria, playing a crucial role in enhancing soil fertility.

Based on existing literature and scientific research, the Fabaceae family is classified into three large subfamilies — Caesalpinioideae, Mimosoideae, and Faboideae. This classification is based on floral structure, pollination mechanisms, leaf shape, and other morphological traits.

This article provides a general description of the Fabaceae family, analyzing its morphological structure, floral characteristics, biological diversity, and taxonomic position. It also discusses the ecological and economic importance of the family representatives, as well as their classification based on phylogenetic and molecular research.

The Fabaceae family includes about 500 (600) genera and 12,000 (18,000) species distributed worldwide. These plants occur as trees, shrubs, subshrubs, and herbaceous plants. In Uzbekistan, there are 422 species belonging to 35 genera. The family is divided into three subfamilies: Caesalpinioideae, Mimosoideae, and Faboideae.

Their stems may be erect, climbing, or prostrate. The leaves are mainly compound trifoliate, palmate, tendrillar, or pinnate, sometimes simple, with lateral leaflets. In compound pinnate leaves, the terminal leaflets sometimes transform into tendrils, while lateral ones may become spines. The flowers are bisexual, usually zygomorphic, and rarely actinomorphic, and are arranged in racemes, heads, umbels, or spikes. They are pollinated by insects and occasionally self-pollinated. The calyx is complex with five usually fused sepals, and the corolla has five petals. The upper petal is enlarged and called the "standard"; the two lateral petals are "wings," and the two lower petals, which enclose the stamens, form the "keel".

The Fabaceae family is divided into three subfamilies: Mimosoideae, Caesalpinioideae, and Faboideae.

Floral formula: ↑ Ca(5) Co1+2+(2) A(9)+1 G1

The subfamily Faboideae includes nearly 12,000 species belonging to 490 genera, widely distributed in tropical, subtropical, and temperate regions of the world. These are trees, shrubs, subshrubs, and herbaceous plants. The leaves are pinnate, palmate-compound or simple, with stipules. The flowers are zygomorphic, bisexual, five-parted with a fixed structure; the calyx consists of five fused sepals. The corolla has five petals (the upper one forms the "standard," the two lateral petals form the "wings," and the two lower petals resemble a "keel"). There are 10 stamens.

Legumes (Latin: Fabaceae, or Leguminosae), also known as Papilionaceae, are a family of dicotyledonous plants with butterfly-shaped flowers. The family includes both perennial and annual trees, shrubs, and herbs that are easily recognized by their legume-type fruits and compound leaves. This widely distributed family comprises approximately 730 genera and about 19,400 species, making it the third-largest plant family after the Asteraceae and Orchidaceae. The high species richness in this family is especially concentrated within the subfamilies Mimosoideae and Papilionoideae, which together account for around 9.4% of all eudicot species. It is estimated that about 16% of all tree species in Neotropical forests belong to this family. The Fabaceae family is also widespread in the tropical rainforests and dry forests of the Americas and Africa.

Despite previous debates about whether Fabaceae should be considered as a single family composed of three subfamilies or as three separate families, a wide body of molecular and morphological evidence now confirms that legumes form a single monophyletic family. This conclusion is supported not only by relationships among legumes and their closest relatives but also by the degree of internal consistency across groups within the family, as well as by all recent phylogenetic analyses based on DNA sequencing. These studies confirm that legumes are a monophyletic group and closely related to families such as Polygalaceae, Surianaceae, and Quillajaceae, which together form the order Fabales.

Alongside grains, tropical fruits, and root crops, leguminous plants have constituted a dietary staple for humans for thousands of years, playing an essential role in human evolution. The long-standing use of legumes in agriculture and nutrition is deeply tied to human history.

Many species within the legume family (Fabaceae) live in mutualistic symbiosis with nitrogen-fixing bacteria. These beneficial interactions occur through the formation of root nodules,

where bacteria convert inert atmospheric nitrogen into biologically active forms. This process benefits not only the host plant but also enhances soil fertility and supports the growth of surrounding plants. As a result, leguminous plants are widely used in agro-industrial systems as soil-restoring and alternative crops.

Members of this family serve as a major source of food products. For example, crops such as beans, peas, lentils, soybeans, and peanuts constitute a fundamental part of the human diet. These plants are rich in protein, making them a crucial nutritional resource, especially in regions where animal protein is scarce. On the other hand, certain species — such as acacia, licorice (Glycyrrhiza glabra), and Kashgar root — are used as medicinal plants in traditional medicine and the pharmaceutical industry.

Leguminous plants (Fabaceae) play a significant role not only as crops but also in landscape architecture, ornamental horticulture, and biomeliorative practices. Some species (e.g., Robinia pseudoacacia — black locust) are particularly valuable for controlling soil erosion, reclaiming desert and semi-desert areas, and reducing atmospheric pollution.

In recent years, advancements in molecular biology and genomics have allowed for a more precise understanding of the phylogenetic position of the Fabaceae family. DNA sequencing data confirm that the family is monophyletic (originating from a common ancestor) and show a close evolutionary relationship with the families Polygalaceae, Surianaceae, and Quillajaceae within the order Fabales. This information is not only of academic interest but also has practical applications in conserving plant genetic resources and improving species through plant breeding.

Moreover, Fabaceae species are highly valued for their resilience to climate change, adaptability to water scarcity, short vegetation cycles, and low soil fertility requirements, making them important for the development of sustainable agriculture. Numerous international agrobiological programs are currently conducting research on members of this family to develop new cultivars, conserve genetic diversity, and ensure future food security.

The Fabaceae family is one of the largest and most ecologically diverse families of flowering plants, distinguished by its broad distribution, adaptive capacity, and biological richness. Its members are not only notable for their morphological features, but also for their economic, ecological, and nutritional significance in human society.

Fabaceae species include trees, shrubs, and herbaceous plants, typically characterized by compound leaves, zygomorphic (bilaterally symmetrical) flowers, and the production of leguminous fruit (pods). A majority of these plants form symbiotic relationships with nitrogen-fixing bacteria in their root nodules, playing a critical role in enhancing soil fertility. Today, members of this family are widely utilized across the globe as food sources, medicinal plants, industrial raw materials, and agromeliorative crops.

Based on modern phylogenetic and molecular research, it has been confirmed that the Fabaceae family represents a single monophyletic group, which facilitates a deeper understanding of its systematic relationships with other closely related plant families. Furthermore, it is important to highlight the historical importance of leguminous plants in human civilization, as well as their potential role in the development of sustainable agriculture.

Therefore, conducting in-depth studies of the Fabaceae family, preserving its genetic resources, and applying the knowledge in practical fields are crucial steps toward ensuring ecological sustainability, food security, and the protection of agrobiodiversity.

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