Pakistan J. Bot. 2 (1): 25–35

PALYNOLOGICAL INVESTIGATIONS OF SOME MEMBERS OF FAMILY LEGUMINOSAE FROM JAMSHORO (SIND), WEST PAKISTAN—I

K.M. KHAN and H.R.A. MEMON

Department of Botany, Sind University, Jamshoro, West Pakistan.

Abstract

The palynological study of 28 plants belonging to three subfamilies of Leguminosae from Sind University Campus, Jamshoro, West Pakistan was undertaken. Colpate, colp-orate and porate type of pollen grains were found. Colpate and colp-orate type of pollen grains were three aperturate; the colp-orate type being more frequent. Porate type pollen grains were found only in polyads.

Introduction

In view of the fact that practically no work has been done so far on the pollen morphological studies of the plants growing in the region of Sind, West Pakistan, a project was undertaken to accomplish this task. To start with we have described the detailed pollen morphology of some members of family Leguminosae collected from Jamshoro, West Pakistan.

Materials and Methods

The polliniferous material was collected in the vicinity of Sind University Campus, Jamshoro, West Pakistan. The material was treated with acetic acid, acetolysed, washed in a mixture of glycerine and distilled water and the pollen grains were mounted in glycerine jelly. The methods followed are described in detail by Erdtman (1966).

Terminology and Classification

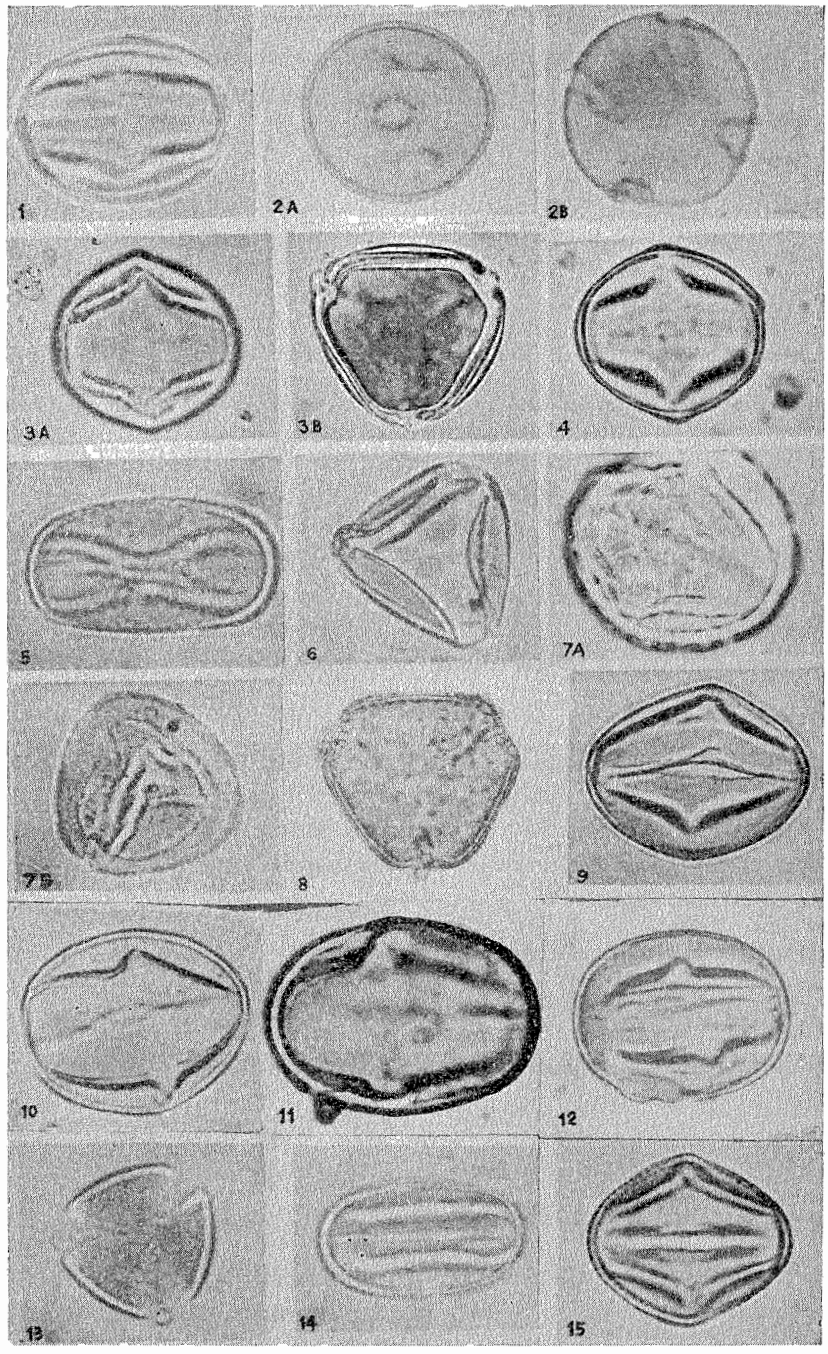
For the detailed description of pollen grains, the terminology and classification of Erdtman (1966) has been used. However a few terms from Wodehouse (1935) and Faegri and Iversen (1956) have also been used.

DESCRIPTIONS

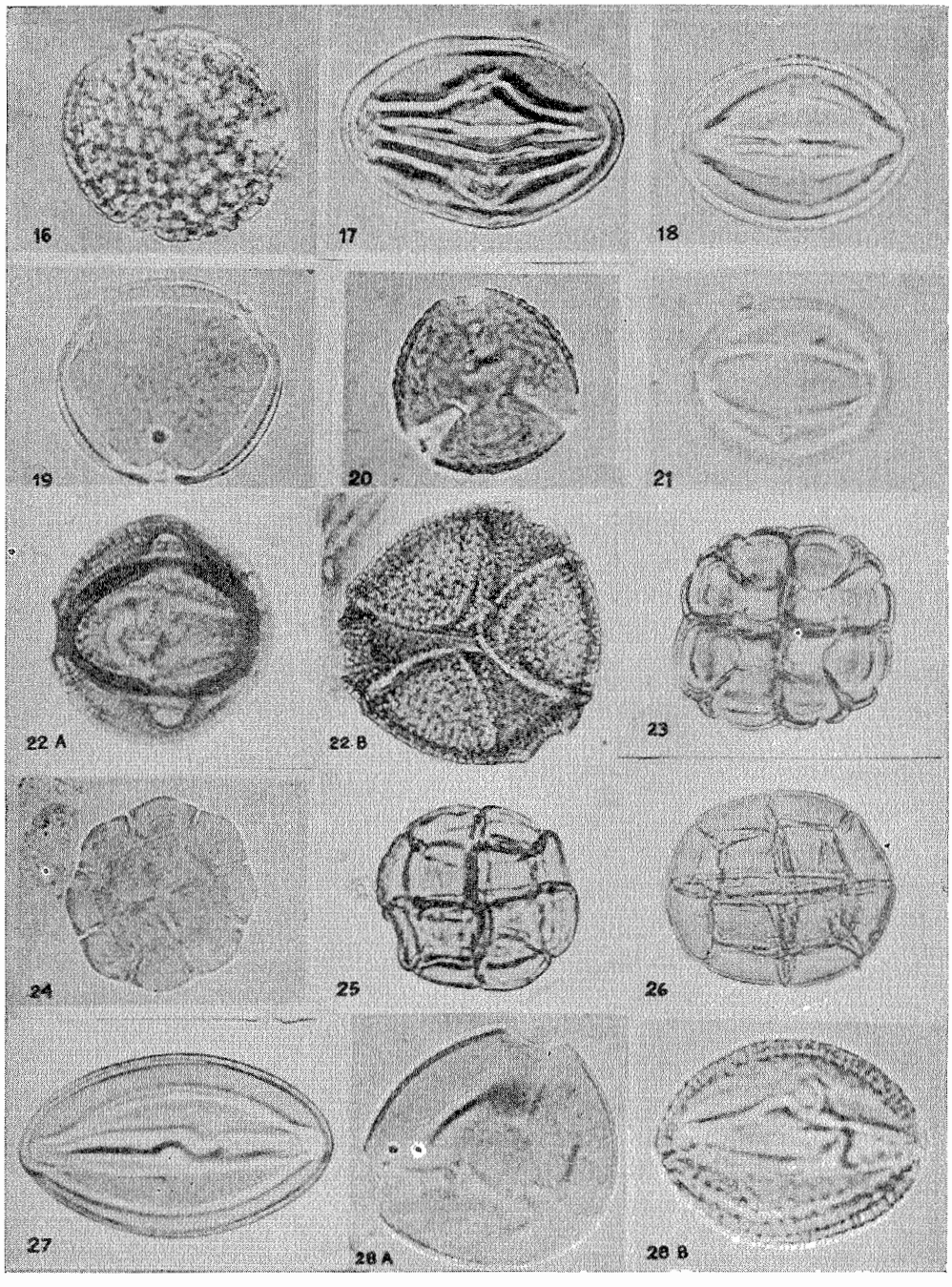
Papilionoideae

Alhagi maurorum Baker (Fig. 1)

Pollen grains 3-colp-orate, prolate spheroidal (c. $28 \times 28\mu$), peritreme. Apocolpium diameter c. 14μ. Amb rounded-triangular (semi-angular). Colpal



1. *Alhagi maurorum;* 2 A-B. *Alysicarpus longifolius;* 3 A-B. *Cyamopsis tetragonoloba;* 4. *Crotolaria burhia;* 5. *Crotolaria juncea;* 6. *Crotolaria ternatea;* 7 A-B. *Dalbergia sisso;* 8. *Indigofera oblongifolia;* 9. *Medicago hispida;* 10. *Medicago sativa;* 11. *Melilotus alba;* 12. *Pisum sativum;* 13. *Sesbania sesban;* 14. *Traverniera nummularia;* 15. *Tephrosia uniflora;*



16. *Caesalpinia pulcherrima;* 17. *Cassia surattensis;* 18. *Cassia angustifolia;* 19. *Cassia fistula;* 20. *Cassia italica;* 21. *Parkinsonia aculeata;* 22 A-B. *Delonic regia;* 23. *Acacia nilotica;* 24. *Acacia dealbita;* 25. *Acacia senegal;* 26. *Albizzia lebbek;* 27. *Prosopis glandulosa;* 28 A-B. *Prosopis cineraria.*

part of aperture c. 21×2.5μ, its margin thickened. Ora more or less lolongate (3·5×7μ).

Exine 3.0μ thick, pertectate. Sexine psilate and as thick as nexine.

Alysicarpus longifolius W. & A. (Fig. 2 A-B)

Pollen grains 3-colp-orate (rarely 4-colp-orate), prolate spheroidal (c. 63×63μ), peritreme. Apocolpium diameter c. 35μ (in 3-colp-orate) & 42μ (in 4-colp-orate). Amb rounded-triangular (semi-angular). Colpal part of aperture c. 29×5.2μ, its margin thickened. Ora more or less circular (dia c. 7μ).

Exine 3.5μ thick, petectate. Sexine more or less psilate and as thick as nexine.

Cyamopsis tetragonoloba (L.) Taub. (Fig. 3)

Pollen grains 3-colp-orate, prolate spheroidal (c. 55×53μ), goniotreme. Apocolpium diameter c. 17.5μ. Amb more or less triangular. Colpal part of aperture c. 28×3.5μ, its margin thickened. Ora more or less circular (dia c. 3·5μ).

Exine 3.5μ thick, pertectate; tenuiexinous at the sides of apertures. Sexine faintly suprastriate (heterobrochate) and as thick as nexine.

Crotolaria burhia Ham. ex Benth. (Fig. 4)

Pollen grains 3-colp-orate, prolate spheroidal (c. 60×54μ), peritreme. Apocolpium diameter c. 17.5μ. Amb rounded—triangular (semi-angular). Colpal part of aperture c. 35×3.5μ, its margin granulate. Ora more or less lolongate (3.5×5.25μ).

Exine 3μ thick, pertectate. Sexine more or less suprastriate, baculiferous and as thick as nexine.

Crotolaria juncea Linn. (Fig. 5)

Pollen grains 3-colp-orate, prolate (c. 45×24μ), more or less ptychotreme. Apocolpium diameter c. 14.0μ. Amb more or less lobed. Colpal part of aperture c. 35×3.5μ, its margin thickened. Oral part of aperture slightly lolongate (c. 3.5×5.2μ), its margin thickened.

Exine c. 3.5μ thick, pertectate. Sexine faintly suprastriate (heterobrochate) and slightly thinner than nexine.

Crotolaria ternatea Linn. (Fig. 6)

Pollen grains 3-colp-orate, subprolate (c. 112×98μ), more or less goniotreme. Apocolpium diameter c. 70μ. Amb more or less triangular. Colpal part of aperture c. 88×3.5μ, its margin thickened (colpi are pseudo?). Oral part of aperture lolongate (c. 10.5×14μ), its membrane rough (ora are only visible in polar view and they do not seem to be situated in the middle of colpi).

Exine c. 5.2μ thick, pertectate. Sexine slightly granulate and more or less as thick as nexine.

Dalbergia sisso Roxb. (Fig. 7)

Pollen grains 3-colp-orate, prolate spheroidal (c. 42×42μ), goniotreme. Apocolpium diameter c. 10.5μ. Amb triangular. Colpal part of aperture c. 17.5×3.5μ, its margin thickened. Ora more or less lolongate (3.5×7μ).

Exine 4.5μ thick, pertectate, tenuiexinous at the sides of apertures, suprastriate (heterobrochate). Sexine baculiferous and as thick as nexine.

Indigofera oblongifolia Forsk. (Fig. 8)

Pollen grains 3-colpate, prolate sphedroidal (c. 60×60μ), goniotreme. Apocolpium diameter c. 25μ. Amb triangular. Colpal part of aperture c. 21×7μ, its margin thickened.

Exine 3μ thick, pertectate, tenuiexinous at the sides of apertures, suprastriate (heterobrochate). Sexine baculiferous and as thick as nexine.

Medicago hispida Gaertin. (Fig. 9)

Pollen grains 3-colp-orate, prolate spheroidal (c. 60×53μ), goniotreme. Apocolpium diameter c. 17.5μ. Amb triangular. Colpal part of aperture c. 46×35μ, its margin thickened. Ora more or less circular (dia c. 4.5μ).

Exine 4.5μ thick, pertectate. Sexine slightly granulate and as thick as nexine.

Medicago sativa Linn. (Fig. 10)

Pollen grains 3-colp-orate, subprolate (c. 60×45μ), peritreme. Apocolpium diameter c. 18μ. Amb rounded-triangular (semi-angular). Colpal part of aperture c. 49.0μ, its margin thickened. Oral part of aperture more or less circular (dia c. 3.5μ), its margin thin.

Exine c. 3.5μ thick, pertectate. Sexine slightly baculiferous and somewhat thinner than nexine.

Melilotus alba Lamk. (Fig. 11)

Pollen grains 3-colp-orate, subprolate (c. 42×35μ), peritreme. Apocolpium diameter c. 10.5μ. Amb rounded-triangular (semi-angular). Colpal part of aperture c. 35×3.5μ, its margin thickened. Oral part of aperture more or less circular (dia c. 3.5μ), its margin thin.

Exine c. 3.5μ thick, pertectate. Sexine slightly baculiferous and somewhat thinner than nexine.

Pisum sativum Linn. (Fig. 12)

Pollen grains 3-colp-orate, spheroidal (c. 52×46μ), peritreme. Apocolpium diameter c. 17.5μ. Amb rounded-triangular (semi-angular). Colpal part of aperture c. 42×3.5μ, its margin thickened. Ora more or less circular (dia c. 3.5μ).

Exine 3.0μ thick, pertectate faintly suprastriate (heterobrochate). Sexine baculiferous and slightly thicker than nexine.

Sesbania sesban (L.) Merill. (Fig. 13)

Pollen grains 3-colpate, prolate (c. 53×35μ), goniotreme. Apocolpium diameter c. 28μ. Amb more or less triangular. Colpal part of aperture c. 49×7μ, its margin more or less granulate.

Exine 4.0μ thick, pertectate, suprastriate (heterobrochate). Sexine baculiferous and as thick as nexine.

Traverniera nummularia DC. (Fig. 14)

Pollen grains 3-colpate, prolate (c. 30×21μ), peritreme. Apocolpium diameter c. 14.0μ. Amb rounded-triangular (semi-angular). Colpal part of aperture c. 26×3.5μ, its margin slightly thickened.

Exine 2.5μ thick, semitectate faintly eustriate (heterobrochate). Sexine baculiferous and as thick as nexine.

Tephrosia uniflora Pers. (Fig. 15)

Pollen grains 3-colp-orate, prolate (c. 49×35μ), peritreme. Apocolpium dia c. 14μ. Amb rounded-triangular (semi-angular). Colpal part of aperture c. 39×3.5μ, its margin thickened. Oral part of aperture more or less circular (dia c. 3.5μ), its margin thin.

Exine c. 3.5μ thick, pertectate. Sexine slightly baculiferous and somewhat thicker than nexine.

Caesalpinioideae

Caesalpinia pulcherrima Sw. (Fig. 16)

(Pollen grains are seen only in polar view).

Pollen grains 3-colpate, prolate spheroidal (c. 70-98μ in diameter), peritreme. Apocolpium dia. c. 28μ. Amb rounded-triangular (semi-angular). Colpi c. 21×8.7μ, their margin very thin.

Exine c. 7.0μ thick, semitectate. Sexine eustriate (heterobrochate) and thicker than nexine.

Cassia surattensis Burm. (Fig. 17)

Pollen grains 3-colp-orate, prolate (c. 70×46μ), peritreme. Apocolpium diameter c. 35μ. Amb rounded-triangular (semi-angular). Syncolpate, colpal part of aperture c. 35×3.5μ, its margin thickened. Oral part of aperture lolongate (c. 3.5×7μ), its margin thickened.

Exine c. 5.2μ thick, pertectate. Sexine baculiferous and more less as thick as nexine.

Cassia angustifolia Wall. (Fig. 18)

Pollen grains 3-colp-orate, subprolate (c. 60×50.5μ), more or less goniotreme. Apocolpium diameter c. 25μ. Amb more or less triangular. Colpal part of aperture c. 52.5×3.5μ, its margin more or less granulate. Oral part of aperture more or less circular (dia c. 3.5μ).

Exine 3.5μ thick, pertectate. Sexine baculiferous and as thick as nexine.

Cassia fistula Linn. (Fig. 19)

Pollen grains 3-colp-orate, prolate, (c. 49×3.5μ), more or less goniotreme. Apocolpium diameter c. 17.5μ. Amb more or less triangular. Colpal part of aperture c. 35×3.5μ, its margin granulate. Oral part of aperture more or less circular (dia c. 3.5μ).

Exine 3.5μ thick, pertectate. Sexine baculiferous and as thick as nexine.

Cassia italica (Mill.) Lamk. ex F.W. Andr. (Fig. 20)

Pollen grains 3-colp-orate prolate (c. $70 \times 53\mu$), goniotreme. Apocolpium diameter c. 17.5μ. Amb triangular. Parasyncolpate, colpal part of aperture c. $53 \times 3.5\mu$, its margin thickened. Ora more or less circular (dia c. 3.5μ).

Exine 3μ thick, pertectate. Sexine baculiferous and as thick as nexine.

Parkinsonia aculeata Linn. (Fig. 21)

Pollen grains 3-colp-orate, prolate spheroidal (c. $46 \times 42\mu$), peritreme. Apcolpium diameter c. 17.5μ. Amb rounded-triangular (semi-angular). Colpal part of aperture c. $42 \times 3.5\mu$, its margin granulate. Ora more or less circular (dia c. 3.5μ).

Exine 3.0μ thick, semitectate, eustriate (more or less homobrochate). Sexine baculiferous and more or less as thick as nexine.

Delonix regia (Bojer) Raf. (Fig. 22)

Pollen grains 3-colp-orate, prolate spheroidal (c. 105-123μ in diameter), peritreme. Apocolpium diameter c. 17.5μ. Amb rounded-triangular (semi-angular). Syncolpate, colpal part of aperture c. $95 \times 7\mu$, its margin finely reticulate. Oral part of aperture slightly lolongate (c. $14 \times 17.5\mu$), its margin thickened.

Exine c. 7μ thick, pertectate. Sexine suprastriate (heterobrochate) and thicker than nexine.

Mimosoideae

Acacia

Pollen grains (of the described species) in polyads (Erdtman 1966) made up of 16 grains, 8 form a cubical central block of two 4's one above the other and the remaining 8 outer grains encircle the block forming the ring. The central grains are cubical with gaps between their corners, but the outer grains are more or less square facing towards the periphery and taper inwards to fit into ring.

Polyads in *A. niolotica* (Lamk.) Willd. (Fig. 23), are flattened, lens shaped, prolate spheroidal (c. $53 \times 53\mu$) and aperturate. The apertures are usually arranged irregularly, they are more or less circular (dia c. 3.5μ) with thickened margins.

Exine 4.0μ thick, pertectate, suprastriate (heterobrochate). It is much thinner on the internal walls of grains, but slightly thickened at the external walls. Sexine baculiferous.

Polyads in *A. dealbita* Link. (Fig. 24) are prolate spheroidal (c. 87.5×87.5μ) and aperturate. The apertures are arranged symmetrically, each present at the corner of individual grain. They are more or less circular (diameter c. 3.5μ) with thickened margins.

Exine 3.5μ thick, pertectate, much thinner on the internal walls of grains, but slightly thickened at the external walls. Sexine baculiferous.

Polyads in *A. senegal* Wild. (Fig. 25) are prolate spheroidal (c. 80×90μ) and aperturate. The apertures are symmetrically arranged, each present at the corner of individual grain. The apertures are more or less circular (dia c. 4.5μ) with the margins thickened.

Exine 4.0μ thick, pertectate much thinner on the internal walls of grains, but slightly thickened at the external walls. Sexine baculiferous.

Albizzia lebbek Benth. (Fig. 26)

Pollen grains are polyads, composed of 16 cells, 8 forming a ring encircling the 8-celled central block of two 4's one above the other. The peripheral cells are more or less rectangular, tapering inwards to fit into ring, while the central cells are more or less rhomboid-shaped with gap, between the cells of their corners. The polyads seem to be flattened, prolate spheroidal (c. 147×127.5μ). The apertures are irregularly arranged, they are more or less circular (diameter c. 3.5μ) with slightly granulate margins. Exine 4.0μ thick, pertectate. Sexine psilate and slightly thinner than nexine. The exine on the internal cells is thickened than the external cells.

Prosopis glandulosa Torr. (Fig. 27)

Pollen grains 3-colp-orate, prolate (c. 63×39μ), peritreme. Apocolpium diameter c. 14.0μ. Amb rounded-triangular (semi-angular). Syncolpate colpal part of aperture c. 60×3.5μ, its margin thickened. Oral part of aperture more or less lolongate (3.5×7μ). its margin thickened.

Exine 3.0μ thick, pertectate. Sexine faintly baculiferous and as thick as nexine.

Prosopis cineraria (Linn.) Druce. (Fig. 28)

Pollen grains 3-colp-orate, prolate (c. 66×42μ), peritreme. Apocolpium diameter c. 17.5μ. Amb rounded-triangular (semi-angular). Colpal part of aperture c. 52×3.5μ, its margin granulate. Oral part of aperture more or less lolongate (3.5×7μ) its margin thickened.

Exine 4.0μ thick, semitectate, eustriate (heterobrochate). Sexine baculiferous and as thick as nexine.

Discussion

The detailed pollen morphological studies of some members (described here) of three subfamilies viz. Papilionoideae, Caesalpinioideae and Mimosoideae, show the single celled and simple (rarely) and complex (oftenly) aperturate type of pollen grains with the exception of a few members of Mimosoideae (*Albizzia lebbek* and *Acacia* species, described here) in which the pollen grains are in polyads.

The common characters found in the pollen of some members of each subfamily are prolate shape and rounded-triangular (semi-angular) amb, 3-colp-orate, peritreme apertures with circular ora, a semitectate striate (in Papilionoideae it is suprastriate, while eustriate in Caesalpinioideae) and pertectate exine with a baculiferous sexine which is about as thick as nexine.

Some of the members of subfamilies Papilionoideae and Caesalpinioideae do share some common characters in being triangular amb, 3-colpate and goniotreme. The prolate spheroidal apertures with lolongate ora, psilate and granulate sexine, type of pollen grains are met in subfamilies Papilionoideae and Mimosoideae.

There are some members (described in this paper) in each subfamily with some isolated characters. For example spheroidal (Fig. 12) and sexine slightly thicker than nexine type of grains are found in subfamily Papilionoideae, while in Caesalpinioideae the pollen grains are subprolate and syncolpate (Figs. 2 & 5) and in Mimosoideae the pollen grains are polyads and polyporate.

In *Alysicarpus longifolius* (Papilionoideae), the pollen grains are usually 3-colp-orate (Fig. 2A), but there are certain exceptions where 4-colp-orate (Fig. 2B) pollen-grains are found. This variation is available only in this species among the described members of family Leguminosae.

Acknowledgments

The authors are greatly indebted to Professors G. Erdtman of Sweden, Suzanne L. Dingen of Australia and S. I. Ali of Karachi University, Pakistan, for their useful criticism and suggestions.

References

Erdtman, G. 1952. Pollen morphology and Plant Taxonomy. Angiosperms (An Introduction to Polynology I). The Chronica Botanica Co. Waltham, Mass. U.S.A. pp. 225-231 & 459-472.

Erdtman, G. 1963. Palynology in 'Advances in Botanical Research'. Ed. R.D. Preston **1**: pp. 149-208.

———1966. Pollen morphology and plant taxonomy. Angiosperms (An Introduction to Palynology I). Revised edition. Hafner Publishing Co. N.Y. & London. pp. 225-231, 459-472 and 543-553.

Faegri, K. and Johs Iversen. 1956. Text book of Pollen Analysis. Blackwell Scientific Publication. Oxford. pp. 14-30.

———1956. Recent trends in Palynology. Bot. Rev. **22**: 639-664.

Felix, Charles J. 1961. An Introduction to Palynology in 'Studies of Paleobotany'. Ed. H.N. Andrew, Jr. John Wiley & Sons, Inc. U.S.A. pp. 436-460.

Hyde, H.A. and K.F. Adams. 1958. An Atlas of Airborne pollen grains, London. MacMillan & Co. Ltd. N.Y. pp. VII-IX, 53 and 105-108.

Wodehouse, R.P. 1935. Pollen grains, their structure; identification and significance in science and medicine. Hafner Publishing Co. N.Y. & London, reprinted in 1965, pp. 541-545.