

PALYNOMORPHS OF OLIGO-MIOCENE IN TAIWAN

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ABSTRACT: Three families, 4 form genera and 9 taxa of the Oligo-Miocene fossil angiosperm palynomorphs from Peikang area in central Taiwan are reported. Four taxa are new species, one is new combination, and two are new records.

KEYWORDS: Oligo-Miocene palynomorphs, Taiwan, Taxonomy.

INTRODUCTION

The palynological investigation of Miocene sedimentary rocks in Taiwan was first started by Lin (1965) from his analysis of a Tertiary coal bed, in which he reported fourteen form genera. Later, Canright (1971, 1974) published two papers based on the palynomorphs recovered from 51 samples from basal Miocene to the Pliocene in north-western Taiwan. The account by Huang's investigations were by far the most comprehensive; he studied the Chuhuangkeng section of Miaoli-hsien, Keelung-Yehliu section and Taipei-Sanhsia section of Taipei-hsien and published the taxonomy of these fossil palynomorph assemblages in a series of paper (1977, 1978a, 1978b, 1978c, 1979, 1980, 1981). His work provides the foundation of the Miocene biostratigraphy in Taiwan. In 1982, the author studied cores and cuttings of Oligo-Miocene age from the Peikang area of central Taiwan. He published the first part of the work on the pteridophytic spores (Shaw, 1984). This is the second part and it is concentrated on the angiosperm pollen. The work is still continuing and more taxonomy will be published in the future.

Taxonomic treatment of Tertiary fossil palynomorphs has been debated by many palynologists for a long time. In this paper, I have adopted artificial form genera names for nomenclature.

MATERIALS AND METHODS

Cores and cuttings samples from four wells in eikang area PK-2, PK-3, SYH-1, PCC-1 were made available to the author (Fig. 1). A total of eighteen conventional cores

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and seventeen cuttings were prepared by the Chinese Petroleum Corporation Micro-paleontological Laboratory for a palynological study.

The extraction of fossil palynomorphs were made by using the method of the author (Shaw, 1984), including the treatment of 10% KOH for the dissolution of humic material. Heavy solution of $ZnCl_2$ for flotation (S. G. 1.8-2.2) and also 30% of HCl, 52% of HF

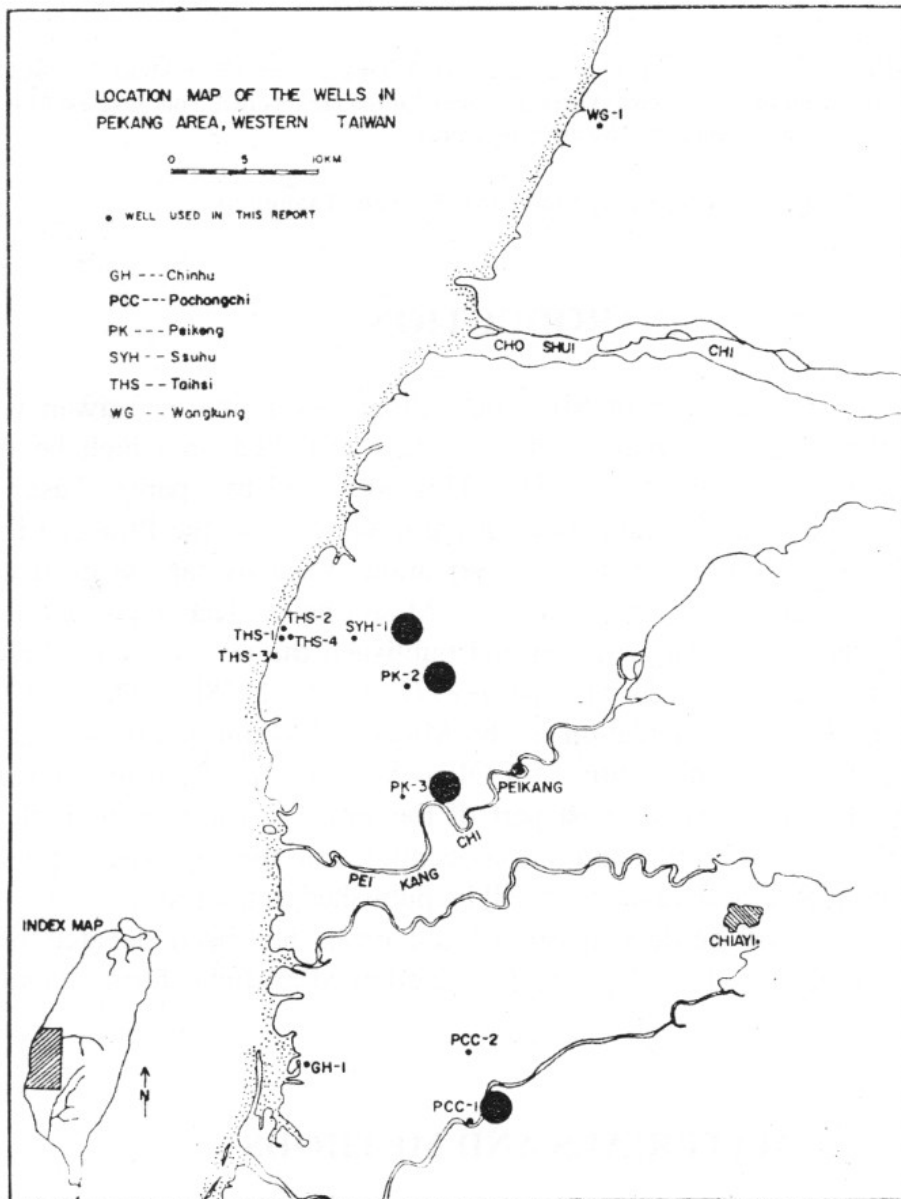


Fig. 1. Exploration wells of Peikang area in Taiwan.

were used for maceration of the laterite pebble samples, which were collected from four exploration wells.

Photomicrographs were taken with a Zeiss Universal microscope equipped with an automatic camera using Kodak Panatomic X (16 DIN) film. For fossil identification, the standard references are Huang (1972, 1980), Jansonius and Hills (1976), Kremp, Spackman, Ames and Kovar (1957-1972). The fossil slides are catalogued and stored at the Micropaleontology Laboratory, Chinese Petroleum Corporation.

RESULTS

Good and accurate taxonomic treatment is important for biostratigraphy. In the process of continuously building up the Miocene flora of Taiwan the author in this paper reports, nine species of the Oligo-Miocene angiosperm palynomorphs are belonging to four form genera from three families. Four of the species described here are new, one is new combination, and two are new records from four wells drilled by CPC at Peikang area in central Taiwan are described. The taxonomic treatment of fossil palynomorphs is as below.

Description of Taxa

Family 1. ACERACEAE

Genus 1. STRIATOPOLLIS Krutzsch 1959

Palaeontographica, Abt. B, Bd. 105, p. 142.

Type species: *Striatopollis sarstedtensis* Krtz. 1959.

Diagnosis: pollen grains 3-colpate, subprolate to prolate in equatorial shape, circular in polar shape; tectum subsulate to finely verrucate; sexine striate (description taken from Jansonius and Hill, 1976).

(1). *Striatopollis taiwanensis* (Huang) *comb. nov.* P1. 1, Figs. 1-9.

Aceripollis taiwanensis Huang in Taiwan 25: 60, Pl. 10, Figs. 24-27. 1980.

Grains 3-colpate, prolate, 31-36 x 20-26 μ ; colpi as long as poles, 29-35 μ long; exine 0.5-1 μ thick; tectum with scabrate or finely verrucate processes; sexine striate.

Slide: PK-3 1860-1865-(2), film 54-25, 26; SYH-1 1359-1368-(6), film 37-38; SYH-1 1348-1351-(1), film 30-17, 18; PK-2 1240-(2)-(3), film 8-4, 5; SYH-1 1359-1368-(6), film 37-38; SYH-1 1265-1270-(1), film 49-0.

Stratigraphic occurrence: It was discovered from the whole Miocene Formation of Taiwan.

Taxonomic affinity: These forms are very similar to those of *Acer* (Huang, 1972).

Genus 2. STRIATRICOLPORITES Van der Hammen ex Leidelmeyer 1966

Leidse Geol. Mededel., V. 38, p. 56.

Type species: *Striatricolporites pimulis* Leid.

Diagnosis: Tricolporate pollen grains with a striate sculpture (description taken from Jansonius and Hill, 1976).

KEY TO SPECIES

1. Grains more than 25 μ wide in polar axis.....(2) *Striatricolporites taiwanensis*
 1. Grains less than 25 μ wide in polar axis.....(3) *Striatricolporites ssuhuensis*

- (2). ***Striatricolporites taiwanensis* sp. nov.** Pl. 2; Figs. 1-5.
 Grains 3-colporate, subprolate in equatorial shape, circular in polar shape; 26-29 x 19-22 μ ; colpi 20-22 μ long; ora circular to elliptic, 2-5 μ in wide; sexine striate; tectum scabrate or finely verrucate processes; exine 1-1.5 μ thick.
 Holotype: Slide PK-2 1346-1351-1-(4); plate 2.; figs. 1, 2; film 54:3, 54:4; CPC Micropaleontology Lab.
 Stratigraphic occurrence: Nanchuang Formation of the Shuinantung Section, the core (1346-1351m) of the well PK-2, is equivalent to Piling Shale of northwestern Taiwan, and the cutting (1200-1210m) of the well SYH-1 is equivalent to Piling Shale of northwestern Taiwan; Middle and Lower Miocene.
 Taxonomic affinity: These forms are very similar to those of *Acer* (Huang, 1972; Biesboer, 1975).

- (3). ***Striatricolporites ssuhuensis* sp. nov.** Pl. 2; Figs. 6-10.
 Grains 3-colporate, 10-20 x 12-13 μ ; colpi about 15 μ long; ora circular to elliptic; tectum subsilicate to scabrate; sexine striate; exine as thick as or less than 1 μ thick.
 Holotype: Slide SYH-1 1285-1290-(4); plate 2.; fig. 6-8.; film 49-19-21; CPC Micropaleontology Lab.
 Stratigraphic occurrence: It was observed from the depth 1200-1210m, 1265-1270m, 1285-1290m, 1295-1304m, and 1359-1368m of the well SYH-1, is equivalent to Piling Shale and Musham Formation of northwestern Taiwan, Lower Miocene.
 Taxonomic affinity: These forms are similar to those of *Acer* (Huang, 1972).

Family 2. AQUIFOLIACEAE

Genus 3. ILEXPOLLENITES Thiergart 1937 ex Potonie 1960.

Type species: *Ilexpollenites iliacus* Potonie 1960.

Diagnosis: Shape ovoid to sphaerical, equator trilobate to circular, pores more or less distinguishable, with equatorial rugae (tricolporate). The exine shows closely but free-standing pilae or clavae, not all of exactly the same height that may be shaped as wedges, pistils, pears, but even warts or rods (description taken from Jansonius and Hill, 1976).

KEY TO SPECIES

1. Grains more than $24\ \mu$ long in polar axis.....2
 1. Grains less than $24\ \mu$ long in polar axis.....3
 2. Clavae more than $1\ \mu$ wide.....(4) *I. asprella*
 2. Clavae less than $1\ \mu$ wide.....(5) *I. Kusanoi*
 3. Clavae $1-0.7\ \mu$ long, $0.4-0.6\ \mu$ wide.....(6) *I. ssuhuensis*
 3. Clavae $3-1.2\ \mu$ long, $2.2-0.7\ \mu$ wide.....(7) *I. taiwanensis*

(4). *Ilexpollenites asprella* Huang in Taiwan **25**: 65, Pl. 7, figs. 10-12. 1980.

Pl. 3; Figs. 4-6.

Grains prolate; $31-35 \times 24-27\ \mu$; clavae $2-2.5\ \mu$ long, $1-1.5\ \mu$ wide.

Selected slide: PK-2 1457-2-(1), film 7-14, 7-15, SYH-1 1285-1290-(4), film 49-23.

Stratigraphic occurrence: It was observed from the core of the well PK-2 1457m, which is equal to Mushan Formation of northwestern Taiwan, and the cutting of the well SYH-1 1285-1290m, which is equal to Piling Shale of northwestern Taiwan, Lower Miocene.

Taxonomic affinity: This form resembles those of *Ilex asprella* (Hook. & Arn.) Champ. ex Benth in Hook. (Huang, 1972: Pl. 14: 1-4).**(5). *Ilexpollenites kusanoi*** Huang in Taiwan **25**: 65-66, Pl. 7, figs. 3-9. 1980.

Pl. 3; Figs. 1-3.

Grains prolate to subprolate; $28-30 \times 18-21\ \mu$; clavae $1.5-2\ \mu$ long, $0.5-1\ \mu$ wide.

Selected slide: SYH-1 1348-1351-(1), film 30-15, 30-16; WG-1 3038-(6), film 15-31.

Stratigraphic occurrence: It was observed from the core of the well WG-1 3038m, which is equal to the Wuchihshan Formation of northwestern Taiwan, Oligocene; and the core of the well SYH-1 1348-1351m (Mushan Formation), Lower Miocene of Taiwan.

Taxonomic affinity: This form resembles those of *Ilex Kusanoi* Hayata. (Huang, 1972: Pl. 14: 9-12).**(6). *Ilexpollenites ssuhuensis*** *sp. nov.*

Pl. 3; Figs. 7-9.

Grains 3-colporate; prolate-spheroidal; $17-19 \times 14-16\ \mu$; laesurae about $15\ \mu$ long; ora obscure; lateral view clavate $1-0.7\ \mu$ long, $0.4-0.6\ \mu$ wide; surface view granulate, size regular about $0.4-0.6\ \mu$ wide; exine $0.5\ \mu$ thick.

Holotype: slide SYH-1 1200-1210-(1); plate 7; figs. 8, 9; film 47-18, 19. CPC Micropaleontology Lab.

Stratigraphic occurrence: It was observed from the cuttings (1200-1295m) of the well SYH-1, which is equal to the Piling Shale of northwestern Taiwan, Lower Miocene.

Taxonomic affinity: This form resembles those of *Ilex* of Aquifoliaceae (Huang, 1972).**(7). *Ilexpollenites taiwanensis*** *sp. nov.*

Pl. 3; Figs. 10, 11.

Grains 3-colporate, prolate-spheroidal to spheroidal; 24-22 x 20-22 μ ; laesurae about 17 μ long; ora obscure; lateral view clavate 1.2-3 long, 0.7-2.2 μ wide; surface view granulate, size varies about 1-3 μ wide; exine 0.7 μ thick.

Holotype: Slide SYH-1 1200-1210-(4); plate 7.; figs. 11.; film 47-36. CPC Micropaleontology Lab.

Stratigraphic occurrence: It was observed from the cutting (1200-1210m) of the well SYH-1, which is equal to Piling Shale of northwestern Taiwan, Lower Miocene.

Taxonomic affinity: This form resembles those of *Ilex* of Aquifoliaceae (Huang, 1972).

Family 3. HYDROCARYACEAE

Genus 4. SPOROTRAPOIDITES Klaus 1954

Type species: *Sporotrapoidites illingensis* Kl.

Diagnosis: Prolate to suboblate; amb triangular to round, with three exinal ridges transverse the body, meeting at angles of 120° at the poles; on the equator, three \pm short, narrow meridional apertures, each are enclosed by one exinal ridges, similar to pollen of recent *Trapa* species. U. Miocene, Austria. (description taken from Jansonius and Hill, 1976).

KEY TO SPECIES

1. Grains more than 30 μ wide in polar axis; exine more than 2 μ thick(8) *Sporotrapoidites erdtmanii*
 1. Grains less than 30 μ wide in polar axis; exine less than 2 μ thick.....(9) *Sporotrapoidites minor*

(8) *Sporotrapoidites erdtmanii* (Nagy) Nagy in *Geologica Hungarica, Series Palaeontologica* 47:163, Pl.93, figs 18-20. 1985 Pl. 4 Figs. 1-3.

Grains 3-porate, subangular in polar view, prolate to rhomboidal in equatorial view, 31-33 x 32-35 μ (including exinal ridges) wide; exine 3 μ thick, with three exinal ridges meeting at the poles, the ridges ca. 5-6 μ wide; sexine psilate to scabrate.

Selected slide: SYH-1 1359-1368-(3), film 36-7-9, 36 -8-10; PK-2 1346-1351-(2), film 32-5-7.

Stratigraphic occurrence: It was observed from the core of the well PK-2 1346-1351m (Piling Shale) and the core of the well SYH-1 1359-1368m (Mushan Formation), Lower Miocene of Taiwan.

Taxonomic affinity: This form is possibly related to the extant species of *Trapa* of the Hydrocaryaceae (Guan et al. 1989; Huang, 1972; Song et al. 1985).

(9) *Sporotrapoidites minor* Guan in Song *et al.* *Anhui Sci. and Tech. Publishing House.* 1:121. Pl.41, figs. 1-43. 1985 Pl. 4 Figs. 4-7

Grains 3-porate, subangular to semi-angular in polar view, prolate to rhomboidal in equatorial view, 24-26 x 21-22 μ (including exinal ridges) wide; exine 1.5 μ thick, with three exinal ridges meeting at the poles, the ridges ca. 3-4 μ wide; sexine psilate. Selected slide: SYH-1 1346-1351-(1), film 30-6-8, 30-7-9; PK-2 1346-1351-(2), film 32-0-3, 32-1-4.

Stratigraphic occurrence: It was observed from the core of the well PK-2 1346-1351m (Piling Shale) and the core of the well SYH-1 1346-1351m (Mushan Formation), Lower Miocene of Taiwan.

Taxonomic affinity: This form is possibly related to the extant species of *Trapa* of the Hydrocharaceae (Huang, 1972; Song et al. 1985).

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台灣漸新統中新統之化石孢粉

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摘 要

本文於台灣中部地區四口地下探井漸新世、中新世地層中，發現並描述三科四形態屬九形態種，其中四種為新種、一種為新聚合種、二種為新記錄種。

關鍵詞：漸新統、中新統、化石孢粉、分類、台灣。

1. 國立台灣史前文化博物館籌備處。

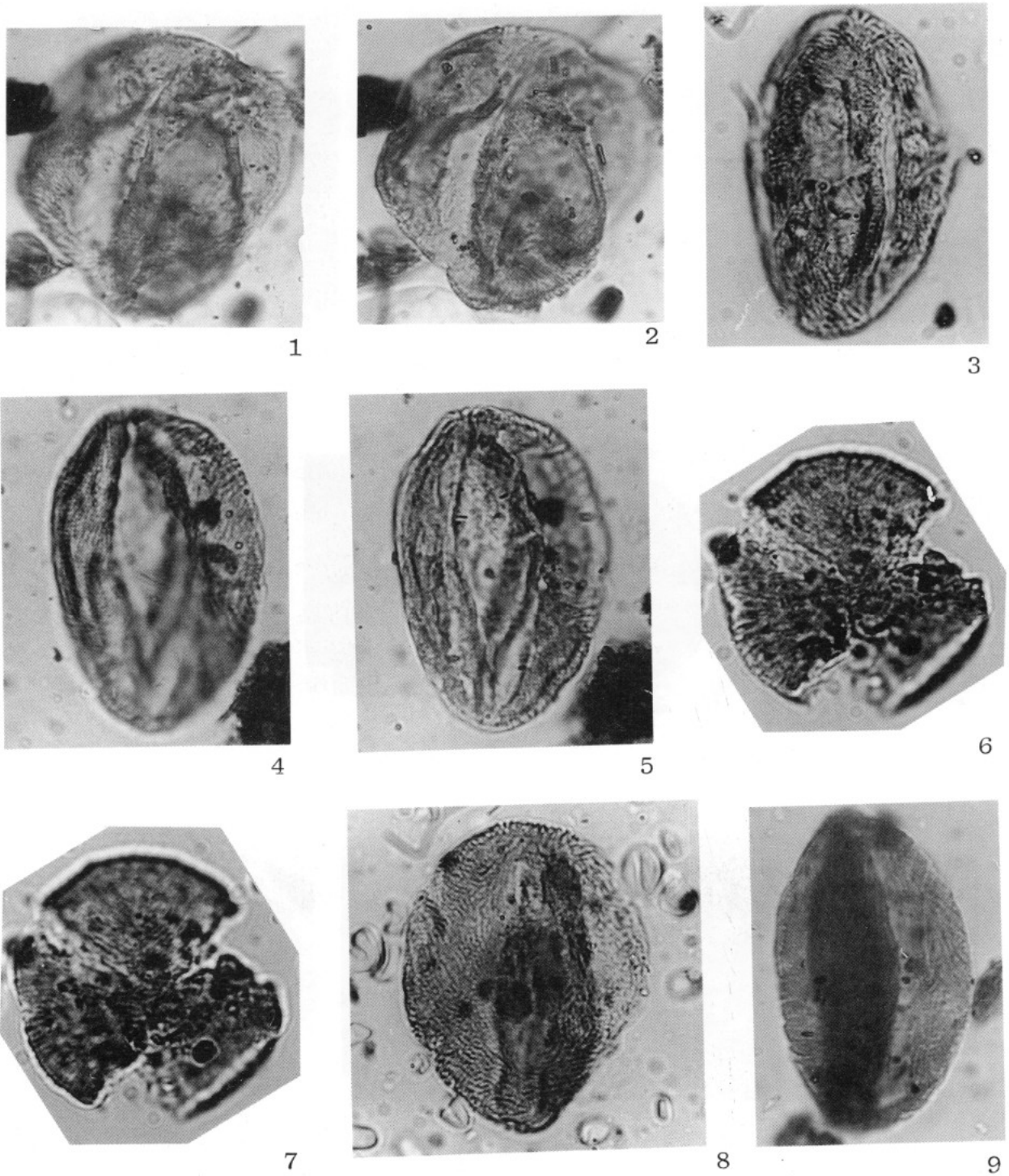


PLATE 1 Fossil palynomorphs of *Striatopollis* (All figures x1550).
Figs. 1-9. *S. taiwanensis* (Huang) *comb. nov.* (Film 54:22, 54:23, 37:38, 8:4, 8:5, 37:38, 40:1).

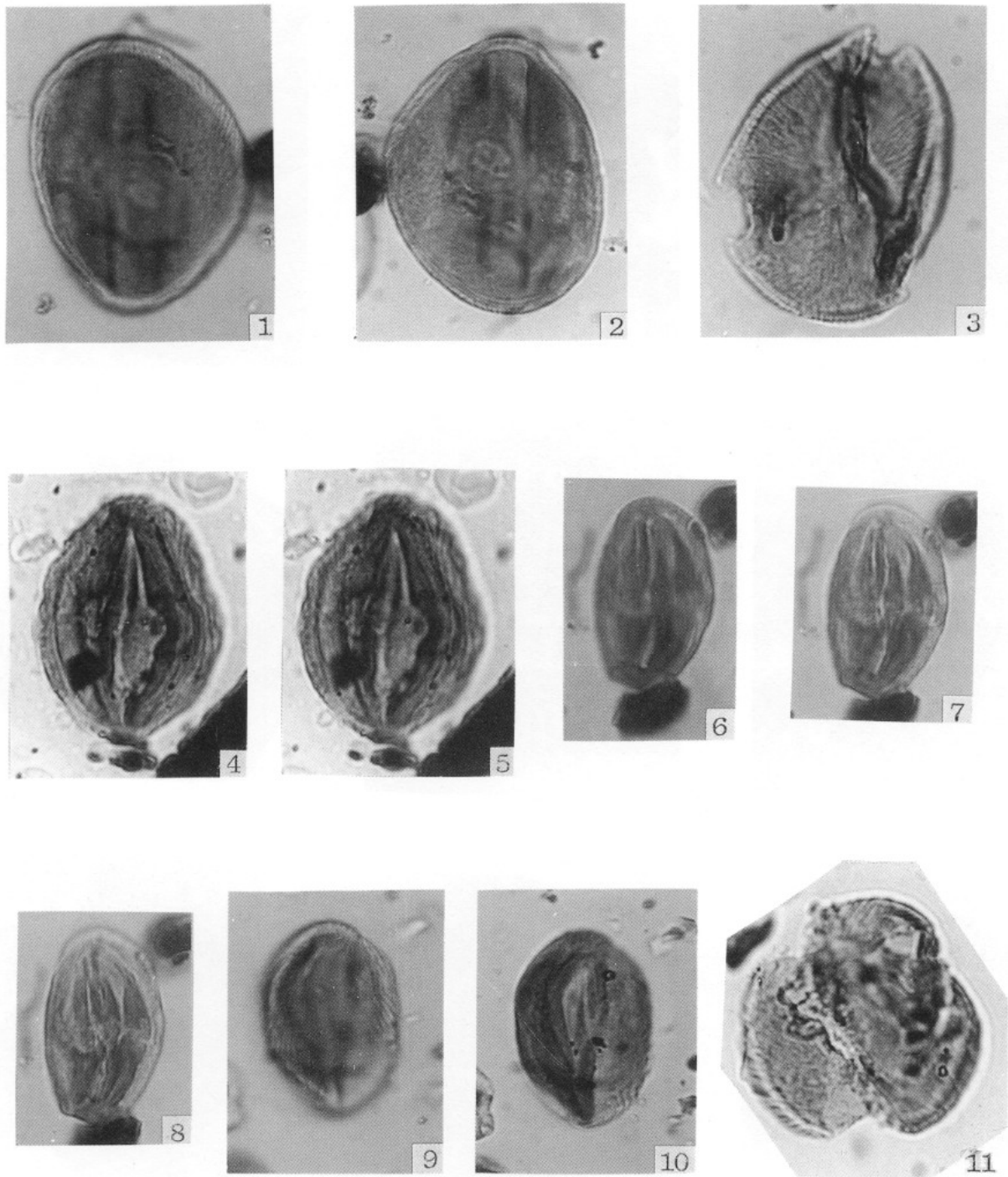


PLATE 2 Fossil palynomorphs of *Striaticolporites* (All figures x1550).
 Figs. 1-5. *S. taiwanensis* sp. nov. (Film 54:3, 54:4, 42:9, 42:44, 42:23);
 Figs. 6-10. *S. ssuhuensis* sp. nov. (Film 40:21, 49:19, 49:20, 48:27, 48:28);
 Figs. 11. *S. taiwanensis* sp. nov. (Film 54:3, 54:4, 42:9, 42:44, 42:23).

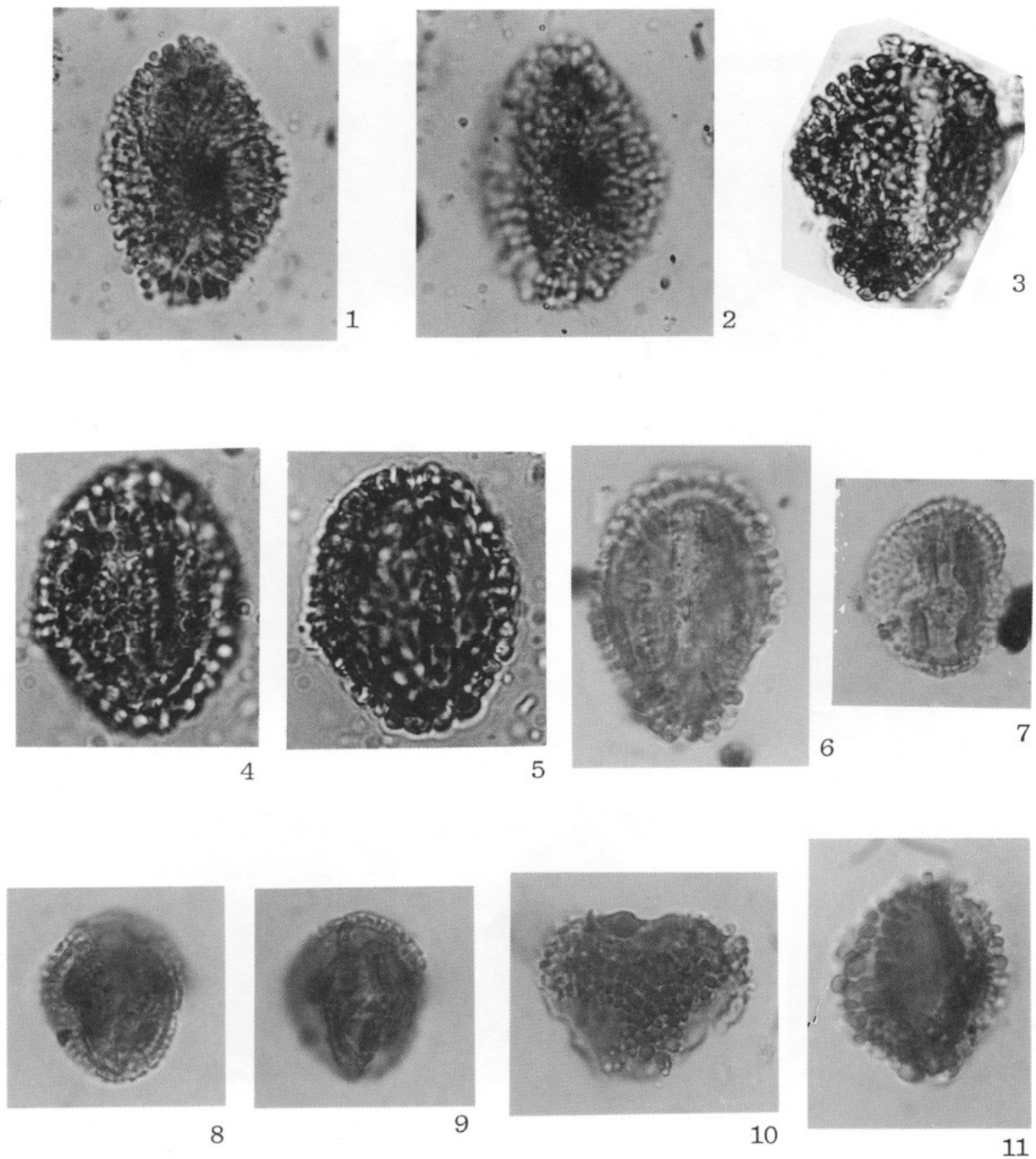


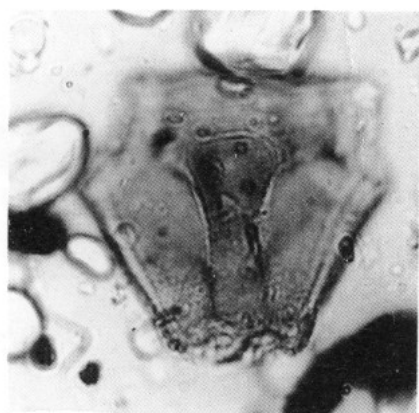
PLATE 3 Fossil palynomorphs of *Ilexpollenites* (All figures x1550)

Figs. 1-3. *I. kusanoi* Huang (Film 30:15, 30:16, 15:31);

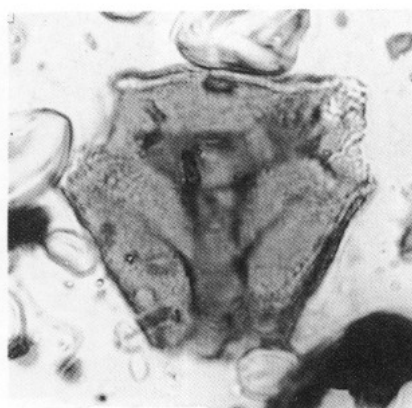
Figs. 4-6. *I. asprella* Huang (Film 7:14, 7:15, 49:23);

Figs. 7-9. *I. ssuhensis* sp. nov. (Film 49:34, 47:17, 47:18);

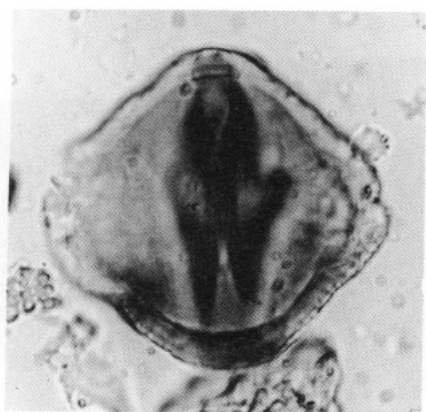
Figs. 10-11. *I. taiwanensis* sp. nov. (Film 47:27, 47:36).



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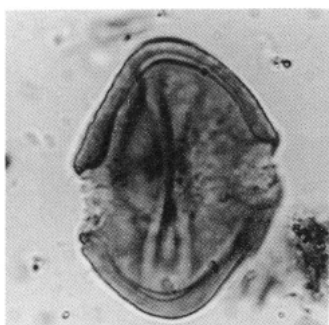
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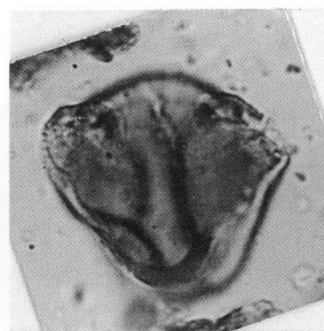
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PLATE 4 Fossil palynomorphs of *Sporotrapoidites* (All figures x1550).
Figs. 1-3. *S. erdtmanii* (Nagy) Nagy. (Film 36:8-10, 36:7-9, 32:5-7);
Figs. 4-7 *S. minor* Guan. (Film 32:0-3, 32:1-4, 30:6-8, 30:7-9).