| | | |
|---|---|---|
| 39 vs. 40 | t = | 6.024** |
| 39 vs. 41 | t = | 7.980** |
| 39 vs. 42 | t = | 8.887** |
| 39 vs. 43 | t = | 11.250** |
| 40 vs. 41 | t = | 2.839** |
| 40 vs. 42 | t = | 4.599** |
| 40 vs. 43 | t = | 7.692** |
| 41 vs. 42 | t = | 1.817 |
| 41 vs. 43 | t = | 4.800** |
| 42 vs. 43 | t = | 2.819** |

** = significant at 1% level

Since all comparisons between mean chromosome numbers were significant, or nearly significant, it can be concluded that parental chromosome number has a pronounced effect upon that of the following generation, and this factor must be considered in evaluating the causes of sterility in autotetraploids.

Since even the progenies of parents with extreme chromosome numbers did not contain individuals beyond the range of 37 to 44, it is logical to conclude that embryos or gametophytes having numbers (or potentially having numbers) beyond this range are non-viable. It is a necessary corollary that aneuploidy *per se* has an important effect upon seed set in 4n maize.

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2. The effect of structural heterozygosity on the degree of preferential segregation in allotetraploids of Zea (4N *Z. perennis* x 4N *Z. mays*).

Polyploidy has undoubtedly played a major role in the speciation of the angiosperms, and has accounted for at least 30% of the extant forms. According to the most popular current theory, this course of evolution entails production of interracial (or wider) hybrids, doubling these to produce allotetraploids, and then (typically) the process of diploidization is completed by divergent genetic and structural modification of the newly combined genomes, until preferential pairing is essentially complete.

However, it does not appear that the actual effects of a defined structural modification on preferential segregation have been measured in an allotetraploid.

By means of genetically marked maize tetraploid stocks carrying Inversion 3a (obtained from Dr. G. G. Doyle), one can quantitate the effect of this structural rearrangement on segregation of the included linked markers $a_1$ - $lg_2$. These data are shown in Table 2.

Table 2. Gametic output of two allotetraploids of *Zea*, similarly marked, but differing structurally.

| Allotetraploid | "Phenotypes" of gametes | | | | No. of gametes |
|---|---|---|---|---|---|
| | $A_1$-$Lg_2$ | $A_1$-$lg_2$ | $a_1$-$Lg_2$ | $a_1$-$lg_2$ | |
| $a_1$ Inv. 3a $lg_2$<br>$a_1$ Inv. 3a $lg_2$<br>$A_1$ $Lg_2$<br>$A_1$ $Lg_2$ | 95.6% | 0.6% | 0.2% | 3.6% | 2003 |
| $a_1$ $lg_2$<br>$a_1$ $lg_2$<br>$A_1$ $Lg_2$<br>$A_1$ $Lg_2$ | 85.4% | 1.7% | 6.8% | 6.1% | 2146 |

Seg. ratio for $\underline{a_1}$ without inversion = 7.75:1
with inversion = 26.32:1

Seg. ratio for $\underline{lg_2}$ without inversion = 12.82:1
with inversion = 23.81:1

The $X^2$ for the effect of the inversion upon the overall array of gametes is 464.356; P = <.0005.

For the effect of the inversion on segregation of $\underline{a_1}$, $X^2$ = 147.370, P =<.0005.

For the effect of the inversion on segregation of $\underline{lg_2}$, $X^2$ = 36.038, P = <.0005.

It can be concluded that the addition of structural divergence into newly formed allotetraploids would greatly increase preferential pairing and enhance the process of diploidization.

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## 3. Trivalent frequencies in several interspecific hybrids of *Zea*.

Since preferential pairing in polysomics has been used as a measure of phylogenetic relationship, it is of interest to apply this measure among species of Zea. Triploid hybrids were made by crossing 4n *Zea perennis* (perennial teosinte) by 2n *Zea mexicana* (Florida teosinte) and 3 strains of 2n *Zea mays*. Since trivalent pairing in these hybrids is non-preferential, and univalent-plus-bivalent pairing is preferential, one can use trivalent frequency as a measure of the degree of preferential pairing. These frequencies are shown in Table 3.