

## PALYNOMORPHS OF JAPANESE ALPINE PLANTS II\*

By

Hideo TOYOKUNI, Yûji TAKAMIYA, Nobuhiko HARA, Shô HÔKIBARA,  
Norikazu OBARA, Shinpei ÔHORA, Hideko TAKAHASHI and Yûji UGAI

(With 5 Plates and 1 Text-figure)

### I Introduction

In the first part of this series "Palynomorphs of Japanese Alpine Plants", pollen grains of 35 species of the Angiospermae were described and photomicrographed. In this second part, those of 24 angiosperm species are enumerated.

In describing pollen characters, the NPC system is introduced along with the other systems employed in the first part.

### II Materials and Methods

The following 24 species of Japanese alpine or subalpine angiosperms native in the Central Mountain Region of Japan were used for the present study: they are *Pleuropteryrum weyrichii*, *Cerastium rubescens* v. *ovatum*, *Dianthus superbus* v. *speciosus*, *Cardamine nipponica*, *Potenilla matsumurae*, *Viola biflora*, *Conioselinum filicinum*, *Tilingia tachiroei*, *Chamaepericlymenm canadense*, *Trientalis europaea*, *Gentianella yuparensis* ssp. *takedae*, *Swertia perennis* ssp. *cuspidata*, *Fauria crista-gallii* ssp. *japonica*, *Lagotis glauca*, *Pedicularis apodochila*, *Veronica schmidtiana* var. *senanensis*, *Galium verum* v. *asiaticum*, *Adenophora nikoensis* (f. *nikoensis* and f. *stenophylla*), *Arnica unalaschcensis* v. *tschonoskyi*, *Saussurea nikoensis* v. *sessiliflora*, *Phleum alpinum*, *Heloniopsis orientalis*, *Lilium medeoloides* and *Tofieldia japonica*.

The way of collecting pollen samples, the method for making microscope slides, the

photomicrographic techniques and the systems of pollen classification were quite the same as those described in the first part. In this second part, however, the NPC system (Figure 1) was also employed in the description of pollen grains.

### III Results of Observations

#### 1) *Pleuropteryrum weyrichii* H. Gross (Polygonaceae)

Pollen samples: Mt. Shirouma (Aug. 2, 1985).  
Pollen type: 6Bb. Pollen shape: circular-triangular - obtuse - convex in polar view and transversely elliptic in equatorial view. Aperture: 3-zonocolpate. NPC=343. Surface pattern: granulate. Pollen size: 18.8-27.5 (24.8) × 22.5-27.5 (25.3) μm.

#### 2) *Cerastium rubescens* Mattf. var. *ovatum* Mizushima (Caryophyllaceae)

Pollen samples: Mt. Shakushi (Aug. 3, 1985)  
Pollen type: 4Ca. Pollen shape: circular both in polar and equatorial views. Aperture: poly-pantoporate. NPC=764. Surface pattern: granulate. Pollen size: 27.3-34.8 (30.0) × 27.0-31.8 (29.3) μm.

#### 3) *Dianthus superbus* L. var. *speciosus* Reichb. (Caryophyllaceae)

Pollen samples: Mt. Shirouma (Aug. 2, 1983).  
Pollen type: 4Ca. Pollen shape: circular both in polar and equatorial views. Aperture: poly-pantoporate. NPC=764. Surface pattern: verrucate. Pollen size: 40.0-50.0 (45.85) × 40.5-50.0 (46.0) μm.

#### 4) *Cardamine nipponica* Franch. et Sav. (Cruciferae)

Pollen samples: Mt. Shirouma (Aug. 2, 1985).

\* Seminarium Palynologicum, Faculty of Liberal Arts, Shinshu University, Matsumoto 390, Japan.
























ATRE- ME	N O M O T R E M E							ANOMO- TREM E
<i>N<sub>0</sub></i> 	<i>N<sub>1</sub></i> 	<i>N<sub>2</sub></i> 	<i>N<sub>3</sub></i> 	<i>N<sub>4</sub></i> 	<i>N<sub>5</sub></i> 	<i>N<sub>6</sub></i> 	<i>N<sub>7</sub></i> 	<i>N<sub>8</sub></i> 
	MONO-	Di-	IRI-	TETRA-	PENTA-	HEXA-	POLY-	
	<i>P<sub>0</sub></i> 	<i>P<sub>1</sub></i> 	<i>P<sub>2</sub></i> 	<i>P<sub>3</sub></i> 	<i>P<sub>4</sub></i> 	<i>P<sub>5</sub></i> 	<i>P<sub>6</sub></i> 	
		CATA-	ANACATA-	ANA-	ZONO-	DIZONO-	PANTO-	
	<i>C<sub>0</sub></i> 	<i>C<sub>1</sub></i> 	<i>C<sub>2</sub></i> 	<i>C<sub>3</sub></i> 	<i>C<sub>4</sub></i> 	<i>C<sub>5</sub></i> 	<i>C<sub>6</sub></i> 	
	-TREM E	-LEPT	-TRICHO- TOMO- COLPATE	-COLPATE	-PORATE	-COLP- ORATE	-POR- ORATE	

Fig. 1 The NPC system (after Erdtman 1969)

NPC means: Number, Position and Character or Form of aperture(s).

Pollen type: 6Bb. Pollen shape: triangular - obtuse - convex in polar view and transversely elliptic in equatorial view. Aperture: 3-zonocolpate, rarely 4-zonocolpate. NPC=343 or 443. Surface pattern: fine reticulate. Pollen size: 22.5-32.5 (26.5) × 27.5-37.8 (34.0) μm.

5) *Potentilla matsumurae* Wolf (Rosaceae)

Pollen samples: Mt. Shakushi (Aug. 3, 1985).

Pollen type: 6Bb. Pollen shape: triangular - obtuse - convex in polar view and elliptic - acuminate - obtuse in equatorial view. Aperture: 3-zonocolporate. NPC=345. Surface pattern: striate. Pollen size: 15.8-22.3 (18.8) × 17.5-20.3 (19.3) μm.

6) *Viola biflora* L. (Violaceae)

Pollen samples: Mt. Shirouma (Aug. 2, 1985).

Pollen type: 6Bb. Pollen shape: circular in polar view and elliptic - acuminate - obtuse in equatorial view. Aperture: 3-zonocolporate.

NPC=345. Surface pattern: granulate. Pollen size: 25.0-32.5 (28.5) × 15.0-22.5 (17.8) μm.

7) *Conioselinum filicinum* Hara (Umbelliferae)

Pollen samples: Mt. Shirouma (Aug. 2, 1985).

Pollen type: 6Bb. Pollen shape: triangular - obtuse - convex in polar view and prolate in equatorial view. Aperture: 3-zonocolporate. NPC=345. Surface pattern: granulate. Pollen size: 7.5-12.5 (10.8) × 22.5-30.0 (26.5) μm.

8) *Tilingia tachiroei* Kitagawa (Umbelliferae)

Pollen samples: Mt. Shakushi (Aug. 3, 1985).

Pollen type: 6Bb. Pollen shape: triangular - obtuse - convex in polar view and prolate in equatorial view. Aperture: 3-zonocolporate. NPC=345. Pollen size: 12.5-17.5 (14.5) × 22.5-30.0 (25.8) μm.

- 9) *Chamaepericlymenum canadense* Aschers. et Graebn. (Cornaceae)  
 Pollen samples: Mt. Shirouma (July 31, 1984).  
 Pollen type: 6Bb. Pollen shape: triangular-obtuse - convex in polar view and circular in equatorial view. Aperture: 3-zonocolpate. NPC=343. Surface pattern: fine reticulate. Pollen size: 18.0-25.5 (22.0) × 17.8-29.3 (23.8) μm.
- 10) *Trientalis europaea* L. (Primulaceae)  
 Pollen samples: Mt. Shakushi (Aug. 3, 1985).  
 Pollen type: 6Db, rarely 6Bb. Pollen shape: circular both in polar and equatorial views. Aperture: 3-zonocolpate. NPC=343. Surface pattern: granulate. Pollen size: 29.0-35.0 (31.8) × 29.5-34.0 (31.5) μm.
- 11) *Gentianella yuparensis* Satake subsp. *takedae* Toyokuni (Gentianaceae)  
 Pollen samples: Mt. Shirouma (Aug. 2, 1985).  
 Pollen type: 6Bb. Pollen shape: triangular-obtuse-convex in polar view and transversely elliptic in equatorial view. Aperture: 3-zonocolporate. NPC=345. Surface pattern: fine reticulate. Pollen size: 47.5-70.0 (58.3) × 45.0-65.0 (55.8) μm.
- 12) *Swertia perennis* L. subsp. *cuspidata* Hara (Gentianaceae)  
 Pollen samples: Mt. Shakushi (Aug. 3, 1985).  
 Pollen type: 6Bb. Pollen shape: triangular-obtuse - convex in polar view and transversely elliptic in equatorial view. Aperture: 3-zonocolporate. NPC=345. Surface pattern: granulate. Pollen size: 25.3-30.3 (28.3) × 30.0-37.0 (33.3) μm.
- 13) *Fauria crista-gallii* Makino subsp. *japonica* Gillett (Menyanthaceae)  
 Pollen samples: Mt. Shirouma (Aug. 3, 1985).  
 Pollen type: 6Bb. Pollen shape: circular both in polar and equatorial views. Aperture: 3-zonocolpate. NPC=343. Surface pattern: reticulate. Pollen size: 24.3-37.0 (30.3) × 32.3-37.3 (34.0) μm.
- 14) *Lagotis glauca* Gaertner (Scrophulariaceae)  
 Pollen samples: Mt. Shirouma (Aug. 2, 1985).  
 Pollen type: 6Bb. Pollen shape: triangular-obtuse - convex in polar view and transversely elliptic in equatorial view. Aperture: 3-zonocolporate. NPC=343. Surface pattern: fine reticulate. Pollen size: 20.2-40.0 (28.3) × 10.0-25.1 (15.3) μm.
- 15) *Pedicularis apodochila* Maxim. (Scrophulariaceae)  
 Pollen samples: Mt. Shirouma (Aug. 2, 1985).  
 Pollen type: 6Bb. Pollen shape: circular in polar view and transversely elliptic in equatorial view. Aperture: 3-zonocolporate. NPC=345. Surface pattern: verrucate. Pollen size: 17.0-20.0 (18.3) × 15.8-18.0 (17.5) μm.
- 16) *Veronica schmidtiana* Regel var. *senanensis* Ohwi (Scrophulariaceae)  
 Pollen samples: Mt. Shirouma (Aug. 3, 1985).  
 Pollen type: 6Bb. Pollen shape: triangular-obtuse - convex in polar view and circular in equatorial view. Aperture: 3-zonocolporate. NPC=343. Surface pattern: verrucate. Pollen size: 21.5-26.5 (23.3) × 25.8-35.5 (29.5) μm.
- 17) *Galium verum* L. var. *asiaticum* Nakai (Rubiaceae)  
 Pollen samples: Mt. Shirouma (Aug. 2, 1985).  
 Pollen type: 6Bc. Pollen shape: circular in polar view and transversely elliptic in equatorial view. Aperture: 6-zonocolpate. NPC=643. Surface pattern: verrucate. Pollen size: 11.5-19.8 (15.3) × 19.3-24.8 (22.0) μm.
- 18) *Adenophora nikoensis* Franch. et Sav. (Campanulaceae)  
 forma *nikoensis*.  
 Pollen samples: Mt. Shirouma (Aug. 4, 1985).  
 Pollen type: 5Ac. Pollen shape: circular both in polar and equatorial views. Aperture: 4-zonoporate. NPC=444. Surface pattern: spinulate. Pollen size: 30.5-49.3 (40.0) × 32.8-50.3 (40.3) μm.  
 forma *stenophylla* Hara  
 Pollen samples: Mt. Shirouma (Aug. 4, 1985).  
 Pollen type: 5Ac. Pollen shape: circular both in polar and equatorial views. Aperture: 4-zonoporate. NPC=444. Surface pattern: spinulate. Pollen size: 22.5-37.5 (30.3) × 26.3-40.0 (34.5) μm.

19) *Arnica unalascensis* Less. var. *tschonoskyi* Kitam. et Hara (Compositae)

Pollen samples: Mt. Shakushi (Aug 3, 1985).  
Pollen type: 6Bb. Pollen shape: triangular-obtuse-convex in polar view and transversely elliptic in equatorial view. Aperture: 3-zonocolporate. NPC=345. Surface pattern: spinate. Pollen size: 18.8-26.3 (23.0) × 21.3-27.5 (24.3)  $\mu\text{m}$ .

20) *Saussurea nikoensis* Franch. et Sav var. *sessiliflora* Kitam. (Compositae)

Pollen samples: Mt. Shirouma (Aug 2, 1985).  
Pollen type: 6Bb. Pollen shape: circular both in polar and equatorial views. Aperture: 3-zonocolporate. NPC=345. Surface pattern: spinate. Pollen size: 38.3-44.0 (42.0) × 41.3-49.3 (45.3)  $\mu\text{m}$ .

21) *Phleum alpinum* L. (Gramineae)

Pollen samples: Mt. Shirouma (Aug 2, 1985).  
Pollen type: 3Aa. Pollen shape: circular both in polar and equatorial views. Aperture: 1-anaporate. NPC=134. Surface pattern: reticulate. Pollen size: 29.3-39.3 (34.8) × 30.8-41.8 (35.8)  $\mu\text{m}$ .

22) *Heloniopsis orientalis* Tanaka (Liliaceae)

Pollen samples: Mt. Shirouma (Aug. 1, 1984).  
Pollen type: 6Bb. Pollen shape: circular in polar view and transversely elliptic in equatorial view. Aperture: 3-zonocolporate. NPC=343. Surface pattern: fine reticulate.

Pollen size: 22.3-27.0 (23.8) × 27.5-33.3 (29.0)  $\mu\text{m}$ .

23) *Lilium medeoloides* A. Gray (Liliaceae)

Pollen samples: Mt. Shirouma (Aug 2, 1985).  
Pollen type: 2Aa. Pollen shape: transversely elliptic in polar view and circular in equatorial view. Aperture: 1-anacolpate. NPC=133. Surface pattern: reticulate. Pollen size: 68.0-83.0 (71.0) × 40.0-65.0 (51.0)  $\mu\text{m}$ .

24) *Tofieldia japonica* Miquel (Liliaceae)

Pollen samples: Mt. Shirouma (Aug. 4, 1985).  
Pollen type: 2Aa. Pollen shape: transversely elliptic in polar view and circular in equatorial view. Aperture: 1-anacolpate. NPC=133. Surface pattern: fine reticulate. Pollen size: 25.0-32.5 (27.0) × 13.8-21.3 (17.8)  $\mu\text{m}$ .

#### V References

[Additional references]

1. Erdtman, G. 1969. Handbook of Palynology.
2. Toyokuni, H. et al. 1983. Palynomorphs of Japanese alpine plants I. in Toyokuni, H. (ed.): Ecosyst. Anal. Alp. Belt, Centr. Mount. Region Jap. 2: 16-34.
3. Ueno, J. 1978. Study of Palynology (in Japanese).
4. Ueno, J. 1979. Kafun-Hyakuwa (in Japanese).

#### EXPLANATION OF PLATES I-V

Most photomicrographs of plates are in a magnification of  $\times 1,000$ , but a few ones are in  $\times 1,500$ . Please refer size ranges in the description of each species. In the case of radially symmetric grains, those in polar and equatorial views in different foci, usually, are presented.

PLATE I

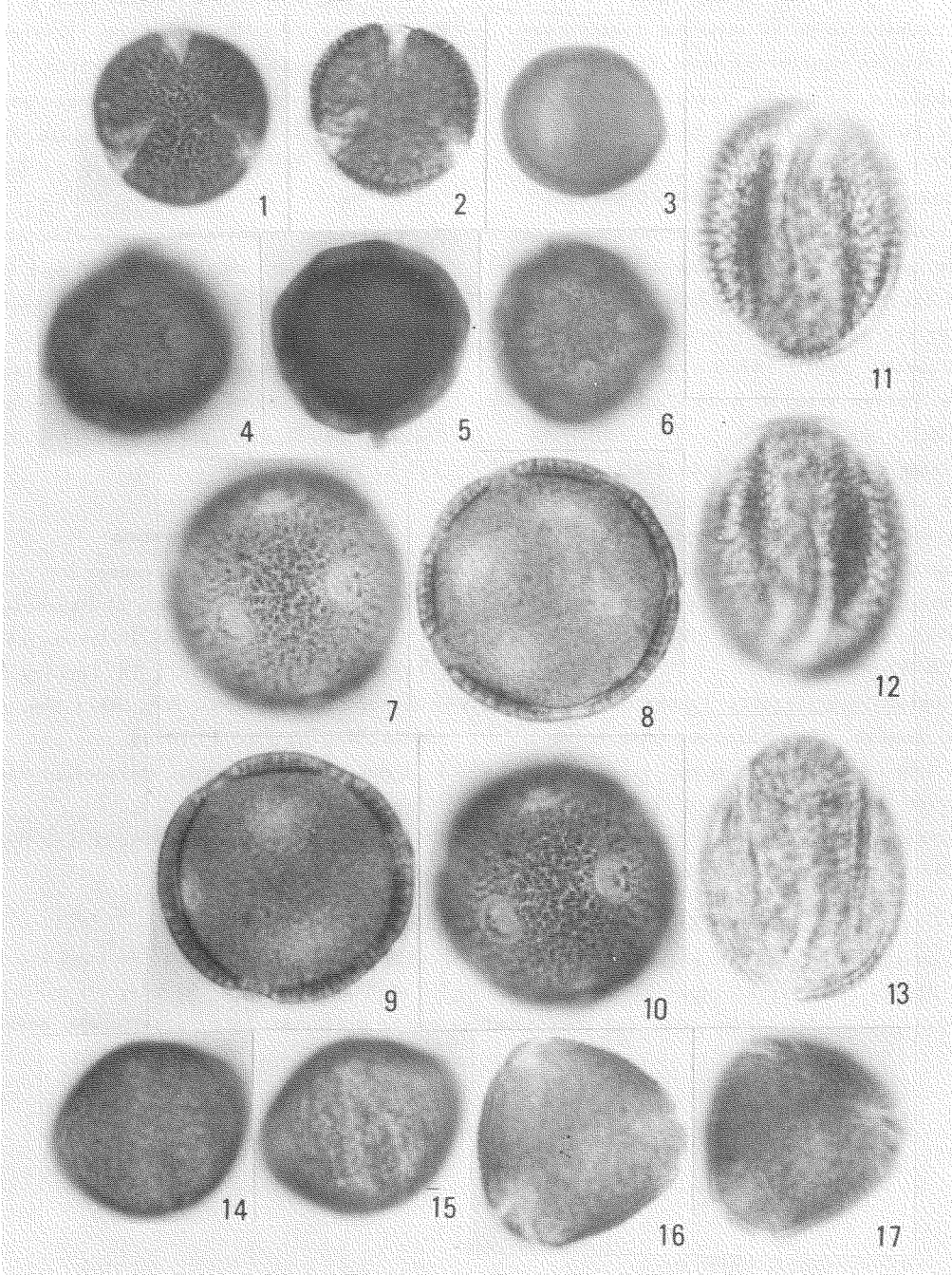
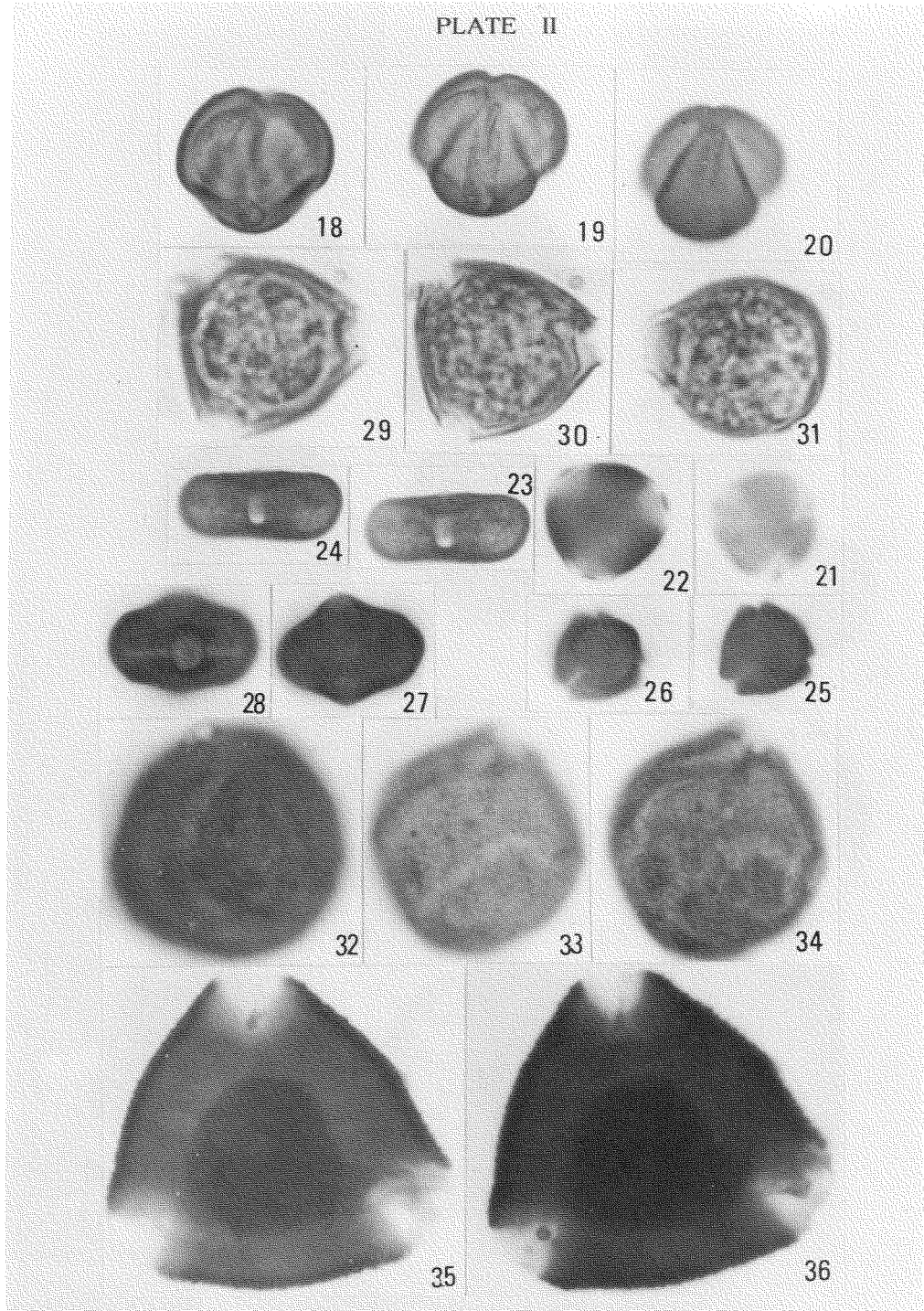


Plate I: Figs. 1-3. *Pleuropteropyrum weyrichii*  
 Figs. 4-6. *Cerastium rubescens* var. *ovatum*  
 Figs. 7-10. *Dianthus superbis* var. *speciosus*  
 Figs. 11-13. *Cardamine nipponica*  
 Figs. 14-17. *Potentilla matsumurae*

PLATE II



Platell: Figs. 18-20. *Viola biflora*  
 Figs. 21-24. *Conioselinum filicinum*  
 Figs. 25-28. *Tilingia tachiroei*  
 Figs. 29-31. *Chamaepericlymenum canadense*  
 Figs. 32-34. *Trientalis europaea*  
 Figs. 35, 36. *Gentianella yuparensis* subsp. *takedae*

PLATE III

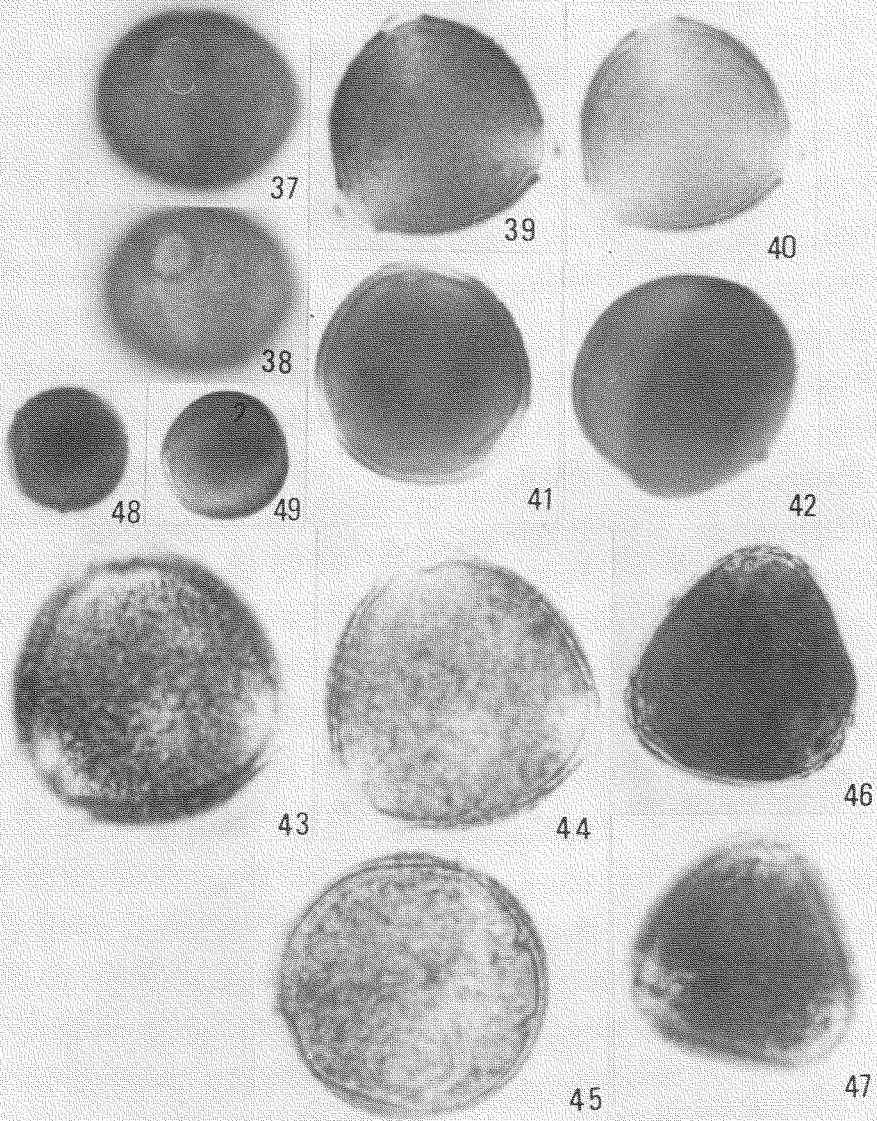


Plate III: Figs. 37-40. *Swertia perennis* subsp. *cuspidata*  
Figs. 41, 42. *Fauria crista-gallii* subsp. *japonica*  
Figs. 43-45. *Lagotis glauca*  
Figs. 46, 47. *Pedicularis apodochila*  
Figs. 48, 49. *Veronica schmidtiana* var. *senanensis*

PLATE IV

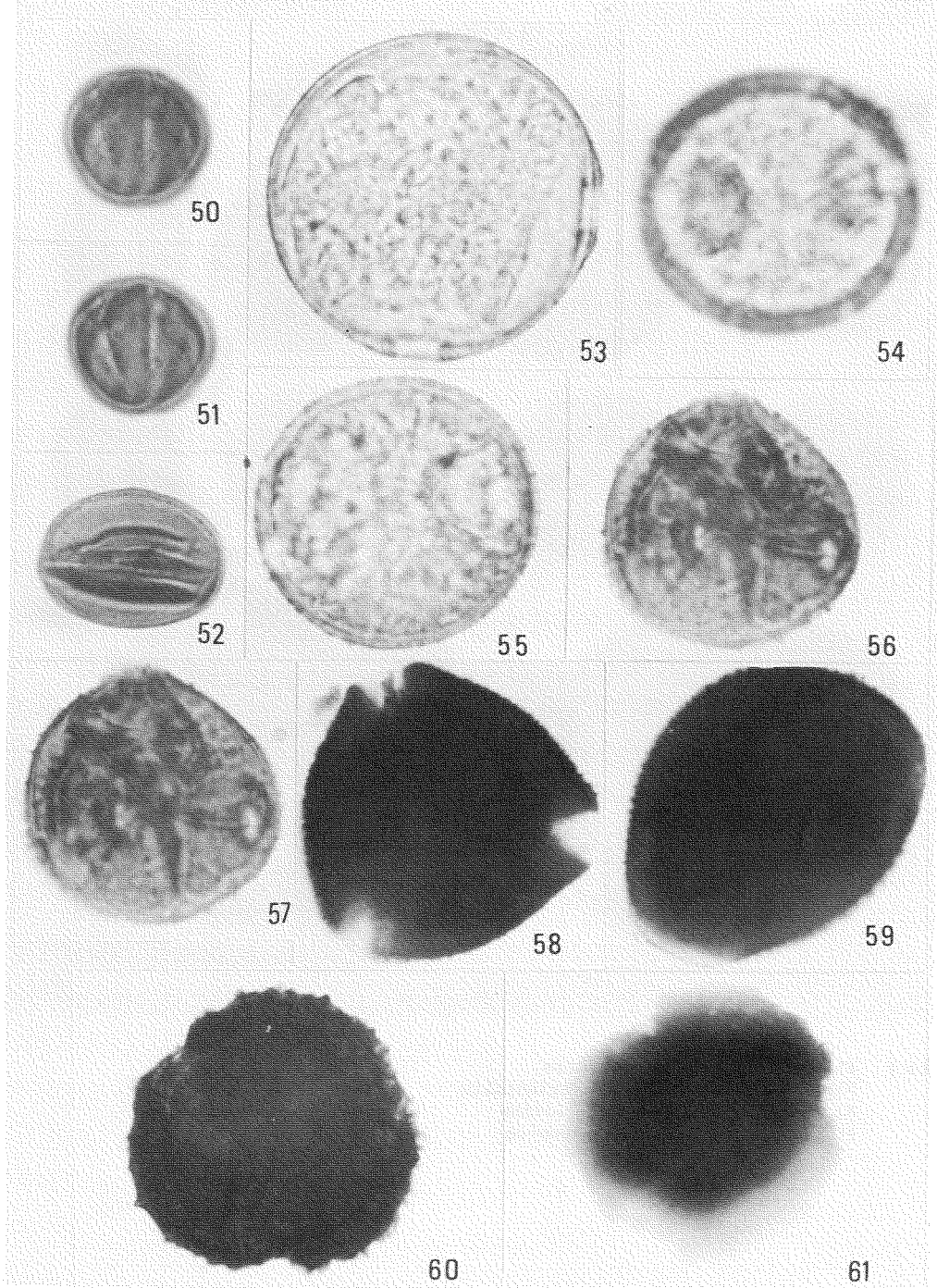


Plate IV: Figs. 50-52. *Galium verum* var. *asiaticum*  
 Figs. 53-55. *Adenophora nikoensis* f. *nikoensis*  
 Figs. 56, 57. *Adenophora nikoensis* f. *stenophylla*  
 Figs. 58, 59. *Arnica unalaschcensis* var. *tschonoskyi*  
 Figs. 60, 61. *Saussurea nikoensis* var. *sessiliflora*



PLATE V

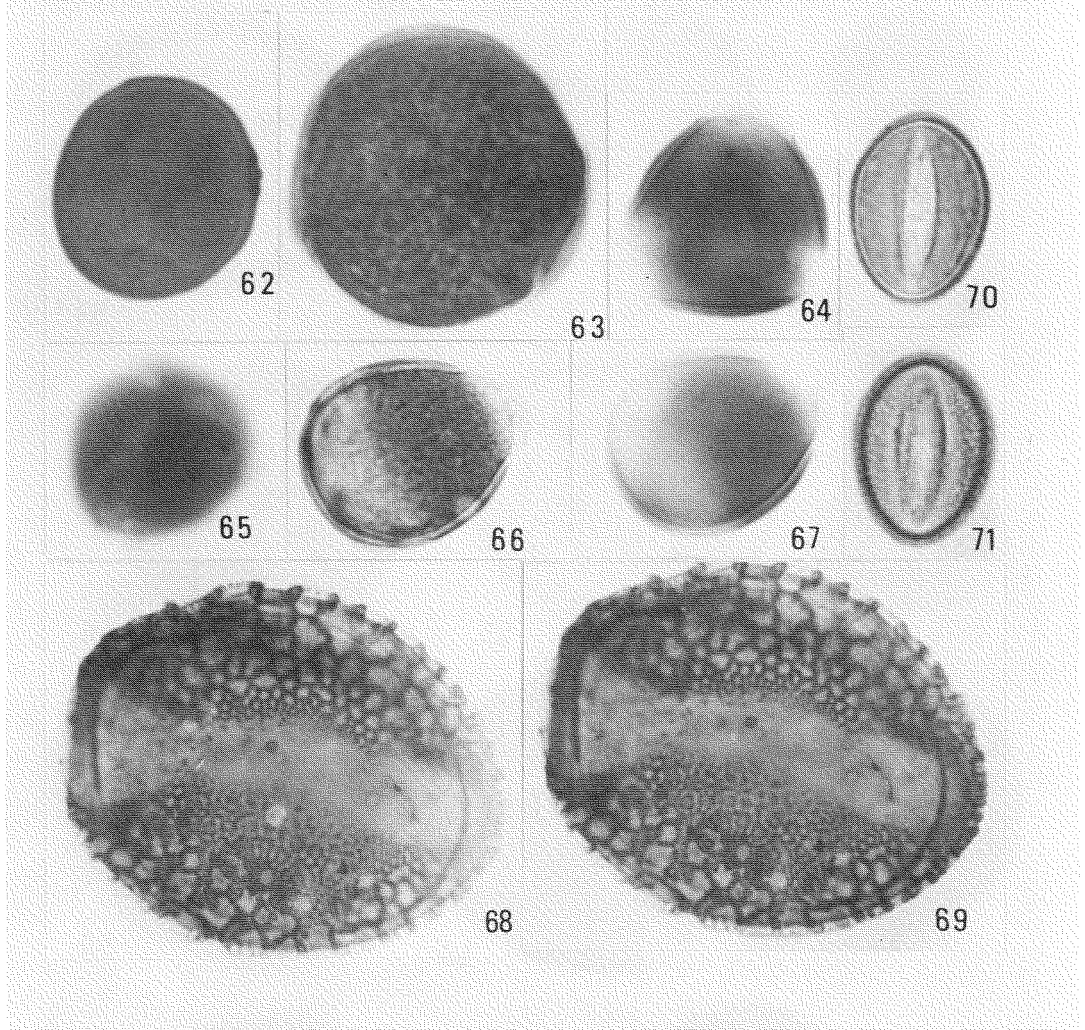


Plate V : Figs. 62, 63. *Phleum alpinum*  
Figs. 64-67. *Heloniopsis orientalis*  
Figs. 68, 69. *Lilium medeoloides*  
Figs. 70, 71. *Tofieldia japonica*