

Some anatomical features of a radiation-induced grape *variegata*¹⁾

by

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Anatomische Merkmale bei einer Rebe mit strahlungsinduzierter Scheckung

Zusammenfassung. — Anatomische und kennzeichnende morphologische Eigenschaften einer strahlungsinduzierten gescheckten Mutante der Rebsorte Pusa Seedless werden beschrieben. Die chlorophyllarmen Sektoren beider Blattseiten, die sich deckten, waren gewöhnlich dünner als die grünen Bezirke. Dies war entweder auf eine verringerte Anzahl Mesophyllschichten oder durch kleinere Zellen oder durch beide Ursachen bedingt. Die Gelbfärbung der chlorotischen Sektoren scheint hauptsächlich auf ihre verminderte Dicke und in gewissem Umfang auf Chlorophyllmangel zurückzuführen zu sein.

In an attempt to standardize methods of inducing somatic mutations in grapes a number of mutations were isolated after N-nitrosomethyl urethane and gamma-radiation treatments. Some of the mutants of systematic types have been described earlier (SHARMA and MUKHERJEE 1972). Three of the radiation-induced mutations, two in Pusa Seedless and one in Bhokri cultivars, were *variegatas*. These mutants had thinner chlorophyll deficient sectors of varying sizes in the leaves and the variegation pattern was in most instances identical on both the surfaces. These were somewhat unusual features not recorded by DERMEN (1947). It was, therefore, considered desirable to describe the salient features of one of the *variegatas* (i. e. PSV 3G-5-8) which was studied for this purpose in greater detail.

Material and Methods

Pusa Seedless (*Vitis vinifera* L.) cuttings were irradiated in 1968 at the Indian Agricultural Research Institute New Delhi. One of the cuttings in the 3 kR lot supported, on sprouting, a chimeral variegated leaf on the M₁ shoot²⁾. The shoot, after heading back upto the affected leaf, produced an axillary shoot having variegated leaves. The cuttings and buds from this mutant have, with rare exceptions, produced variegated plants in the next and subsequent vegetative generations.

The anatomical features of the variegated leaves were studied by taking the transverse sections in such a way that both chlorotic and normal sectors were included in the sections. The mesophyll layers were counted and leaf thickness and cell size of the two parenchymata were measured after staining with safranin.

In addition, some of the distinguishing morphological features of the mutant were described according to the taxonomic procedures adopted by BIOLETTI (1938). The colour comparison of the chlorotic and the normal sectors was done with the help of Horticultural Colour Charts (Royal Horticultural Society).

Results

The *variegata* had following distinguishing morphological and anatomical features:

¹⁾ A part of Ph. D. thesis submitted by the first author to the post-graduate school, I.A.R.I., New Delhi in 1970.

²⁾ M₁ shoot means the (unbranched) shoot emerging from the irradiated bud on the irradiated cutting.

Leaves variegated, somewhat deeply- and narrow-lobed, slightly smaller than normal, sometimes cupped; petiolar sinus wide open; teeth more in number though less conspicuous; chlorotic sectors yellowish with mostly uniform pattern on both the surfaces; green sectors, when approaching margin, sometimes lined with very narrow chlorotic border; lighter shade either due to decrease in chlorophyll pigments or fewer mesophyll cells or smaller cells or due to any combination of these, if thinner then the number of spongy cell-layers reduced from normal five to three or rarely four. Thinness conspicuous on under surface providing false impression of etched out lower epidermis. The comparative data on these distinguishing features are given in Table 1.

The variant, with somewhat restricted vegetative growth, was late in sprouting in spring by about 25 days.

Discussion

The Pusa Seedless *variegata*, which happened to be a viable and almost uniformly stable mutant, was different from the *variegatas* commonly observed in grapes, citrus, peaches etc. as is evident from the present observations and the descriptions given by DERMEN (1947). The chlorotic patches were generally thinner than the green portions of the leaves and the variegation pattern was identical on the two surfaces in almost all cases. The chlorotic nature appeared more to be due to the fewer spongy parenchyma layers and smaller cell size in palisade and spongy layers than due to deficiency of chlorophyll.

Table 1

Comparative quantitative values of some distinguishing features of the *variegata* mutant and parent cultivar Pusa Seedless

Quantitative Daten über Unterscheidungsmerkmale der gescheckten Mutante im Vergleich zur Ausgangssorte Pusa Seedless

Character	Yellow sectors or variegated leaves	Green sectors or normal leaves
1. Leaf size (length \times width) cm	7.41 \times 9.83	8.43 \times 10.62
2. Leaf length cm/petiole length cm	1.66 \pm 0.30	1.46 \pm 0.13
3. Petiolar sinus form (depth/width)	0.564 \pm 0.222	8.00 \pm 7.20
4. No. of teeth/cm ² area (length \times width)	1.200 \pm 0.05	0.687 \pm 0.170
5. Petiolar sinus: depth cm	1.63 \pm 0.21	2.40 \pm 0.32
width cm	2.71 \pm 0.93	1.00 \pm 0.81
6. Colour: Unfolding leaves	Slightly lighter than Garnet brown (0918/3)	Spinach green (960/3)
Mature leaves	Primrose yellow (601/3)	Spinach green (960/1 to 2)
7. Leaf thickness μ	67.4 (-30.9%)	97.6
8. Size of epidermal cells:		
upper μ	12.0 \pm 0.10	10.9 \pm 0.62
lower μ	7.2 \pm 1.37	12.0 \pm 0.62
9. Size of mesophyll cells:		
Palisade cells μ	12.0 \pm 0.10	17.90 \pm 1.32
Spongy cells μ	7.2 \pm 1.37	15.11 \pm 1.83

The *variegata* may prove to be of value from the academic view point for confirming the inheritance of such variegation as suggested by DURQUETY and DESTANDEAU (1967). It is less likely that the mutant would produce bunches having variegated berries, as BREIDER (1953) contended that mutations in pigmentation of the leaf were independent of those in the grape berry, although this variegation was not strictly a mutation in pigmentation alone. Most probably, the Pusa Seedless *variegata* was like the radiation-induced tomato variegatas which, according to GRÖBER (1963, 1967), contained one or more chromosome fragments of various sizes in their karyotypes. Green and yellow tissues on variegated shoots of those tomatoes were stated to be due to irregular fragment distribution during mitosis. If the same is true in the present case, there is likelihood of induction of sterility to some extent in the mutant and this can be known after it starts flowering.

Summary

Some anatomical and a few distinguishing morphological features of radiation-induced Pusa Seedless *variegata* have been described. The chlorophyll deficient sectors, which were identical on the two surfaces of the leaves, were usually thinner than the green sectors and thinness was either due to the reduced number of mesophyll layers or smaller cells or both. The yellow colouration of chlorotic sectors seemed to be mainly due to thinness of the sectors and to some extent due to lack of sufficient chlorophyll.

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