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POLLEN MORPHOLOGY OF SOME SPECIES OF RHAMNACEAE FROM WEST BENGAL

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ABSTRACT

Pollen morphology of 10 species and 2 varieties of Rhamnaceous taxa belonging to all the four tribes have been worked out. Pollen morphology of the family shows a tendency of evolution from basic morphoforms to the derived ones. Pollen grains of all the taxa investigated have been found to possess triangular or sub-triangular amb with three equatorial apertures situated at the angles (angulo aperturate). In *Ziziphus xylopyrus* the pollen grains are pororate and in rest nine species those are colporate with circular or lalongate endoapertures. Exine ornamentation shows a gradual tendency from granulose to rugulo-reticulate or reticulate pattern. Palynological features have been evaluated in understanding the taxonomy of the family.

INTRODUCTION

The family Rhamnaceae consists of 55 genera and 900 species. It is a cosmopolitan family but most common in tropical and subtropical regions of the world. More than half of the species belong to 5 large genera viz. RHAMNUS (150), ZIZIPHUS (100), GOUANIA (60), BERCHEMIA (25) and SAGERETIA (35) and are mainly tropical (Airy Shaw 1978). The family is represented by 7 genera and 17 species in W. Bengal. Lawson (1875) divided the Indian Rhamnaceae into four tribes. Review of literature reveals that pollen morphological information so far at hand is very meagre and mainly contributed by Erdtman (1952), Van Campo (1958), Straka and Simon (1967), Petria (1967) and Huang (1972). Indian works in the field are very meagre and mainly contributed by Nair (1965) and Jain & Nanda (1966).

Fossil leaf remains have been described by Jones & Dilcher (1980) from Middle Eocene deposits of Kentucky and Tennesse but pollen grains identified as Rhamnaceous date back only from Oligocene. This study will also be helpful for future identification of fossil pollens and correlations of stratigraphy.

MATERIALS AND METHOD

Materials studied for the present study are represented from all the tribes (sensu Hooker, *l.c.*). Polliniferous materials were collected from different university herbaria and from the duplicate herbaria of the Central National Herbarium (CAL) and acotolysed (Erdtman, 1952) for palynological preparation for light microscopy. Observations were made on the mean of 20-25 readings. Photo-micrographs were enlarged × 1000. Pollen morphological terminology of Erdtman (*l.c.*) & Faegri & Iversen (1964) were followed. Pollen slides were preserved in the sporotcheck of CNH and in the Palynological Laboratory, Univ. of Burdwan. For palynological descriptions species

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have been arranged alphabetically for convenience.

OBSERVATION

Six genera studied for the present contribution from four different tribes (Hooker, *l.c.*) of the family Rhamnaceae reveal that pollen morphologically it is a stenopalynous family. Pollen medium sized, oblate to oblate-spheroidal to prolate in shape, exine 1.5 - 2.5 µm thick, with psilate, granulate, regulate-reticulate, finely reticulate or reticulate ornamentations. Apertures either porate or colporate. Colpus long slit like mostly, pores circular or rarely lolongate or lalongate, sometimes crassimarginate. Pollen morphological characters of the individual species investigated are given below. Salient pollen morphological features of the materials studied are given in the Table-I.

POLLEN MORPHOLOGICAL DESCRIPTIONS

Berchemia floribunda Wall.

Pollen grains spheroidal to oblate-spheroidal, P × E = 16 - 17.5 × 17 19 (8.5-16.5) µm; colporate, colpus long, slit like, extending up to poles; endoaperture circular, 3.5 - 4 µm; exine 1 µm thick, sexine = nexine, surface obscure.

Gouania leptostachya DC.

Pollen grains oblate to oblate-spheroidal, P × E = 20 - 23 × 26 - 28 (21.5-27) µm; tricolporate, colpus long, extending up to poles; slit like, crassimarginate, endoaperture circular, ± 3.5 µm; exine 1 µm thick, sexine = nexine, finely reticulate, ± rugulo-reticulate encircling the apertures.

Helinus lanceolatus Brandis.

Pollen grains oblate spheroidal, P × E = 28 - 31 × 33 - 35 (30-34) µm; tricolporate, colpus long, slit like, crassimarginate, endoaperture 4.5 × 7.5 µm; lalongate: exine 1.5 µm thick, sexine = nexine.

Rhamnus nipalensis Wall.

Pollen grains oblate to oblate-spheroidal, P × E = 19 22 × 24 26.5 (21-25) µm; colporate, slit like, endoaperture circular, exine 1 µm thick, sexine = nexine, finely reticulate, lumina 1 µm.

R. trangula L.

Pollen grains oblate to oblate-spheroidal, P × E = 20 - 22 × 22. - 24.5; colporate, colpus long slit like, crassimarginate, endoaperture lalongate = 3.5 × 5 µm; exine 1 µm thick, very finely reticulate, rugulo-reticulate near the apertures, sexine = nexine.

Ventilago madraspatana var. **calyculata** King.

Pollen grains prolate spheroidal, P × E = 27 29 × 29 31 (28.5-30) µm; tricolporate, colpus slit like, endoaperture circular, crassimarginate; exine = 2 µm thick, finely reticulate.

V. madraspatana var. **madraspatana** Gaertn.

Pollen grains prolate spheroidal, P × E = 29 - 32 × 27 30 (30.5-28) µm; tricolporate, colpus slit like, extending up to poles, crassimarginate; endoaperture circular, ± 9 µm; exine thin, 1.5-2 µm thick, sexine = nexine, exine obscure/finely granulose.

Ziziphus mauritiana Lamk.

Pollen grains spheroidal, to oblate-spheroidal, P × E = 30 - 32.5 × 30 33 (31.5-32) µm; tricolporate, colpus long slit like, extending up to poles; endoaperture small, circular, ± 5µm in diameter; exine finely reticulate, rugulo-

Table - I : Salient palynological features of the material studied

Species	Shape	Size	EXIN		APERTUR			Remarks
		P×E Mean µm	Thickness µm	Ornamentation	Type	Ecto aperture	Endo-aperture	amb
Berchemia floribunda	Spheroidal to ob. spheroidal	16.5 × 18.5	1	obscure	colporate	slit like	circular	
Gouania leptostachya	oblate to ob. spheroidal	21.5 × 27	1	finely reticulate/ rugulo-reticulate	colporate	slit like	circular	
Helinus lanceolatus	oblate spheroidal	30 × 34	1.5	microreticulate	colporate	slit like	lalongate	
Rhamnus nipalensis	oblate spheroidal	21 × 25	1	finely reticulate	colporate	slit like	circular	
Rhamnus trangula	oblate spheroidal	21 × 23.5	1	finely reticulate/ ruguloreticulate	colporate	slit like	lalongate	
Ventilago madraspatana var. *madraspatana*	oblate spheroidal	30.5 × 28	1.5 - 2	obscure/finely granulose	colporate	slit like	circular	triangular
var. *calyculata*	prolate spheroidal	28.5 × 30	2	finely reticulate	colporate	slit like	circular	
Ziziphus mauritiana	spheroidal to ob. spheroidal	31 × 32	2	finely reticulate/ ruguloreticulate	colporate	slit like	circular	triangular
Z. oenoplia	oblate to ob. spheroidal	27.5 × 30	2	finely reticulate	colporate	slit like	circular	triangular, sides straight
Z. rugosa	oblate-spheroidal	21 × 27.5	±1	finely reticulate	colporate	slit like	circular	
Z. xylopyrus	spheroidal to ob.spheroidal	21 × 24 µm in diameter	1 - 1.5	finely reticulate/ ruguloreticulate	Pororate with annulus	slit like	circular	

reticulate surrounding the aperture, ± 2 µm thick, sexine = nexine.

Ziziphus oenoplia Mill.

Pollen grains oblate to oblate-spheroidal, P × E = 26 30 × 26.5 - 31 (27.5-30) µm; tricolporate, colpus long slit like, endoaperture circular, ± 8 µm, crassimarginate;exine ± 2 µm thick, finaly reticulate, sexine = nexine.

Z. rugosa Lamk.

Pollen grains oblate spheroidal, P × E = 21 33 × 26 - 29 (29-27.5) µm; tricolporate, colpus long, slit like, extending up to poles; endoaperture circular, 5µm; exine 1.75 - 2 µm thick, finely reticulate, sexine = nexine.

Z. xylopyrus Willd.

Pollen grains spheroidal, rarely oblate spheroidal, 21-24(22) µm; triporate, pore ± 4 µm including annulus; exine 1-1.5 µm thick, finely reticulate, ruguloreticulate in the aperture area, lumina less than 1 µm, sexine = nexine.

MATERIALS STUDIED

Berchemia floribunda Wall. Darjeeling: *S. N. Bash* 3561, 6.9.1961; *Banerjee, R. N.* 396400; *P. Barua* 398, 12.1.1959. Bardwan: *Pal & Pal* 206. *Gouania leptostachya* DC. Jalpaiguri : *B. Safui & Party* 10362, 17.9.1967: Malda : *Ghosh, R. B.* 24439, 4.7.1959. *Bhattacharya, P.* 599, 12.8.71. *Helinus lanceolatus* Brandis. Murshidabad : *Pal, A.* 329, 5.8.92, *Mukherjee, P. K.* 19726; *Rao, G. V. S.* 23250, (Bihar border); Malda : *Aditya, A.* 4596, 16.7.1991. *Rhamnus nipalensis* Wall. I.B.G. : Nil, No 1186 *Det. K. P. Biswas*; Bolpur: *Banerjee, R. N.* 55539, 1967, *Subir Sen* 539, 10.4.69 *R. trangula* L. Darjeeling : *S. N. Biswas* 579, Jalpaiguri : *S. N. Das* 78291. 5.5.59. *Ventilago madraspatana* Gaertn. var. *madraspatana* W. BENGAL : JDH *s.n.*, CAL 87822; Birbhum : *Srinivas* 3241, 9.9.66; Baharampur : *Pal, A.* 5596, 8.5.91, *Chakravarty, P.* 9786, 5878. *V. madraspatana* var. *calyculata* King Herb. Sulp. Kurz., Kurz. *s.n.* 3.11.68, CAL 87812. *Ziziphus mauritiana* Lamk. Jalpaiguri : *B. Safui & Party* 10556; Santiniketan : *B. P. Guha, s.n.* CAL 2295. *Z. oenoplia* Mill. Chandannagar *S. K. Mukherjee* 4625, 6.9.58, CAL 208, Burdwan : *Pal, P.* 2350; *Mondal. M. S.* (fresh) I.B.G.: *Z. rugosa* Lamk. Midnapur : *J. S. Gamble* 9302. CAL 88462; *S. K. Maity* 1086, Tangi : *Mondal, M. S.* 9953, 7.1.73. *Z. xylopyrus* Willd. Maithon: *Dutt, A. K.* 1079, 3.2. 1968, Birbhum: *S. K. Mukherjee,* 98317, CAL 87819.

Plate 1

Explanation of Plates (× 1000)

Fig. 1-2. *Ventilago madraspatana* : Aperture and optical section.

Fig. 3-4. *Gouania leptostachya* : Finely reticulate exine ornamentation and optical section equatorial.

Fig. 5-6. *Berchemia floribunda* : Details of exine and optical section equatorial.

Fig. 7-9. *Ziziphus mauritiana* : Details of exine, aperture and optical section equatorial.

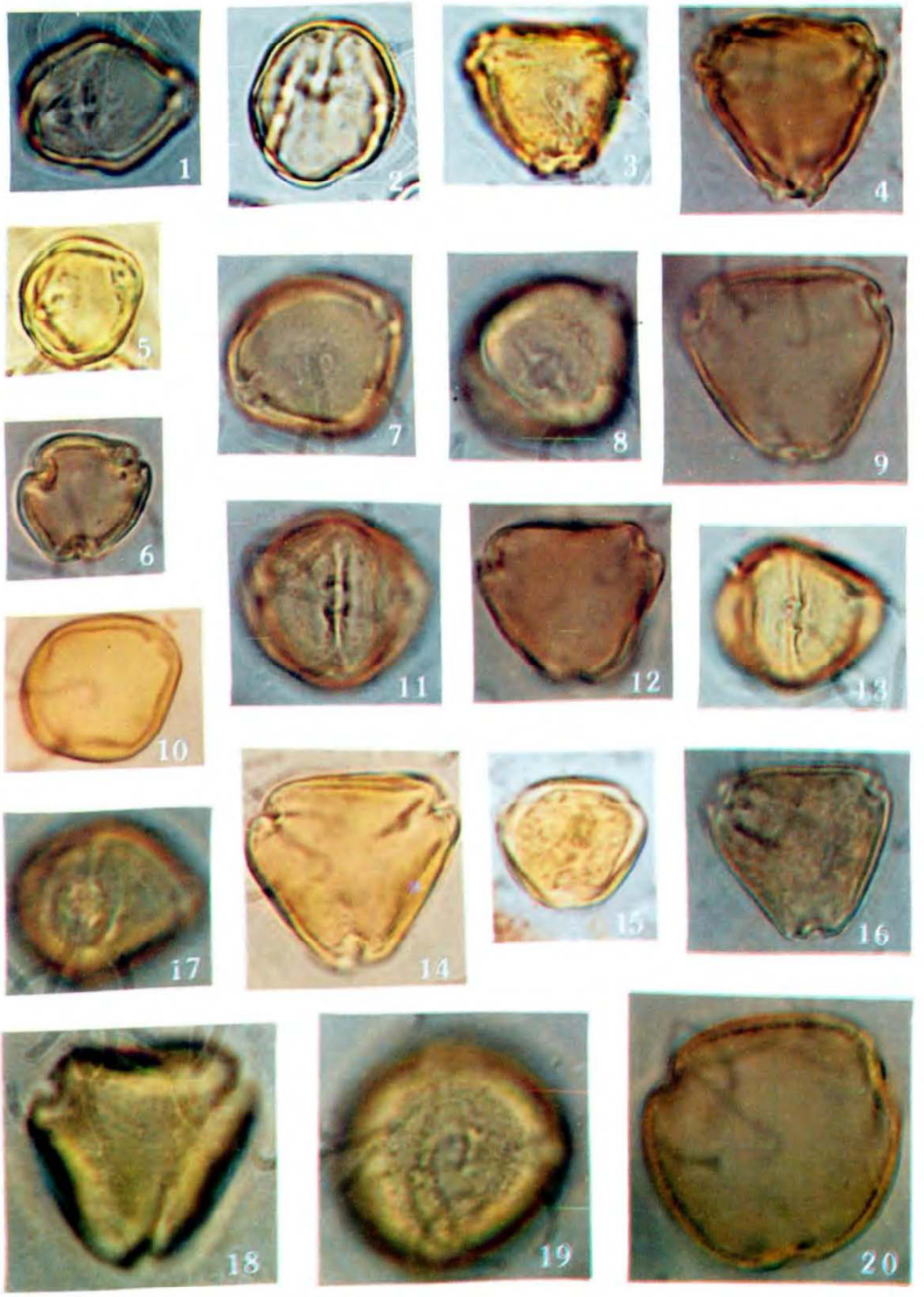
Fig. 10. *Ziziphus oenoplia* : Optical section meridional and aperture profile.

Fig. 11-13. *Rhamnus trangula* : Details of aperture, optical section equatorial and details of exine

Fig. 14-16. *Ziziphus xylopyrus* : Optical section equatorial & details of exine.

Fig. 17-18. *Ziziphus rugosa* : Details of aperture and exine at poles.

Fig. 19-20. *Helinus lanceolatus* : Details of aperture, exine and optical section equatorial.


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DISCUSSION

From the foregoing observation it is apparent that pollen morphological characters of the family like shape, size, aperture, exine ornamentation etc. are very overlapping and it is difficult to prepare palynological key for identification up to species level. Pollen diamensional diagram of the genera studied (Fig. 1) shows that only genus VENTILAGO has a tendency from prolate spheroidal to prolate shape and out of six genera studied only BERCHEMIA have exceptionally smaller pollen grains (16.5 × 18.5). All other four genera studied are having overlapping shape and size.

Cytological information so far available is by Adatia and Gajapathy (1960), Kurosawa (1971), Mehra and Khosla (1969), Mehra and Sareen (1969), Khosoo and Singh (1963), Malla *et al.* (1976), Bergman (1964), Srinivasan (1952) and others. It is apparent that chromosome numbers are also very much close for the genera and it is ranging from 20-(24)-34 excepting the genus ZIZIPHUS were it is comparatively higher and ranging from 24-96. Palynologically the species of ZIZIPHUS is to some extent different in having comparatively advance exine ornamentation with microreticulate to reticulate characters.

It is apparent from the foregoing palynological observation and literature on chromosome number reports that the

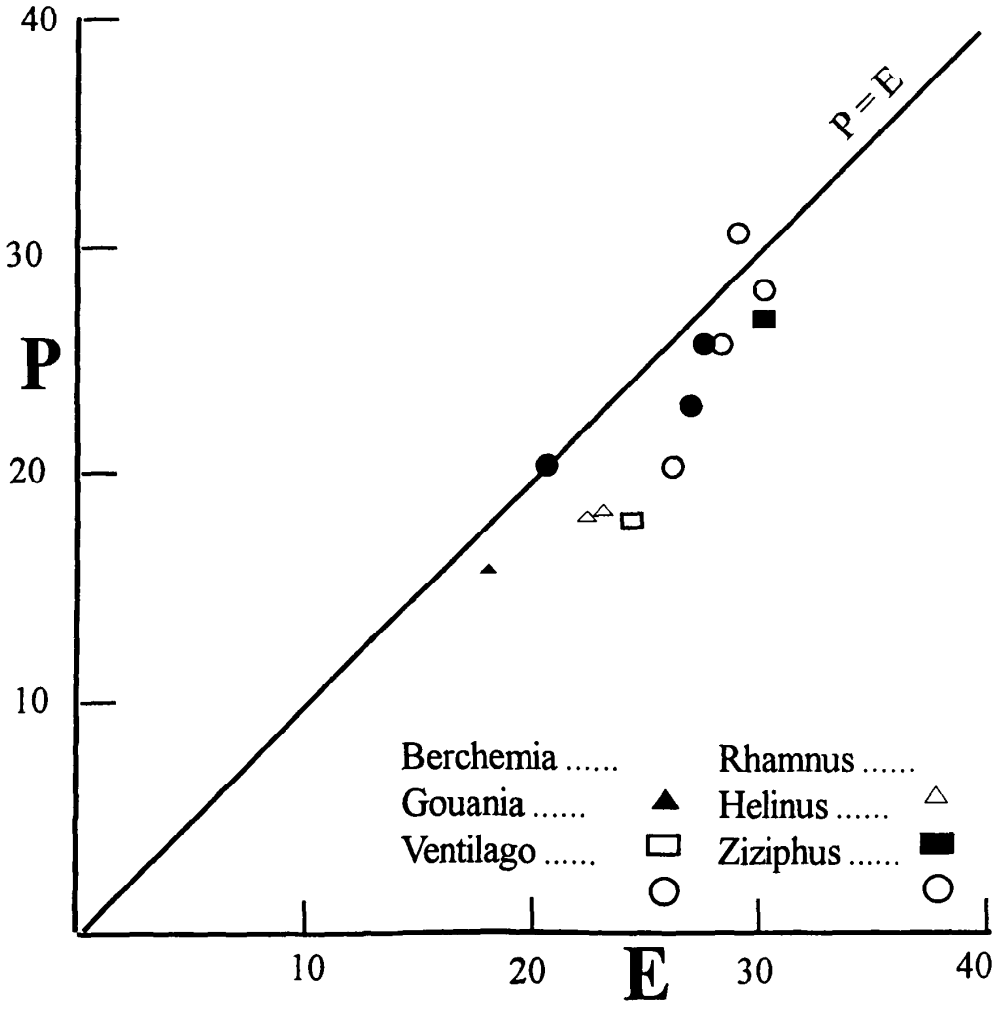


Fig. 1. Pollen dimensional diagram in μm.

assemblage of the member of Rhamnaceae is quite natural but pollen morphology do not support any distinctiveness towards differentiations of the family in to different tribes.

The origin of Rhamnales has been sought from the Rosales in common complex with the ancestors of the Celastrales and Sapindales. [Behenke (1974) and Prichard (1955)]. There are some strong serological affinities among the members of Rhamnaceae, Celastraceae, Hydrangeaceae and Crassulariaceae. The later two families are newly created families and taken out from Rosaceae (*s.l.*). Pollen grains of Sapindales (Sapindaceae, Muller, 1970, 1971) and ROUREA complex of Connaraceae (Mondal, 1990) are to some extent similar with that of Rhamnaceae. A detailed study covering world pollen materials of all the genera is essential to trace the phylogeny of the family.

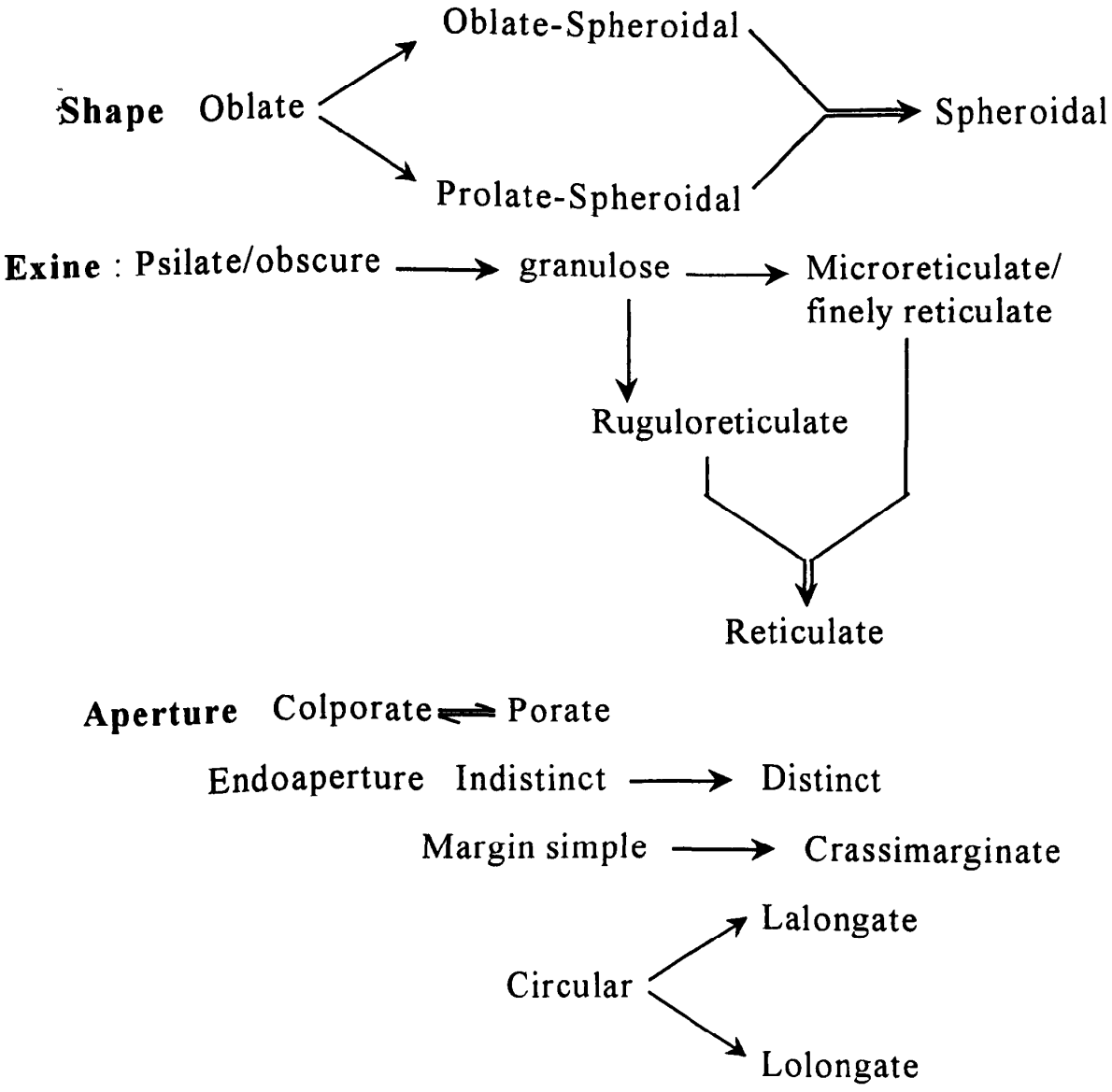


Fig. 2. Pollen morphological trend in Rhamnaceae.

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