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Research Article

Morphological Study of Pollen as an Aid in Criminal Investigation

Pradip Hirapure*, Sanjay Jagtap, Nadar Elsy Rani Jabadurai
Department of Forensic Biology, Govt. Institute of Forensic Science, Mumbai, India

***Corresponding author**
Pradip Hirapure
Email: pradiphirapure@gmail.com

Abstract: Study of the pollens, Palynology, is now gaining importance in forensic casework analysis. They not only help to link the particular type of flowers found at a crime scene but also to the time (season), when they are in bloom. Forensic palynology refers to the use of pollen and spore evidence in legal cases. The main forensic application of palynology is in providing associative evidence, assisting to prove or dis-prove a link between people and objects with places or with other people. The present study was conducted to examine the pollen morphology of various plants found in Institute Of Science, which are flowering during the month of February and March. Pollen morphology of 9 plants of different species was studied and documented using compound microscope.
Keywords: Palynology, Pollen garin, forensic Botany, Spores

INTRODUCTION

Forensic palynology has been a law enforcement tool for over 50 years. Forensic palynology is the application of pollen and spores in solving legal issues, either civil or criminal. Pollen and spores can be obtained from an extremely wide range of items, including bodies. Pollen and spores provide clues as to the source of the items and the characteristics of the environments from which the material on them is sourced [1].

Pollen and spore production and dispersion are important considerations in the study of forensic palynology. First, if one knows what the expected production and dispersal patterns of spores and pollen are for the plants in a given region, then one will know what type of "pollen fingerprint" to expect in samples that come from that area [2]. Soil, dirt, and dust are common elements at almost every crime scene. As such they should be collected carefully because often these elements contain abundant pollen and spores .Samples of dirt collected from the clothing, skin, hair, shoes, or car of a victim might prove useful in linking the victim with the location where the crime occurred [3]. The same would be true of any suspects thought to be associated with a crime. Mud found on a stolen vehicle, or a vehicle used in a crime, could link the vehicle with the scene of a crime or link it to the place from which it was stolen. Dirt found associated with other objects or other types of conveyances thought to be associated with a crime also might yield pollen evidence useful in linking those items with a specific crime or a specific geographical location [4].

As the number of cases that pollen and spores are successfully used as evidence in forensic cases increases. Recently solved criminal cases show that the forensic use of pollen and spores can be used in many different crimes. A short list of these cases show many ways pollen is now being used in the courtroom. Forgery, Production and distribution of illegal drugs, Assaults, Robbery, Rapes, Homicide, Genocide, Terrorism, Arson, Hit and run crimes, Counterfeiting of currency, Identifying the origin of fake prescription drugs such as Viagra. Pollen and spore evidence has also been used to resolve different types of civil cases. There are many ways in which pollen and spores are being used as evidence. Following is a list of civil cases where pollen and spores have been used as evidence in Forged documents, Fake antiques, Authentication of paintings by master artists, Removal of artifacts from historic or archaeological sites, Illegal poaching of animals including fish, Illegal pollution of the environment [5].

Pollen and spore exines are amazingly diverse, sometimes even to the species level, and their production is generally seasonally and often geographically restricted, thus their presence can point to a specific season, sometimes even a specific location, in which a crime was committed [6]. There are many published examples of pollen morphology among related families or within families or genera that illustrate this diversity and consequently their usefulness as trace evidence [7-10]. In addition, they have other advantages. They are slow to decay pollen

can be retrieved from rocks millions of years old, a valuable asset for oil companies and archeologists. Because they are microscopic, they remain unseen, silent witnesses and even if they were visible, unlike fingerprints, they would be nearly impossible to eliminate from a crime scene. In forensic biology, pollen can tell a lot about where a person or object has been, because regions of the world, or even more particular locations such a certain set of bushes, will have a distinctive collection of pollen species [11].

MATERIALS AND METHODS

Collection and preservation of pollen sample

Pollen samples were obtained from the wild plants as well as from cultivated ornamentals in botanical garden at institute of science, Mumbai (India). All the flowers were collected from those plants which flowers during the period of February and March. The pollen grains were prepared for light microscopy by the standard methods described by Erdtman [12]. Sample were identified

Preparation of pollen slides

The preserved material was prepared by acetolysis method according to Erdtman [12] for light microscope, which involves the introduction of acetolysed mixture comprising acetic anhydride mixed with concentrated sulphuric acid in the ratio 9:1. The tubes were immersed in boiling water bath for 3-5 min, centrifuged and the supernatant decanted. The residue was washed water and decanted, about few drops of glycerin was added and mounted on slide. The prepared slides were studied under light microscope for morphological studies and photograph of pollen grains was taken under oil immersion (E100, 1.25) using a 10X eye piece.

RESULTS

Pollen Morphology

Pollen morphology of nine species varies from different plant species and accordingly is described:

Table 1: Pollen morphological description

Sl. No.	Name of plants	Family	Pollen Morphology
1.	*Hibiscus schizopetalus (Dyer) Hook. f.*	Malvaceae – Mallow family	Pantoporate, Spheroidal, Surface between spines is granulate, large spines
2.	*Averrhoa bilimbi L*	Oxalidaceae – Wood-Sorrel family	Prolate, Spheroidal, Projection absent, tripolate
3.	*Diospyros peregrina*	Ebenaceae	Oval shaped
4.	*Hamelia patens Jacq. – Scarletbush*	Rubiaceae – Madder family	Spheroidal, tripolate
5.	*Ixoracoccinea*	Rubiaceae – Madder family	Globose, zonocolporate, verrucate.
6.	*Plumbago auriculata Lamk.*	*Plumbaginaceae*	Prolate, colporate, tectum granulate
7.	*Jatropha panduraefolia Andr.*	*Euphorbiaceae.*	Spheroidal, projection absent
8.	*Rosa setigera*	Rosaceae	Spheroidal, granulate
9.	*Hibiscus rosa-sinensis.*	Malvaceae	Spheroidal, polynantoporate, tectum granulate

(1A) **(1B)**

Fig. 1: 1A: Flower of *Hibiscus schizopetalus*, 1B: Pollen of *Hibiscus schizopetalus* under microscope


(2A) **(2 B)**

Fig. 2: 2(A): Flower of *Averrhoa bilimbi*, 2(B): Pollen of *Averrhoa bilimbi* under microscope

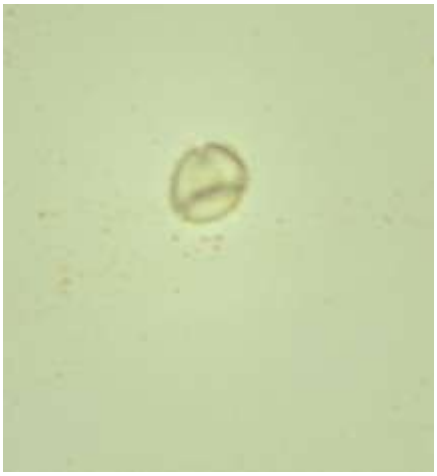

3(A) **3(B)**

Fig. 3: 3A: Flower of *Diospyros peregrina*, 3(B): Pollen of *Diospyros peregrina* under microscope


4(A) **4(B)**

Fig. 4: 4(A) Flower of *Hamelia patens*, 4(B): Pollen of *Hamelia patens* under microscope

5(A)



5(B)

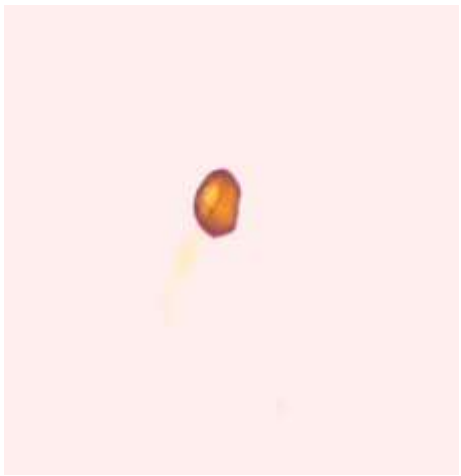
Fig. 5: 5(A) Flower of *Ixora coccinea*, 5(B): *Pollen of Ixora coccinea* under microscope

6(A)

6(B)

Fig. 6: 6(A) Flower of *Plumbago auriculata*, 6(B): Pollen of *Plumbago auriculata* under microscope

7(A)



7(B)

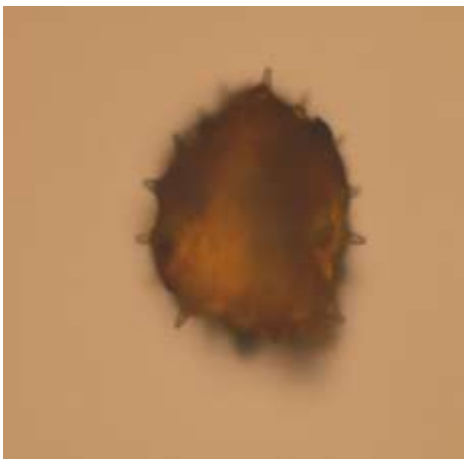
Fig. 7: 7(A) Flower of *Jatropha panduraefolia Andr.*, 7(B): Pollen of *Jatropha panduraefolia Andr.* under microscope

8(A)

8(B)

Fig. 8: 8(A) Flower of *Rosa setigera*, 8(B): Pollen of *Rosa setigera* under microscope

9(A)



9(B)

Fig. 9: 9(A) Flower of *Hibiscus rosa-sinensis*, 9(B): Pollen of *Hibiscus rosa-sinensis* under microscope

CONCLUSION

The pollen from 9 different plants found in Institute of Science botanical garden was studied and the data base was made. The pollen sources were *Hibiscus schizopetalus (Dyer) Hook. f., Averrhoa bilimbi L.) Diospyros peregrina (gaertn.) Guerke, Hamelia patens Jacq.-Scarletbush, Ixoracoccinea, Plumbago auriculata Lamk, Jatropha panduraefolia Andr, Rosa Setigera, Hibiscus rosa-sinensis.* Different pollen types were recognized. This database is useful in identification of criminal investigation of forensic importance. It also helps in identification, comparison of other pollen grains of surrounding area.

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