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Pollen Morphology of *Barleria* L. (Acanthaceae) from India

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ABSTRACT

The pollen grain morphology of 19 species and one variety of *Barleria* L. from India, investigated by Light Microscopy and Scanning Electron Microscopy, is presented. The pollen grains of the species studied are spheroidal or sometimes more or less distinctly three-lobed and tri-brevicolporate; the tectum is reticulate, honey comb like. The genus *Barleria* has pollen grains of distinct morphology, that appears to be isolated within the family with relatively specific pollen grain morphology. Uniform intrageneric pollen grain morphology also indicates monophyly of the group.

Key words: SEM, *Barleria*, palynology

Abbreviations: LM - Light Microscopy; SEM - Scanning Electron Microscopy

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Introduction

Barleria is a large pantropical, polymorphic, widely spread genus within the family Acanthaceae, represented by about 250 species (Judd et al., 2008) to 300 (Balkwill & Balkwill, 1997) distributed predominantly in tropical regions of the Old World. The species are distributed from Japan in the far East, through South Asia, India, Africa, Madagascar to as far west as Central America and Mexico (Balkwill & Balkwill, 1998). The centre of maximum species diversity is in tropical East Africa, followed by South Africa and Asia. In India, the genus is represented by 26 species of which 14 are endemic. While *B. acanthoides* occurs in the western part of Rajasthan and Punjab states, the remaining 25 species are found in Peninsular India.

The taxonomic value of pollen grain characters in Acanthaceae was first pointed out by Radlkofer (1883). Many workers have described the pollen grains of *Barleria* (Lindau, 1893, 1895; Bhaduri, 1944; Raj, 1961, 1973; Bremekamp, 1965; Chaubal, 1966; De, 1968; Balkwill & Getliffe Norris, 1988; Scotland, 1990; Scotland & Vollesen, 2000), however, palynological data exist for relatively few species within the genus. The present study on pollen grains of 19 species and one variety of *Barleria* was undertaken to explore pollen grain morphology in order to better understand the taxonomy of this genus in India.

Material and methods

Pollen grain samples, fixed in glacial acetic acid, were

acetolysed (9:1 acetic anhydride: concentrated sulphuric acid – freshly prepared) following the technique of Erdtman (1960) and divided in to two parts, one for SEM and the other for LM. For SEM, acetolysed samples were dehydrated in an ethanol series. Pollen grains were mounted on glass slides using double sided sticky tape and air dried. The slides were then mounted on SEM stubs and coated with Platinum using Emscope SC 500 sputter coater and examined using a JOEL JSM6360 scanning electron microscope at 5 and 10 kV.

The pollen grain measurements were made from semi-permanent preparations of acetolysed pollen grains mounted in glycerine jelly. Measurements for at least ten pollen grains of each species were taken and mean with standard deviation is presented. The values of P (polar axis length) and E (equatorial diameter) were measured and the P/E ratio was calculated. The terminology used for pollen grain description follows terms accepted by Punt et al. (1994, 2006). The qualitative and quantitative characters of pollen grains are summarized in Table 1 and shown by SEM photograph (Figs. 1 and 2).

Results

The pollen grains of *Barleria* species studied are stenopalynous (Table 2; Figs. 1 and 2). They are spheroidal or sometimes more or less distinctly 3-lobed in polar outline, tri-brevicolporate, 83.2-125.6 x 95.6-144 µm. The P/E ratio ranged from 0.81-0.96. The colpi are long, distinctly demarcated or merging into the

Table 1. Comparative account of qualitative and quantitative characters of *Barleria* species

Sr.No.	Name of the species	Polar axis length(μm)	Equatorial diameter (μm)	P/E	Colpus length (μm)	Colpus width (μm)	Porediameter (μm)	Surface ofNexine
1.	<i>B. acuminata</i> Nees	84.00 \pm 2.66	96.80 \pm 4.13	0.86	38.0 \pm 1.41	13 \pm 0.66	4 \pm 0.44	Smooth
2.	<i>B. courtallica</i> Nees	104.0 \pm 4.98	127.6 \pm 7.64	0.81	37.0 \pm 1.41	06 \pm 0.94	2.5 \pm 0.6	Smooth
3.	<i>B. cristata</i> L. var. <i>cristata</i>	91.20 \pm 3.15	98.40 \pm 3.37	0.92	21.0 \pm 1.82	05 \pm 0.66	3 \pm 0.63	Smooth
4.	<i>B. cristata</i> L. var. <i>dichotoma</i> (Roxb.) Prain	86.80 \pm 3.29	95.60 \pm 3.97	0.90	25.0 \pm 1.69	06 \pm 0.81	3 \pm 0.63	Smooth
5.	<i>B. cuspidata</i> Heyne ex Nees	105.2 \pm 3.29	118.8 \pm 4.63	0.88	30.0 \pm 1.76	18 \pm 1.00	7 \pm 0.63	Smooth
6.	<i>B. gibsoni</i> Dalzell	89.60 \pm 2.79	100.8 \pm 3.15	0.88	15.4 \pm 1.26	07 \pm 0.77	6 \pm 0.63	Smooth
7.	<i>B. grandiflora</i> Dalzell	125.6 \pm 4.69	144.0 \pm 3.77	0.87	32.0 \pm 1.94	14 \pm 0.89	6 \pm 0.63	Smooth
8.	<i>B. involucreata</i> Nees var. <i>elata</i> (Dalzell) C.B.Clarke	106.0 \pm 3.39	125.6 \pm 4.69	0.84	43.7 \pm 1.76	12 \pm 0.89	6 \pm 0.63	Smooth
9.	<i>B. lawii</i> T.Anderson	98.40 \pm 3.86	113.2 \pm 4.23	0.86	30.5 \pm 1.58	11 \pm 1.0	8 \pm 0.63	Smooth
10.	<i>B. longiflora</i> L.	114.4 \pm 4.29	130.8 \pm 3.79	0.87	35.2 \pm 1.87	09 \pm 0.89	8 \pm 0.63	Smooth
11.	<i>B. montana</i> Nees	102.4 \pm 5.05	115.6 \pm 4.78	0.88	30.1 \pm 1.37	02 \pm 0.63	1.5 \pm 0.5	Baculate
12.	<i>B. mysorensis</i> Roth	83.20 \pm 2.52	96.00 \pm 3.26	0.86	23.0 \pm 1.69	10 \pm 1.0	6 \pm 0.77	Smooth
13.	<i>B. nitida</i> Nees	87.60 \pm 3.97	100.8 \pm 4.54	0.86	21.2 \pm 1.61	09 \pm 0.63	5 \pm 0.63	Smooth
14.	<i>B. noctiflora</i> L.f.	92.00 \pm 3.26	110.8 \pm 3.79	0.83	15.0 \pm 1.24	04 \pm 0.77	3 \pm 0.77	Smooth
15.	<i>B. prattensis</i> Santapau	97.60 \pm 3.37	101.6 \pm 3.37	0.96	29.0 \pm 1.76	07 \pm 0.77	6 \pm 0.63	Smooth
16.	<i>B. prionitis</i> L.	96.40 \pm 2.27	104.0 \pm 2.66	0.92	25.0 \pm 1.33	12 \pm 1.0	6 \pm 0.77	Smooth
17.	<i>B. repens</i> Nees	84.00 \pm 3.26	95.60 \pm 3.97	0.87	26.4 \pm 1.42	12 \pm 0.77	5 \pm 0.63	Smooth
18.	<i>B. strigosa</i> Willd.	102.0 \pm 3.39	114.0 \pm 5.41	0.89	37.0 \pm 1.76	11 \pm 0.63	5 \pm 0.63	Granulate
19.	<i>B. terminalis</i> Nees	103.2 \pm 3.67	116.4 \pm 2.95	0.88	26.0 \pm 1.63	07 \pm 0.77	5 \pm 0.77	Granulate
20.	<i>B. tomentosa</i> Roth	95.60 \pm 3.15	109.6 \pm 4.69	0.87	30.5 \pm 1.58	11 \pm 0.77	9 \pm 0.77	Smooth

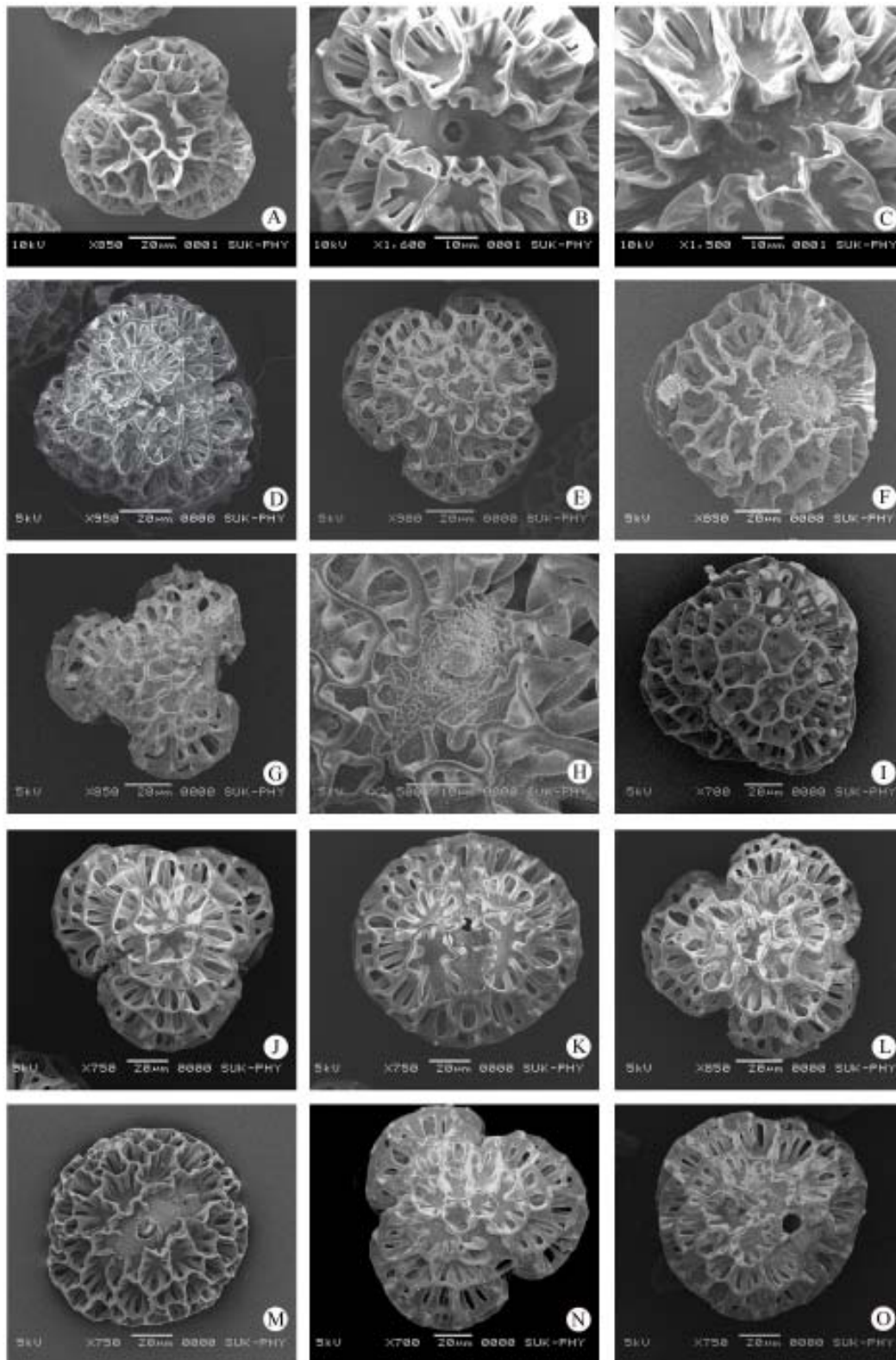


Fig. 1: A-O. Pollen of *Barleria*. A & B. *B. acuminata*. A. Polar view; open reticulate tectrum, tri-brevicolporate; B. Details of brevicolporus; C. *B. courtollica*. details of brevicolporus; D. *B. cristata* var. *cristata*. apertural view; E. *B. cristata* var. *dichotoma*. polar view; F. *B. cuspadata*. apertural view; G & H. *B. gibsoni*. G. polar view; H. details of brevicolporus; I. *B. grandiflora*, mesocolpial view showing two colpori; J&K. *B. involucrata* var. *eleta*, J. polar view; K. apertural view; L&M. *B. lawii*, L. polar view; M. apertural view; N&O. *B. longiflora*, N. polar view; O. apertural view.

Table 2. Localities of *Barleria* pollen grain collection

Sr. No.	Name of taxon	Places of collection
1.	<i>Barleria acuminata</i> Nees	Tamilnadu: Karandamalai hills, Madurai, <i>SMS2537</i> , 30.1.2007 (SUK); Murugamalai, Coimbatore, <i>SMS2551</i> , 23.6.2008 (SUK).
2.	<i>Barleria courtallica</i> Nees	Karnataka: Ulvi, Karwar, <i>SMS2544</i> , 22.1.2006 and <i>SMS2545</i> , 17.2.2008 (SUK); Kolar-Tirthahally road, Shimoga, <i>SMS2540</i> , 5.2.2007 (SUK).
3.	<i>Barleria cristata</i> L. var. <i>cristata</i> (Roxb.) Prain	Maharashtra: Nagzira, Gondia, <i>SMS2503</i> , 21.10.2005 (SUK). Phonda, Ratnagiri, <i>SMS2517</i> 10.12.2005 (SUK) Karnataka: Nandi hill, Bangalore, <i>SMS2530</i> , 25.7.2006 (SUK).
4.	<i>Barleria cristata</i> var. <i>dichotoma</i>	Maharashtra: Phonda, Ratnagiri, <i>SMS2518</i> , 10.12.2005 (SUK); Tillari, Kolhapur, <i>SMS2506</i> , 6.11.2005 (SUK).
5.	<i>Barleria cuspidata</i> Heyne ex Nees	Maharashtra: Varand ghat, <i>SMS2510</i> , 15.11.2005 (SUK); Phonda ghat, <i>SMS2520</i> , 10.12.2005 (SUK).
6.	<i>Barleria gibsoni</i> Dalz.	Maharashtra: Durgawadi-Junner, Pune, <i>SMS2542</i> , 24.2.2007 (SUK); Ajankyatara, Satara, <i>SMS2522</i> , 23.12.2005 (SUK); Katiayani, Kolhapur.
7.	<i>Barleria grandiflora</i> Dalz.	Maharashtra: Valvan-Radhanagiri, Kolhapur, <i>SMS2519</i> , 10.12.2005 (SUK); Varand ghat, Pune, <i>SMS2508</i> , 15.11.2005 (SUK). Karnataka: Chandwadi-Ansi road, Karwar, <i>SMS2523</i> , 25.12.2005 (SUK).
8.	<i>Barleria involucrata</i> Nees var. <i>elata</i> C.B. Clarke	Maharashtra: Amboli ghat, Sindhudurg, <i>SMS2521</i> , (Dalzell) 11.12.2005 (SUK). Karnataka: Ansi ghat, Karwar.
9.	<i>Barleria lawii</i> T. Anderson	Maharashtra: Anjenari hill, Nasik, <i>SMS2505</i> , 25.10.2005 (SUK); Malshej ghat, Pune, <i>SMS2513</i> , 16.11.2005 (SUK); Rajur, Ahmadanagar, <i>SMS2531</i> , 27.11.2006 (SUK).
10.	<i>Barleria longiflora</i> L.	Maharashtra: Agavashiva range, Satara, <i>SMS2502</i> , 16.10.2005 (SUK) and Khambataki ghat, Satara, <i>SMS2514</i> , 17.11.2005 (SUK). Tamilnadu: Alagar valley, Madurai, <i>SMS2539</i> , 30.1.2007, (SUK).
11.	<i>Barleria montana</i> Nees	Tamilnadu: Bisan valley and Silambar valley, Madurai, <i>SMS2536</i> , 29.1.2007 (SUK).
12.	<i>Barleria mysorensis</i> Roth	Karnataka: Near GKVK campus, Bangalore, <i>SMS2530</i> , 14.3.2007, (SUK); Tamil Nadu: Salem, Dharampuri, <i>SMS2552</i> , 23.6.2008 (SUK).
13.	<i>Barleria nitida</i> Nees	Tamilnadu: Bisan valley and Silambar valley, Madurai, <i>SMS2535</i> , 29.1.2007 (SUK); Karandamalai hills, Madurai, <i>SMS2538</i> , 30.1.2007 (SUK); KMTR forest, Thrinulvelly.
14.	<i>Barleria noctiflora</i> L.f.	Tamilnadu: Alagar valley, Madurai, <i>SMS2534</i> , 29.1.2007 (SUK).
15.	<i>Barleria prattensis</i> Santapau	Maharashtra: Varandh ghat, Pune, <i>SMS2509</i> , 15.11.2005 (SUK); Khandala, Pune, <i>SMS2511</i> , 16.11.2005 (SUK); Dev dongar-charanmal, Dhule, <i>SMS2526</i> , 16.1.2006 (SUK). Gujarat: Nesu reserve forest, Songad, <i>SMS2528</i> , 23.1.2006 (SUK). Kerala: KFRI campus, Trissur.
16.	<i>Barleria prionitis</i> L.	Maharashtra: Umbarti-Pinpalner, Dhule, <i>SMS2524</i> , 7.1.2006 (SUK); Amgaon, Gondia, <i>SMS2504</i> , 22.10.2005 (SUK). Gujarat: Bedi-Vyara, Surat. Karnataka: Gokak, Belgaon; Bangalore; Hampi. Tamilnadu: Alagar valley, Madurai, <i>SMS2533</i> , 29.1.2007 (SUK). Bihar: Bhagalpur, <i>SMS2541</i> , 8.2.2007 (SUK). Kerala: KFRI campus, Trissur.
17.	<i>Barleria repens</i> Nees	Maharashtra: Kolhapur, <i>SMS2529</i> , 14.3.2006 (SUK). Karnataka: GKVK Campus, Bangalore, <i>SMS2543</i> , 14.3.2007, (SUK)
18.	<i>Barleria strigosa</i> Willd.	Karnataka: Bangalore, <i>SMS2532</i> , 28.1.2007 (SUK). West Bengal: CNH Campus, Howrah, Darjeeling.
19.	<i>Barleria terminalis</i> Nees	Maharashtra: Amboli ghat, Sindhudurg; Waghavale-Ucchate, Satara, <i>SMS2507</i> , 6.11.2005 (SUK). Goa: Dongargaon waterfall, South Goa.
20.	<i>Barleria tomentosa</i> Roth	Karnataka: Badami, Bijapur, <i>SMS2501</i> , 9.10.2005 (SUK).

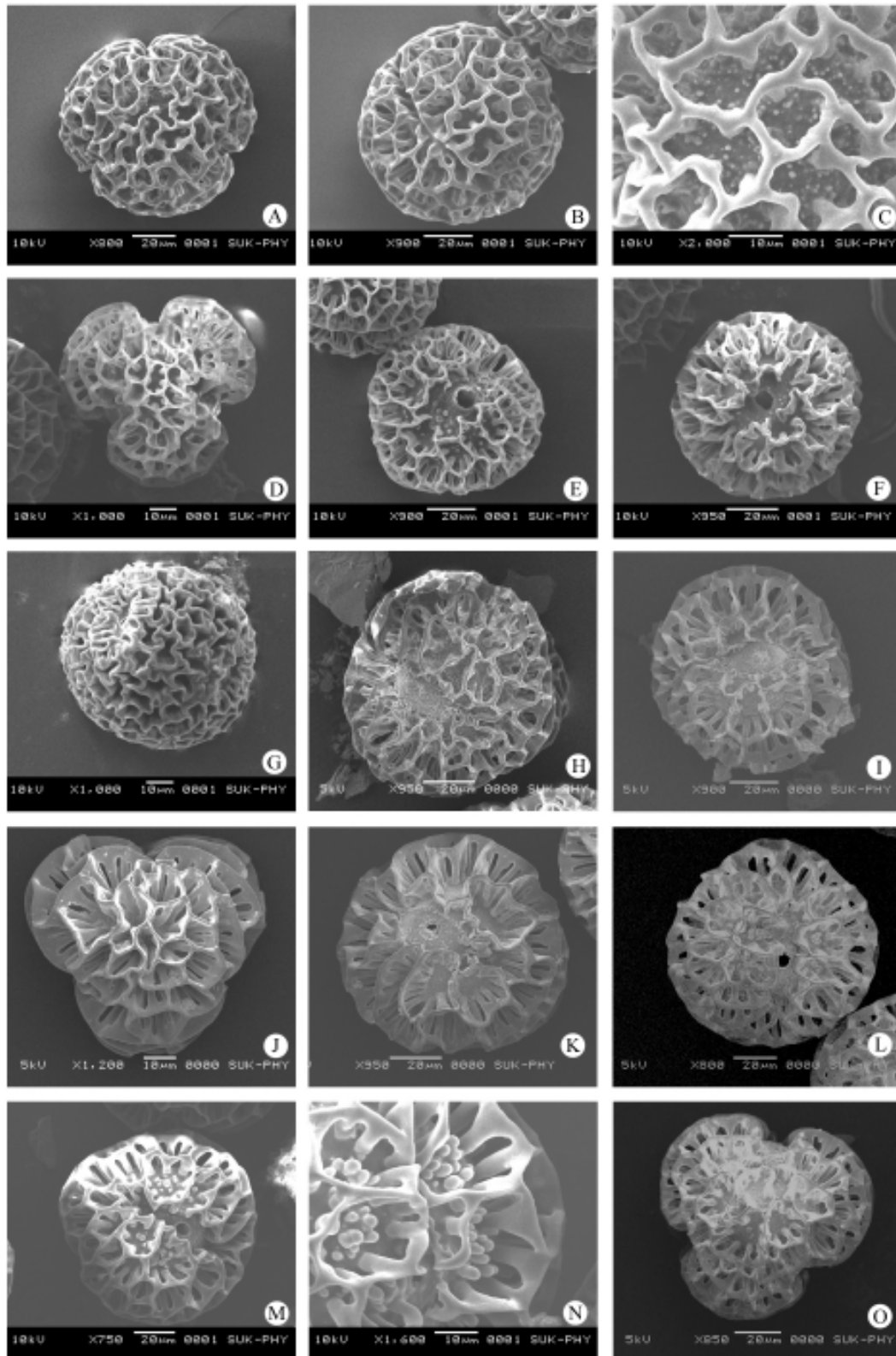


Fig. 2: A-O. Pollen of *Barleria*. A-C. *B. montana*, A. polar view, open reticulate tectum, tri-brevicolporate; B. apertural view, C. close up of tectum; D&E. *B. mysorensis*, D. polar view; E. apertural view; F. *B. nitida*, apertural view; G. *B. noctiflora*, mesocolpial view; H. *B. prattensis*, apertural view; I. *B. prionitis*, apertural view, J&K. *B. repens*, J. polar view; K. apertural view; L. *B. strigosa*, apertural view with granular lumina; M&N. *B. terminalis*, M. apertural view; N. closeup of aperture with scattered granules in lumina; O. *B. tomentosa*, polar view.

reticulum; margins of colpi are smooth or granular. The colpus membrane is smooth or covered with granules forming semi-circular structures. The colpus size varied from 15-43 x 2-14 μm . The porus area is generally small, i.e. 1.5-9 μm in diameter. Exine sculpturing is reticulate, honey comb like; muri are wavy, simply columellate; lumen is smooth and irregular in shape. The size of columellae and tectum varies from species to species. The nexine forms a homogenous layer without granules except for baculate in *Barleria montana* and granulate in *B. strigosa* and *B. terminalis*.

Discussion

Our results showed that the general pollen grain morphology of Indian *Barleria* species is more or less consistent, except for some variations in size, shape and ornamentation. Among the *Barleria* species, *B. grandiflora* and *B. longiflora* have the largest pollen grains with polar axis length up to 125.6 μm and 114.4 μm respectively. Interestingly, these two species have the largest and longest flowers among Indian *Barlerias*. The smallest pollen grains with minimum polar axis length were observed in *B. mysorensis* (83.2 μm). Grains with maximum equatorial diameter i.e. 144 μm were observed in *B. grandiflora*, while smallest equatorial diameter was measured in *B. cristata* var. *dichotoma* (95.6 μm). The colpi are very narrow in *B. montana* (2 μm) as compared to the other species (Fig. 2 A-C).

Pollen grains in *Barleria* species is prolate, 3-porate or 3-colporate (Raj, 1961, 1973; Chaubal, 1966; Scotland & Vellosen, 2000). Pollen grain is usually tri-brevicolporate. *Barleria* pollen grains are distinct within the family Acanthaceae, but show close similarities with their closely related genera like *Crabbea*, *Lepidagathis* and *Ruellia* in reticulate ornamentation.

References

- Balkwill, M.J. & Balkwill, K. 1997. Delimitation and infra-generic classification of *Barleria* L. (Acanthaceae). *Kew Bulletin*, 52(3): 535-573.
- Balkwill, M.J. & Balkwill, K. 1998. A preliminary analysis of distribution pattern in a large, pantropical genus, *Barleria* L. (Acanthaceae). *Journal of Biogeography*, 25: 95-110.
- Balkwill, K. & Getliffe Norris, F.M. 1988. Classification of the Acanthaceae: A Southern African perspective. Monograph in Systematic Botany. Missouri Botanical Garden, St. Louis, Missouri, 25: 503-516.
- Bhaduri, S. 1944. A contribution to the morphology of pollen grains of Acanthaceae and its bearing on taxonomy. *Journal of Department of Science, Calcutta University*, 1: 25-38.
- Bremekamp, C.E.B. 1965. Delimitation and sub-division of the Acanthaceae. *Bulletin of Botanical Survey India*, 7: 21-30.
- Chaubal, P.D. 1966. Palynological studies on the family Acanthaceae. Ph.D. Thesis, University of Poona, Poona.
- De, A. 1968. Cytological, anatomical and palynological studies as an aid in tracing affinity and phylogeny in the family Acanthaceae IV: Palynology and final conclusion. *Transitory of Bose Research Institute, Calcutta*, 31: 17-29.
- Erdtman, G. 1960. The acetolysis technique: a revised description. *Svensk Botanisk Tidskrift*, 54: 561-564.
- Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. & Donoghue, M.J. 2008. *Plant systematics: A phylogenetic approach*. Third ed. Sinauer Associates, Inc., Sunderland. 611 pp.
- Lindau, G. 1893. Beiträge zur Systematik der Acanthaceen. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie*, 18: 36-64.
- Lindau, G. 1895. Acanthaceae. In: *Die naturlichen Pflanzenfamilien*, Vol. 4(3b): A. Engler & K. Prantl, ed. W. Engelmann, Leipzig, pp. 274-354.
- Punt, W., Blackmore, S., Nilsson, S. & Le Thomas, A. 1994. Glossary of pollen and spore terminology. Laboratory of Palaeobotany and Palynology Contribution Series No. 1, Laboratory of Palaeobotany and Palynology Foundation, Utrecht, The Netherlands.
- Punt, W., Hoen, P.P., Blackmore, S., Nilsson, S. & Le Thomas, A. 2006. Glossary of pollen and spore terminology. Revised Palaeobotany and Palynology, 143: 1-181.
- Raj, B. 1961. Pollen morphological studies in the Acanthaceae. *Grana Palynologia*, 3: 3-108.
- Raj, B. 1973. Further contribution to the pollen morphology of the Acanthaceae. *Journal of Palynology*, 9: 91-141.
- Radlkofer, L. 1883. Ueber den systematischen Werth der Pollenbeschaffenheit bei den Acanthaceen. *Sitzungsber. Math.-Phys. Cl. Konigl. Bayer. Akad. Wiss. München*, 13: 256-314.
- Scotland, R.W. 1990. Systematics and Palynology of Acanthaceae. Ph.D. thesis, University of Reading, Reading.
- Scotland, R.W. & Vollesen, K. 2000. Classification of Acanthaceae. *Kew Bulletin*, 55: 513-589.