Nuclear DNA Contents in Four Primitive Angiosperms

Kurze Mitteilung

By

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Abstract: The basic (2C) nuclear DNA content has been determined for the first time in four primitive angiosperms by means of scanning densitometry of Feulgen-stained nuclei. The mean values obtained are the following: Liriodendron tulipifera L. (2n = 38): 1.58 pg; Magnolia soulangiana SOUL-BOD. (2n = 76): 11.95 pg; Cinnamomum camphora T. NEES (2n = 24): 1.18 pg; Illicium anisatum L. (2n = 28): 6.72 pg. These values do not represent extremes, but rank among low DNA amounts. All species display at least low degree of endopolyploidy.

Recently BENNETT & SMITH (1976) published a review on the nuclear DNA content of all angiosperms studied in this respect. Among them there are, however, no representatives of primitive families. In order to see whether primitive angiosperms display extremely low or high DNA values or not, we investigated four species by scanning densitometry.

Very young leaves were fixed in ethanol/acetic acid for 24 h, Feulgen-stained according to a standard procedure (MÜLLER 1966), and squashed. Permanent slides were made by the dry-ice technique, and the total extinction of telophases, prophase and interphase nuclei determined with a scanning cytophotometer (Leitz MPV-2) interfaced to a computer (Digital Equipment PDP-8). The preparation of the material and the measurements have been made independently by every one of us, using also different standards for the calibration of absolute DNA contents (Phaseolus vulgaris L. cv. Saxa: 1.8 pg; Rheoe discolor L.: 14.4 pg; Allium cepa L.: 33.5 pg; for references see BENNETT & SMITH 1976). The results of the three measurement series were not significantly different, so that the mean of all individual
measurements (transformed into pg values) has been taken to calculate the DNA amounts in the species studied. About 200 data have been collected from each species. Vouchers are preserved in the Herbarium Universitatis Lutrensis (KLU).

The following results have been obtained. The amounts of DNA in nuclei of *Cinnamomum* and *Liriodendron* are very small (respectively 1.18 and 1.58 pg), but do not represent extremely small values; those of *Illicium* and *Magnolia* (6.72 and 11.95 pg) are much higher, but also rank among those of species with rather low DNA contents. The chromosome numbers were checked in all four species and were found to be identical with the numbers given in the literature (Fedorov 1969). The results are summarized in Table 1.

Table 1. Basic nuclear DNA amounts (2 C) and chromosome numbers in four primitive angiosperms

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>DNA Content (pg ± S.D.)</th>
<th>Chromosome Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnoliaceae</td>
<td><em>Liriodendron tulipifera</em> L.</td>
<td>1.58 ± 0.03</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td><em>Magnolia soulangiana</em> SOUL-BOD.</td>
<td>11.95 ± 0.44</td>
<td>76</td>
</tr>
<tr>
<td>Lauraceae</td>
<td><em>Cinnamomum camphora</em> T. NEES</td>
<td>1.18 ± 0.03</td>
<td>24</td>
</tr>
<tr>
<td>Illiciaceae</td>
<td><em>Illicium anisatum</em> L.</td>
<td>6.72 ± 0.28</td>
<td>28</td>
</tr>
</tbody>
</table>

Although we did not especially search for them, nuclei with multiple DNA amounts have been detected in all species. This indicates the occurrence of some kind of endopolyploidization in the developing leaves.

The occurrence in primitive angiosperms of DNA values that are not extremely low is of interest, as very low values are expected on the basis of the general concept of nuclear DNA increase during gross evolution (Rees & Jones 1972, Lewin 1974, Nagl 1976a). The fact that the oldest angiosperms do not have the smallest DNA amounts may be best explained by the suggestion of Ehrendorfer et al. (1968) that most primitive angiosperms are ancient palaeopolyploids, ranging up to 24-ploidy.

The measurement series in all four species revealed the existence of nuclei with multiple DNA amounts in the differentiating region of the young leaves. This evidently indicates the occurrence of endopolyploidy. The highest values found without specific search for have been obtained in *Liriodendron tulipifera* (16C), the species with the lowest DNA content. These findings are consistent with the hypothesis put forward by Nagl (1976b), in that endopolyploidy is under-