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ANALYSIS OF PALYNOLOGICAL STUDIES ON MEDICINAL REPRESENTATIVES OF THE FAMILY FABACEAE

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Annotatsiya. *Mazkur ishda Fabaceae oilasining dorivor vakillariga oid palinologik tadqiqotlar ilmiy adabiyotlar asosida tahlil qilindi. Gulchang donalarining shakli, o‘lchami, aperturalari va ekzina ornamentatsiyasining taksonomik ahamiyati umumlashtirildi. Yorug‘lik mikroskopiyasi (LM) va skanerlovchi elektron mikroskopiya (SEM) usullarining imkoniyatlari ko‘rib chiqildi. Tahlil natijalari gulchang morfologik belgilaridan dorivor o‘simliklarni identifikatsiya qilish va morfologik jihatdan yaqin taksonlarni farqlashda qo‘shimcha diagnostik mezon sifatida foydalanish mumkinligini ko‘rsatdi.*

Калит сўзлар: *Fabaceae, dorivor o‘simliklar, gulchang morfologiyasi, palinologiya, ekzina, taksonomiya.*

Аннотация. *В данной работе на основе научной литературы проведён анализ палинологических исследований лекарственных представителей семейства Fabaceae. Обобщено таксономическое значение формы, размеров, апертур и орнаментации экзины пыльцевых зёрен. Рассмотрены возможности применения световой микроскопии (LM) и сканирующей электронной микроскопии (SEM). Результаты анализа показали, что морфологические признаки пыльцы могут использоваться в качестве дополнительных диагностических критериев при идентификации лекарственных растений и различении морфологически близких таксонов.*

Ключевые слова: *Fabaceae, лекарственные растения, морфология пыльцы, палинология, экзина, таксономия.*



Abstract. *This study analyzes palynological investigations of medicinal representatives of the family Fabaceae based on scientific literature. The taxonomic significance of pollen grain shape, size, apertures, and exine ornamentation was summarized. The applicability of light microscopy (LM) and scanning electron microscopy (SEM) was considered. The results of the analysis showed that pollen morphological characters can be used as additional diagnostic criteria for the identification of medicinal plants and the differentiation of morphologically similar taxa.*

Keywords: *Fabaceae, medicinal plants, pollen morphology, palynology, exine, taxonomy.*

1. INTRODUCTION

Plants are among the most important natural resources for humanity, providing food, forage, medicinal raw materials, and many other essential resources. Medicinal plants have been traditionally used by various cultures for the prevention and treatment of diseases since ancient times. According to the World Health Organization, traditional medicine, including the use of medicinal plants, remains an important component of healthcare practices in many countries [1]. Therefore, the scientific study of medicinal plants, their accurate identification, and ensuring the authenticity of medicinal raw materials are important areas of modern biology and pharmacognosy.

Accurate identification of plant species is of particular importance in ensuring the quality of medicinal plant raw materials. In this regard, in addition to vegetative and generative morphological characters, micromorphological characteristics can also serve as supplementary diagnostic tools. The shape, size, apertures, and exine structure of pollen grains may exhibit characteristic features in different taxa [2].

Palynology, as a field of science that studies pollen grains and spores of plants, is closely associated with systematics, evolutionary botany, paleobotany, ecology, and applied biology. The study of pollen morphology can facilitate the identification of plants at different taxonomic levels, the differentiation of closely related taxa, and, in

some cases, provide additional evidence for the authentication of medicinal raw materials.

The family Fabaceae is one of the large and ecologically and economically important families of angiosperms. It includes numerous plant species of food, forage, melliferous, and medicinal importance. Mabberley characterized Fabaceae as one of the large and important families of angiosperms [3]. Therefore, the study of morphological and micromorphological characteristics of Fabaceae representatives has both theoretical and practical significance.

The aim of this study is to summarize scientific information on pollen morphology in medicinal representatives of the family Fabaceae, comparatively analyze the main palynological characteristics, and highlight their taxonomic and diagnostic significance.

2. MATERIALS AND METHODS

The study was based on a review of scientific literature. Information on pollen morphology of representatives of the family Fabaceae reported in scientific publications was examined using a comparative analytical approach.

The following morphological and micromorphological characteristics of pollen grains were used as the main criteria for analysis:

overall shape of pollen grains;

pollen grain size;

polar and equatorial views;

number of apertures;

type and arrangement of apertures;

structure of the exine layer;

ornamentation of the exine surface.

In addition, studies focusing on the palynological authentication of medicinal representatives of Fabaceae were reviewed separately. The capabilities of light microscopy (LM) and scanning electron microscopy (SEM), as applied in the reviewed

literature, were taken into consideration for the identification and characterization of palynological features [4–6].

No new experimental data were obtained in this study. The results were derived from the systematization and comparative analysis of information reported in previously published scientific studies.

3. RESULTS

3.1. Main Diagnostic Features of Pollen Morphology in Fabaceae

The literature analysis showed that the pollen morphology of Fabaceae representatives is characterized by a set of several interrelated features. The shape and size of pollen grains, polar and equatorial views, the number, type, and arrangement of apertures, as well as the structure of the exine layer and its surface ornamentation are important for taxonomic comparison.

The reviewed studies indicate that comparisons based on a combination of several morphological characteristics, rather than on a single feature, allow differences among taxa to be assessed more accurately. Pollen grain shape and size may vary among different plant taxa, whereas some characteristics may be similar in closely related species [2].

Therefore, pollen morphology should not be considered an independent and sole criterion for assessing taxonomic relationships, but rather as a supplementary diagnostic criterion that complements other morphological and anatomical characteristics.

3.2. Significance of Microscopic Methods in Palynological Studies

The use of light microscopy and scanning electron microscopy in palynological studies of Fabaceae representatives has been reported. Light microscopy allows the general shape, size, and apertures of pollen grains to be evaluated.

SEM, in turn, enables detailed examination of fine ornamental elements of the exine surface. Consequently, it expands the possibility of detecting micromorphological differences among morphologically similar taxa.

Luz et al. studied the pollen morphology of representatives of the family Fabaceae in the Pau-de-Fruta Specially Protected Area in the state of Minas Gerais, Brazil. In their study, pollen grains of different taxa were morphologically compared, and differences in pollen shape, apertures, and exine ornamentation were reported as potentially useful characteristics for distinguishing taxa [4].

3.3. Pollen Ornamentation in Fabaceae Representatives

Bapir and Galalaey investigated the pollen morphology of five species of the family Fabaceae: Colutea cilicica Boiss. & Balansa, Glycyrrhiza glabra L., Spartium junceum L., Robinia pseudoacacia L., and Anagyris foetida L. [5].

Light microscopy and scanning electron microscopy were used in the study. The pollen grains of the investigated species were predominantly monad, small to medium-sized. The exine ornamentation included perforate, fossulate, reticulate, regulate, and granulate patterns [5].

These findings indicate that exine ornamentation can serve as an important micromorphological characteristic for the comparative study of Fabaceae representatives.

3.4. Palynological Characteristics of Medicinal Fabaceae Representatives

Studies focusing on the pollen morphology of medicinal Fabaceae representatives have also been reported. Mohammed et al. investigated the pollen morphology of six medicinal plant species belonging to the family Fabaceae in the Al-Madinah Al-Munawwarah region of Saudi Arabia: Cullen plicatum, Leucaena leucocephala, Pithecellobium dulce, Senna italica, Tephrosia apollinea, and Vachellia flava [6].

The main focus of the study was to determine the pollen morphological characteristics of these species and to evaluate the possibility of distinguishing them based on these characteristics [6].

The literature analysis showed that, in addition to pollen shape and size, apertures and exine ornamentation are important comparative characteristics of

medicinal Fabaceae representatives. In particular, micromorphological characteristics may provide additional diagnostic information for morphologically similar taxa.

Table 1.

Main Palynological Characteristics of Fabaceae Representatives and Their Diagnostic Significance

Palynological characteristic	Description	Taxonomic significance
Shape	General pollen grain shape in polar and equatorial views	Comparison of closely related taxa
Size	Size parameters of pollen grains	Assessment of differences among species
Apertures	Number, type, and arrangement of apertures	Use as a diagnostic characteristic
Exine	Structure and surface characteristics of the exine layer	Identification of micromorphological differences
Ornamentation	Perforate, fossulate, reticulate, regulate, and granulate patterns	Differentiation and identification of taxa

The data presented in the table indicate that, when evaluating pollen morphology in Fabaceae representatives, it is appropriate to consider several characteristics comprehensively, including shape, size, apertures, and exine ornamentation, rather than relying on a single characteristic.

4. DISCUSSION

The analyzed scientific sources show that the pollen morphology of representatives of the family Fabaceae has been studied in different geographical regions. The microscopic methods used in these studies have made it possible to

identify characteristics ranging from the general morphological features of pollen grains to the micromorphological structure of the exine surface.

The taxonomic significance of pollen morphology is primarily associated with its application as a combination of several diagnostic characteristics. While general characteristics such as shape and size may indicate initial differences among taxa, micromorphological characteristics such as apertures and exine ornamentation provide additional information for detailed comparisons of closely related taxa.

Studies focusing on medicinal representatives of Fabaceae, particularly the research conducted in the Al-Madinah Al-Munawwarah region, indicate that pollen characteristics can be used for the identification and authentication of medicinal plants [6]. However, interpreting palynological characteristics as a sole means of identification requires scientific caution. It is more appropriate to evaluate them together with vegetative, generative, anatomical, and other diagnostic characteristics.

The results of the analysis indicate that the available information on pollen morphology of Fabaceae representatives has been generated across different geographical regions and for individual taxa. Therefore, studying the palynological characteristics of medicinal Fabaceae representatives occurring in the local flora using a unified methodological approach represents a relevant direction for further research.

Future studies involving a comprehensive investigation of pollen morphology of local Fabaceae species using LM and SEM, statistical analysis of morphometric characteristics, and comparison of the obtained results with existing international palynological data may expand the potential of taxonomic diagnostics.

5. CONCLUSION

The literature analysis demonstrated that pollen morphology of medicinal representatives of the family Fabaceae provides important taxonomic and practical information. Characteristics of pollen grains, including shape, size, polar and equatorial views, apertures, and exine ornamentation, can be used as supplementary diagnostic features for comparing and distinguishing different taxa.

The reviewed studies indicate that light microscopy provides important opportunities for determining the general morphological characteristics of pollen grains, whereas scanning electron microscopy enables a detailed characterization of the micromorphological structure of the exine surface.

Palynological studies of medicinal Fabaceae representatives demonstrate that pollen characteristics can be used as supplementary diagnostic tools for plant identification and the authentication of medicinal raw materials. At the same time, the comprehensive evaluation of palynological characteristics together with other morphological and anatomical features is scientifically appropriate.

Comparative studies of pollen morphology of medicinal Fabaceae representatives distributed in different geographical regions, standardization of palynological characteristics, and determination of their taxonomic diagnostic value represent important directions for future research.

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