



Analytical study on importance of Pollen grains used as evidence in Forensic Science

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Abstract

Forensic Science is the application of different Scientific domains to deliver justice, in relation with this Forensic Botany is the utilization of Botanical Evidences in Forensic aspects. Leaf, Flower, Pollen Grains etc. are some of the common plant materials which can be utilized as a Botanical Evidence in Forensic Science. Through proper identification, collection and preservation of these will help as supporting evidence to prove a person's presence in crime scene. Forensic Palynology is the branch of Forensic Science which deals with use of Pollen and Spores to provide justice. Pollen grains are very tiny in nature but they are Individualistic nature make them acceptable as a Forensically relevant Evidence. Pollens are not visible with naked eyes due to this the culprit may not aware that the pollen has transferred to his body. Likewise, some of it may cause allergic in some people, it will help to find the location also. The pollen has many peculiarities, this branch is not that developed much even now. This study is deals with collection and analysis of some commonly present flowers and their pollen grains which grows in a particular location of Tamil Nadu. Pollen grains were observed under Microscope to study its Individual characters. Due to lack of time and availability of instruments study has done in a base level. Even though this may help to refer regarding pollen grains and their characters.

Keywords: Forensic Palynology, Pollen Grains, Individuality, Trace Evidence, Crime Scene.

Introduction

A tiny naked thing can provide vital information regarding a person's presence in a crime scene, Pollen Grains are them. If it is properly located, collected and preserved it will give a good amount of information like location, presence etc. of a person¹. Pollens are naked to eyes but it has good potential in solving a crime. Forensic Botany is the branch of Forensic Science which utilizes plant materials like leaves, flowers, seeds, plants as such for providing justice². In that Forensic Palynology is the branch of Forensic Science which deals with the study of Pollen Grains and Spores which can be used as evidence to prove a Suspect – Crime Scene – Victim triangle³.

As the pollens are naked to eyes the culprits may not aware about the presence of these tiny particles in their body. Due to this the chance of distraction of these evidences voluntarily by the culprits will be less and the persistence of pollens are high also⁴. There are some more features related with pollen is to temperature, cold etc. They have a sticky nature so it will get adhere to the place which come in contact and it will stay for a long time without getting damaged by external factors⁵.

The proper identification and analysis of pollen can help in determining the geographical location of both culprits and victim. It also helps to identify whether the body is moved from one place to another place that is the crime scene primary or

secondary in nature⁶. Some of the pollen grains will cause allergic to some people, this is also a fine characteristic feature of pollen grains⁶.

Like all the other evidences pollens are also unique, plants in all over the globe contains different kinds of pollen grains which can be utilized in Forensic examination⁷. Considering this nature, the location identification can be possible through proper examination of these tiny tools⁸. Even though these pollens are reliable Forensic Palynology is an under developed branch in Forensic Science. The admissibility of these evidences by court can be the most preliminary reason for this. Researches regarding pollen and its characters are also very less comparing with other branches⁹. Going deep into it a record related with case used pollen as an evidence can be seen on 1959. As suggested the importance of pollen can be utilized in identifying locations, because some plants will grow in particular locations and seasonal changes also there. So, time and location can be determined according to this¹⁰.

Like Diatoms are using as evidence in drowning cases, pollen grains can also be used as a good tool in many cases like murder, rape, accidents etc., if the crime is happening in an outdoor crime scene it will be more helpful to identify culprits' presence if these naked tiny particles are identified and processed properly¹¹. For this more and more researches should happen in this field, some people with good knowledge in

Palynology and Forensic Science should be there¹². Now a days plants are using in indoor also as business, hobby etc⁸. Due to the naked nature of pollen chance of distraction by the culprits are also less, even a hard machine wash can only make it destroy¹².

This study has conducted on nine commonly occurring indoor and outdoor plants, and its pollens were collected and analyzed under microscope. This was conducted as a base level experiment, so this contains some limitations also. Even though this can be used as a reference for getting idea regarding pollens of different plants and its microscopical features.

Plants used for study: Madagascar periwinkle: *Catharanthus roseus*: The Madagascar periwinkle is herbaceous evergreen plants which is perennial in nature. Usually this will grow up to 100 cm tall with shining, oval dark green leaves. Flower of this plants is five petaled pink shaded in colour with a shape of pinwheel. The flower contains spherical pollen grains with sculptured exine in it. The plant having good medicinal benefits which can use for cancer treatment also.

Cape Jasmine: *Gardenia jasminoides*: This plant is commonly a evergreen flowering shrub with white flower having four petals with fragrances. Leaves are leathery, smooth and dark green. One feature of flower of this plant is it will turn its white colour into yellow by passing time. Pollens are most probably ellipsoidal or spherical in nature with thick exines.

Hibiscus: *Hibiscus rosa-sinensis*: This plant is also an evergreen, woody shrub which is very commonly seen outdoor plant. 1-3 meter tall up to these plants will grow with red, yellow, white and may in orange-coloured flowers. Leaves have dark green colour, with glossy appearance. These plants are bisexual may get pollinated through insects also. Pollens are very large, spherical in shape with pantoporate exine.

Sulfur Cosmos: *Cosmos sulphureus*: This is an annual herb with fast growing nature, this is used as an ornamental plant most commonly. Growth rate is up to 100 with pinnate leaves. Flowers are of orange or reddish in color. This plant is also having the nature of pollinating by the insects. Pollen grains with tricolporate, spherical with spiny exine which help to attach better.

Bauhinia (mountain Ebony): *Bauhinia variegata*: This is a medium sized deciduous ornamental tree which grow 12 m maximum. Bilobed leaves are present in them. Flowers are large pink to purple, with white margin on them having good fragrant. Ellipsoidal, spherical tricolporate pollens with tick exine are present in them.

Rosa: *Rosa rubiginos*: Rose is used as an ornamental plant everywhere in this world. This is a flowering perennial shrub. Flowers are large, present as clusters with fragrant. Flower present is wide variety of colors including red, yellow, orange and more. Spherical pollens with thick exine are also present in these flowers.

Yellow Elder (Yellow bells): *Tecoma stans*: It is a semi – evergreen shrub with ornamental values, which grow up to 7 meter in height. Leaves are compound and pinnately arranged. Flowers arranged as clusters like a trumpet shape. Spherical, tricolpate pollens with smooth exine.

Rosebay (oleander): *Nerium oleander*: This plant is cultivating as an ornamental plant everywhere, which is an evergreen, shrub grow up to 6 meters height. In stems as a set of three leaves are arranged. Flowers are pink, red, yellow or white in color with five petals. Spherical, ellipsoidal, tricolporate pollen grains with smooth, thick exine present in this.

Frangipani: *Plumeria*: A semi – evergreen deciduous ornamental tree which grows in tropical as well as sub-tropical regions. Tree produces a latex which can see when cut on it. Grow up to 8 meters in height with branches. Large waxy flowers are seen in these plants with spherical pollen grains and thick exine for attaching.



Figure-1A: Madagascar periwinkle.

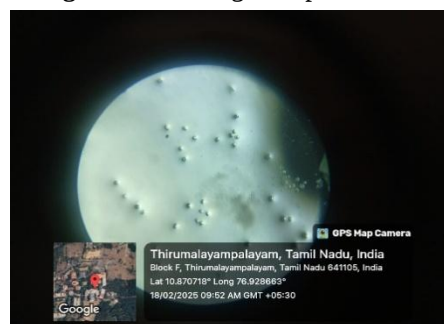


Figure-1B: Pollen View of Madagascar periwinkle.



Figure-2A: Cape Jasmine.



Figure-2B: Pollen View of Cape Jasmine.

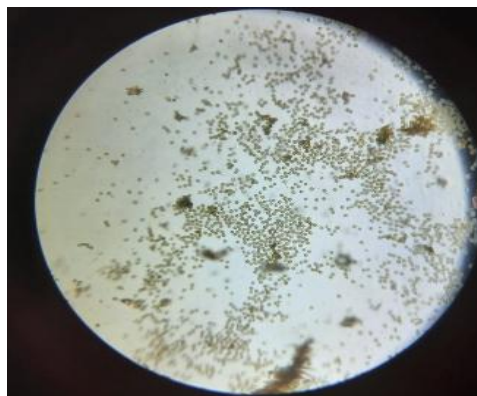


Figure-4B: Pollen View of Sulfur Cosmos.

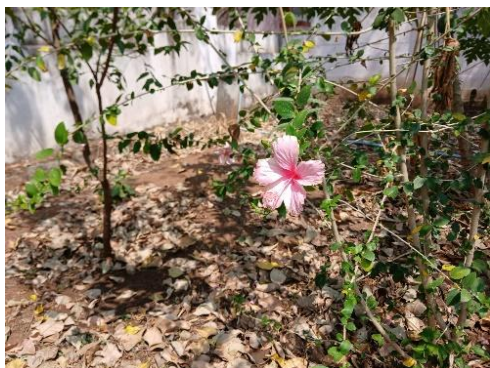


Figure-3A: Hibiscus.



Figure-5A: Bauhinia (mountain Ebony).

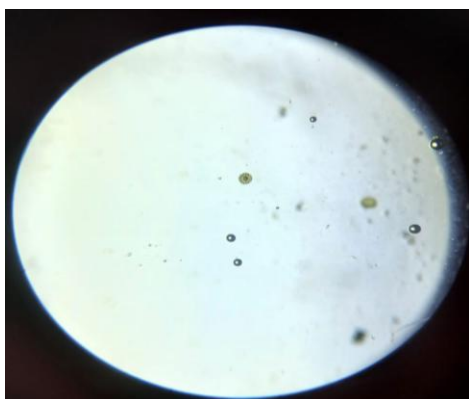


Figure-3B: Pollen View of Hibiscus.

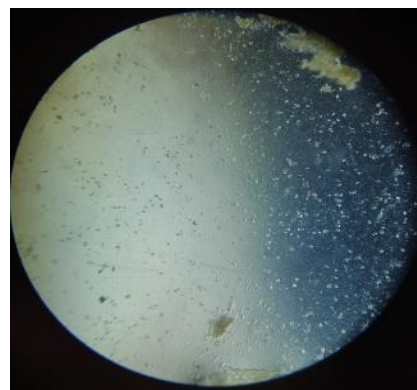


Figure-5B: Pollen View of Bauhinia (mountain Ebony).



Figure-4A: Sulfur Cosmos.



Figure-6A: Rosa.

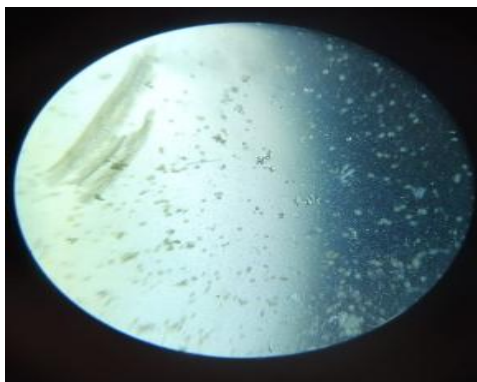


Figure-6B: Pollen View of Rosa.

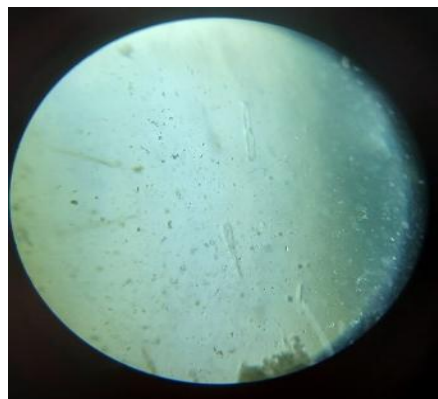


Figure-8B: Pollen View of Rosebay (Oleander).



Figure-7A: Yellow Elder (Yellow bells).



Figure-9A: Frangipani.



Figure-7B: Pollen View of Yellow Elder (Yellow bells).

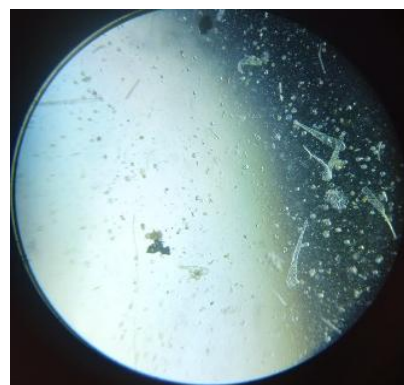


Figure-9B: Pollen View of Frangipani.



Figure-8A: Rosebay (Oleander).

Materials and Methods

Ethical statement: I hereby state that this research project entitled “Analytical study on importance of pollen grains used as evidence in forensic science” research work carried out by me under the Department of Criminology and Forensic science, School of Investigative Science and Technology, Nehru Arts and Science College Coimbatore.

Participants: For this study, 9 commonly present outdoor flowering plants were collected through simple random sampling. Madagascar periwinkle, Frangipani, Rosebay (oleander), Rosa, Bauhinia (mountain Ebony), Sulfur Cosmos,

Hibiscus and Cape Jasmine were the plants selected as the sample because of the availability and more number of distribution in our area.

Research design: The experimental design adopted for this study, Pollen grains collected from flowers and viewed under microscope to determine the characteristic variations in different pollens, which make it possible for using as a forensic evidence.

Tool of data collection: The study was conducted in the month of February and the temperature observed very high. In this study, nine commonly available outdoor plants were identified. They are Madagascar periwinkle, Cape Jasmine, Hibiscus, Sulfur Cosmos, Bauhinia (mountain Ebony), Rose, Yellow Elder (Yellow bells), Rosebay (oleander), Frangipani. It was collected from herbal garden of Nehru Arts and Science College, Coimbatore. Flowers of each plant were collected with proper safety measures for pollen grains analysis. Samples collected using, Gloves, Distilled Water, Microscope Slide, Coverslips, Forceps, Ethanol, Sterile Blade, Microscope, Camera.

Procedure: Collected flowers were carefully opened using a sterile blade to take the pollen grains out. Properly washed microscope slide was taken, added a drop of distilled water and pollen grains from each plant were placed in that drop of water in separate slides. Coverslip was placed over it and observed through microscope. Same pollens were crushed using a forceps which was made sterile using ethanol and then pollen were placed in drop of water in a microscopic slide. Placed coverslip and observed through microscope. Observations were documented through camera for further analyzes.

Data analysis: Collected flowers pollens were properly differentiated from flowers, kept under sterile slide and observed under microscope in 100 X. Observations were properly captured using mobile camera for documentation.

Results and Discussion

Pollen grains of each flower carefully observed through microscope and documented, the method used for the identification of pollen grain was preliminary method, so some microscopic features are visible only. This is one of the limitations of the study also.

Discussion: The basic concept of forensic Science is Individual character of an object which make them admissible them in court as evidence. Each thing which is in this world is different weather it is created by man or God. So, by applying same rule here, pollen grains are also different. Through the microscopic analysis it is proved also. Each plants contain different pollen grains and they show difference in microscopic analysis. This makes pollen also as evidence in Forensic point of view. The distribution of some plants varies with locations also, so this helps for the identification of geographical location. With this

alibi, location change of a body also can be identified. Pollen grains are stick in nature, they make stick in the cloths, body of a culprit or a victim. So, with this the culprit, victim, crime triangle can also be connected. But the problem is this fields are very much underdeveloped and studies are not going properly.

Conclusion

Forensic Palynology is one of the developing branches in Forensic Science, through proper collection, preservation and analysis of pollen grains it will give many answers which hidden in a scene of crime. Through this study some of the common features of the pollen grains are only observed, but with this also it is possible to compare the features of a Known and Unknown Pollen grain. Plants and flowers are most commonly seen thing around us, through proper development of this branch it can be done easily. Making a chart for all the plant pollen will make comparison easy.

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References

1. Linskens, H. F. (1964). Pollen physiology. *Annual Review of Plant Physiology*, 15(1), 255-270.
2. Rakshanda, A., & Reddy, J. (2022). Pollen in forensic palynology: An exploration into a crime-solving tool. *Int J Environ Agric Biotechnol*, 7, 048-53.
3. Ezegbogu, M. O. (2021). Identifying the scene of a crime through pollen analysis. *Science & Justice*, 61(3), 205-213.
4. Bhawana Saini and Surya Shekhar Daga, (2025). The forensic flora of Jaipur: Pollen analysis as a tool for science and justice. 238-248,
5. Bryant, V. M. (2009). Pollen and spore evidence in forensics. *Wiley encyclopedia of forensic science*, 1-16.
6. Wasti, Q. Z., Sabar, M. F., Farooq, A., & Khan, M. U. (2024). Stepping towards pollen DNA metabarcoding: A breakthrough in forensic sciences. *Forensic Science, Medicine and Pathology*, 20(4), 1464-1474.
7. Milne, L. A., Bryant, V. M., & Mildenhall, D. C. (2024). Forensic palynology. In *Forensic botany* (pp. 112-146). CRC Press.
8. Khan, A., Bashir, K., Rashid, A. F., Khan, S. M. S., & Janan, M. (2024). Forensic botany: Unraveling crimes with nature's clues. *Journal of Integrative Medicine and Public Health*, 3(2), 60-65.
9. Boi, M. (2018). The importance of palynology in forensic investigations. *Forensic Sci. Add. Res*, 3, 1-2.

10. Alotaibi, S. S., Sayed, S. M., Alosaimi, M., Alharthi, R., Banjar, A., Abdulqader, N., & Alhamed, R. (2020). Pollen molecular biology: Applications in the forensic palynology and future prospects: A review. *Saudi journal of biological sciences*, 27(5), 1185-1190.
11. Morgan, R. M., Davies, G., Balestri, F., & Bull, P. A. (2013). The recovery of pollen evidence from documents and its forensic implications. *Science & Justice*, 53(4), 375-384.
12. Medical Lab Notes (2025). Pollen Grains Microscopy, Introduction, Identification and Key Notes. March 31, 2025.