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# NUCLEAR VARIABILITY IN THE GROWTH PROCESS OF YOUNG FRUITS AT *CUCURBITACEAE* FAMILY

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**Key words**: amitosis, endopolyploidy, fruit growth, species of *Cucurbitaceae* Family, statistic parameters, diameter and surface of the nucleus

**Abstract**: During the process of the young fruit growth and development occur certain cytogenetics phenomena. As result of that is activating processes of amitosis and endopolyploidy in fruits tissues and onset vascular bundle. It was observed a great nuclear varibility in analysed tissues.

## INTRODUCTION

which genome copy number Nuclear variability is a process, which appears on the all-ontogenetic stadies of plants, especially in young ones. Some researches have demonstrated the apparition of the nuclear variability in growth and development of young fruits. Variation the dimensions of the nuclei was due in different structures actively participating in growth process, as the exocarp, mesocarp, endocarp and placenta.

Nuclear enlargement, which has been shown to occur in parenchyma cell of mesocarpus, is due to endoreduplication, a process by is increased by nonselective nuclear DNA replication (Lur and Setter T., 1993, Aloni 1987, Galbraith 1991).

Our previous works were shown the enlargement of nuclei and nuclear fragmentation, especially near of vascular bundles on setting in young fruits. We have found responsible for the nuclear variability the activation of the amitosis (direct division) and endopolyploidy .process.

Based on the reported results we proposed to approach the functionality of amitosis and endopolyploidy mechanism important in fruit growth and development.

## MATERIALS AND METHODS

As working material were used the young fruits from *Cucurbitaceae* family. The following five cultivated species were investigated after fecundation: *Cucurbita pepo* L., *Cucurbita maxima* Duch., *C. pepo* var. *oblonga* Ser., *Citrullus lanatus* Mansf. and *Cucumis sativus* L. The fragments of fruits were fixed in neutral formol 4% and then were included in paraffin. The material was sectioned at 5-8µm thicknesses at paraffin microtome. The sections were coloured with haematoxylin and then dehydrated in alcohol and mounted in Canada balsam. On these sections it were analysed the nuclear variability in the fruit structures. Also, were investigated the wood vessels formation and xylogenesis evolution. For calculating the surface of the nuclei

were measured the longitudinal and transversal nuclear diameter. Statistic analyses were used the following parameters: arithmetic mean ($\bar{x}$), standard deviation (S), variation coefficient (S%), line of regression and correlation coefficient (R).

## RESULTS AND DISSCUTIONS

It was performed the measurement of transversal and longitudinal nuclear diameter in some species of *Cucurbitaceae* family. The measurements have shown the importance of nuclear variability in pericarpe tissue and as well as in nuclear agglomeration reached near the vascular bundles. The results are presented in tables 1 and 2.

### 1. The variation of nuclear length

From the table 1 has been observed that greatest coefficient of variation (S%), in value of 39,08% was *at Cucumis sativus* L. The lowest value of 28,8% of this parameter was observed in *Cucurbita maxima* Duch. The arithmetic mean ($\bar{x}$) of longitudinal diameter was included between 8,14 ± 0,41µm (*C. pepo var. oblonga*). The minimum value of nuclear length was measured at *C. pepo var oblonga*, being of 2,5 µm and maximum being of 15,62 µm was observed at *Cucumis sativus*.

**Table no. 1. Variation of nuclear diameter (µm) from young fruits of species at *Cucurbitaceae* Family**

| Specia | Min | Max | $\bar{x} \pm Sx$ | $S^2$ | S | S% |
|---|---|---|---|---|---|---|
| *Cucurbita pepo* L. | 3,75 | 13,75 | 8,59 ±0,41 | 8,44 | 2,90 | 33,7 |
| *Cucurbita maxima* Duch. | 5 | 15 | 8,5 ±0,34 | 5,99 | 2,44 | 28,8 |
| *C. pepo* var. *oblonga* Ser. | 2,5 | 14,5 | 8,14 ±0,41 | 8,49 | 2,91 | 35,7 |
| *Citrullus lanatus* Mans f. | 5 | 14,37 | 8,49 ±0,37 | 7,18 | 2,68 | 31,54 |
| *Cucumis sativus* L. | 3,75 | 15,62 | 8,43 ±0,46 | 10,87 | 3,29 | 39,08 |

### 2. The variation of nuclear surface

Nuclear surface was calculated after circle or elipse formula:

$Sc=\pi r^2$, $Se=\pi ab$

where, r= circle radius, a, b = semiaxes of ellipse (Marin A., 1972).

The species investigated from *Cucurbitaceae* family have shown an interesting variation in surface of the nuclei (table 2). The variation coefficient (S%) has been observed between 32,77% (*Citrullus lanatus*) and 43,42 % (*C. maxima*). Arithmetic mean ($\bar{x}$) had a variation beginning with 32,51±1,85µm$^2$ (*Cucumis sativus*) and ending with 35,9±2,2 µm$^2$ (*C. maxima*). The nuclear surface had a variation between 9,81µm$^2$ (*C. pepo*) to 88,31µm$^2$ (*C. maxima*).

**Table no 2. Variation of nuclear surface ($\mu m^2$) from young fruits of species at *Cucurbitaceae* Family**

| Specia | Min | Max | $\bar{x} \pm Sx$ | $S^2$ | S | S% |
|---|---|---|---|---|---|---|
| *Cucurbita pepo* L. | 11,03 | 67,46 | 34,19 ±1,88 | 178,3 | 13,35 | 39,05 |
| *Cucurbita maxima* Duch. | 19,62 | 88,31 | 35,9 ±2,2 | 243,17 | 15,59 | 43,42 |
| *C. pepo* var. *oblonga* Ser. | 9,81 | 67,46 | 33,73 ±2,04 | 209,03 | 14,45 | 42,86 |
| *Citrullus lanatus* Mans f. | 19,62 | 56,42 | 33,38 ±1,54 | 119,71 | 10,94 | 32,77 |
| *Cucumis sativus* L. | 14,15 | 61,32 | 32,51 ±1,85 | 172,06 | 13,11 | 40,34 |

Statistical analyses have demonstrated as well as microscopic observations the great variability of the nuclear dimensions, length and surface. From the figure 1 result that species of *Cucurbitaceae* have presented the linear, simple regressions, with a significant negative coefficient of correlation between nuclei number (in fragmentation) and diameter fruit growth. The same negative correlations were observed between decreasing of the nuclei frequency and growing diameter fruit.

These observations demonstrated the variability of the nuclei from the analysed tissues during the fruit growth. Although we are able to demonstrate, after flower fecundation, the appearance of certain cytogenetic mechanisms involved in fruit growth process. The processes, which actively participated, were the amitosis and endopolyploidy, thus we are able to explicate the variation of the nuclei dimensions in whole pericarpe tissue and them participation in vascular bundle formation. During the fruit growth in volume and diameter, the density and frequency of the nuclear agglomerations have decrease.

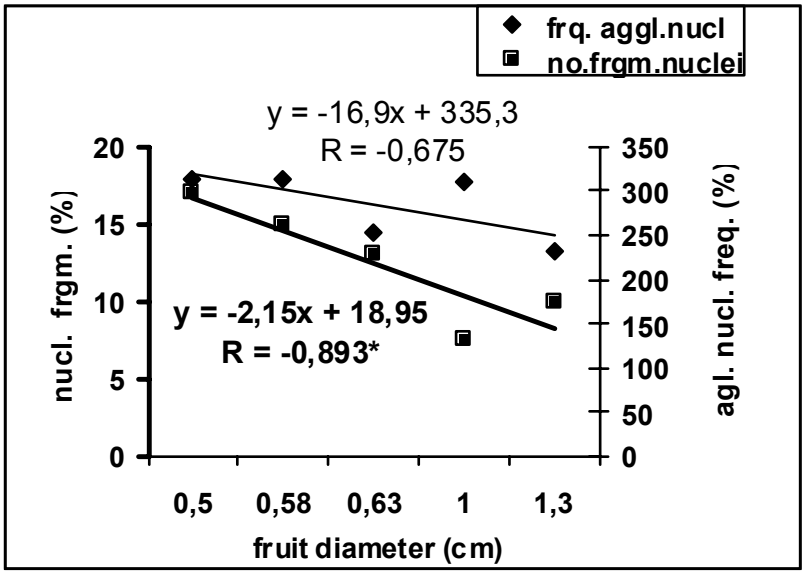
These observations linked with our previous works indicated that amitosis and endopolyploidy have been responsible for the fast fruit growth and tissues differentiation (Nagl, 1976, Gavrilă, 1989, Acatrinei, 1997-2001). Amitosis frequency arrived in a peak after fecundation (7-15 days) while fruit was growing participating to fruit increase (graphic. 1).

## CONCLUSIONS

1. During the plant ontogeny have occurred certain cytogenetic process that activate the fast fruit growth (1,5-2 months) until maturation.
2. Analysing processes involved in fruit growth we were found the amitosis and endopolyploidy actively participating in tissues differentiation as vascular bundles, pericarp, placenta and more.
3. Values of the variation coefficient (S%) concerning nuclear length were between 28,8-39,08% respectively, concerning nuclear surface were between 32,77-43,42%.

4. Statistic analyses have shown the negative correlations significant between nuclei number in fragmentation, and respectively, between frequencies of nuclear agglomeration with fruit diameter growth.
5. The microscopic observations linked with statistic analyses have demonstrated the enlargement of the nuclei (endopolyploidy) and the appearance of the direct divisions (amitosis) after flower fecundation.

**Figure 1-Correlations between fragmentation nuclei percent and respectively between nuclear agglomerations with fruit diameter in *Cucurbitaceae* Family**




Legend: nucl. frgm.= nuclei in fragmentation, frq. aggl. nucl.= frequency of nuclear fragmentation; no. frgm.nuclei= number of fragmentations nuclei

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