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パイナップルの葉挿，培養個体における各種照射法の変異誘発効果

Effects of Various Irradiation Methods on Mutation Induction of Regenerants through Leaf Trimming and Tissue Culture in Pineapple

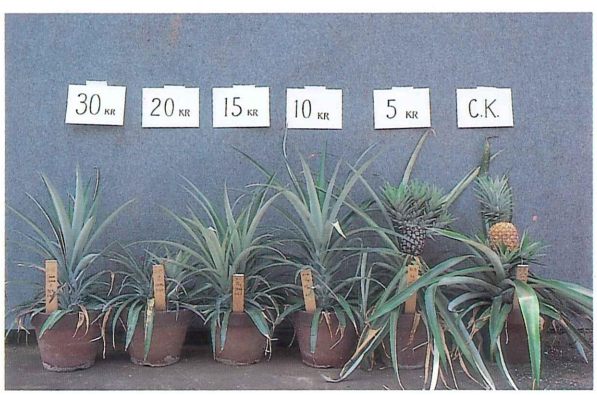
パイナップルの育種では，交雑によるよりも自然の芽条変異による栄養系選抜が主流をなしてきた。しかし自然界では，芽条変異体は極めて低頻度で偶然の機会にしか現れないために，効果的な突然変異育種法の確立が強く望まれてきた。さらに，パイナップルは永年性草本作物で２～３年の作季を要し，かつ増殖率が極めて低く，育種推進上の最大の障害となっていた。変異誘発頻度と増殖効率を共に高めるために，効果的な放射線育種法について検討を行った。

品種スムースカイエンのハワイ系（葉縁無刺，葉裏多毛茸）を供試して，A．無照射，B．緩照射，C．半急照射，およびD．急照射により処理した植物体から，葉挿法および培養法によって個体の再生を図り，葉部の変異形質を検出した（図１）。

緩照射による植物体の典型的な障害は，50 Gy (5 kR)で冠芽の多芽状がみられ，200 Gy (20kR)以上で生長点が損傷を受け，分げつが多発した(図２)。緩照射，半急照射および急照射を総合した側芽のLD_{50}およびLD_{100}の総線量は，線量率が高まるにつれて急速に低下し，明瞭に線量率に依存した(図３)。側芽に対する適正照射量は，LD_{50}に沿った低い線量域で複芽の発生が目安となる。また照射植物体からのカルス生成の限界は，照射植物の生長点のLD_{100}の曲線とほぼ一致した。

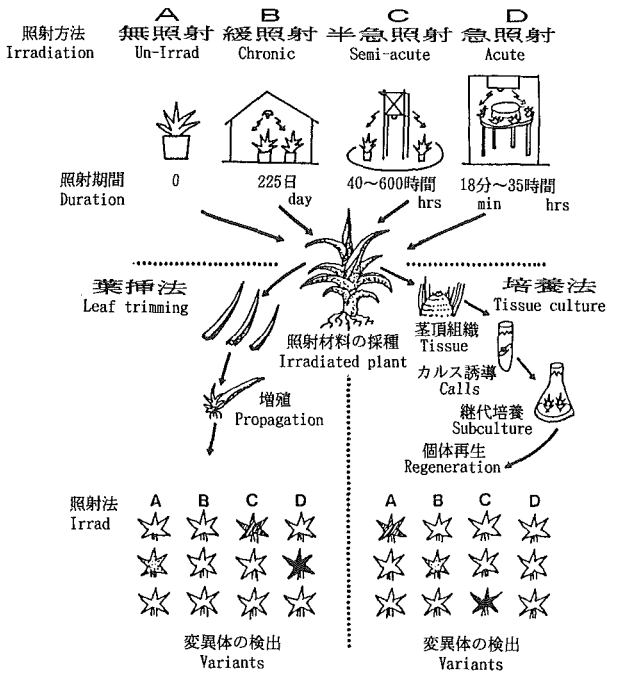
図４には照射と培養によって得た再生個体に現れた葉部の変異を示した。無毛茸は葉挿法では緩照射０％，半急照射0.9%，急照射0.4%であったが，培養法では緩照射 3.9%，半急照射1.9%，急照射3.0%で，緩照射＋培養により変異の頻度が高まった（図５）。無毛茸変異体は作業者の呼吸器の職業病を回避するのに有用である。また葉色変異体は，葉挿法では急照射でのみ誘発され，培養では半急照射および急照射で３％以上の高い頻度で現れた。葉色変異のようなドラスチックな変異は高線量の照射で誘発され易かった。葉縁の有刺は培養区で高頻度に発生したが，本品種は有刺由来の無刺自然変異体であるため，内在していた有刺のキメラ層が培養により拡大したもので，多くは誘発変異体とは考え難い。なお，パイナップルの種苗増殖率は，通常の株分けに比べて葉挿法では約30倍，培養では500倍以上に達した。

これにより従来有効な育種法がなかったパイナップルでは，適正な放射線照射と培養の複合法の適用によって，変異の頻度と増殖効率をともに向上できる効果的な放射線育種法が確立された。（永冨成紀）



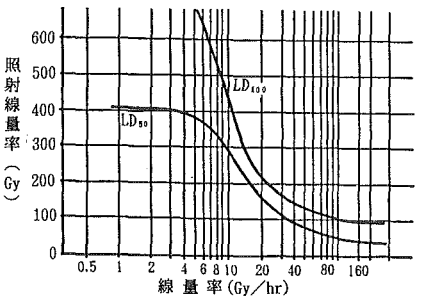
第２図　パイナップル植物体の緩照射による障害
Fig. 2. Damage by chronic irradiation on growing plant in pineapple

第４図　照射培養法による葉部変異体
Fig. 4. Typical variants appeared on leaves of regenerants through irradiation and tissue culture.



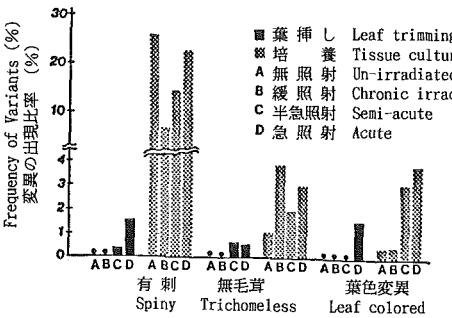
第１図　パイナップルの変異誘発方法

Fig. 1.　Scheme for the experiment of mutation induction in pineapple



第３図　側芽の各線量率における致死線量(LD_{100})および半致死線量(LD_{50})の分布曲線

Fig. 3.　Distribution curves for LD_{100} and LD_{50} on various dose rate in lateral buds of pineapple.



第５図　各種照射植物由来の葉挿法および培養法による葉部変異個体の出現率

Fig. 5.　Percentage of variants through leaf trimming and tissue culture from various irradiated plants.

Effects of Various Irradiation Methods on Mutation Induction of Regenerants through Leaf Trimming and Tissue Culture in Pineapple

In pineapple breeding, the mainstream is clonal separation rather than cross-breeding. As spontaneous bud mutants which can be used for breeding work appear very rarely, it is essential to establish an effective method for inducing mutation in pineapple. In addition, very low rate of propagation has been a major barrier in development of the breeding. The present study had been carried out to find out a method for increase both of induced mutation and propagation.

A Hawaiian line of cultivar 'Smooth Cayenne' having traits of smooth leaf margin and profuse trichome on abaxial leaf surface was used as the material. Variegated leaf characters were observed on regenerants through leaf trimming and tissue culture techniques derived from irradiated plants of four methods; A. Un-irradiated, B. Chronic, C. Semi-acute, and D. Acute (Fig. 1).

Typical damages observed were multiple crown at total dose of 50Gy(5kR) and multiple shoots due to injury of meristems above 200Gy(20kR) in growing plant under chronic irradiation in gamma-greenhouse (Fig. 2). Total dose required for 100% lethal (LD_{100}) and 50% (LD_{50}) of germination in lateral buds, evidently depends upon dose rate over a wide range from the chronic to acute (Fig. 3). Suitable doses for mutation induction are suggested in the lower region alondside with LD_{50} curve where multiple shoots are generated from the irradiated lateral bud by leaf trimming. The limit of callus induction from irradiated plant generally agreed with the LD_{100} curve.

Typical variants appeared on leaves of generated plants through leaf trimming and tissue culture are shown in Fig. 4. Trichomeless variants were more frequently obtained by tissue culture than by leaf trimming (Fig. 5). The mutant is useful to avoid a disease of the respiratory organ for the workers to be caused by dust of trichhome.

Leaf colored variants were induced only by acute irradiation with leaf trimming and reached at more than 3% by acute and semi-acute with tissue culture. Such drastic mutants as leaf colored were liable to be induced by acute irradiation at high doses. Spiny variants occurred at high frequency by tissue culture, were unlike induced mutants but were segregated from chimeric plants in which original layer of spiny trait coexists with smooth. Propagation rate comparing with ordinal suckering incresed by approximately 30 times for leaf trimming and 500 times for tissue culture.

In conclusion, combined method of proper irrdiation with tissue culture techniques markedly increases efficiencies both of induced mutation and propagation and is a new measure which present high improvement to the conventional practice in pineapple.

(Shigeki NAGATOMI)

〒319-22　茨城県那珂郡大宮町　私書箱３号
農林水産省農業生物資源研究所放射線育種場
Institute of Radiation Breeding, NIAR, MAFF
P. O. Box 3, Ohmiya-machi, Ibaraki, 319-22
JAPAN