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POLLEN MORPHOLOGY OF
TRIBE TRICHOSPOREAE (GESNERIACEAE) IN CHINA
AND ITS SYSTEMATIC SIGNIFICANCE

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Abstract. Morphological studies of pollen of twelve species in four genera of tribe Trichosporeae (Gesneriaceae) from China are reported in this paper. The pollen grains of tribe Trichosporeae are tricolporoidate or rarely tricolporate, suboblate or spheroidal in shape, circular or subangular in polar view and nearly round or round in equatorial view. Pollen varies in size, colpus characters and ornamentation between species and genera. There is a fragmentary reticular tectum on the colpus membrane of *Loxostigma griffithii*, and this type of tectum probably represents a comparatively primitive character. In *Aeschynanthus*, the pollen grains of sections *Haplotrichum* and *Diplotrichum*, in which the corolla usually has indistinct bilabiate limbs, are comparatively small; in sections *Microtrichum*, *Xanthanos* and *Aeschynanthus*, in which the corolla has distinct bilabiate limbs, the pollen grains are large. The delimitation of the two ends of the colpi in section *Didymocarpoides*, which is terrestrial and primitive in the genus *Lysionotus*, is indistinct, although it is distinct in section *Lysionotus*. Based on this study, and on information in relevant references, a key to the genera of tribe Trichosporeae is presented based on characteristics of the pollen grains.

There are four genera in Tribe Trichosporeae Fritsch (Gesneriaceae) in China. Most of the species are distributed throughout south and southwestern China (Wang et al., 1990). Only a few morphological studies of the pollen of species and genera of the tribe have been published, and most of them have been based on studies using light microscopy (Erdtman, 1952; Xi, 1982; Ying et al., 1993). Twelve species in four genera chosen from the tribe in China were studied using SEM with the goal to present more evidence from pollen morphology for use in understanding the systematics of the tribe.

Materials and methods

All materials studied, except for *Anna ophiorrhizoides*, *Loxostigma griffithii*, *L. cavaleriei*, *Aeschynanthus buxifolius* and *A. mimetes*, which were collected from specimens in the herbarium of the Institute of Botany, Chinese Academy of Sciences (PE), were collected from nature and fixed in FAA. The materials for SEM study were dried through a 70%, 80%, 90%, 95%, 100% alcohol gradient, and directly mounted on double sided adhesive tape on stubs, then coated with gold for 3 minutes, then observed and photographed through a Hitachi S-800 SEM. Three photographs were taken of each sample in polar, equatorial and fine detail view. The species examined in this study are

listed in Table 1. The terminology of pollen characteristics is in accordance with Erdtman's handbook (Erdtman, 1969).

Results

Pollen grains of tribe Trichosporeae are tricolporoidate or rarely tricolporate, suboblate or spheroidal in shape, circular or subangular in polar view, and nearly round or round in equatorial view.

A detailed description of the pollen grains of all species examined in this study is presented in Table 2.

Discussion

Burt (1963) classified eight genera within tribe Trichosporeae. Among the eight genera, he later combined *Dichotrichum* Reinw. ex W. Vriese with *Agalmyla* Blume. It is also difficult to distinguish *Euthamnus* Schltr. from *Aeschynanthus* and it may be that they should be combined. Wang and Pan (1982) found that there are short hairs on the two ends of the seeds of *Anna* Pellegr., which was formerly classified in tribe Didymocarpaceae, so they transferred it to tribe Trichosporeae. Of the seven genera in the tribe, only *Loxostigma* Clarke and *Agalmyla* have a pistil with two round or oblong stigmas (i.e. two carpels not apically coherent); the other five genera are completely

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syncarpous. The colpus membranes of *Loxostigma griffithii* are covered with a type of fragmentary reticular structure which is abnormally broken in *L. cavaleriei* (H. Lév. & Vaniot) Burt (Plate I: 10–12).

Table 2 shows that the indistinct delimitation of colpi and the colpus membrane with a reticular tectum may represent a comparatively primitive character (Plate I: 7–9). In *Aeschynanthus*, the pollen grains of section *Haplotrichum* Benth (A. *acuminatus* Wallich ex A. DC. and A. *acuminatissimus* W. T. Wang) and section *Diplotrichum* Benth (A. *minetes* Burt), in which the corollas usually have indistinct bilabiate limbs, are comparatively small; in contrast, they are large in section *Microtrichium* Clarke (A. *buxifolius* Hemsley), section *Xanthanos* W. T. Wang (A. *denticuliger* W. T. Wang), and section *Aeschynanthus*, i.e., *Holocalyx* Benth (Burt, 1975), A. *boschianum* De Vriese R. Br., and A. *parvifolius* (Luegmayer, 1993), in which the corollas have distinct bilabiate limbs. Section *Didymocarpoides* W. T. Wang is primitive in the genus *Lysionotus* D. Don and contains three species which are terrestrial erect subshrubs with herbaceous or papery leaves. These species have anthers without appendages and have subulate appendages shorter than the seeds at each end of the seed. *Lysionotus oblongifolius* W. T. Wang belongs to this section. The delimitation of the two ends of the colpus in *L. oblongifolius* is indistinct (Plate III: 4–6), but is distinct in section *Lysionotus* (Plate III: 7–9), which is an epiphytic subshrub

or small shrub with thick papery to coriaceous leaves, anthers with appendages, and with hairy appendages equal to or longer than the seed at the two ends of the seeds.

A key to the genera of tribe Trichosporeae in China examined in this study is presented based on characteristics of the pollen and from information gathered from the literature.

1. Pollen grains spheroidal in shape.
 2. Pollen circular in polar view; colpi short and rather broad; colpus membrane coarsely reticulate or with sparse granular processes, finely reticulate; lumina large, irregular. *Loxostigma*
 2. Pollen subangular or circular in polar view; colpi rather long and narrow or rather broad; colpus membrane with dense granular processes, protruding in the middle, or rarely not protruding, finely or coarsely reticulate; lumina small, in the middle, or rarely not in the middle; finely or coarsely reticulate; lumina small, large or rather large, circular, subcircular, elliptical, irregular. *Aeschynanthus*
1. Pollen grains suboblate.
 3. Colpi long and narrow; colpus membrane with dense granular or tubercular processes, slightly protruding in the middle; finely reticulate with small lumina or verrucate with fine, dense perforations; muri thin. *Anna*
 3. Colpi rather long and narrow; colpus membrane with dense tubercular processes, protruding in the middle, finely reticulate; muri thin or rather coarse, with tubercles; lumina small or large. *Lysionotus*

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LITERATURE CITED

- BURTT, B. L. 1963. Studies in the Gesneriaceae of the Old World. XXIV. Tentative keys to the tribes and genera. *Notes Roy. Bot. Gard. Edinburgh* 24: 205–220.
- BURTT, B. L. & P. J. B. WOODS. 1975. Studies in the Gesneriaceae of the Old World. XXXIX. Towards a revision of *Aeschynanthus*. *Notes Roy. Bot. Gard. Edinburgh* 33: 471–489.
- ERTDMAN, G. 1952. *Pollen Morphology and Plant Taxonomy. Angiosperms*. Almqvist & Wiksell, Stockholm.
- ERTDMAN, G. 1969. *Handbook of Palynology*. Munksgaard, Copenhagen.
- LUEGMAYER, E. 1993. Pollen characters of Old World Gesneriaceae (Cyrtandroideae) with special reference to SE Asia taxa. *Grana* 32: 221–232.
- WANG, W. T. 1983. Revisio *Lysionoti* Sinici (Gesneriaceae). *Guihaia* 3: 249–284.
- . 1990. *Flora Reipublicae Popularis Sinicae*. Vol. 69. Science Press, Beijing.
- . & K. Y. PAN. 1982. Notulae de Gesneriaceae Sinensibus III. *Bull. Bot. Res.* 2: 144–146.
- XI, Y. Z. 1982. *Angiosperm Pollen Flora of Tropic and Subtropic China*. Science Press, Beijing.
- YING, T. S., D. E. BOUFFORD, & Y. L. ZHANG. 1993. *The endemic Genera of Seed Plants of China*. Science Press, Beijing.

TABLE 1. Species examined and voucher information for this study

| Species | Locality | Collector | Voucher Number |
|---|--------------------|------------------|----------------|
| <i>Anna mollifolia</i> (W. T. Wang) | Xizhou, Yunnan | Y. Z. Wang | 93013 |
| <i>A. ophiorrhizoides</i> (Hemsley) | Emei, Sichuan | W. P. Fang | 0558748 |
| <i>Loxostigma griffithii</i> (Wright) | Pingxiang, Guangxi | Southwest Exped. | 1360576 |
| <i>L. cavaleriei</i> (H. Lév. & Vaniot) | Napo, Guangxi | D. Fang | 1312431 |
| <i>Aeschynanthus buxifolius</i> Hemsley | Pingbian, Yunnan | H. T. Tsai | 62551 |
| <i>A. denticuliger</i> W. T. Wang | Hekou, Yunnan | Y. Z. Wang | 92090 |
| <i>A. mimetes</i> Burt | Nanchao, Yunnan | C. W. Wang | 75379 |
| <i>A. acuminatus</i> Wallich ex A. DC. | Hekou, Yunnan | Y. Z. Wang | 92024 |
| <i>A. acuminatissimus</i> W. T. Wang | Xichou, Yunnan | Y. Z. Wang | 93008 |
| <i>Lysionotus oblongifolius</i> W. T. Wang | Napo, Guangxi | Y. Z. Wang | 92036 |
| <i>L. pauciflorus</i> Maxim. var. <i>latifolius</i> W. T. Wang | Xichou, Yunnan | Y. Z. Wang | 92031 |
| <i>L. serratus</i> D. Don var. <i>pterocaulis</i> C. Y. Wu ex W. T. Wang | Hekou, Yunnan | Y. Z. Wang | 92078 |

TABLE 2. Morphological characteristics of pollen grains in Tribe Trichosporae (Gesneriaceae) in China. Aperture type in all species examined was 3-colporoidate.

| Species | Shape P: polar view E: equatorial view | Size | Colpus characteristics | Ornamentation (SEM) | Figure |
|---------------------------------|--|--|--|--|----------------|
| <i>Anna mollifolia</i> | Suboblate P: circular E: subround | (9.6–13.1) 11.6 × 13.5 (11.2–15.6) (P:E = 0.86) | Long and narrow, distinctly delimited colpus membrane with dense tubercular processes, slightly protruding in middle | Finely verrucate with fine, dense perforations | Plate I, 1–3 |
| <i>A. ophiorrhizoides</i> | Suboblate P: circular E: subround | (13.9–17.8) 15.8 × 18.4 (16.3–20.1) (P:E = 0.86) | Long and narrow, colpus membrane distinctly delimited, with dense granular processes, slightly protruding in middle | Finely reticulate; muri thin; lumina small, circular, subcircular or elliptical | Plate I, 4–6 |
| <i>Loxostigma griffithii</i> | Spheroidal P: circular E: round | (12.6–17.5) 14.4 × 16.3 (14.5–18.3) (P:E = 0.88) | Short and rather broad, distinctly delimited, with reticular membrane | Finely reticulate; muri thin; lumina large, irregular | Plate I, 7–9 |
| <i>L. cavaleriei</i> | Spherical P: circular E: round | (15.8–20.7) 17.8 × 19.1 (17.0–21.3) (P:E = 0.93) | Short and rather broad, distinctly delimited; colpus membrane with coarse granular processes | Finely reticulate; muri thin; lumina large, irregular | Plate I, 10–12 |
| <i>Aeschynanthus buxifolius</i> | Spheroidal P: subangular E: round | (12.2–16.8) 14.5 × 16.2 (14.2–18.0) (P:E = 0.90) | Rather long and narrow, distinctly delimited; colpus membrane with dense tubercular processes, protruding in middle | Finely reticulate; muri thin; lumina small, circular, subcircular, elliptic or irregular | Plate II, 1–3 |
| <i>A. denticuliger</i> | Spheroidal P: subangular E: round | (18.4–23.0) 20.9 × 23.2 (21.2–25.0) (P:E = 0.90) | Rather long and rather broad, distinctly delimited; colpus membrane with sparse granular processes, protruding in middle | Finely reticulate; muri thin; lumina large, circular, subcircular, elliptical or irregular | Plate II, 4–6 |
| <i>A. mimetes</i> | Spheroidal P: subangular E: round | (10.0–13.8) 11.6 × 13.1 (10.85–15.0) (P:E = 0.89) | Rather long and narrow, distinctly delimited; colpus membrane with dense granular processes, protruding in middle | Finely reticulate; muri thin; lumina small, circular, subcircular, elliptical or irregular | Plate II, 7–9 |

TABLE 2. (cont.) Morphological characteristics of pollen grains in Tribe Trichosporae (Gesneriaceae) in China. Aperture type in all species examined was 3-colporoidate.

| Species | Shape P: polar view E: equatorial view | Size | Colpus characteristics | Ornamentation (SEM) | Figure |
|--|--|---|---|--|-----------------|
| <i>A. acuminatus</i> | Spheroidal P: subangular E: round | (11.2–14.7) 13.0 × 14.4 (12.4–17.5) (P:E = 0.90) | Rather long and narrow, distinctly delimited; colpus membrane with dense granular processes, protruding in middle | Coarsely reticulate; muri thin; lumina rather large, irregular | Plate II, 10–12 |
| <i>A. acuminatissimus</i> | Spheroidal P: circular E: round | (10.7–14.5) 12.5 × 13.8 (11.1–15.5) (P:E = 0.91) | Rather long and narrow, distinctly delimited; colpus membrane with dense granular processes | Finely reticulate; muri thin; lumina small, circular, subcircular, irregular | Plate III, 1–3 |
| <i>Lysionotus oblongifolius</i> | Suboblate P: circular E: subround | (13.0–16.7) 14.9 × 17.0 (14.8–18.8) (P:E = 0.88) | Rather long and narrow, indistinctly delimited; colpus membrane with dense tubercular processes, protruding in middle | Fine reticulate; muri thin; lumina small, circular, subcircular or elliptical | Plate 3, 4–6 |
| <i>L. pauciflorus</i> var. <i>latifolius</i> | Suboblate P: circular E: subround | (12.0–15.7) 13.9 × 15.9 (12.9–18.0) (P:E = 0.87) | Rather long and narrow, distinctly delimited, colpus membrane with dense tubercular processes, protruding in middle | Finely reticulate; muri thin; lumina small, circular, subcircular of elliptical | Plate III, 7–9 |
| <i>L. serratus</i> var. <i>pterocaulis</i> | Suboblate P: circular E: subround | (10.5–14.3) 12.6 × 14.9 (12.8–17.0) (P:E = 0.85) | Rather long and narrow, distinctly delimited; colpus membrane with dense tubercular processes protruding in middle | Finely reticulate; muri rather coarse, with tubercles; lumina small, circular, subcircular or elliptical | Plate 3, 10–12 |

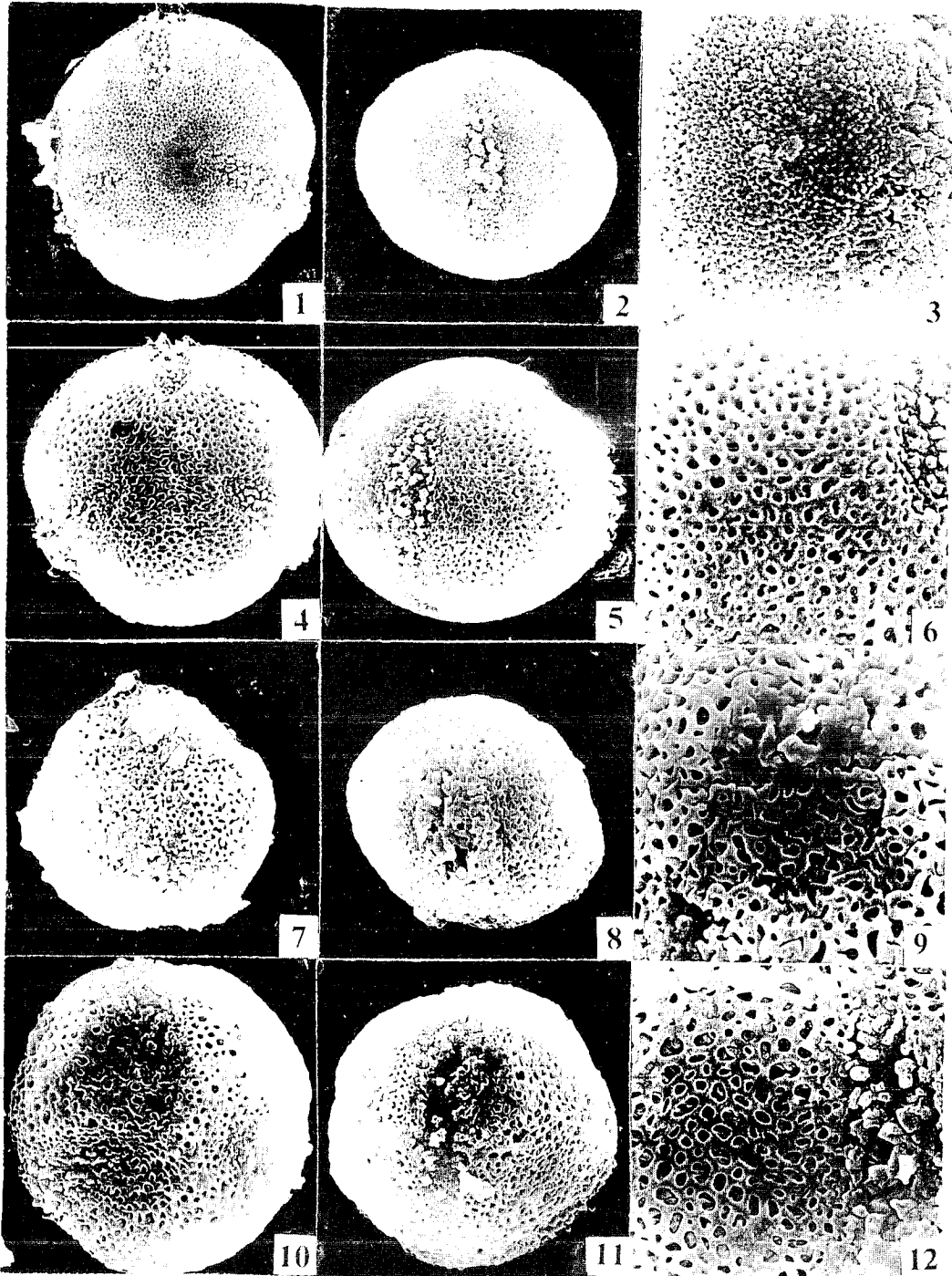


PLATE I. SEM photographs of pollen grains of *Anna* and *Loxostigma*. 1-3, *Anna mollifolia*; 4-6, *A. ophiorhizoides*; 7-9, *Loxostigma griffithii*; 10-12, *L. cavaleriei*. (4-5, 7-8, 10-11, $\times 2400$; 1-2, $\times 3000$; 3, 6, 9, 12, $\times 6000$).

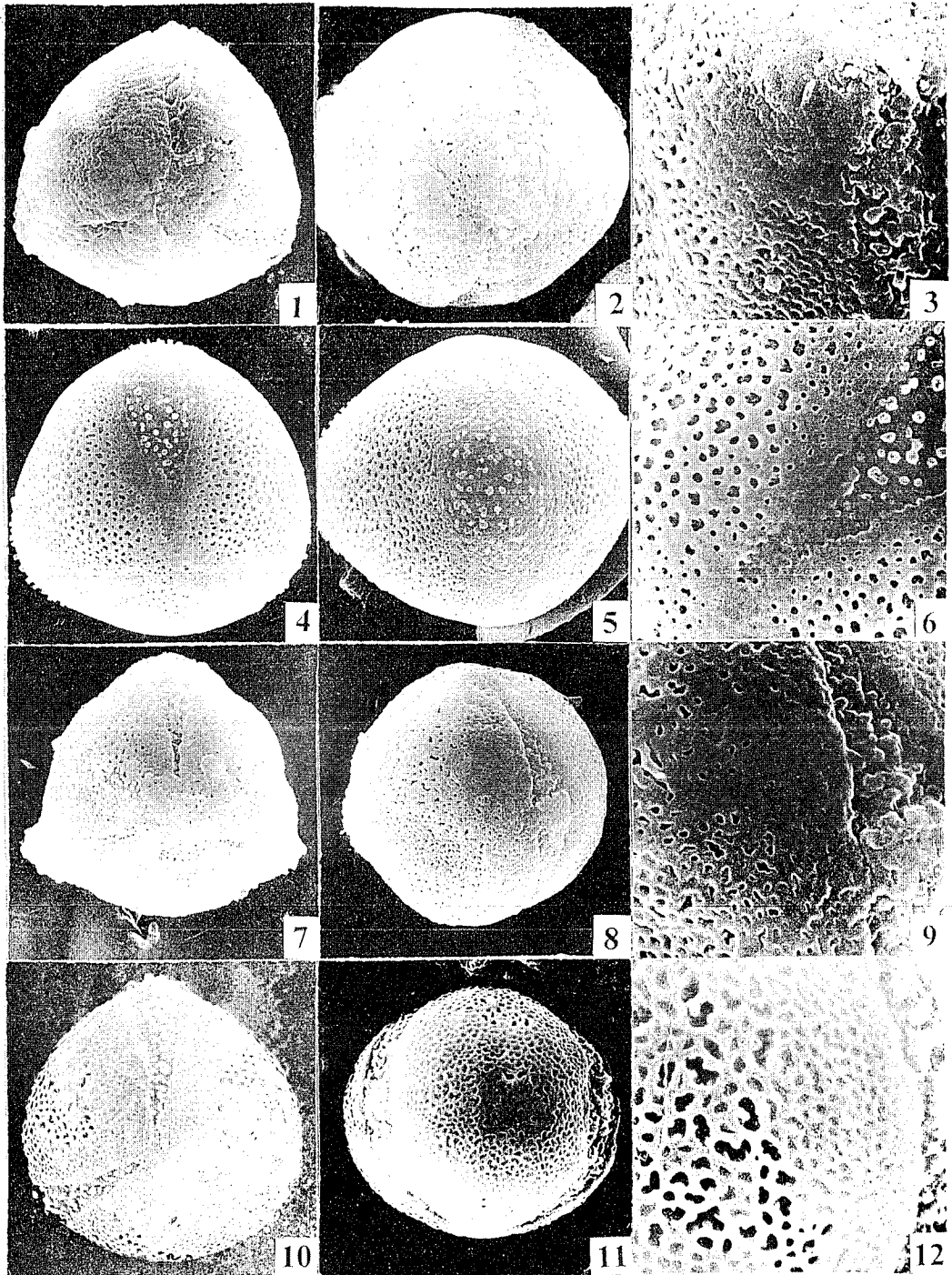


PLATE II. SEM photographs of pollen grains of *Aeschynanthus*. 1-3, *A. buxifolius*; 4-6, *A. dentigera*; 7-9, *A. mimetes*; 10-12, *A. acuminatus*. (4, $\times 1800$; 5, $\times 2100$; 1, 7-8, $\times 2400$; 2, 10-11, $\times 3000$; 6, 4200; 3, 9, $\times 6000$; 12, $\times 7200$).

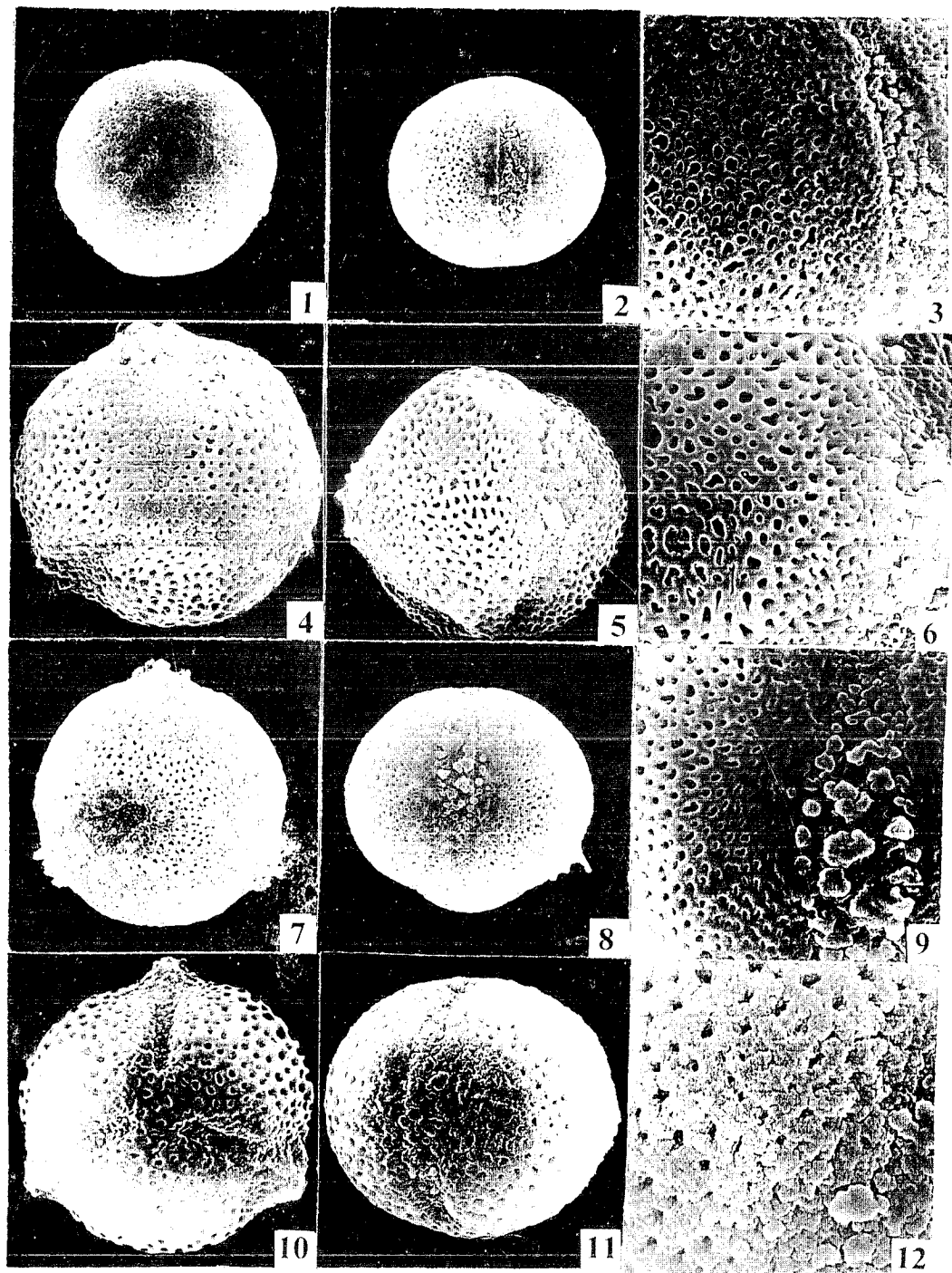


PLATE III. SEM photographs of pollen grains of *Aeschynanthus* and *Lysionotus*. 1-3, *A. acuminatissimus*; 4-6, *Lysionotus oblongifolius*; 7-9, *L. pauciflorus* var. *latifolius*; 10-12, *L. serratus* var. *ptero-caulis*. (1-2, 7-8, $\times 2400$; 4-5, 10-11, $\times 3000$; 3, 9, $\times 6000$; 6, 12, $\times 6600$).