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Studies on pollen morphology of *Ipomoea* species (Convolvulaceae)

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Pollen morphology of four species of *Ipomoea* viz., *Ipomoea fistulosa* (Mart. ex Choisy), *I. palmata* Forssk, *I. quamoclit* L. and *I. triloba* L. (Convolvulaceae) from Sant Gadge Baba Amravati University Campus have been examined by Light and Scanning Electron Microscope (SEM). Pollen grains are usually pantoporate, radially symmetrical, circular in outline, tectum echinate, circular aperture between the spine, suboblate-oblate spheroidal or spheroidal. Among the four species of *Ipomoea* maximum pollen size (97.39-100.86µm) across was found in *I. quamoclit* whereas, minimum pollen size (59.17-65.75 µm) across was noted in *I. palmata.* The maximum spine length (8-14µm) was recorded in *I. palmata,* while it was minimum (4.99-7.33µm) in *I. triloba.* Considering pore size all four species of *Ipomoea* showed close similarities with minor differences. Sculpturing pattern was found to be uniform in all studied species of *Ipomoea.*

Key words: Pollen morphology, *Ipomoea*, LM, SEM.

The Convolvulaceae (Morning Glory Family) is a beautiful family which is widely cultivated as ornamentals. About 55 genera and 1930 species of the Convolvulaceae are widely distributed through temperate and tropical regions and abundant in tropical America and tropical Asia (Saensouk, 2007). One of the major genera is *Ipomoea,* represented by 600 species (Judd *et al*., 2002). The Convolvulaceae is an Eurypalynous family. The palynological observation on convolvulaceae were made at the end of 19th century by Hallier (in Sengupta, 1972), who recognized two groups "Echinoconiena" with echinate pollen and "Psiloconie" with psilate and granulate pollen (Telleria and Daners, 2003). Later on Erdtman (1952) morphologically grouped the pollen of this family in "Ipomoea" type and "other types".

Sengupta (1966) investigated the pollen morphology of nine Indian species of *Ipomoea*. Nayar (1990) studied seven genera of *Ipomoea* based on light microscopy study. The study of morphology of pollen grains is basic necessity of palynology because of its fundamental value in the recognisation and identification of grains found in various conditions (Arora and Modi, 2008). The Scanning Electron Microscope offers a rapid means of observing pollen wall surfaces, as well as providing greater resolution than the Light Microscope. The potryal of pollen surfaces has been greatly improved by the Scanning Electron Microscope (Ridgway and Skvarla, 1969).

The pollen morphology of Convolvulaceae is known to be highly diverse and has taxonomic importance (Telleria and Daners, 2003). Considering

this fact, the present study was undertaken to know the pollen morphology of four *Ipomoea* species by Light and Scanning Electron Microscope.

Materials and Methods

Four species of *Ipomoea* were collected and identified from Sant Gadge Baba Amravati University Campus. Herbarium specimen of each species was prepared and kept at departmental herbarium. Anthers were collected from the mature flowers and stored in 70% alcohol. The collected material was crushed with a glass rod in plastic centrifuge tube. The crushed material was filtered through fine meshes to isolate pollen grains.

The pollen grains were prepared for light and scanning electron microscopy by the standard method described by Erdtman (1952). For light microscopy, the pollen grain were mounted in stained glycerine jelly and observations were made with Trinocular Fluroscence Microscope (Axiostar HBO 50/AC Carl zeiss). For SEM studies, pollen grain were suspended in a drop of ethanol and directly transpired with a fine pipette to a metallic stubs using double sided cello tape and coated with gold palladium in a sputtering chamber (POLARON SPUTTER COATER). The SEM examination was carried out on a LEO electron microscope (LEO 430). The measurement are based on 10 readings from each pollen type and the pollen grain diameter, spine number, spine length, pore size was measured. The number of spines N was calculated according to Hanks and Fryxell (1979) using the formula $N = (\text{Equatorial diameter}/\text{Interspinal distance})^2 \times \pi$. For the interspinal distance, three distances were measured and then averaged. The terminology used in accordance with Erdtman (1952), Fageri and Iverson (1964), Bhattacharya *et. al.* (2006) and Agashe (2006).

Results

Description of pollen type :

1*) Ipomoea fistulosa*

Pollen grains 68.93-78.9 µm in diameter, Oblate-Suboblate, radially symmetrical, outline circular, pantoporate, pores equidistantly distributed, tetragonal area formed by the spine and the ridges of bacula around each extrapolar region, aperture circular deep, 2.86-3.91 µm in diameter, sculpturing echinate, spine 111-141, blunt, 5.92-7.4 µm long, distance between spine 7.40-11.74 µm, bulbous protuberance at the base of spine, 7.30 – 8.14 µm in diameter, metareticulate exine showing microreticulum [Table 1, Fig. 1-2 (LM) and Fig.9-10 (SEM)].

2) *Ipomoea quamoclit*

Pollen grains 97.39-100.86 µm in diameter, oblate spheroidal – spheroidal, radially symmetrical, outline circular, pantoporate, tetragonal area formed by the spine and the ridges of bacula around each extrapolar region, aperture circular 3.17-3.52 µm in diameter, sculpturing echinate, spine 174-183, blunt, 6.95-7.8 µm long, distances between spine 9.56- 13.06 µm, bulbous protuberance at the base of spine, 7.41-8.11 µm in diameter, exine microreticulum between the spine and on the bulbous base. [Table 1, Fig. 3-4 (LM) and Fig. 11-12 (SEM)].

3) *Ipomoea triloba*

Pollen grains 63.27-73.26 µm in diameter, Oblate-Suboblate, radially symmetrical, outline circular, pantoporate, pores equidistantly distributed, tetragonal area formed by the spine and the ridges of bacula around each extrapolar region, aperture circular 2.17-2.86 µm in diameter, sculpturing echinate, spine 136-263, blunt 4.99-7.33 µm long, distance between spine 8-10 µm, bulbous protuberance at the base of spine, 5.56-6.08 µm in diameter, metareticulate exine shows microreticulum with microspine. [Table 1, Fig. 5-6 (LM) and Fig. 13-14 (SEM)].

Fig. 1: *I. fistulosa* (40X)

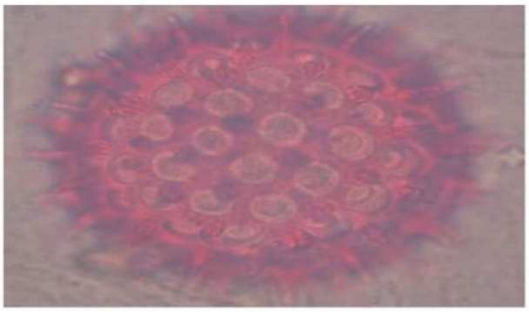

Fig. 2: *I. fistulosa* (100X)

Fig. 3: *I. quamoclit* (40X)

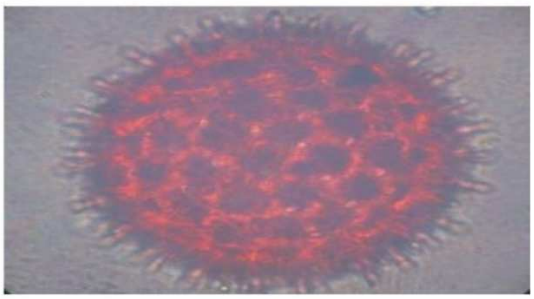

Fig. 4: *I. quamoclit* (100X)

Fig. 5: *I. triloba* (40X)

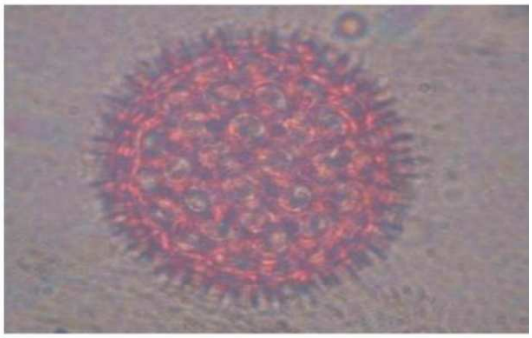

Fig. 6: *I. triloba* (100X)

Fig. 7: *I. palmata* (40X)

Fig. 8: *I. palmata* (100X)

Fig. 1-8: Light micrographs of *I. fistulosa* pollen (40X and 100X), *I. quamoclit* pollen (40X and 100X), *I. triloba* pollen (40X and 100X), *I. palmata* pollen (40X and 100X).

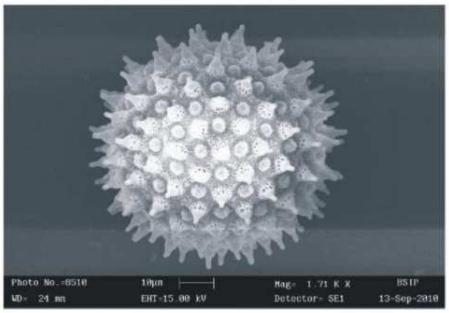

Fig. 9

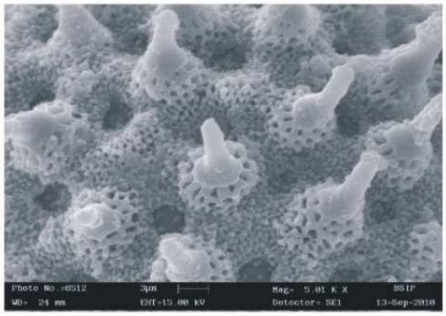

Fig. 10

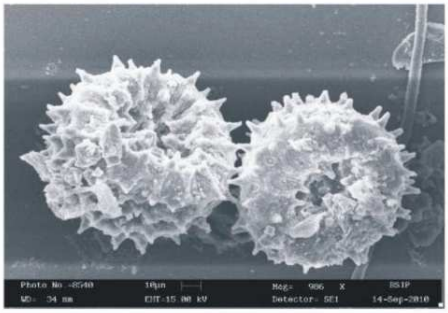

Fig. 11

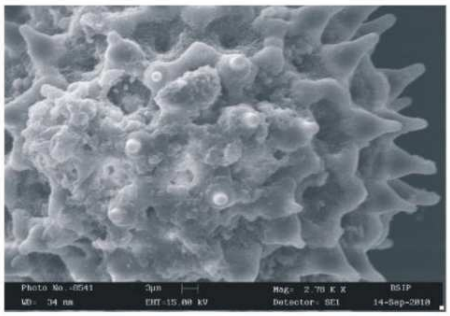

Fig. 12

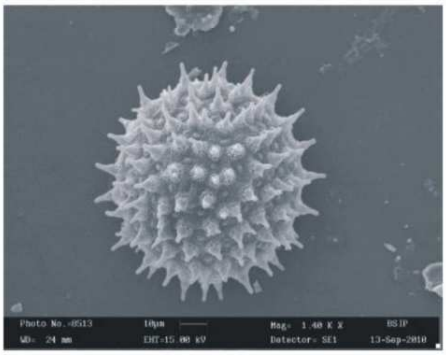

Fig. 13

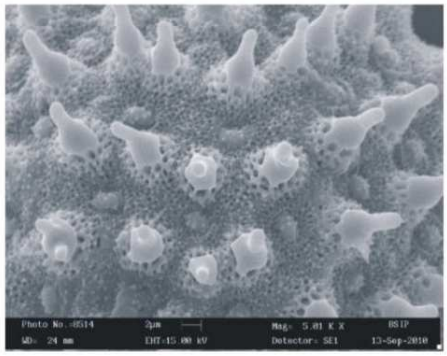

Fig. 14

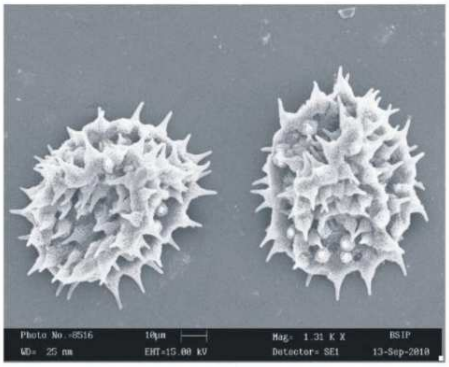

Fig. 15

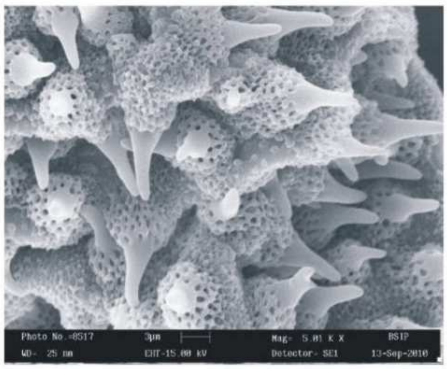

Fig. 16

Fig. 9-16: SEM micrograph showing exine sculpture of pollen grains, fig. 9-10 *I. fistulosa*, fig. 11-12 *I. quamoclit*, Fig. 13-14 *I. triloba*, fig. 15-16 *I. palmata*

4) *Ipomoea palmata*

Pollen grains 59.17-65.75 µm in diameter, oblate, radially symmetrical, outline circular, pantoporate, tetragonal area formed by the spine and the ridges of bacula around each extrapolar region, aperture circular 4-5 µm in diameter, sculpturing echinate, spine 129-156, pointed, 8-14 µm long, distance between spine 9.33-11.33 µm, bulbous protuberance at the base of spine, 5.11-6.13 µm in diameter, metareticulate exine showing microreticulum. [Table 1, Fig. 7-8 (LM) and Fig. 15-16 (SEM)].

Table 1. Pollen grain characteristics of four *Ipomoea* sps.

Sr. No.	Species	Pollen shape	Pollen grain diameter (µm)	Aperture diameter (µm)	Spine lenth (µm)	Interspinal distance (µm)	Spine number
1	*I. fistulosa*	Oblate-Suboblate	68.93-78.9	2.86-3.91	5.92-7.4	7.40-11.74	111-141
2	*I. quamoclit*	Oblate spheroidal-spheroidal	97.39-100.86	3.17-3.52	6.95-7.8	9.56-13.06	174-183
3	*I. Triloba*	Oblate-Suboblate	63.27-73.26	2.17-2.86	4.99-7.33	8-10	136-263
4	*I. palmata*	Oblate	59.17-65.75	4-5	8-14	9.33-11.33	129-156

Discussion

The pollen morphology of Convolvulaceae is known to be a highly diverse and has a taxanomoic importance (Telleria and Daners, 2003). Van Campo (1976), included Convolvulaceae in the broad group of Angiospermic families with successive form pollen evolutionary pattern from tricolpate-pantoporate. Being an important genus of family Convolvulaceae four species of *Ipomoea* showed pantoporate aperature in present study, it is very much similar with above observations.

The present studies noted echinate and pantoporate characters in all four *Ipomoea* species, these finding are exactly similar to that of Erdtman (1971) and Rao and Lee (1970) observations.

Hsiao and Kuoh (1995) had divided 18 *Ipomoea* sps. in to two groups based on spines and the ridges of bacula around the extrapolar region form a distinct tetragonal to hexagonal area, similar observation noted in *Ipomoea triloba* and *Ipomoea quamoclit* respectively.

Erdtman (1952) and nayar (1990) both reported the bulbous protuberances at the base of spine as a distinct character in genus *Ipomoea,* the similar observation was found in all the four presently studied Ipomoea species.

Pollen shape, size and sculpturing pattern of four species of *Ipomoea* exhibit nearly matching characters with Nayar's (1990) observations.

Except *Ipomoea palmata* remaining three species exhibit blunt ended spines which were in accordance with Adekanmbi and Ogundipe (2006).

All studied *ipomoea* species showed metareticulate exine pattern which was previously noted by Borsch and Barthlott (1998) and Telleria and Daners (2003).

Conclusion

The present study concludes that, three species of *Ipomoea* showed blunt spine while *Ipomoea palmata* reveals pointed spines. It was also observed that, as the number of spine increases the aperture size

reduces in case of *I. quamoclit* and *I. triloba*. In all studied species of *Ipomoea* sculpturing pattern was found to be uniform. Metareticulate exine pattern was found in all studied *ipomoea* species.

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