

STUDIES ON THE POLLEN MORPHOLOGY OF SIMAROUBACEAE

R. K. BASAK

Botanical Survey of India, Calcutta

ABSTRACT

In continuation to a previous communication on the pollen morphology of Asiatic representatives of the family Simaroubaceae (Basak, 1963), pollen grains of 17 more taxa have been described and illustrated. The study reveals that the pollen grains are more or less of uniform type. The significance of these pollen characters in taxonomic considerations is discussed.

INTRODUCTION

There is much difference of opinion among systematists regarding the taxonomy of the family Simaroubaceae (Nootboom, 1962b). The work on the pollen morphology of the family Simaroubaceae was undertaken to find out how pollen structure can help in a better understanding of the taxonomy of the family. In continuation to a previous communication on the pollen morphology of Asiatic representatives of this family (Basak, 1963), pollen grains of 17 more taxa have been described and illustrated.

MATERIALS AND METHODS

The present investigation is based upon pollen grains of 7 genera and 17 species, not occurring in Asia. All the materials were obtained from the Central National Herbarium, Botanical Survey of India, Calcutta. Permanent pollen preparation was made following Erdtman's (1960) revised acetolysis method. The descriptive terminology for the pollen grains is the same as followed earlier (Basak, l.c.). For future reference, the pollen slides have been deposited in the palynology unit of the Botanical Survey of India, Calcutta.

OBSERVATIONS

Brunellia boliviana Britton ex RusbyAMERICA. Bolivia: *Miquel* 839 (CAL)

Pollen grains 3-zonocolporate, polar view subcircular, equatorial view spherical, prolate spheroidal (90%) to subprolate in shape ($16 \times 15 \mu$; range $15.5-17.6 \times 13.6-16 \mu$); colpi 3, $12 \times 2 \mu$ each, margin thin; ora 3, lalongate, $2 \times 6 \mu$, membrane granulate; exine about 2μ thick, sexine slightly thicker than nexine, surface pattern rough, echinulate reticulate; polar field index 1:3.6 (Pl. I, Figs. 1-4).

B. comocladifolia H. B. & K.

AMERICA. Urban 4372 (CAL)

Pollen grains 3-zonocolporate, polar view subcir-

cular, equatorial view spherical, prolate spheroidal to subprolate in shape ($18 \times 16.5 \mu$; range $17-19 \times 15.5-17 \mu$); colpi 3, $14 \times 2 \mu$ each, margin thin; ora 3, lalongate, $2 \times 5 \mu$; exine about 2μ thick, sexine thicker than nexine, surface pattern rough and irregular, slightly echinulate (like Burseraceae); polar field index 1:3.6 (Pl. I, Figs. 5-7).

Dictyoloma peruvianum Planch.AMERICA. Bolivia: *Miquel* 1385 (CAL)

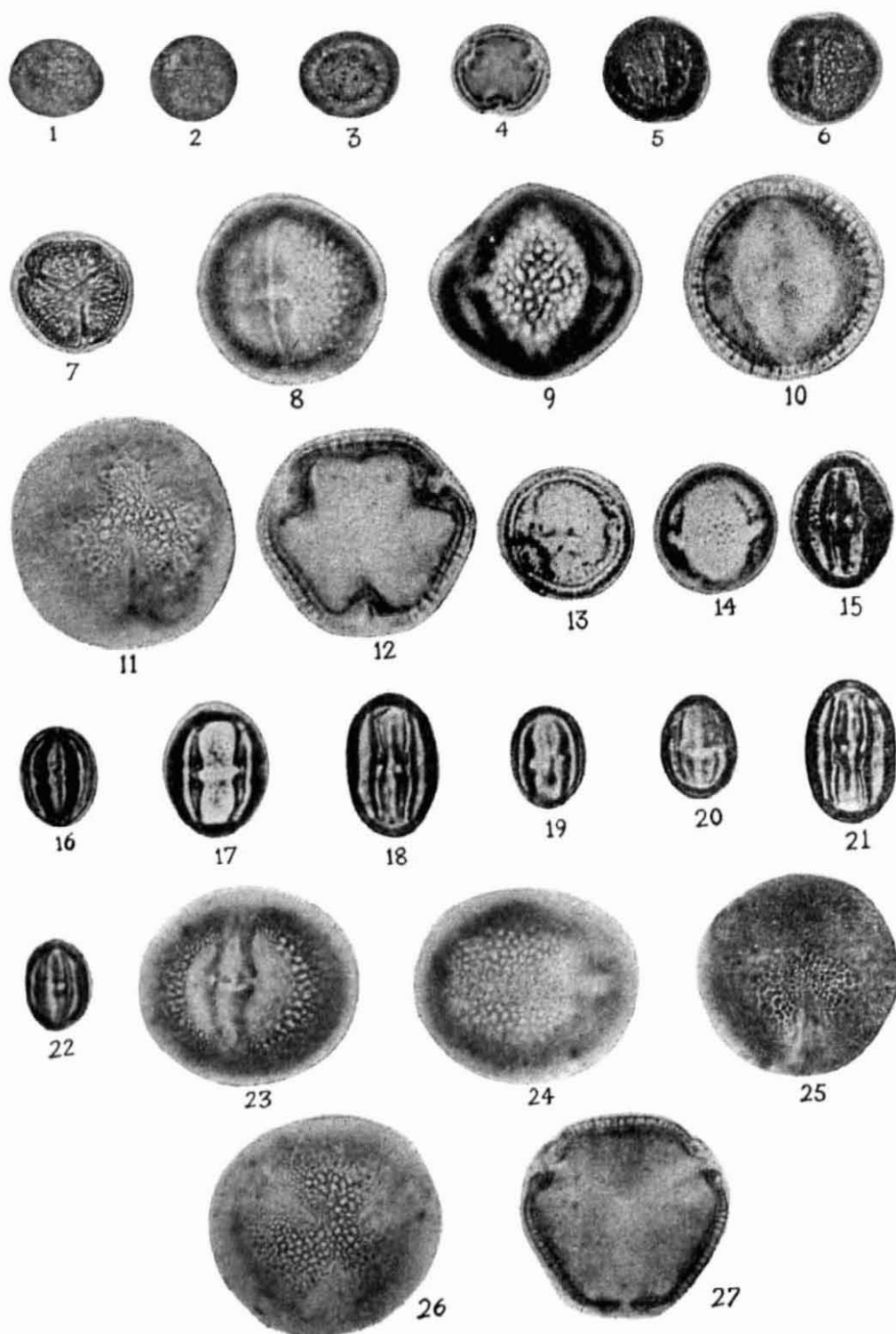
Pollen grains 3-zonocolporate, spherical in polar and equatorial view, oblate spheroidal to prolate spheroidal in shape ($39.7 \times 38.7 \mu$; range $35.2-41.6 \times 36-41.6 \mu$); colpi 3, $26 \times 5 \mu$ each; margin rather thin, ends acute; ora 3, lalongate, $3 \times 5 \mu$, lateral ends rounded; exine about 3.5μ thick, exine thicker at poles than at equator, sexine thicker than nexine, sexine about 2μ , surface pattern coarsely reticulate, heterobrochate, duplibaculate, bacula about 0.5μ ; polar field index 1:5 (Pl. I, Figs. 8-12).

Samadera mekongensis Engl.MALESIA. *Hochreutiner* 82 (CAL)

Pollen grains 3-zonocolporate, polar view subcircular, equatorial view spherical, prolate spheroidal (50%) to spheroidal in shape ($25.2 \times 24.2 \mu$; range $24.2-25.6 \times 22.4-25.6 \mu$); colpi 3, $19 \times 2 \mu$ each, broader near the ora at equator; ora 3, lalongate, $4 \times 9 \mu$; rectangular, membrane smooth; exine about 2.5μ , thick, sexine thicker than nexine, sexine 1.6μ ; surface pattern distinctly reticulate, simplibaculate, homobrochate, meshes about 1μ ; polar field index 1:3.2 (Pl. I, Figs. 13-14).

Simaba cuneata A. St. Hil. et Tul.AMERICA. Bratilia: *Biedel* s.n. (CAL)

Pollen grains 3-zonocolporate, polar view circular, equatorial view elliptical, prolate (60%) to subprolate in shape ($23.7 \times 17.5 \mu$; range $21-25 \times 15-20 \mu$); colpi 3, $17 \times 2 \mu$ each; ora 3, lalongate, $3.5 \times 6.4 \mu$, membrane smooth; exine about 2μ thick, sexine

Plate I : Figs. 1-27 ($\times$ c. 1000)

1-4. *Brunellia boliviana*. 5-7. *B. comocladifolia*. 8-12. *Dictyoloma peruvianum*. 13-14. *Samadera mekongensis*.
 15. *Simaba cuspidata*. 16. *S. glabra*. 17-18. *S. nigrescens*. 19-20. *S. suffruticosa*. 21. *Simarouba*
glauca. 22. *Soulamea fraxinifolia*. 23-27. *Spathalia simplex*.

as thick as nexine, surface pattern finely reticulate, duplibaculate; polar field index 1:2.5.

Simaba cuspidata Spruce ex Engl.

AMERICA. PROV. Rio negro: *Spruce s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view circular, shallowly lobed, equatorial view elliptical, prolate in shape ($23 \times 16.5\mu$; range $21-25.6 \times 15-17.6\mu$); colpi 3, $16 \times 2\mu$ each; ora 3, lalongate, $3.2 \times 6.5\mu$, lateral ends rounded; exine about 2μ thick, sexine slightly thinner than nexine, surface pattern coarsely reticulate, duplibaculate, heterobrochate; polar field index 1:3.2 (Pl. I, Fig. 15).

S. foetida Benth.

AMERICA. PROV. Para: *Spruce s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view circular, equatorial view elliptical, prolate in shape ($22.5 \times 14.5\mu$; range $22.4-25.6 \times 13-16\mu$); colpi 3, $19 \times 3\mu$ each, margin thin; ora 3, lalongate, $3.2 \times 6.5\mu$, lateral ends rounded; exine about 2μ thick, sexine as thick as nexine, surface pattern finely reticulate; polar field index 1:3.

S. glabra Engl.

AMERICA. Bratilia: *Biedel s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view subcircular, equatorial view elliptical, prolate in shape ($23.5 \times 16\mu$; range $22-24.8 \times 14.4-17.6\mu$); colpi 3, $19 \times 4.8\mu$ each; ora 3, lalongate, $1.5 \times 6.4\mu$, lateral ends rounded; exine about 2.5μ thick, sexine slightly thicker than nexine, surface pattern finely reticulate, simplibaculate, homobrochate; polar field index 1:3.2 (Pl. I, Fig. 16).

S. glandulifera Gardn.

AMERICA. Bratilia: *Biedel s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view subcircular, equatorial view elliptical, subprolate in shape ($26.5 \times 20.5\mu$; range $24-28.8 \times 19.2-22.4\mu$); colpi 3, $19.5 \times 3.5\mu$ each; ora 3, lalongate, $4 \times 9.6\mu$, membrane smooth; exine about 3μ thick, sexine as thick as or sometimes thicker than nexine, surface pattern finely reticulate, homobrochate, multibaculate, bacula about 0.5μ ; polar field index 1:3.3.

S. nigrescens Engl.

AMERICA N. S. *Wight s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view subcircular, equatorial view elliptical, subprolate in shape ($25.2 \times 20\mu$; range $24-27 \times 17.6-22\mu$); colpi 3, $16 \times 3\mu$ each; ora 3, lalongate, $3 \times 8\mu$, membrane smooth; exine about 2.5μ thick, sexine thicker than nexine, surface pattern finely reticulate, thick-walled multibaculate; polar field index 1:3.1. Pl. I, Figs. 17-18.

S. obovata Spruce ex Engl.

AMERICA. *Spruce s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view subcircular, equatorial view elliptical, prolate in shape ($21.5 \times 14\mu$; range $21-23 \times 13-14.4\mu$); colpi 3, $19.2 \times 2.5\mu$ each; ora 3, lalongate, $3 \times 5\mu$, lateral ends rounded; exine about 2μ thick, sexine as thick as nexine, surface pattern finely reticulate, homobrochate; polar field index 1:2.8.

S. salubris Engl.

AMERICA. Bratilia: *Biedel s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view subcircular, equatorial view elliptical, subprolate in shape ($33 \times 27\mu$; range $29-35 \times 25.6-30\mu$); colpi 3, long, $28 \times 4.8\mu$ each, colpi ends taper gradually towards the poles; ora 3, lalongate, $3 \times 8\mu$, rectangular, membrane smooth; exine about 3μ thick, sexine as thick as nexine, surface pattern finely reticulate, homobrochate, lumen comparatively larger than other species; polar field index 1:5.1.

S. suffruticosa Engl.

AMERICA. Bratilia: *Biedel s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view subcircular, equatorial view elliptical, prolate in shape ($24.5 \times 17\mu$; range $23-25.6 \times 16-17.6\mu$); colpi 3, $21 \times 3\mu$ each; ora 3, lalongate, $3.5 \times 8\mu$, membrane smooth; exine about 2μ thick, sexine thicker than nexine, surface pattern reticulate, lumen thickness as thick as the wall; polar field index 1:2.7 (Pl. I, Figs. 19-20).

Simarouba glauca DC.

AMERICA. Cultivated in Calcutta Botanic Garden: *Calder s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view circular, equatorial view elliptical, prolate in shape ($27.5 \times 17.5\mu$; range $25.6-30.4 \times 16-19.2\mu$); colpi 3, $21 \times 3.2\mu$ each, colpi ends taper gradually towards the poles; ora 3, lalongate, $3.2 \times 8\mu$, elliptical in shape; exine about 2.5μ thick, sexine slightly thicker than nexine, surface pattern reticulate, homobrochate; polar field index 1:2.8 (Pl. I, Fig. 21).

S. tridilloides St. Hill.

AMERICA. Bratilia: *Biedel s.n.* (CAL)

Pollen grains 3-zonocolporate, polar view subtriangular, equatorial view elliptical, subprolate in shape ($28 \times 25\mu$; range $25.6-28.8 \times 24-27.2\mu$); colpi 3, $20 \times 4\mu$ each, colpi ends taper gradually towards the poles; ora 3, lalongate, $3.2 \times 8\mu$, elliptical; exine about 2.5μ thick, sexine slightly thicker than nexine,

Harrisonia in surface sculpturing (Basak, l.c.). (Pl. I, Figs. 23-27).

DISCUSSION AND CONCLUSION

The study on the pollen morphology of 7 genera and 17 species of Simaroubaceae reveals that the pollen grains are 3-colporate, small to medium in size ($15.41 \times 13.41 \mu$) and prolate to oblate spheroidal in shape. Most of these species belong to a common pollen type characterised by elliptical to spherical 3-colporate grains with circular to subcircular amb, distinctly lalongate ora and commonly reticulate surface pattern. Such a pollen type is also met within a majority of the species studied earlier (Basak l.c.). Thus palynological investigations point out that the family consist of related species with a more or less homogeneous group of pollen grains. In *Brunellia* however, the surface pattern is rough and echinulate, which is distinct from other members of the family.

In order to compare the difference in pollen size in the various species studied, the lengths of equatorial and polar axes are plotted on rectangular co-

AMERICA. Cultivated in Calcutta Botanic Garden:
No data (CAL)

KEY TO GENERA

- B. *Exine reticulata***

- a. Grains above 35μ

Dictyoloma
D. peruvianum
Spathalia
S. simplex

- b. Grains usually less than 30μ

Samadera
S. mekongensis

Simaba
S. cuneata
S. cuspidata
S. foetida
S. glabra
S. glandulifera
S. nigrescens
S. obovata
S. salubris
S. suffruticosa

Simarouba
S. glauca
S. tridilioides

- BB. Exine striate**

Soulamea
S. fraxinifolia

- BBB. Exine echinulate**

Brunellia
B. boliviana
B. comocladifolia

- AA.** *Amb triangular, angulaperturate, os square :*

Quassia
Q. amara L.
(Basak, l.c.)

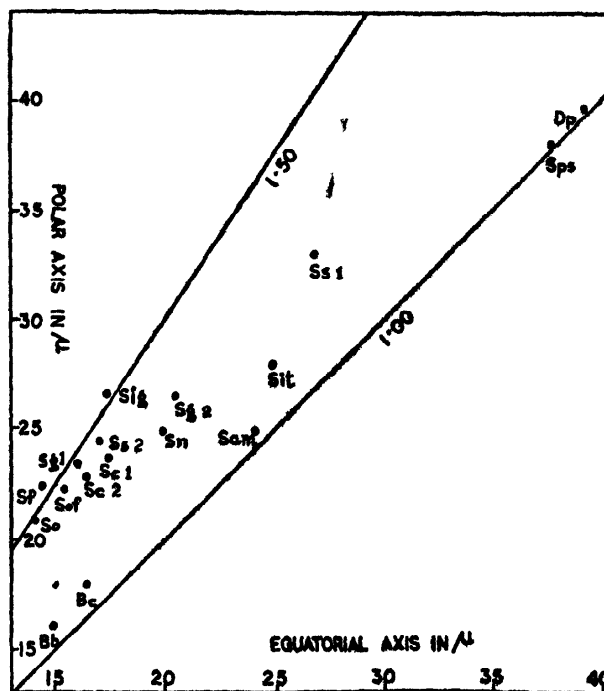


Fig. 1: Diagram showing size variation in pollen grains of Simaroubaceae

Bb—*Brunellia boliviana*. Bc—*B. eomocladifolia*. Dp—*Dictyolema peruvianum*. Sam—*Samadera mekongensis*. Sc—*Simaba cuneata*. Sc2—*S. cuspidata*. Sf—*S. foetida*. Sg1—*S. glabra*. Sg2—*S. glandulifera*. Sn—*S. nigrescens*. So—*S. obovata*. Ss1—*S. salubris*. Ss2—*S. suffruticosa*. Sig—*Simarouba glauca*. Sit—*S. tridiloides*. Sol—*Sonolamea fraxinifolia*. Sps—*Spathalia simplex*.

ordinates (Fig. 1). It shows that most of the species fall between iso-ratio line of 1 to 1.5 as pointed out for the Asiatic representatives of the family (Basak, l.c.).

Taxonomical considerations:

Bentham and Hooker (1862) consider the genus *Brunellia* as a member of the family Simaroubaceae. Later, the genus is referred to the family Cunoniaceae by Gundersen (1950) and to a separate family Brunelliaceae by Engler (1930) and Hutchinson (1959). The rough and echinulate type of surface pattern in *Brunellia* supports the transfer of the genus to a separate family (cf. Erdtman, 1952). Pollen grains similar to *Brunellia* are not found in Simaroubaceae.

After critically checking the generic identities, Nooteboom (1962a) concludes that with the exception of *Harrisonia* and *Eurycoma*, all genera of the tribe Simaroubeae should be merged into one enlarged genus *Quassia*. This emended genus *Quassia* comprises four sections e.g., *Quassia*, *Samadera*, *Simaba* and *Simarouba*. The present palynological study on the tribe Simaroubeae provides evidences for supporting such concept. The pollen grains of sections *Samadera*, *Simaba* and *Simarouba* come close to each other in their shape classes and structural patterns. So, from the point of view of pollen morphology they can be placed together under the wider concept of a genus. The suboblate, angulaperturate, striato-reticulate pollen grains with square type of ora in *Quassia amara* however, belong to an entirely different pollen type (Basak, l.c.). This

type of grain has not been observed in any other member of the tribe. Thus it appears that on pollen morphological grounds, the genus *Quassia*, like *Harrisonia* and *Eurycoma*, may be kept apart from the other genera merged under the tribe Simaroubeae (Nooteboom, l.c.). In this connection it should be emphasized that problems of phylogeny can be better understood and solved only when data from all disciplines of study are considered.

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