საქართველოს მეცნიერებათა ეროვნული აკადემიის მოამბე, ტ. 2, №1, 2008
BULLETIN OF THE GEORGIAN NATIONAL ACADEMY OF SCIENCES, vol. 2, no. 1, 2008

Plant Growing

Changes in Turkish Loquat (Armut, Akko, Taza) Seeds Caused by Mutagen Nitrosoethyl Urea

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ABSTRACT. Experiments revealed that chemical mutagen nitrosoethyl urea affects seeds of Turkish loquat, reducing their germination ability to some degree and causing an increase of the spectrum of their morphological mutations. *© 2008 Bull. Georg. Natl. Acad. Sci.*

Key words: *mutagen nitrosoethyl urea, Armut, Akko, Taza, mutative changes.*

Loquat (*Eriobotria japonica* L.) is a subtropical fruit-bearing culture. It originated in China, Japan and Northern India; it is cultivated in almost every subtropical country. Loquat belongs to the rose family - *Pomoideae,* genus - *Eriobotria* (*Erion* – down, *botris* – inflorescence), which points to one of its main attributes – fuzziness of inflorescence. It has two major locations of origin – China and Japan. Fruit of Chinese loquat is large, pear-shaped, and orange, meaty, ripens relatively late. Fruit of Japanese loquat is small, roundish, yellow, less meaty, ripens early [1].

Experiments were carried out to obtain new selection materials from Turkish loquat (Armut, Akko, Taza) and study the effect of chemical mutagen nitrosoethyl urea (NEU) on loquat seeds. It is established that chemical mutagens are considerably effective in generating mutations that cause hereditary changes in the organism.

Armut, a Turkish variety of Japanese loquat, ripens early. It is a roundish fruit of medium size, reddish-orange, delicious, fairly sweet.

Akko is a late ripening species, with pear-shaped fruit of medium size, red-orange, delicious, fairly sweet.

Taza is a mid-seasonal species; its fruit is large, pear-shaped, orange, delicious, rather sweet.

Materials and Methods. We followed a method developed by N. Zozii and S. Makarova at the Moscow Institute of Chemical Physics [2]. The method has been modified by Sh.Goliadze, I.Kerkadze and A.Diasamidze for citrus plants at the department of genetics and selection of the Scientific-Research Institute of Tea and Subtropical Cultures in Anaseuli, Georgia [3].

The above-mentioned Turkish loquat was used as the material of the experiment. After being dried for three days at room temperature, their seeds were subjected to 24- hour exposure with different concentrations of mutagen. Since the seed peel is resistant to the mutagen penetration into the kernel, the experiment was carried out both with peeled and unpeeled seeds [4]. Treatment of seeds was administered under laboratory conditions. Treated seeds were sowed in boxes where their germination and mutation process was observed (see the Table).

As the Table shows, the percentage of germination of unpeeled seeds is almost twice smaller than that of peeled seeds. However, the effect of chemical mutagen on the overall changes in the loquat plant is relatively greater. This fact confirms that the seed peel acts like a certain barrier blocking to some extent penetration of the chemical mutagen solution into the kernel. It was also established that concentration of the solution affects the germination of both peeled and unpeeled seeds. In particular, relatively high concentration of the solution inhibits the ability of germination, and in some cases may be lethal. In case of diluted (low concentration) solutions, germination ability of unpeeled seeds is slightly less than that of the control samples.

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Table

Changes in Turkish Loquat (Armut, Akko, Taza) Seeds Caused by Mutagen Nitrosoethyl Urea

Mutagen Concentration	Number of seeds treated with the mutagen	Amount of germination	Percentage of germination	Phenomenon of albinism	Percentage of albinism	Percentage of albinism	Phenomenon of polyembryony	Percentage of polyembryony	Percentage of mutations
Unpeeled seeds.									
1:500	100	59	59.0	4	5.4 –3.0	1	1	22	38.7- 7
1:1000	100	75	75.0	0	0	4	5.5-2.7	24	34.5-5.6
1:2000	100	91	91.0	0	0	5	5.7-2.8	30	31.9-5.9
Peeled seeds									
1:500	100	25	25.0	2	8.8-2.0	0	0	14	61.0-10.1
1:1000	100	39	39.0	1	2.8-2.1	0	0	16	42.5-9.0
1:2000	100	48	48.0	1	2.1-1.6	1	2.1-1.8	23	49.0-7.5
Control	100	97	97.0	0	0	1	1.05-1.5	2	2.1-1.5

The effect of the chemical mutagen on the loquat plant should be considered the cause of mass recurrence of so-called albino plants, commonly germinated both from peeled and unpeeled seeds, and it is directly linked with the degree of concentration in the mutagen solution.The biological nature of this phenomenon is, most probably, the result of the mutagen effect on the genes that control the development and functioning of chlorophyll grains. Such wide proliferation of albino plants is usually observed when peeled seed kernels are treated with solutions of high concentration. The effect of chemical mutagen emphasized the phenomenon of polyembryony of loquat seeds. Polyembryony does not frequently occur in plants. In loquat plants, only a very small percentage of such seeds are encountered.

Treatment of unpeeled seeds with small doses of the mutagen nitrosoethyl urea stimulates germination of additional embryos in the nucelluses. However, the outcome may be even lethal if the treatment is administered directly on the nucelluses of peeled seeds.

The purpose of using chemical mutagen is to increase the spectrum of mutations in the plant as it is shown in the concluding data of the Table. Under mutations we mean variations in plant's height, shape of its leaves, their dentation, indumentum, quantity, distribution and so on.

As the Table shows, the overall number of mutations in treated seeds increases several times in comparison with the control samples; it reaches 34.5-38.7% in the plants germinated from unpeeled seeds treated with the mutagen. As for the plants germinated from the peeled seeds, the spectrum of mutations is wider and deeper.

The majority of the resulting mutations are negative, for example, albino plants (plants with misshapen leaves, crooked stem, fascial off-shoots, greater or lesser downiness, varying growth intensity, etc.); such plants die in 2-3 months. How hazardous or beneficial these mutations are can be observed after the plant enters the fruit bearing phase. It should be also noted that the majority of such morphological mutations have adapting nature and are eliminated in new shoots in the same year or in the second vegetation period.

Thus, treatment of Turkish loquat (Armut, Akko, Taza) seeds with the chemical mutagen nitrosoethyl urea reduces considerably their ability of germination, the effect being especially well observed in the case of peeled seeds.

In addition, the effect of nitrosoethyl urea manifests itself in the increase of the spectrum of morphological mutations that disappear in the next vegetation period. Among the mutation types, one encounters rare fascial forms with irregular distribution of underdeveloped leaves. The possible usability of these mutations will be evaluated after fruit is born.

მემცენარეობა

იაპონური მუშმულის თურქული ჯიშების (Armut, Akko, Taza) თესლებზე მუტაგენ ნიტროზოეთილშარდოვანას ზემოქმედებით გამოწვეული ცვლილებები

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ავტორების მიერ ექსპერიმენტულად დადგინდა, რომ ქიმიური მუტაგენი ნიტროზოეთილშარდოვანა (ნეშ) იაპონური მუშმულის თურქული ჯიშების (Armut, Akko, Taza) თესლებზე ზემოქმედებისას გარკვეულწილად ამცირებს მათი აღმოცენების უნარს და იწვევს მორფოლოგიურ ცვლილებათა სპექტრის ზრდას.

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Received November, 2007