

It is suggested that programs submitted to such a repository should be freely available for distribution and that the repository agency cannot be responsible for accuracy or correctness of the programs or algorithms. It is further suggested that only 'higher level' languages such as FORTRAN, ALGOL, or PL/1 be accepted.

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1. Analysis of factors controlling chiasmata in maize.

Evidence regarding the genotypic control of chiasmata in maize is provided by (1) differences between inbred lines and (2) the greater genetic rather than the environmental (error) component of variance (Rao, 1966: M.S. Thesis, Orissa University of Agriculture & Technology, Bhubaneswar, India). The genotypic control appears to be exerted by a polygenic system besides the few known major genes. Environment is divisible into at least two major components: (1) general or external environment comprising factors like temperature, nutrition, etc. and (2) special or internal environment to which meiocytes are directly exposed inside the plant body. While appreciable information is available on the action of the first component, much less is known about the contribution, if any, of the second component. One approach to this problem of the internal environment appeared to be offered by the observed asynchrony of PMC division in many lines of maize (Rao, 1966). For example, within individual anthers one could find (1) about half of the PMC's in pachynema-diplonema or earlier stages and half at diakinesis, (2) cells mostly in diakinesis, (3) half in diakinesis and the rest in later stages. In case the groups of anthers provided different extra-cellular environment for the PMC's at diakinesis, any difference in chiasma frequency should lend information about the role of the internal component, i.e. inter-cellular influences. The study undertaken with this objective appeared to reveal the operation of at least two further components of the 'internal environment': one temporal and related to the onset or progress of the stage of division, the other spatial due partly to interaction with the neighboring cells.

Eight inbred lines and three single crosses were taken for the present study. The total number of anthers examined from each line is indicated in Table 1. Chiasma frequency of PMC's at diakinesis was noted in acetocarmine squash preparations. Anthers were grouped into three classes according to the frequency of division stages: (1) about 1:1, diakinesis: early stages, (2) mostly diakinesis, and (3) about 1:1, diakinesis: late stages. For convenience these will be referred to as Groups 1, 2 and 3, respectively.

From the data presented in Table 1, a regular trend may be noted in all inbreds except one (Ext 127). In these there is a decreasing order of

chiasma frequency: Group 1 > Group 2 > Group 3. Contrasted with this trend is the reverse picture in the two hybrids, Ext. 355 X Ext. 357 and Ext. 357 X Ext. 139, in which Group 3 > Group 2 > Group 1. But the trend in the remaining cross (Ext. 139 X Ext. 127) is comparable to that in the inbreds. Further comparison between the hybrids and their inbred parents in case of the two crosses showing the different trend reveals the following: (1) In Group 1 anthers chiasma frequency of the PMC's is higher in the inbreds than the corresponding hybrid, and (2) in Group 3 anthers the chiasma frequency is higher in the hybrid than the parents.

The three groups of anthers represent different stages of development of the anther, Group 1 being slightly early and Group 3 being relatively more advanced in development. Diakinesis in these groups would be correspondingly in the early, middle and late stages. One would then expect to find the changes associated with the progress of the division stage. One important change is terminalization. The observed decrease in chiasma frequency in inbreds may be partly due to terminalization as diakinesis advances. Besides this temporal factor, there must be some other factor(s) affecting observed chiasma frequency. For in the two hybrids, instead of a decrease as expected due to terminalization, there is a consistent increase. Even assuming that there is no terminalization (although some must have occurred as a normal event) in these two hybrids, the excess will still have to be accounted for. Whatever be the cause of this increase, it is apparent that two opposing factors control diakinesis chiasmata-- one reducing the number through terminalization and the other tending to counteract it. Further, the relative effects of the two factors are different in inbreds and hybrids. While the first appears to predominate in most inbreds, it is obscured in some hybrids, in which the second appears to prevail. The rate and/or the degree of terminalization appears to be different in inbreds and hybrids in general.

The exact nature of the second factor can at best be speculated at this stage. The condition in which high frequency of chiasmata is observed would suggest the possibility that the neighboring cells in an advanced stage of division may be exerting an enhancing effect. It is perhaps simpler to view the role of the neighboring cells as negative rather than positive. In case there is any competition between meiocytes for any material limited in quantity but essential for chiasma formation, then PMC's entering into the appropriate division stage later than others may have more chiasmata due to lack of competition. The possible role of such a spatial factor along with the temporal one in controlling chiasma number needs further investigation. Since Group 3 anthers are likely to produce pollen earlier than Group 1 anthers, it may be expected that in many hybrids earlier formed pollen will yield recombinants in a greater frequency than later formed pollen. Whether this would apply to the eggs is doubtful, but perhaps worth exploring.

Table 1
Variation in chiasma frequency at diakinesis in anthers of Groups 1-3 (No. of anthers studied is given inside parentheses)

Line (#1 - #8 are inbred lines)	Anther group based on the frequency of division stages		
	Group 1 (diak. & early stages)	Group 2 (mostly diak.)	Group 3 (diak. & late stages)
#1 Nayagarh	18.73 (4)	18.38 (4)	18.09 (7)
#2 Ext 357	18.40 (2)	17.35 (4)	17.14 (5)
#3 Kenduguda	---	18.75 (4)	17.90 (4)
#4 Ext 139	---	17.38 (4)	17.34 (3)
#5 Jhadgan	18.47 (3)	18.20 (4)	17.50 (1)
#6 Jeypore	18.30 (1)	18.30 (4)	17.80 (3)
#7 Ext 355	19.00 (1)	18.63 (3)	--
#8 Ext 127	18.30 (3)	17.83 (4)	17.97 (3)
#9 Ext 355 X Ext 357	17.80 (1)	19.15 (4)	19.18 (4)
#10 Ext 357 X Ext 139	17.50 (2)	17.58 (4)	17.97 (3)
#11 Ext 139 X Ext 127	19.20 (1)	18.05 (4)	--
All inbred lines (Pooled)	18.52	18.10	17.72
All hybrids (Pooled)	18.00	18.26	18.66

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2. Dissociation of the nucleolus from the organizer site in a few lines of maize.

In the course of a study of the comparative cytology of inbred and hybrid maize particularly in relation to developmental homeostasis, the nucleolus was found to be dissociated from the nucleolus organizer in a few PMC's at diakinesis. The condition was not due to any mechanical damage during squashing, nor could it be considered as a normal situation associated with the late stage of diakinesis. In the PMC's exhibiting this abnormality, the nucleolus was found to be appreciably larger than those in the normal cells in the comparable stage of division. A survey of several local inbred lines and a few hybrids appeared to reveal this abnormality more frequently in the vigorous hybrids rather than inbreds. The frequency of appearance of this condition in different lines has been indicated in Table 1.