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パイナップルの放射線照射による無毛茸突然変異体の選抜と構造解析

Selection and Stracture Analysis on Trichomeless Mutants Induced by Gamma Rays in Pineapple

パイナップルの葉身表面を覆う毛茸(trichome)は，乾燥に対する防御や養水分の吸収を助ける機能を持つと推察されている。一方，毛茸は栽培管理，収穫，加工の工程において，容易にはげ落ちて飛散し，作業者の呼吸器障害を引き起こす職業病の原因ともなっている。

有用な無毛茸突然変異体を誘発し選抜するために，種々の放射線照射を行い，毛茸発生程度の異なる変異系統を分離し，毛茸の構造との関連性を明らかにした。

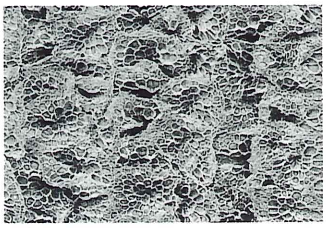
主要栽培品種スムースカイエンハワイ系を用いて，ガンマールームおよびガンマーグリーンハウスにおいて，冠芽及び植物体に対して急照射及び緩照射を行い，葉挿し増殖により毛茸変異体を選抜した。変異体の毛茸程度により0(無)から9(多)までの10段階に評価し，各葉身裏面の標本を走査型電子顕微鏡により検鏡し，毛茸体およびその構成細胞について計測した。

個体照射では，毛茸変異の区分キメラが誘発され，比較観察の材料にした(第1図)。原品種の葉裏の毛茸は，表層の葉脈間隙に沿って派生し，摩擦により剝離され易い構造をもっていた(第2図)。毛茸の直径は，原品種では320×240μmであり，その毛茸変異であるNW-1からNW-5までの系統では，毛茸の長辺は49〜196μmの幅があった(第1表)。NW-2の毛茸直径は49×46μmで，原品種に比べると面積比3％程度に減少し，通常は観察できない気孔が露わになった(第3図)。外見から判定した毛茸程度は，毛茸サイズの変化によく一致した(第1表)。

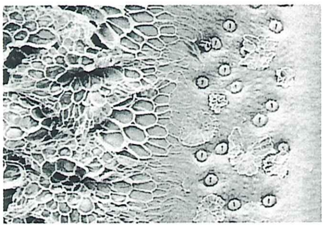
葉表面の毛茸は，葉裏に比べ遥かに薄く疎らで，花弁状膜が規則的に並んでいた(第4図)。無毛茸変異体では，クレーター状の気孔が露わになり，CAM植物であるパイナップルの同化機構の一端を観察できた。

毛茸変異系統は増殖して実用形質の検定をする一方で，まだ推定の域を出ない毛茸の機能についての解析が期待される。　(永冨　成紀)

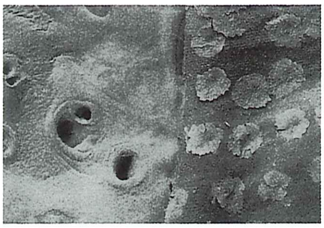
第1図　パイナップルの区分キメラの無毛茸突然変異体
Fig. 1.　Sectorial chimera of trichomeless mutants induced by gamma rays in pineapple



第2図　パイナップル原品種スムースカイエンの葉身裏面の毛茸の走査型電子顕微鏡による観察像
Fig. 2.　Trichomes on abaxial leaf surface in the original variety 'Smooth Cayenne' observed under SEM



第3図　無毛茸変異系統'NW-2'の葉身裏面の変異セクターの電顕像．毛茸正常(左)，無毛茸セクター(右)
Fig. 3.　Mutation sector of trichomeless on abaxial leaf surface in the mutant line 'NW-2' observed under SEM. Normal trichomes(Left), and trichomeless sector (Right)



第4図　無毛茸変異系統'NW-2'の葉身表面の変異セクターの電顕像．無毛茸セクター(左)，毛茸正常(右)
Fig. 4.　Mutation sector of trichomeless on adaxial leaf surface in the mutant line 'NW-2' observed under SEM. Trichomeless sector(Left) and normal trichomes(Right)

表1　パイナップルの放射線誘発の毛茸突然変異系統の葉裏における毛茸の変異
Table 1. Variation of trichome on abaxial leaf surface in trichomeless mutant lines of pineapple

系　統	毛	茸			毛	茸 細 胞	
Variety	程度 (1)	長(μm) (2)	幅(μm) (3)	面積比 (4)	長(μm) (5)	幅(μm) (6)	長幅比 (7)
Smooth Cayenne	9	320	246	100	37.8	25.0	1.51
NW-1	3	150	129	25	26.1	14.8	1.76
NW-2	1	49	45	3	19.8	6.4	3.09
NW-3	1	65	60	5	11.1	5.0	2.22
NW-4	5	195	154	38	31.5	17.5	1.80
NW-5	5	189	152	37	32.9	16.8	1.96
Yellow Mauritius	9	263	201	67	37.3	32.9	1.13
Taino No.4	9	258	201	66	39.7	30.3	1.31

(1) Rank of trichome : 1 (無, None) ~ 9 (極多, Very profuse)
(2) Length(μm), (3) Width(μm), and (4) Ratio of area in trichome
(5) Length(μm), (6) Width(μm), and (7) Ratio of L/W in trichome cell

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Trichome which coats with leaf surface in pineapple is estimated to have some functions to tolerate against drought and to help in absorption of water and nutrients. On the other hand, trichome which is prone to come off and dust during cultivation, harvesting and fruit-processing, is known to be a course of a disease of respiratory organs in the workers. It is investigated an association between degree of trichome and ultra-structure of trichomeless mutants induced by various irradiations.

Trichomeless mutants were selected from generated plants propagated by leaf trimming method from crowns and plantlets irradiated acutely in a gamma room and chronically in a gamma greenhouse using a variety, Smooth Cayenne (Hawaiian Line). Degree of trichome in each mutant line was ranked from 0 (none) to 9 (very profuse), and trichome of each specimen was observed and measured under scanning electron microscope.

Leaf surfaces with sectorial chimera in induced mutants were used for observation (Fig. 1). On abaxial surface, trichome, thin membranes like double-petaled flower, derived from space between leaf veins, were covered with all surface area, which peel off easily by rubbing (Fig. 2). The average diameter of trichome was 320 μm in Smooth Cayenne and 49 to 196 μm in its 5 trichomeless mutant lines (Table 1). A trichome in NW-2 being only 3% areas to the original variety,revealed stomata which usually never be observed (Fig. 3). One cell size of trichome was also significantly decreased in the mutant lines, and only 6% areas in NW-3 comparing with the original variety. Close agreement between degree of trichome in appearance and size of trichome under ultra-structure was obtained (Table 1).

On adaxial surface, thin trichome similar to floral petal were arranged sparsely with regular distance (Fig.4). Stomata like a crater exposed in the trichomeless mutant exhibit one part of structure of photosynthetic organs in CAM plant.

While it is necessary to investigate agronomic characters of trichomeless mutants in view of breeding, it is expected to elucidate functions of trichome from physiological standpoint.

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