(Short Communication)

# Pollen Ultrastructure in Interspecific and Intervarietal $F_1$ Hybrid Grapes

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We divided some grapes into two groups (type-Ⅰ or -Ⅱ) based on their pollen ultrastructure. These grapes were hybridized between the different groups, and the pollen ultrastructure of the $F_1$ hybrids was observed with a scanning electron microscope (SEM).

Five $F_1$ hybrids between type-Ⅰ and type-Ⅱ pollen groups had type-Ⅰ pollen. Therefore the detailed pollen ultrastructure of type-Ⅰ pollen may be genetically dominant over type-Ⅱ pollen.

**Key words :** *Vitis*, grape, pollen ultrastructure, $F_1$ hybrid

In a previous paper[1], we found that some wild grapes native to East Asia can be divided into two groups (type-Ⅰ or -Ⅱ) based on their pollen ultrastructure by scanning electron microscopic (SEM) observation. Type-Ⅰ pollen has perforations in the lumina, while type-Ⅱ pollen has granules in the lumina. This character can be used to identify and classify the genus *Vitis* because related species belong to the same group. In wild grapes native to East Asia[1], we found that only *V. ficifolia* var. *lobata* (Japanese name : Ebizuru) and its related species had type-Ⅱ pollen.

Since Ebizuru is distributed widely in Japan[2] and its flowering habits are ever-bearing[3], Ebizuru may be hybridized with *V. ficifolia* var. *ganebu* (Japanese name : Ryuukyuuganebu)[4], *V. shiragai* (Japanese name : Shiragabudou)[5] or other wild grapes in Japan. If grapes whose pollen is type-Ⅰ are hybridized with those with type-Ⅱ pollen, which pollen type does the hybrid grape have ?

We examined the pollen ultrastructure in interspecific and intervarietal $F_1$ hybrids between grapes with different pollen type by SEM.

## Materials and Methods

The materials are shown in Table 1. They were hybridized by the combinations shown in Table 2. All the wild grapes used as a seed or a pollen parent had pseudo-hermaphroditic flowers that were functionally dioecious. The functional male flowers had well developed stamens with germinable pollen grains and a small ovary without a style ; the functional female flowers had poorly developed stamens with inaperturate pollen grains and a large ovary with prominent stigma[1, 4]. The former cannot be pollinated but has ovules in the ovary, and the latter can be pollinated but the pollen cannot germinate[4].

**Table 1. Scientific names, Japanese or cultivar names, pollen exine types and frower types of wild and cultivated grapes in parents of investigated hybrids**

| Scientific name | Japanese or cultivar name | Pollen exine type* | Flower type |
|---|---|---|---|
| *Vitis flexuosa* Thunb. | Sanakakuzuru | I | dioecious |
| *V. ficifolia* Bunge var. *lobata* (Regel) Nakai | Ebizuru | II | dioecious |
| *V. ficifolia* Bunge var. *izu-insularis* Hara | Shichitouebizuru | II | dioecious |
| *V. ficifolia* Bunge var. *ganebu* Hatusima | Ryuukyuuganebu | I | dioecious |
| *V. kiusiana* Momiyama | Kumagawanbudou | I | dioecious |
| *V.* sp. | Daisankakuzuru** | I | dioecious |
| *V. shiragai* Makino | Shiragabudou | I | dioecious |
| *V. vinifera* L. | ' Nehelescol ' | I | hermaphrodite |
| *V. labruscana* Bailey | ' Ishihara Wase '*** | II | hermaphrodite |
| *V. vinifera* L. | ' Centennial '**** | I | hermaphrodite |

* Type-I pollen has perforations in lumina and type-II pollen has granules in lumina.

** Tentative name. An unidentified wild grape native to Japan.

*** Tetraploid cultivar from bud mutation of ' Campbell Early '. The seed parent of ' Kyoho ' (*V. labruscana*) grape.

**** Tetraploid cultivar from bud mutation of ' Rozaki '. The pollen parent of ' Kyoto ' grape.

**Table 2. Pollen exine and flower types of investigated grapes**

| Code no. | Plant material (seed parent × pollen parent, or cultivar name) | Pollen exine type* | | Flower type |
|---|---|---|---|---|
| | | parent | $F_1$ hybrid | |
| 1 | Ebizuru × Sankuzuru | II × I | I | dioecious |
| 2 | Kumagawabudou × Shichitouebizuru | I × II | I | dioecious |
| 3 | Ryuukyuuganebu × Ebizuru | I × II | I | dioecious |
| 4 | Daisankakuzuru × Ebizuru | I × II | I | dioecious |
| 5 | Wild grape that seemed to be hybrid between Shiragabudou and Ebizuru | —** | I | dioecious |
| 6 | ' Nehelescol ' | — | I | hermaphrodite |
| 7 | Ebizuru × ' Nehelescol ' | II × I | I | hermaphrodite |
| 8 | ' Ishihara Wase ' | II*** | II | hermaphrodite |
| 9 | ' Centennial ' | — | I | hermaphrodite |

* See Table 1.

** Unknown

*** ' Campbell Early '

Except ' Ishihara Wase ', all these grapes were cultivated in the experimental orchard of Osaka Prefecture University, while ' Ishihara Wase ' was cultivated at Kyoto University.

Flower buds were taken a few hours before they opened from field-grown plants and were stored dry in individual glass vials. Air-dried pollen was placed on adhesive tape attached to a metal stub and was Pt-Pd coated *in vacuo* by the usual techniques prior to viewing and photographing in a SEM (Hitachi, S-800). The observed exine areas of the pollen grains were as described in a previous paper [1].

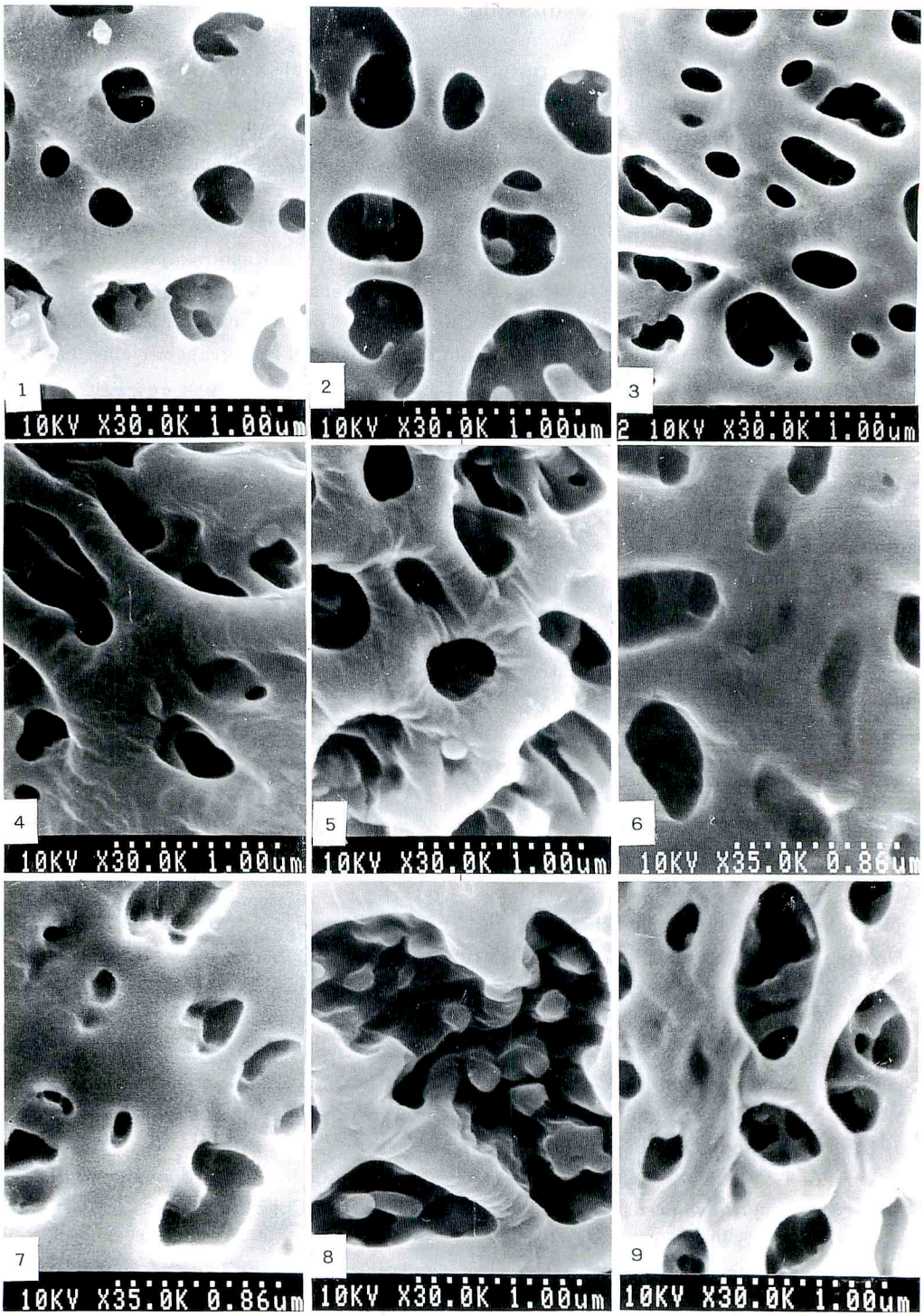


Fig. 1 - 9. SEM photographs of grape pollen exine. These photo nos. correspond to the code nos. in Table 2.

## Results and Discussion

The characteristics of the pollen ultrastructure are shown in Table 2 and Figs. 1 - 9. The pollen ultrastructure of all the $F_1$ hybrids between grapes with type- I and with type- II pollen was type- I (*Figs.* 1 - 4, 6). The pollen exine of the code- 5 grape was also type- I (Fig. 5).

The pollen exine of ' Ishihara Wase ' was type- II (Fig. 8) and that of ' Centennial ' was type- I (Fig. 9). In a previous paper [1], ' Kyoho ', a hybrid of ' Ishihara Wase ' and ' Centennial ', was type- I .

Maas [6] observed the pollen ultrastructure of *V. vinifera*, *V. cinerea*, *V. rupestris* and *V. amurensis*. However, the pollen ultrastructure of these grapes is similar. Tompa-Kashirskaja [7] observed some grape pollen grains by SEM finding that the pollen grain dimensions and exine sculpturing varied among the intra- and interspecific hybrids. Moreover, while Tompa-Kashirskaja [8] examined the pollen from functionally male, female, and hermaphrodite flowers of four grape varieties using TEM (transmission electron microscopy) and SEM, the exine sculpture of these grapes was divided into two types : tectate perforate, and semitectate. Tompa-Kashirskaja and Kozma [9] observed pollen grains from geographic-ecological groups of *V. vinifera* varieties by SEM, and found that the exine sculpturing varied with variety. However, all the above research is based not on the lumen forms in the murus, but on the pollen exine sculpturing.

Chao and Yuan [10] analyzed the isozymes of 11 wild grapes native to China and showed that *V. adstricta*, which belongs to the Ebizuru group [11], is highly evolved. According to their opinion, grapes with type- II pollen may be highly evolved. In the future, we will study the relationship between pollen ultrastructure and evolution by DNA analysis, and other methods.

In conclusion, the detailed pollen ultrastructure of type- I pollen may be genetically dominant over type- II pollen.

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(短報)

# ブドウ属植物の種間ならびに変種間交雑 $F_1$ 個体における花粉の表面微細構造

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前報において，東アジア産ブドウ属花粉の表面微細構造が 2 グループ（Ⅰ型およびⅡ型）に大別されることを見出した．その結果を基に，Ⅰ型を持つものとⅡ型を持つものとの間で交雑を行い，得られた $F_1$ 個体の花粉を走査型電子顕微鏡（SEM）で観察したところ，いずれもⅠ型の花粉であった．また，日本原産野生種のエビヅル（*Vitis ficifolia* var. *lobata*）はⅡ型花粉を，シラガブドウ（*V. shiragai*）はⅠ型花粉を持つが，両種が自然交雑したと思われる個体の花粉もⅠ型花粉であった．そのため，Ⅰ型花粉はⅡ型花粉に対して遺伝的に優性ではないかと思われた．