

## Study of Pollen Morphology of Some Medicinal Plants of Family Apiaceae

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### Abstract

This paper deals with the study of evaluation of the pollen morphology of three plants of family Apiaceae – *Centella Asiatica* (L.) Urban, *Foeniculum vulgare* Mill. and *Caram copticum* (L.) to identify informative pollinic characteristics that contribute to the taxonomic classification of the genus. The morphology of the pollen grains and the exine structure were investigated under a light microscope with the help of an oculomotor. Differences in the pollen morphology were found in the species, mainly in the terms of shape, pollen aperture and ornamentation pattern of the exine. Pollination is entomophilous with the help of insects. The pollen morphology of the species of the *Centella Asiatica*(L.) Urban, *Foeniculum vulgare* and *Caram copticum* has shown palynological characteristics that have specific diagnostic value, thus allowing a better understanding of the taxonomy of the family.

### Keywords

Morphology, *Centella Asiatica*(L.) Urban, Palynological characters, pollen and pollination.

### **Introduction**

*Centella Asiatica* (L.) Urban belonging to the family Apiaceae has been used as an ethnomedicinal herb for thousands of years in India, China, Srilanka, Nepal and Madagascar. There are various names given to this plant in various literature. Name Mandookparni and Gotu Kola is given in Hindi and Bhekaparni in Sanskrit. It is used to cure skin problems, diarrhea, ulcers, asthma, neurological disorders, etc. Due to the great morphological diversity, pollen grains have been used for taxonomic purposes, assisting in the morphological characterization and identification of some species to generate phylogenetic information that more accurately expresses the origin and evolution of the organisms. The pollen characteristics are fundamental for taxonomic classification because each species, genus and family are defined by shape, size, colour and ornamentation of the exine. Pollen is present within the anther. Many cytological changes lead to another dehiscence. Many studies on pollen release show pollen bursting and their release is associated with the androecium morphology, the biology of flowering and environmental factors. There are many mechanisms by which pollen is released. Anemophilous plants are generally known to produce pollen in large amounts. Entomophilous plants bear smooth pollen with or without pollenkit. The capacity to produce pollen is primarily under genetic and physiological control. However, the real production per plant may vary significantly from year to year due to environmental factors.

### **Material and Methods**

The seeds of plants were brought from Patanjali, Haridwar. They were sown in a kitchen garden. Pollen morphology was studied under a light microscope following Erdtman's (1952) acetolysis method. Flower buds were selected and anthers were crushed to take out the pollens in distilled water. The material was sieved through the mesh. The preserved anthers were crushed in distilled water in plastic tubes and then sieved into a centrifuge tube. The pollen water solution was then centrifuged for about 2-3 minutes at 2000 rpm. The solvent was discarded and to pellet freshly prepared acetolysis solution (conc. sulphuric acid: Acetic anhydride in the ratio 1:9) was added. The tubes were placed in the water bath at 80-100 degrees until the solution became brown. Then it was centrifuged. The supernatant was discarded and the pellet was washed in acetic acid solution 2-3 times. Finally to the pellet 50% glycerine was poured out. A piece of gelatin jelly was taken on the tip of a needle and touched with a pollen pellet. The piece of jelly-carrying pollen was placed on a slide and sealed with paraffin wax by covering it with a coverslip. Average measurements of 10 pollen of each species were taken and tabulated. To count total pollen production per flower hemocytometer was used. Then pollen is observed under 40x power. The measurements were based on 10 readings from the pollen of three plants. Polar axis(P), equatorial diameter (E), P/E ratio, exine(ex), colpi long axis (clg), colpi short axis (clt), pori long axis (plg), pori short axis(plt) and costae were also measured. These characters were observed under a microscope with the help of an oculomotor.

### **Observations**

The pollen of all three plants is found to be different in shape, size and structure during palynological studies. during observations, the shape of pollen of *Foeniculum vulgare* was found to be elongated while *Centella Asiatica* is circular and *Caram copticum* ovate. The exine is very resistant to disintegration. Average pollen diameter of *Foeniculum vulgare* Mill. is 3.0  $\mu$ m, *Centella asiatica* (L.) Urban is 2.0  $\mu$ m, while *Caram copticum* (L.) is 4.0  $\mu$ m. Colpi size is 0.2  $\mu$ m in *Foeniculum vulgare*, *Centella asiatica* (L.) Urban is 0.1  $\mu$ m, *Caram copticum* (L.) is 0.3  $\mu$ m. Measurement of the

equatorial axis is 3.0  $\mu\text{m}$  in *Foeniculum vulgare* Mill. , 5.0  $\mu\text{m}$  in *Centella asiatica* (L.) Urban and 2.0  $\mu\text{m}$  in *Caram copticum*. P/E ratio is 1.2 in *Foeniculum vulgare* Mill. ,0.2 in *Centella asiatica* (L.) Urban, 1.2 in *Caram copticum* (L.). Pollen is shed in Monad stage. Pollen measurements were taken under 40 x and x10x objective lenses. Pollen grains are isopolar in *Centella asiatica* (L.) Urban and *Caram copticum* while heteropolar in *Foeniculum vulgare* Mill. (Fig 1-10).

**Table-1: Showing Characters of Pollen in Three Members of Family Apiaceae**

	<b>Centella Asiatica (L.) Urban (Average) <math>\mu\text{m}</math></b>	<b>Caram Copticum (L.) (Average) <math>\mu\text{m}</math></b>	<b>Foeniculum Vulgare Mill. (Average) <math>\mu\text{m}</math></b>
Pollen Shape	Circular	Ovate	Elongated
Pollen Diameter ( $\mu\text{m}$ )	2.0	4.0	3.0
Colpi Size ( $\mu\text{m}$ )	0.1	0.3	0.2
Polar Axis ( $\mu\text{m}$ )	1.0	4.0	5.0
Equatorial Axis ( $\mu\text{m}$ )	5.0	2.0	3.0
P/E Ratio ( $\mu\text{m}$ )	0.2	1.2	1.2
Stage	Monad	Monad	Monad
Aperture Type	Tricolporate	Tricolporate	Tricolporate
Ornamentation [Light Microscope]	Scrabrate	Scrabrate	Psilate

### Result and Discussion

Pollen is released after maturation from anther. The colour of anther also changes as it reaches dehiscence. A powdery mass accumulates at the tip of another after dehiscence. The colour of anther changes from red, black, and pink. The red colour showed undehisced anther while black colour showed dehisced anther. Pollen morphological characters are tabulated in Table-1. The pollen grains are radially symmetrical in *Foeniculum vulgare* and *Caram copticum*. In this study, the shape is circular in *Centella Asiatica*(L.)Urban, ovate in *Caram copticum* while in *Foeniculum vulgare* they are elongated. The polar axis ranges from 1-5  $\mu\text{m}$  and the Equatorial axis 3-5  $\mu\text{m}$ . The longest pollen is observed in *Foeniculum vulgare* Mill. while smallest observed in *Caram copticum*. The longest polar axis is observed in the *Foeniculum vulgare* while the smallest in *Caram copticum*. The exine thickness ranges from 3-7  $\mu\text{m}$ . Exine was thick in *Centella Asiatica*(L.) Urban. The pollen morphology has taxonomic significance.

The palynological study shows that the characters of pollen are helpful in the taxonomical, phylogenetic and biogeographical study of the plants as these characters are reliable and fixed. It is also supportive in the context of the system of classification and identification of plants. Pollen ornamentation also plays a significant role in pollen identification and the type of pollination.

**Pollen Morphology (*Centella asiatica* (L.) Urban)**



Fig:1. Stamens



Fig:2. Opened flowers

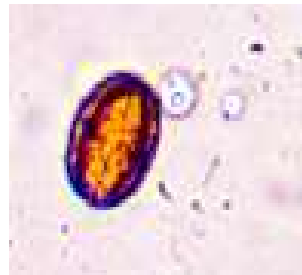


Fig:3. Pollen(Phase Contrast )



Fig:4. Pollen(Simple Microscope)

**Pollen Morphology (*Foeniculum vulgare*)**



Fig:5. Stamen



Fig:6. Opened flower



Fig:7. Pollen(Phase contrast)



Fig:8. Pollen(Simple Microscope)

**Pollen Morphology (*Caram copticum*(L.))**



Fig:9.Stamens



Fig:10.Opened flowers



Fig:11.Pollen(Phase contrast)



Fig:12.Pollens(Simple Microscope)

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