

Pollen Morphology and Taxonomic Position of Two Taiwanese *Pyrola*: *P. albo-reticulata* HAYATA and *P. morrisonensis* HAYATA

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Hideki TAKAHASHI* : Pollen Morphology and Taxonomic Position of Two Taiwanese *Pyrola* : *P. albo-reticulata* HAYATA and *P. morrisonensis* HAYATA

高橋英樹* : 台湾産イチヤクソウ属2種 (*Pyrola albo-reticulata* と *P. morrisonensis*) の花粉形態と分類学的位置

Introduction

Pollen morphology of 16 species of the genus *Pyrola* was described in a previous paper (TAKAHASHI, 1986). The grain size and the exine sculpture indicate continuous and serial variation from species to species within the genus. In this genus these palynological characters have taxonomic significance for the recognition of the infrageneric taxa, especially in some sections. The pollen of two Taiwanese *Pyrola* species; *P. albo-reticulata* HAYATA and *P. morrisonensis* HAYATA, have not been examined in the previous study. Therefore in this paper the pollen morphology of these two species is described based on electron microscopy. Variation in the exine sculpture within an individual and species was also critically examined. Based on the palynological evidence and the other external morphology the taxonomic position of the two Taiwanese *Pyrola* is discussed.

Materials and Methods

Two or three anthers were removed from each herbarium specimen and acetolyzed at 90-95°C for 5 minutes. For light microscopy (LM) the grains were mounted in silicone oil (viscosity 3000 cs.) and sealed with rapid mounting media (Entellan new). These microscopic slides for LM are deposited in the Botanic Garden, Faculty of Agriculture, Hokkaido University. For scanning electron microscopy (SEM), acetolyzed grains were sputter coated with gold, examined and photographed with a Hitachi Akashi MSM 4C-101 scanning electron microscope. For the clarification of the variability of the exine sculpture,

three herbarium specimens of each species were examined, and five to ten SEM photographs were taken for each specimen. Then four representative photographs in each specimen were chosen for figures. Voucher specimens of all material examined are preserved in the Herbarium of the Department of Botany, Faculty of Science, Kyoto University (KYO). Herbarium data are shown in Table 1.

Results

In both species, general pollen morphology accords with the description on the genus by TAKAHASHI (1986). In this paper the grain size, the exine sculpture and the other remarks are briefly described.

Pyrola albo-reticulata HAYATA (Table 1, Fig. 1-6)

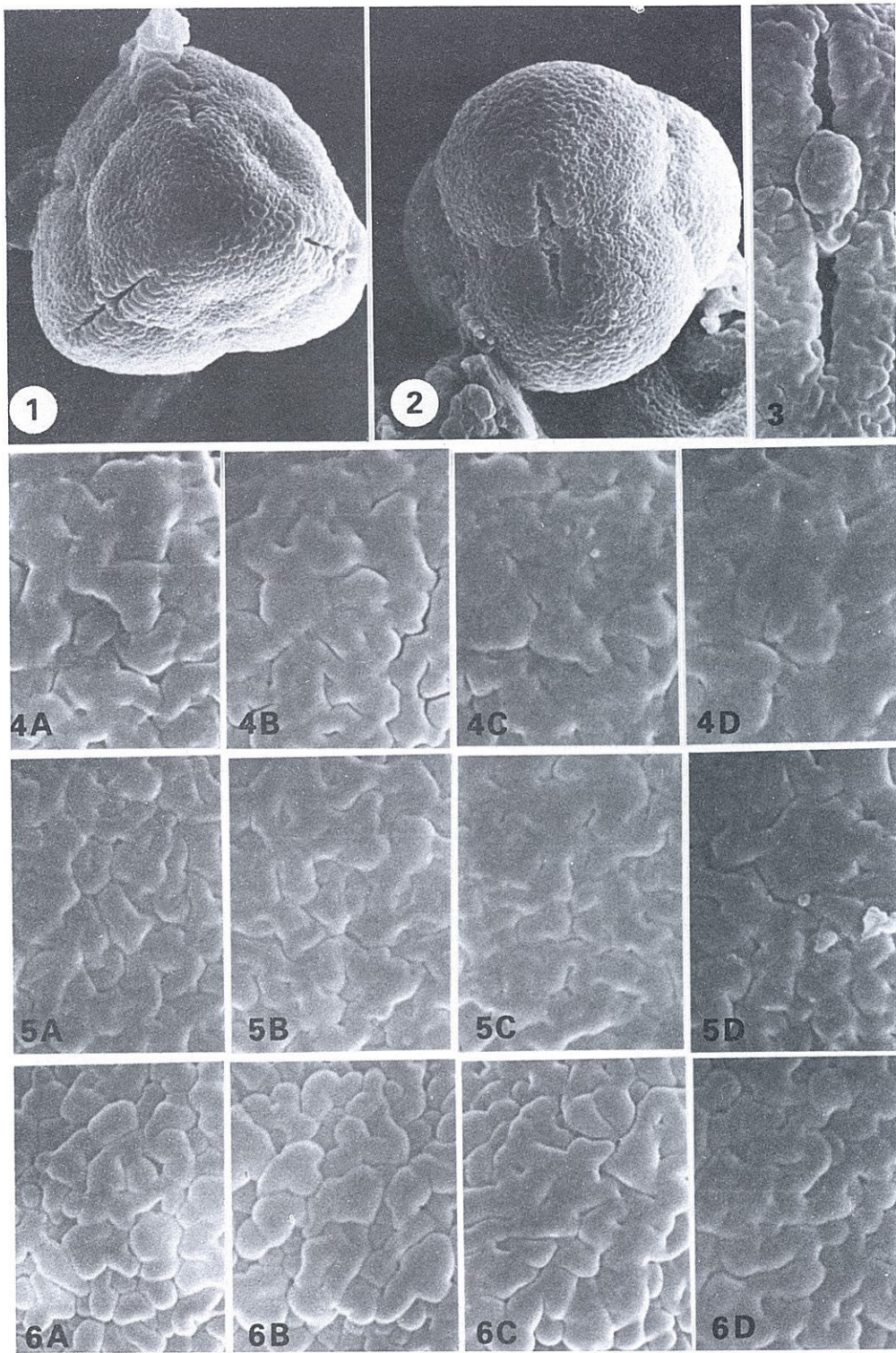
The mean of the pollen tetrad diameter (=D, see Fig. 1 in TAKAHASHI, 1986) in each sample varies from 35.8 to 37.9 μm . The exine sculpture in the distal area is basically rugulate. Because of an increase in the breadth of rugulae and decrease in the breadth of the grooves between rugulae, the sculpture tends to be rugulate-psilate (Fig. 4D). On the other hand, the exine sculpture tends to be verrucate-rugulate in some grains because of the reduction of the length of rugulae (Fig. 6A).

Table 1. Herbarium data, pollen tetrad diameter and figure numbers of two Taiwanese *Pyrola*

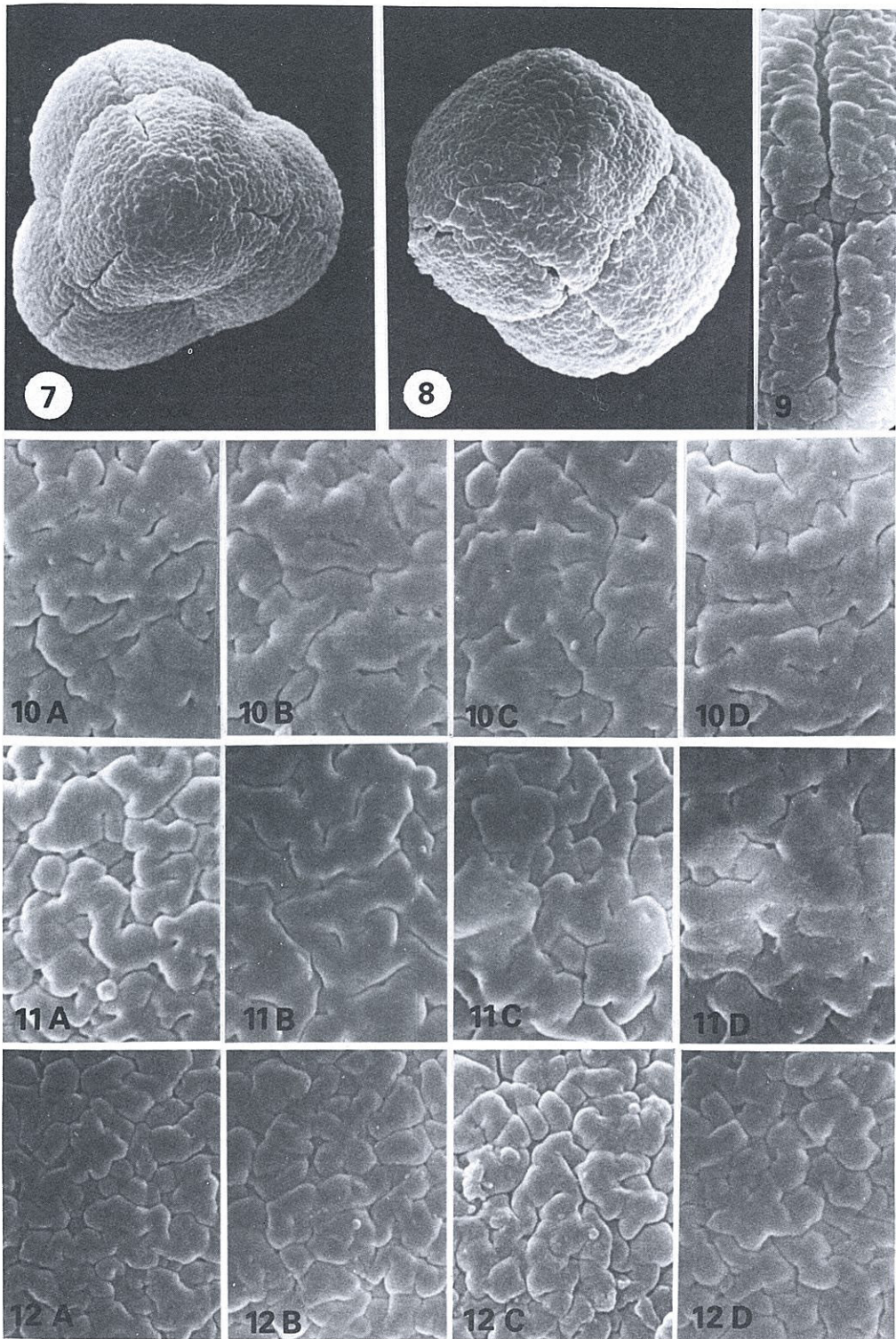
Taxa Collector & number	Pollen tetrad diameter (μm) Smallest-mean-largest (S.D.)	Figure
<i>P. albo-reticulata</i>		
J. OHWI 2510	32.5-35.8-40.0 (1.5)	1-4
J. OHWI 2483	33.8-37.0-40.5 (1.4)	5
K. KOZIMA & T. SHIOMI 2064	33.8-37.9-42.5 (1.8)	6
<i>P. morrisonensis</i>		
J. OHWI 3944	31.2-33.8-36.8 (1.4)	9, 10
J. OHWI 2565	33.0-35.3-37.8 (1.1)	7, 8, 11
J. OHWI 3140	32.2-34.4-39.5 (1.2)	12

The measurements are based on 20 tetrads from each collection. In J. OHWI 2565 expanding tetrads are selected for the measurements because of the occurrence of giant dyads (ca. 7%) and frequent occurrence of shrinking pollen grains (ca. 80%).

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Figs. 1-6. Pollen morphology of *Pyrola albo-reticulata* HAYATA. Fig. 1: Distal view of a tetrad ($\times 1320$). Fig. 2: Lateral view of a tetrad showing two concurrent colpi ($\times 1320$). Fig. 3: Two concurrent colpi ($\times 3300$). Figs. 4-6: Exine sculpture in the distal area from three specimens. A-D showing variation within each specimen. All $\times 6600$. Figs. 1-4 from OHWI 2510 (KYO), Fig. 5 from OHWI 2483 (KYO), Fig. 6 from KOZIMA & SHIOMI 2064 (KYO).



Figs. 7-12. Pollen morphology of *Pyrola morrisonensis* HAYATA. Fig. 7: Distal view of a tetrad ($\times 1320$). Fig. 8: Giant dyad ($\times 1320$). Fig. 9: Two concurrent colpi ($\times 3300$). Figs. 10-12: Exine sculpture in the distal area from three specimens. A-D showing variation within each specimen. All $\times 6600$. Figs. 7, 8 and 11 from OHWI 2565 (KYO), Figs. 9 and 10 from OHWI 3944 (KYO), Fig. 12 from OHWI 3140 (KYO).

Pyrola morrisonensis HAYATA (Table 1, Fig. 7-12)

The mean diameter of the pollen tetrad in each sample varies from 33.8 to 35.3 μm . The exine sculpture in the distal area is basically rugulate. A variation in the exine sculpture is also revealed in this species. The exine sculpture sometimes tends to be verrucate-rugulate (Fig. 12A-D). —In OHWI 2565 giant dyads (ca. 7% ; Fig. 8) and others, triads and monads (ca. 1%) occur together with the tetrads. In this collection shrinking tetrad occurs in high percentage (ca. 80%).

Discussion

The pollen of two Taiwanese *Pyrola* have been examined under light microscopy by UENO (1962) and HUNAG (1972). UENO (1962) reported that the pollen tetrad size and exine thickness in *P. morrisonensis* (37 μm , 1.5 μm respectively) are larger than in *P. albo-reticulata* (32 μm , 1 μm). On the other hand in HUANG's pollen flora (1972) the pollen size is not so different between two species (35-44 μm in *P. morrisonensis* and 35-45 μm in *P. albo-reticulata*). In this study pollen tetrad diameter in *P. morrisonensis* is somewhat smaller than in *P. albo-reticulata* : (31.2-33.8-35.3(-39.5) μm in the former against (32.5-35.8-37.9(-42.5) μm in the latter. The exine sculpture of the two species is basically rugulate and it is difficult to distinguish them from each other by this character. Though some tendency to be verrucate or psilate in the exine sculpture is found in some specimens or grains, complete verrucate or psilate sculptures are never found in these species. Variability of the exine sculpture within a specimen is usually weak, but wide variation is revealed within a species. Therefore in order to recognize the exine sculpture of a species, three or more specimens in a species have to be examined. The occurrence of giant dyads in *P. morrisonensis* (J. OHWI 2565) seems not to be a characteristic feature for this species. In *Pyrola* the occurrence of giant dyads other than the usual tetrad is sometimes found (e. g., a few samples in *P. alpina* and *P. japonica* revealed in TAKAHASHI, 1986). This phenomenon may be attributed to the sporadic aberrancy in meiosis of the pollen mother cell (PMC).

P. albo-reticulata is a species native to Taiwan recorded by HAYATA (1913). Later, in a Taiwanese flora (HSIEH, 1978), this species was

treated as a synonym of *P. decorata* H. ANDRES recorded from China. But *P. albo-reticulata* is usually treated as a distinct species from *P. decorata* (e. g., in K ŘISA, 1971 ; Iconographia Cormophytorum Sinicorum, 1974). As HARA (1970) has stated already, *P. albo-reticulata* forms one natural group together with *P. japonica* KLENZE found in Japan, Korea and N. China, *P. decorata* in W. China, Tibet and Bhutan, and *P. sumatrana* H. ANDRES in Sumatra. This species group is characterized by small flower numbers per inflorescence (usually less than 10 in number), imperfectly protected winter buds, and leaves dark green often with veins whitish above, and dark reddish beneath. K ŘISA (1971) recognized the subseries *Japonicae* composed of *P. sumatrana*, *P. japonica* and *P. albo-reticulata*, but the three species together with *P. decorata* should be recognized as a section rank, at least within the genus *Pyrola*.

At first *P. morrisonensis* was recognized as *P. elliptica* NUTT. var. *morrisonensis* HAYATA, but later it was recognized as a distinct species (HAYATA, 1913). ANDRES (1914) recognized this species within subsection *Obscura* of section *Ampliosepala* together with the following species : *P. chlorantha*, *P. renifolia*, *P. soldanellifolia*, *P. gracilis*, and *P. atropurpurea*. Except for ANDRES' opinion, the taxonomic position of *P. morrisonensis* has not been discussed until now. This species has winter buds perfectly protected by imbricate membranaceous scales clearly different from naked winter buds in *P. chlorantha* SW. and *P. renifolia* MAXIM. Therefore ANDRES' opinion (1914) is not supported. *P. morrisonensis* should be related to the members of section *Pyrola* except for subseries *Japonicae* and *P. decorata* in K ŘISA's system (1971).

The rugulate exine sculpture of two Taiwanese *Pyrola* species revealed in the present study suggests that these species are hardly related to subgenus *Amelia*, having verrucate exine sculpture and section *Scotophylla*, having psilate sculpture. This palynological evidence does not contradict the above-mentioned relationships of the two species based on the external morphology.

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摘 要

1986年にイチヤクソウ属の花粉形態と分類体系

の関係について報告したが、その際あつかえなかった台湾産の2種 (*Pyrola albo-reticulata* HAYATA と *P. morrisonensis* HAYATA) の花粉形態を観察・記載し、それらの分類体系における位置について考察した。

これら2種の花粉の表面模様は、変異はあるものの基本的には rugulate で一致しており、4集粒のサイズでわずかの差が認められる (試料あたりの平均値は *P. albo-reticulata* で 35.8—37.9 μm , *P. morrisonensis* で 33.8—35.3 μm である)。

すでに原 (1970) が述べているように、*P. albo-reticulata* は日本とその近隣産の *P. japonica*, 中国西部からブータンに産する *P. decorata*, スマトラに分布する *P. sumatrana* と共にひとつの自然群をなしている。この群は花序あたりの花数が10個以下と少なく、冬芽が舟形・膜質にならないりん片葉に不完全に包まれていること、しばしば脈が白色で裏面が赤色になる暗緑色の葉をもつことなどで特徴づけられ、十分に節ランクとして独立させうる東アジア固有のグループである。一方 *P. morrisonensis* の分類学的位置については ANDRES (1914) が *P. chlorantha* や *P. renifolia* などとともに *Ampliosepala* 節のなかの *Obscura* 亜節に位置づけている以外あまり議論されていない。この種は冬芽が舟形・膜質のりん片で完全に包まれている点で、*P. chlorantha* や *P. renifolia* のりん片が退化し裸出した冬芽とは明瞭に異なる。KŘÍSA (1971) の認める *Pyrola* 節から上述の *P. japonica* らの種群をのぞいた中にいれるべきである。

花粉表面模様をもとにすると台湾産イチヤクソウ属2種は、はっきりした verrucate 模様をもつ *Amelia* 亜属や psilate 模様をもつ *Scotophylla* 節からは明瞭に区別できる。しかしそれ以上の類縁関係については花粉形質のみからでは推定できない。ただし今回の花粉形質の結果は上述の外部形態から推定されるこれら2種の類縁関係と矛盾してはいない。

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○ 森 和男 雷竜の花園 東アジア野生植物研究会。昭和62年5月20日発行。A5判, 190頁。頒価不明。
“ブータンの人々は己が国を ドウルック・ユル竜の国と呼ぶ 竜は雷雲を従えて天に昇る”

すなわち、雷竜の国の花の旅の紀行文を納めたのが本書である。著者は、私の文章は北杜夫氏の“どくとるマンボウ航海記”に影響されたという。その文に、彼の写した写真と彼の手になる植物図を添え、出国から帰国までの経過を綴っているのだから、楽しく読むことができるであろう。

著者宛 (〒662 西宮市松下町5-8) に申しこまれると入手できると思う。

(里見信生)