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Review Article

Role of pollen morphology in taxonomy and detection of adulterations in crud drugs

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Abstract

Present paper communicates 42 species of angiosperms depicting characteristics of pollen grains as shape, color, exine ornamentations, and type of apertures. Pollen morphological characters are very important in plant identifications in field. Pollen surface features plays significant role in taxonomy and detection of crud drugs. Firsthand information is gathered from field and provided in this research article.

More Information

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Introduction

The use of herbal medicine for the treatment of diseases and infections is a safe and traditional therapy.

Pollen morphological characters are used to identify adulterations in crud drugs or dry herbs of some medicinal plants as pollen grains are very minute and are adhered in any part of the crud drugs.

In developing countries, medicinal plants are attaining greater importance in the primary health care of individuals and communities. Medicinal plants form a large group of economically important plants that provide the basic raw materials for indigenous pharmaceuticals

Pollen characters are useful in solving complicated problems of interrelationships between various taxa and assessment of their status in the classification, particularly with reference to the families, subfamilies, tribes, genera, species, and subspecies. Pollen morphology is conducted as an aid to the morphological study and a significant tool for modern taxonomist for the delimitation of species. Mature pollen grain size, exine sculpturing, and number of pores are the most distinctive features. Palynological data has been useful at generic and specific level. This analysis also helps in qualitative analysis of drug powder and the correct identification of drug. It plays an important role in our daily life as well. Aerobiology has received much attention due to its wide application in allergology, forestry, agriculture, horticulture, archaeology, and plant geography.

Pollen morphological characters were fully appreciated by authors such as Lindley, von Mohl & Fritzsche as early as 1830-1840. But generally, these characters are overlooked by taxonomist due to lack of sufficient data. Recently, however, considerable attention is being paid to pollen morphology, and the science of palynology (study of spores & pollen grains) has entered into current taxonomic thinking.

first comprehensive book on palynology was written by Wodehouse (1935) & subsequently Erdtman contributed a treatise on pollen analysis (1943). The first manual, Pollen Morphology and plant Taxonomy, appeared in 1952 which deals with angiosperm [1]. This book provided a summary of pollen morphological characteristics of all angiosperm families. As result of the work of these early authors there has recently been a great increase in the comparative analytical studies of pollen morphology and wall structure. Results of considerable systematic and phylogenetics value have been obtained and the conclusions drawn from such studies are generally in agreement with those drawn from other fields of study.

Characters of pollen grains & their role as plant identification in taxonomy and pharmaceutical value as detection of adulterations in crud drugs

The main characters of taxonomic value in pollen grains are

number & position of furrows, number, position of complexity of apertures & form of sculpturing of the exine. Variations is also shown in size & general types.

Most angiospermous pollen grain fall into only two general types, Uniaperturate & triaperturate, from which some less common types have been derived. Uniaperturate pollen grain have a single germinal furrow or pore situated at the proximal or distal position. The proximal form of apertures is always found in pteridophyta but in pteridosperms, the position is reported to be either proximal or distal (Potonie, 1967). The proximal aperture is sometimes found in primitive angiosperms (Nair, 1968), but the distal position is predominant in flowering plants. Uniaperturate pollen grains are characteristics of the monocotyledon & some members of Magnoliidae.

Triaperturate pollen grains have three germinal furrows, either radiating like the lines of a trilete mark from a common point or forming a triangle at the distal position. Various other numbers of furrows & other types of apertures are situated along the equatorial line (zonal position) or distributed over the entire surface (global distribution). The triaperturate or triaperturate-derived pollen grains occur in the bulk of dicotyledons & are unknown elsewhere. Thus, along with the zonal & global position of apertures, evolved many aperturate condition also.

The taxonomic & evolutionary importance of pollen morphology may be at specific, generic or higher levels. In many cases the types of pollen of a taxon is characteristic & constant. Such a taxon is termed stenopalynousor unipalynous [2], & may be exclusive of that group, e.g. thick walled grains of the Gyrostemonaceae of Australia. In other cases, the types of pollen may vary considerably in size, aperture, stratification of exine, etc. Such taxa are termed euirypalynous or multipalynous. Stenopalynous taxa are generally considered to be very natural. Asclepiadaceae, Cruciferae, Gramineae, Labiatae, etc. are some of the stenopalynous families. Eurypalynous taxa, on the other hand, are taken to be heterogeneous, at least in certain instances. Palynological data are particularly useful in the delimitation of eurypalynous taxa. Families such as Rubiaceae, Acanthaceae, and Verbenaceae are highly eurypalynous and a revised classification of some of these has been proposed by some taxonomists (Bremekamp, 1944, 1950.)

Methodology

The pollens were prepared for light microscopy by standard method. Pollen materials were separated from their anthers with the help of forceps and needle under a dissecting microscope. The pollen grains ready for microscopic observations by acetolysis method and were placed on slide. The measurements were based on 15-20 readings for every specimen. Pollen characteristics of pollen grains as shape, color, exine ornamentations, type of apertures.

Regular field tours were arranged to collect the plants in flowering condition for preparing pollen grain slides. Collected plants from the fields were identified with the help of floras [3-5].

Pollen grains mounted & observed under microscope, light microscope, research trinocular & binocular microscopes. Pollen grains were identified with the help of some published literature [1,2,6-9].

In the present work 42 angiosperm plants species are arranged systematically with their botanical names followed by family and characteristic of pollen grains viz. shape, color, exine ornamentation and type of aperture [9,10] (Table 1).

Discussion

In present study, pollen grain morphology of 42 plant species studied. The microscopic observations under light microscope revealed that pollen grains of plants are psilate, rugate to spinulose, verrucate, reticulate, bacculate (bottle shape), spiny, psilate (with smooth surfaces).

The evaluation of crude drug which eventually enters the commercial market is obviously of considerable importance. The pharmacognostic studies consist of the collection of various parts of these plants, their identification, standardization, and authentication through various taxonomic markers and macro- and microscopic characters. Companies involved in the crude drug sale generally avoid special recommendations on the use of a product. There are no applicable standards of quality for crude drugs, and they are not usually standardized with respect to the concentration of active components. So, it is necessary to target such crude drugs to various standards of quality, purity, and safety, if acceptable consumer usage is to be achieved. To authenticate crud drugs it is very necessary to go through microscopic scientific studies e.g palynological data.

Conclusion

Present work will be very helpful for writing pollen flora of local, regional, state & even pollen flora of the country. This work is important for researchers, palynologist & graduate & post graduate students for identification of plant on the basis of simply pollen grains. This palynological work is most important for forensic science to detect the crime on the basis of pollen grains & spores. Pollen morphology has been regarded as a taxonomic character of high significance & used the character along with basic chromosome numbers as a basis for circumscribing groups of genera. This palynological work is also very important for evolutionary studies and to detect adulterations in crude drugs of plant origin.

Table 1: Systematic Enumeration of the plants studied.

Sr. No.	Botanical Names	Family	Characteristics of Pollen Grains			
			Shape	Color	Exine ornamentation	Types of apertures
1	***Quisqualis indica*** L.	Combretaceae	Elliptical	Light brown	Psilate	Colpate
2.	***Pedilanthus tithymaloides*** (L.) Poit.	Euphorbiaceae	Rounded	Brown yellow	Psilate(smooth)	Porate
3.	***Stachytarpheta jamaicensis*** (L.)Vahl	Verbenaceae	Elliptical, rod, rounded, circularin outline	White	Psilate	Porate, colpate
4.	***Spathodea campanulata*** Beauv.	Bignoniaceae	Circular, irregular in outline	Light brown	Psilate	Porate, (trizonoporate, Colporate)
5.	***Crossandra undulifolia*** Salib.	Acanthaceae	Rod shaped	Light red & yellow	Spinulose	Bicolpate
6.	***Ixora parviflora*** Vahl.	Rubiaceae	Rounded, circular	Light yellow	Psilate (smooth)	Colporate
7.	***Hyptis suaveolens*** (L.) Poit.	Lamiaceae	Rounded, circular in outline	Brownish yellow	Psilate	Porate
8.	***Moringa concanensis*** Nimmo ex Dalz. & Gibs.	Moringaceae	Elliptic, oval	Faint cream	Psilate	Colpate (monocolpate)
9.	***Cleome viscosa*** L.	Cleomaceae	Elliptic	Light yellow	Psilate	Colpate(bicolpate)
10.	***Rhynchosia minima*** (L.) DC.	Papilionaceae	Slightly triangular in shape, circular	Brown, greenish	Psilate	Porate (Trizonoporate)
11.	***Lantana camara*** L.	Verbenaceae	Rounded	Yellow	Psilate	Porate
12.	***Azadiracta indica*** A. Juss.	Meliaceae	Rounded,elliptical	Hyaline	Psilate	Colpate (bicolpate)
13.	***Thevetia peruviana*** (Pers.) Shetty & Singh	Apocynaceae	Triangular, semi-circular, trichotomous	Light yellow	Psilate	Porate(trizonoporate)
14.	***Euphorbia indica*** Lam.	Euphorbiaceae	Elliptic	Light yellow	Psilate	Colpate
15.	***Pyrostegia venusta*** Miers.	Bignoniaceae	Elliptic, oval	Light yellow	Psilate	Colpate (bicolpate)
16.	***Euphorbia millii*** *Des. moul.*	Ephorbiaceae	Elliptic, circular, oval	Light brown	Psilate (thick eticulate)	Colpate (bicolpate)
17.	***Tecoma stans*** (L.) Juss. Ex Kunth	Bignoniaceae	Rounded, elliptical,circular	Yellow brown	Psilate	Colpate (tricolpate)
18.	***Justicia gendarussa*** Burm. *f.*	Acanthaceae	Elliptic, oval,circular in outline	Light yellow	Psilate	Porate, colpate (triporate)
19.	***Ipomoea obscura*** (L.) Ker.-Gawl.	Convolulaceae	rounded / circular in outline	Light brown	Spiny	Porate (Pantoporate)
20.	***Sonchus oleraceus*** L.	Compositae	Quadranguler trianguler	Light yellow	Spinulate	Porate(Pantoporate, trizonoporate)
21.	***Clitoria ternatea*** L.	Papilionaceae	Quadrangular,triangular	Light gray	Psilate	Porate (broad colpi)
22.	***Datura innoxia*** Mill.	Solanaceae	More / less rounded	Light gray	Psilate (thick)	Porate (Trizonoporate)
24.	***Jatropha pandurifolia*** Andr.	Euphorbiaceae	Circular /rounded	Light yellow	Rugulate, reticulate (thick)	Porate
25.	***Alternanthera sessilis*** (L.).R.Br. ex DC.	Amaranthaceae	More/ less circular in outline	Light yellow	Psilate	Porate(Trichotomous)
26.	***Launaea Procumbens*** (Roxb.) Ramayya & Rajgopal	Compositae	Triangular, Semi circular	Light yellow	Verucate (reticulate)	Porate (Trichotomoproate)
27.	***Plumbago zeylanica*** L.	Plumbaginaceae	Rounded	Light yellow	Psilate	Porate (Trizonoporate)
28.	***Oscimum sanctum*** L.	Labiatae	Rounded	Light yellow	Short Spiny	Porate
29.	***Ocimum basilicum*** L.	Labiatae	Rounded	Cream white blackish /Hyaline	Reticulate	Porate(pantoporate)
30.	***Portulaca quadrifida*** L.	Portulaceae	Rounded,circular (double layer)	Yellowish	Spiny	Porate(pantoporate)
31.	***Sida cordifolia*** L.	Malvaceae	Rounded	Brown	Spiny	Porate (Pantoporate)
32.	***Rhoeo discolor*** (L.) Hance	Commelinaceae	Rod shape	White	Psilate	Colpate
33.	***Hibiscus rosa-sinensis*** L.	Malvaceae	Rounded or circular in outline	Light brown	Bacculate(bottle shape)	Porate (pantoporate)
34	***Sida acuta*** Burm.*f.*	Malvaceae	More/less rounded	Light brown	Rugate to Spinulose	Porate (pantoporate)
35	***Vinca rosea*** L.	Apocynaceae	Rounded / circular	Light yellow, pinkish at border		Porate
36	***Bougainvillea spectabilis*** Willd.	Nyctaginaceae	Rounded	White brown		Spinulose
37	***Asystasia dalzelliana*** Santapau	Acanthaceae	Rod shape / elliptical	Faint white	Psilate (smooth)	Porate (Dizonoporate)
39	***Lindenbergia macrostachya*** (Benth.) Benth.	Scrophulariaceae	Elliptical	White-hyaline	Psilate	Colpate
40	***Vernonia cinerea*** (L.) Less.	Compositae	Circular/rounded in outline	Faint brown	Verrucate, reticulate	Porate(Trizonoporate)
41.	***Tridax procumbens*** L.	Compositae	Quadrate/more or less circular in utline	Light black	Spiny	Porate (Pantoporate)
42.	***Euphorbia clarkeana*** Hook. *f.*	Euphorbiaceae	Rounded	Light brown	Psilate	Porate (aperture on distal position)

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