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PALYNOLOGICAL STUDY OF THE GENUS *SALIX* L. (*SALICACEAE*) FROM PAKISTAN

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Abstract

The present study is confined to the plynological study of the *Salix* L., of Pakistan. In this study the genus *Salix* L., has shown the different shapes of the pollen grains, such as the circular, elliptic, broadly and narrowly elliptic and triangular. Similarly the general outline was oblate to circular in the polar view and triangular to circular in equatorial view that ranged between 14 – 28 μ in polar axis (P) and 15 – 25 μ in equatorial axis (E). Considerable morphological variations have been observed in two species, viz., *S. persica* and *S. australior* in which the pollen grains were broadly elliptic in equatorial view whereas in the other species they were elliptic-obtuse in the equatorial view.

Introduction

Taxonomically the family *Salicaceae* is a natural taxon consisting of 3 genera and 620 species distributed mainly in Northern hemisphere. In Pakistan the family is represented by 2 genera, c. 32 species and 1 subspecies (Ali, 2001). The members of the family are cosmopolitan in distribution, they abound in four centers of the temperate zone, such as Pacific North America, the area around Behring's Sea, Central Europe and the Himalayas. However they are absent in Australia. The pollen morphology has been carried out to obtain the characters that would be helpful in taxonomy and classification. The genus *Salix* Linn. is probably the commonest woody genus in the mountainous areas and it shows wide range of variations. There has been no investigation concerning *Salicaceae* and *Salix* pollen grains.

Pollen morphology of 9 *Salix* species was studied: viz., *S. denticulata* N.J. Andress., *S. denticulata* ssp. *Hazarica* (Parker) Ali, *S. acmophylla* Boiss., *S . capusii* Franch., *S . persica* Boiss., *S. tetrasperma* Roxb., *S. babylonica* Linn., *S . wilhelmsiana* M. Bieb., and *S. australior* Anderss.

Ralph & Robert (1979) worked on the pollen morphology of *Anacardiaceae* of Northeastern North America. All grains were classified as monad, isopolar, radially symmetric, tricolporate and having mostly striate sculpture and/or reticulate and only one specie *Rhus aromatica* was psilate (smooth).

Kaepylae (1984) collected the pollen with Burkard spore trapped in Turku and Jyvaeskylae, in Southern and central Finland. The most significant relationships with wind speed were found in *Salix* and *Quercus*, the pollen of which tends to remain in lumps.

Hyvaerinen (1985) obtained a 56 cm long core covering ca.9, 000 years from a small unnamed lake at 295 m elevation. Four local pollen assemblage zones had reflected an early pioneer phase in the appearance and spread of *Salix* some 8,000 years ago.

Chung & Jones (1989) worked on the morphology of Hosta Tratt. (*Funkiaceae*) and related genera and investigated the pollen grains of 22 taxa of Hosta and 9 taxa of closely related monocotyledons by light microscopy (LM), scanning electron microscopy (SEM), and transmission electron microscopy (TEM).

Material and Methods

Pollen samples were obtained from the Herbarium specimens of Quaid-I-Azam University herbarium (ISL) or from fresh field samples. The voucher specimens were deposited in Quaid-i-Azam University herbarium (ISL).

The anthers were removed with the help of forcep and needle and unwanted parts were discarded, then anthers were placed in acetic acid (3:1) for 1 hour before preparation of the slide. Anthers were crushed and debris was removed. Glycerin jelly stained with 1% safranine was taken with fine mounted needle and rolled over the pollen of the glass slide containing pollens. The prepared slide was studied under the microscope. For each grain different measurements were recorded for polar diameter, equatorial diameter and the thickness of exine. By these measurements P/E ratio of the pollen grains was calculated (Tables 1-2).

Results

1. *S. denticulata* N.J. Andress. (Fig. 1)
Shape: Tricolporate, Pollen grains are isodiametric.
Equatorial view: Elliptic obtuse

Polar view: Circular
Equatorial diameter (E): (12.7-) 15 (-17.5) µm
Polar diameter (P): (17.5-) 18.75 (20) µm
Exine: Thin usually less than 1 µm, ca. 0.5 µm

2. *S. denticulata* ssp**. *hazarica*** (Parker) Ali (Fig. 2)
Shape: Tricolporate, pollen grains are more or less isodiametric.
Equatorial view: Elliptic obtuse
Polar view: Circular
Equatorial diameter (E): (17.5-) 15 (-12.5) µm
Polar diameter (P): (15-) 13.75 (-12.5) µm
Exine: Thin less than 1 µm, ca.0.5 µm

3. *S. acmophylla* Boiss. (Fig. 3)
Equatorial view: Narrowly elliptic
Polar view: Circular
Equatorial diameter (E): (20-) 21.25 (-22.5) µm
Polar diameter (P): (17.5-) 15 (12.5) µm
Exine: Thin usually less than 1µm, c a.0.7µm

4. *S. capusii* Franch. (Fig. 4)
Equatorial view: Elliptic obtuse on one side acuminate
Polar view: Circular

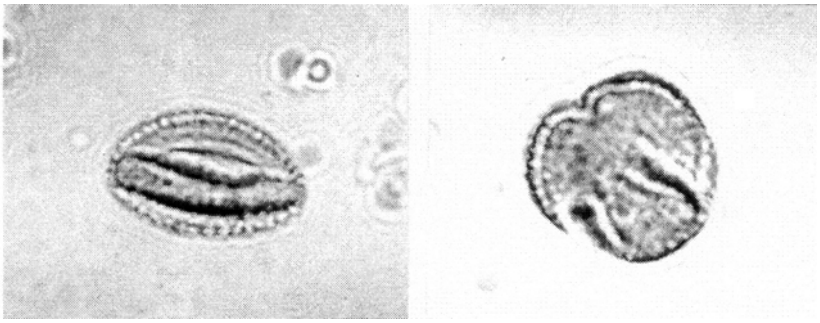


Fig. 1. *Salix denticulata* N.J. Anderss. a) Equatorial view, b) Polar view

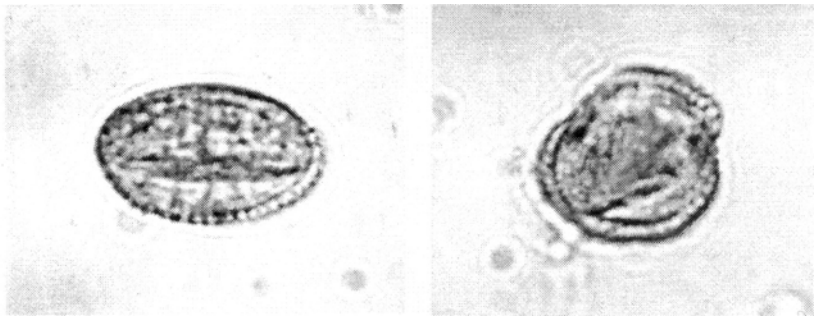


Fig. 2. *Salix denticulata* ssp. *Hazarica* (Parker) Ali a) Equatorial view, b) Polar view

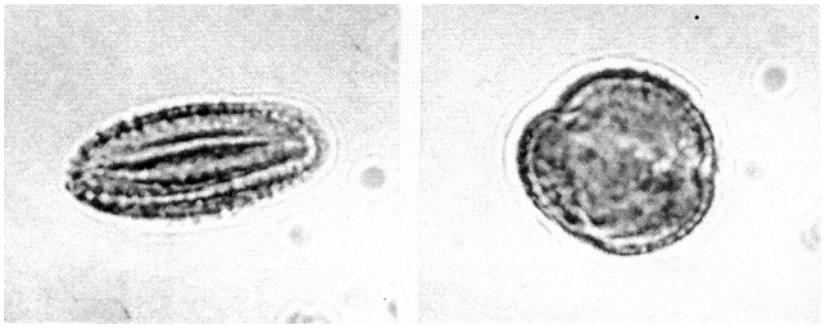


Fig. 3. *Salix acmophylla* Boiss. a) Equatorial view, b) Polar view

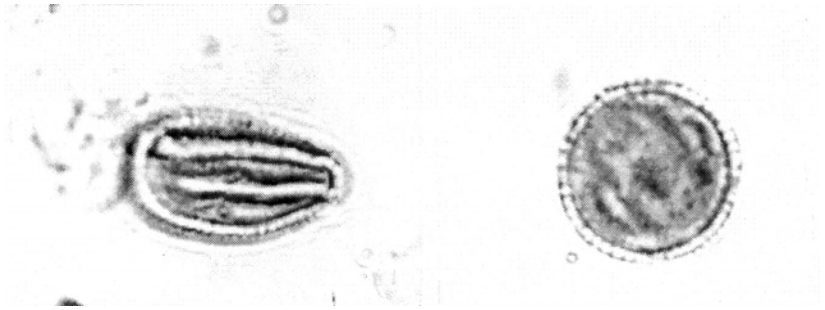


Fig. 4. *Salix capusii* Franch. a) Equatorial view, b) Polar view

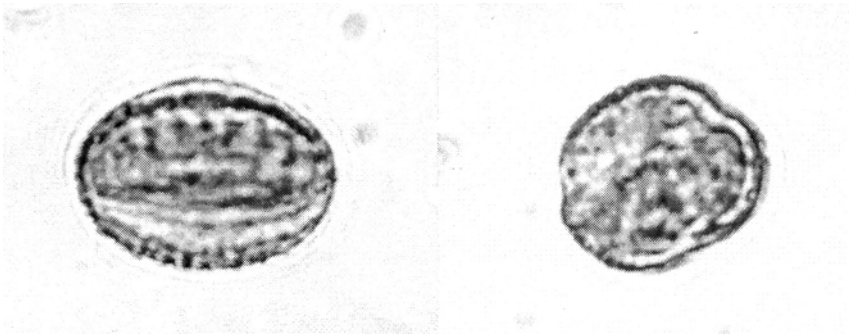


Fig. 5. *Salix persica* Boiss. a) Equatorial view, b) Polar view

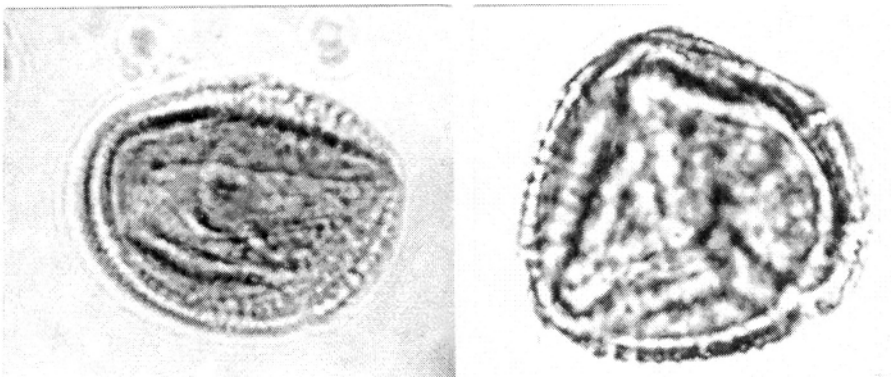


Fig. 6. *Salix tetrasperma* Roxb. a) Equatorial view, b) Polar view

Equatorial diameter (E): (17.5-) 19.37 (-21.25) µm
Polar diameter (P): (22.15-) 20 (-21.25) µm
Exine: Thin generally less than 1 um, ca.0.7 µm

5. *S. persica* Boiss. (Fig. 5)
Equatorial view: Elliptic obtuse
Polar view: Circular

Equatorial diameter (E): (22.5-) 23.75 (-25) µm
Polar diameter (P): (17.5-) 20 (-22.5) µm
Exine: Usually thin less than 1 um, ca. 0.6 µm

6. *S. tetrasperma* Roxb. (Fig. 6)
Equatorial view: Broadly elliptic
Polar view: Triangular
Equatorial diameter (E): (25-) 26.25 (-27.5) µm
Polar diameter (P): (32.5-) 28.75 (-25) µm
Exine: Usually equal to 2µm in thickness

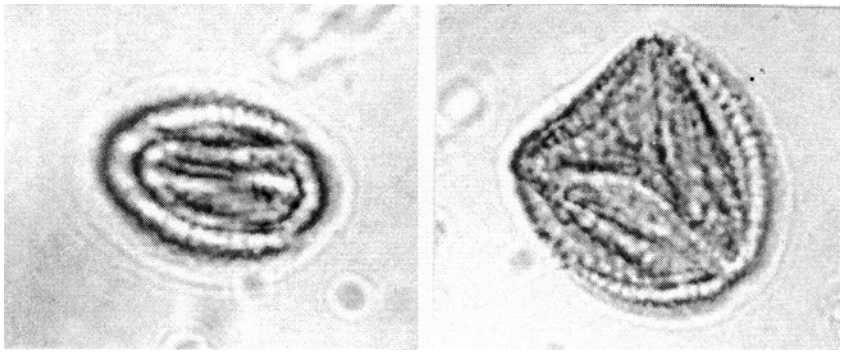


Fig. 7. *Salix bobylonica* Linn. a) Equatorial view, b) Polar view

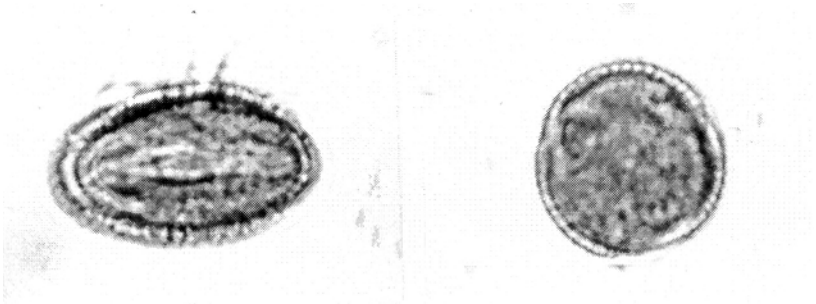


Fig. 8. *Salix withelmsiana* M. Bieb. a) Equatorial view, b) Polar view

7. *S. babylonica* Linn. (Fig. 7)
Equatorial view: Elliptic
Polar view: Triangular
Equatorial diameter (E): (25-) 22.5 (-20) µm
Polar diameter (P): (22.5-) 23.75 (-25) µm
Exine: Usually thin and less than 1 µm as equal to 0.5 µm

8. *S. wilhelmsiana* M.Bieb. (Fig. 8)
Equatorial view: Elliptic
Polar view: Circular
Equatorial diameter (E): (15-) 16.25 (-17.5) µm
Polar diameter (P): (17.5-) 20 (-22.5) µm
Exine: Thin usually less than 1 µm

9. *S. australior* Anderss. (Fig. 9)
Equatorial view: Broadly Elliptic
Polar view: Circular
Equatorial diameter (E): (25-) 22.5 (-20) µm
Polar diameter (P): (22.5) 23.75 (-25) µm
Exine: Thin generally less than 1 µm

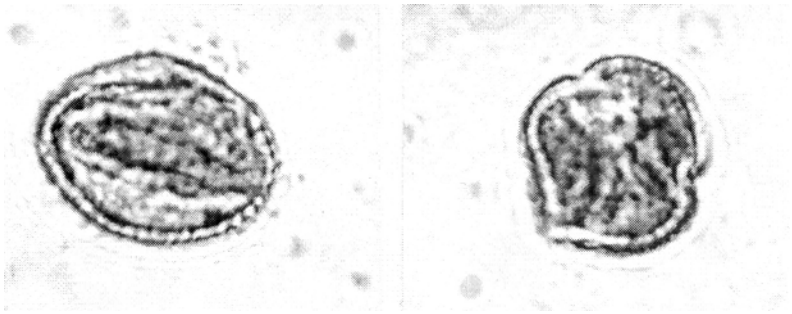


Fig. 9. *Salix australior*. a) Equatorial view, b) Polar view

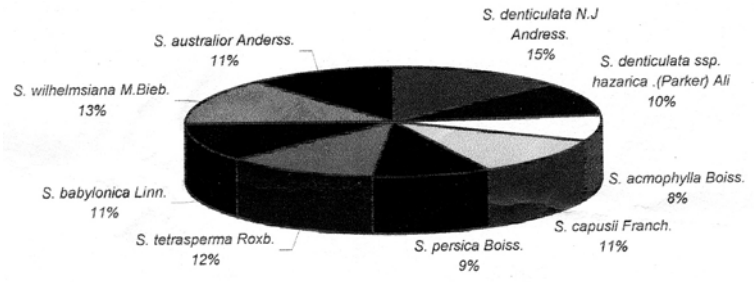
Table 1. Measurement of pollen grains of *Salix* examined in glycerine jelly preparation.

S. No.	Name of species	Polar diameter mean (μm)	Equatorial diameter mean (μm)	P/E in (μm)
1.	*S. denticulata* N.J Andress.	18.75	15.0	1.25
2.	*S. denticulata* ssp. *hazarica* (Parker) Ali	13.75	15.0	0.91
3.	*S. acmophylla* Boiss.	15.0	21.25	0.70
4.	*S. capusii* Franch.	20.0	19.37	1.03
5.	*S. persica* Boiss.	20.0	23.75	0.84
6.	*S. tetrasperma* Roxb.	28.75	26.25	1.09
7.	*S. babylonica* Linn.	23.75	22.5	1.05
8.	*S. wilhelmsiana* M. Bieb.	20.0	16.25	1.23
9.	*S. australior* Anderss.	23.75	22.5	1.05

Table 2. Pollen morphology of *Salix* species.

S.No.	Name of species	Exine thickness in (μm)	Pollen type
1.	*S. denticulata* N.J Andress.	0.5	Tricolporate
2.	*S. denticulata* ssp. *hazarica.* (Parker) Ali	0.5	Tricolporate
3.	*S. acmophylla* Boiss.	0.7	Tricolporate
4.	*S. capusii* Franch.	0.7	Tricolporate
5.	*S. persica* Boiss.	0.6	Tricolporate
6.	*S. tetrasperma* Roxb.	2	Tricolporate
7.	*S. babylonica* Linn.	0.5	Tricolporate
8.	*S. wilhelmsiana* M. Bieb.	1	Tricolporate
9.	*S. australior* Anderss.	1	Tricolporate

Pie Chart showing polar and equatorial diameter ratios



Discussion

Pollen grains in the genus *Salix* are (2-)3-(-6)-aperturate colporate two celled. Pollen grains of all the *Salix* sp., taken under consideration were tricolporate like other members of *Salicaceae.*

Under the light microscope pollen grains generally exhibits a varying sculpturing patterns is helpful in identifying the family or genus. The morphological diversity in pollen grains and simple methods of handling them, make palynological studies a valuable tool. These data have proven taxonomically useful at all taxonomic levels. Sculpturing of pollen wall is so precise and consistent in its major features that it forms the basis for a well-developed field of pollen taxonomy (Erdtman, 1969)

In the present study the different shapes of the pollen grains, such as circular, elliptic, broadly and narrowly elliptic and triangular were found. The general outlines were triangular to circular in equatorial view and oblate to circular in polar view. The size of the pollen grains of all the taxa ranged between 14–28 µm in polar axis (P) and 15–25 µm in equatorial view (E).

Some variations were also observed in two species as *S. persica* and *S. australior* were broadly elliptic in their equatorial view and other species were more or less similar as S. d*enticulata* ssp. *hazarica &* N.J. Andress were found elliptic obtuse in equatorial view and circular in polar view. All the examined *Salix* pollen grains appeared to have long, acute or obtuse ended colpi.

The glycerin jelly measurements showed not many variations in exine thickness in the centers of mesocolpi. The range was 0.5–2 µm for different species. *S. tetrasperma* seemed to possess thickest exine. Thinnest exine was found in two subspecies of *S denticulata and S. babylonica.* When pollen characters were incorporated, the clustering and scattering pattern remained almost same.

On the account of palynology more collection is needed, as no flowering specimen was available for study. On the basis of the available characters the only herbarium specimen were studied and the measurement of the polar and equatorial view, exine and the P\E ratio were observed. Moreover its pollen grains were (2-) 3(-6)-aperturate, colporate (colporoidate), 2-celled, mostly tricolporate.

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