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Interphase Nuclear Behaviour of *Triticum-Hordeum* Hybrids

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Abstract: The present study was carried out for making a keen observation on interphase nuclei of F_1s and their respective parents. Mean values for chromocentre number were found to be higher that of their respective *Hordeum* parents and but lower than that of their *Triticum* parents. The number of chromocentres were always less compared to their chromosome number in all the F_1s. The percentage of heterochromatin per nuclear area in different hybrids ranged from 24.69% (*H. nudum* × *T. durum*) to 28.38% (*T. aestivum* × *H. nudum*). Nuclear Volume (NV) and Interphase Chromosome Volume (ICV) were found to be proportionally related the number and size of chromosomes. Mean values for Interphase Chromosome Volume (ICV) in the hybrids were found to decrease when compared to *Triticum* species but increased when compared to *Hordeum* species.

Key words: Intergeneric hybrids, interphase nuclear behaviour

INTRODUCTION

The genetic consequence of intergeneric hybridization is one of important subject matter for cytogenetical research. Nuclear behaviour such as heterochromatin percentage, DNA content or DNA synthesis, genome differentiation or identification of genome involving *Hordeum* and *Triticum* species has been specific for particular varietals or species combinations. The decrease of pairing of both wheat and barley homologous chromosome in addition and substitution lines is a complex process in which factor such as genes controlling meiotic pairing, constitutive heterochromatin and cryptic Wheat-barley interactions can play important roles. Barley chromosomes were subsequently eliminated. This system has potential for Wheat haploid production (Dayal, 1975; Dayal and Prasad, 1983) mentioned that the number of chromocentre is considered to be genetically controlled indicating it is a species-specific character. Effect of variation in heterochromatin content on pairing in intergeneric hybrids has already been suggested in *Hordeum* × *Secale* and *A. crassa* × *Secale* hybrids (Gupta and Fedak, 1985a, b). The reduction in the number of chromocentres in all the hybrid might be due to overlapping of chromocentres indication the somatic association of chromosomes. The variation in the proportion of heterochromatin can serve as an indication of differential DNA replications (Nagl and Fusening, 1979). In this study the interphase Nuclear behaviour was considered characters in several *Triticum-Hordeum* hybrids.

MATERIALS AND METHODS

The experiment was conducted Prof. S. Alam Cytogenetics Laboratory, Department of Botany, Rajshahi University, Rajshahi Bangladesh in the year of 2002-2003. The materials used for the present study were two wheat (*Triticum*) species and two barley (*Hordeum*) species and their F_1 hybrids. A very few crossed seeds along with that of their respective parents were used.

In order to study the interphase nuclear behaviour hybrid seeds along with that of their parents were allowed to germinate in petridish over moist filter paper at room temperature (22-24°C). Root tips of 1.0-1.5 cm. lengths were collected from 8.0 to 10.0 am and were fixed in 1:3 aceto-alcohol for 48 h at room temperature (22-24°C). Then they were transferred to 70% ethanol and stored in a refrigerator till used. The preserved root tips were stained using Haematoxylin. The meristematic zones of the stained root tips were squashed in 0.5% acetocarmine on a clean slide and the meristematic cells were covered with a cover glass. Then heat-cool and pressures technique was applied until almost all the cells were scattered in all directions.

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Nuclear volume of the cells was measured by oculometer and converted in to micron with the help of stage micrometer. The Nuclear Volume (NV) was calculated using the formula of a sphere, $NV = 4/3\pi r^3$ (Nayer *et al*., 1971). The mean nuclear volume divided by the somatic chromosome number gave the Interphase Chromosome Volume (ICV) as mentioned below:

ICV = $4/3\pi r^3$/ Somatic chromosome number (in case of parents) In case of hybrids × values for different somatic chromosome numbers were used as follows:

$$ICV = \frac{4/3pr^3}{1+2+3.....+n = \overline{X}}$$

Number of chromocentre and heterochromatin percentage:- chromocentres were counted from the temporary prepared slides under microscope and photomicrographs were taken from desired preparations. As chromo centers correspond to heterochromatin (Nagl and Fusening, 1979) percentage of heterochromatin values were obtained statistically by determining the area of nucleus and of chromocentres by plainmetry. The heterochromatin values were expressed as percent nuclear area as follows:-

Heterochromatin% = chromocentre area / nuclear area x 100

RESULTS

The F_1 hybrids along with their parents obtained from different crosses of wheat and barley were studied for the diameter of interphase nuclei, number of chromo center, heterochromatin percentage per nuclear area, Nuclear Volume (NV) and Interphase Chromosome Volume (ICV) were determined and the results are given in Table 1. Interphase nuclei in different F_1s are presented in Fig. 1A-E.

The number of chromocentres in different crosses were found to vary and the values ranged from 15.7 (*T. durum* × *H. nudum*) to 22.30 (*T. aestivum* × *H. nudum*). In general the mean values for number of chromocentre in all the hybrids were found to be higher than their *Hordeum* parents but lower than that of their *Triticum* parents. Moreover, all the hybrids showed the number of chromocentres less than the expected chromosome number. In all the parents the chromocentre numbers were also less than the observed chromosome number. The present results indicated that the heterochromatin percentage per nuclear area at different hybrids were found to vary differentially and it was range from 24.69 (*H. nudum* × *T. durum*) to 28.38 (*T. estivum* × *H. nudum*). The findings revealed that the mean values for heterochromatin percentage per nuclear area in all the crosses were found to be lower than that of their parents except *T. durum* and *H. nudum* × *T. aestivum.* It was noticeable that the differences between heterochromatin values among the hybrids along with their parents were not prominent.

The nuclear volume of different crosses were found to vary differentially and it was range from 31.60 ((*T. durum* × *H. vulgare*) to 53.85 μm (*H. vulgare* × *T. aestivum*) in the hybrids. The present results also revealed that the mean values for Nuclear Volume (NV) of all the crosses were found to be higher than that of their barley parents but lower than their wheat parents. It was also indicated that the crosses *H. vulgare* × *T. durum*, *T. aestivum* × *H. nudum*, *T. durum* × *H. nudum* and *H. nudum* × *T. durum* were found to be differed but the variations were not remarkable.

The Interphase Chromosome Volume (ICV) in different crosses varied differentially and the values ranged from 1.73 (*T. aestivum* × *H. nudum*) to 2.18 μm (*H. nudum* × *T. durum*). The Table 1 also reveals that

Table 1: Interphase chromosome volume of both *Triticum-Hordeum* species and their F_1 hybrids

Name of species/lines	No. of expected chromosome 2n	Observed chromosome range 2n	No. of chromo-centre x̄±SE	Hetero chromatin presentage per nuclear area x̄±SE	Occular values for interphase nuclei x̄±SE	$NV=4/3\pi r^3$ x̄±SE	Interphase chromosome volume ICV=NV / 2n/mean range values x̄±SE
Triticum æstivum (*T. a.*)	42	42	34.5±0.833	28.07±1.43	5.73±0.203	112.20±2.518	2.67±0.058
Triticum durum (*T. d.*)	28	28	22.50±0.898	26.09±1.23	4.81±0.212	57.73±2.138	2.06±0.076
Hordeum vulgare (*H. v.*)	14	14	10.40±0.400	28.14±1.11	3.46±0.182	21.62±1.10	1.54±0.801
Hordeum nudum (*H.n.*)	14	14	10.20±0.290	28.05±0.737	3.44±0.109	21.25±1.23	1.51±0.103
T.a × *H.v.*	28	24-28	21.11±0.556	27.39±1.08	4.44±0.126	45.68±0.837	1.75±0.030
H.v × *T.a.*	28	23-28	16.20±0.592	26.73±0.759	4.69±0.180	53.85±1.16	2.11±0.404
T.a × *H.n.*	28	24-28	22.30±0.615	28.38±0.468	4.42±0.092	45.07±0.637	1.73±0.97
H.n. × *T.a.*	28	22-28	17.00±0.470	26.42±0.780	4.47±0.083	46.51±1.19	1.86±0.043
T.d. × *H.v.*	21	15-21	16.20±0.592	26.73±0.092	3.93±0.063	31.60±0.833	1.75±0.040
H.v. × *T.d.*	21	17-21	21.40±0.872	26.15±0.635	4.17±0.092	37.76±0.637	1.98±0.970
T.d. × *H.n.*	21	16-21	15.70±0.597	25.04±0.442	4.07±0.99	35.10±0.565	1.89±0.026
H.n. × *T.d.*	21	17-21	15.80±0.629	24.69±0.628	4.30±0.132	41.50±0.69	2.18±0.043

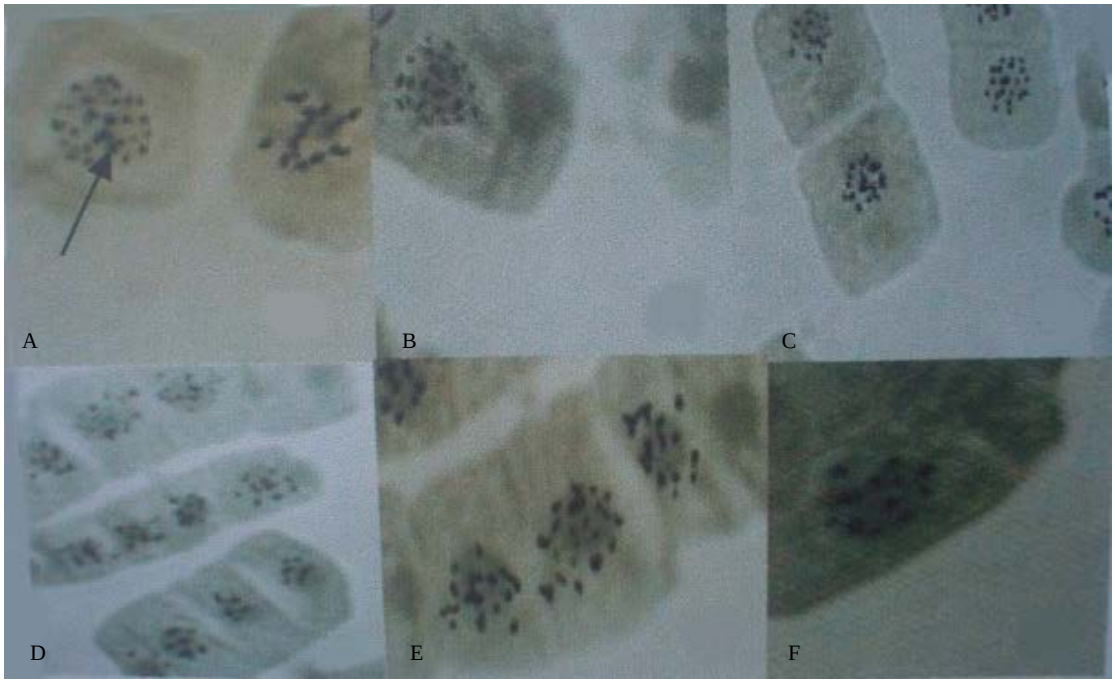

Fig. 1A-F: Representative plate of interphase nuclei in root tip cells of F1s of wheat and barley crosses. A. *T. aestivum* × *H. vulgare*. B. *T. aestivum* × *H. nudum*. C. *H. vulgare* × *T. aestivum*. D. *H. nudum* × *T. aestivum*. E. *T. durum* × *H. vulgare*. F. *T. durum* × *H. nudum*

mean values for Interphase Chromosome Volume (ICV) in all most all the crosses were higher than their barley parents but lower than their wheat parents, except the hybrid of *H. nudum* and *T. durum*. and I × *T. aestivum*. In this cases the values for ICV were higher than that of *T. durum* (2.06).

DISCUSSION

Lafontaine (1974) stated that the structural organization in plant cell nuclei are two types, chromocentric and reticulate. In the present study interphase nuclei of meristametic cells of wheat-barley hybrids and their respective parents were found to be reticulate. Interphase nuclear phenotype of different hybrids studied from their root tip cells in the present investigation were found to vary among them and also from that of their respective parents. Mean values for number of chromocentres were higher than that of their *Hordeum* parent and lower than that of their *Triticum* parent. Besides, in all the hybrids number of chromocentres were not found to be equal to the expected chromosome number, even the values were less than the observed chromosome number in most of the cases. Similar results were found in case of all the parental species also. Number of chromocentres were always less compared to their chromosome number. The reduction in the number of chromocentre in all the hybrids and their parents might be due to fusion, or overlapping of chromocentres. In addition, particularly in hybrids this might be due to positively less and irregular appearance of chromosome number. However, in parental species the reduction of chromocentres indicates the proper association of somatic chromosomes. On the contrary, the less chromocentre numbers in all the hybrids do not indicate somatic association of the chromosomes. However, Samad *et al.* (1992) reported that chromocenter numbers in two species of *Corchorus* and their hybrids were more or less same, which were, however, found to reduce than the expected number of chromosome. As chromocentres correspond to heterochromatin (Nagl and Fusening, 1979) heterochromatin values were determined by planimetry and were expressed as percent number area. The values for heterochromatin per nuclear area in different hybrids varried differentially and ranged from 24.69% (*T. durum* × *H. vulgare*) to 28.35 (*H. nudum* × *T. aestivum*). The heterochromatin values were always found to less than their respective parent. Samad *et al.* (1992) found heterochromatin values in F_1 to be closer to the male parent of *Chorchorus*. While studying Nuclear Volume (NV) and Interphase Chromosome Volume (ICV) in four parents of *Triticum*

and *Hordeum* and their hybrids, both NV and ICV were found to be dependent and proportionally the number and size of chromosomes. The number and size of *Triticum* chromosome are always more than that of *Hordeum* and thus, both NV and ICV of *Triticum* species were more compared to those of *Hordeum* species. However, mean values for Interphase Chromosome Volume (ICV) in the hybrids were found to decrease compared to *Triticum* species but increased when compared to *Hordeum* species. The increased ICV might be due to the higher number and also size of the chromosomes in the F_1 compared to that of *Hordeum* species. The effect of the hybrid condition on *H. vulgare* chromosomes was the formation of wider nucleolar constrictions and larger Nucleolus Organizer Regions (NORs) than in parental *H. vulgare*, suggesting a compensational mechanism for nucleolus activity.

REFERENCES

Dayal, N., 1975. Genotypic control of chromocentres in Radish, *Raphanus sativus* L. var. *radicola* Pers. Cytolgia, 28: 429-435.

Dayal, N. and C. Prasad, 1983. Genetic regulation of chromocentres in Radish. *Raphanus satitvus* L. Cytologia, 48: 245-252.

Gupta, P.K. and G. Fedak, 1985a. Hybrids of *Hordeum californicum* and 2x *H. brevisubulatum* S. I. with *Agropyron caninum* Can. J. Genet. Cytol, 27: 380-386.

Gupta, P.K. and G. Fedak, 1985b. Meiosis in seven intergeneric hybrids between *Hordeum* and *Secale*. Z. zflanzenzuecht, 94: 262-273.

Lafontaine, J.G., 1974. In: Busch, H. (Ed). The Cell Nucleus. Vol. I. Acad. Press New York, London, 1: 149-185.

Nayer, G.G., K.P. George and A.R. Gopal Ayengar, 1971. The relationship between cytological abnormalities and interphase chromosome volume in plants growing in a high radiation area. Radiation Bot., 11: 175-178.

Nagl, W. and H.P. Fusening, 1979. Types of chromatin organization in plant nuclei. Plant Syst. Evol. Suppl., 2: 221-233.

Samad, M.A., G. Kabir and A.S. Islam, 1992. Chromosome banding in two species of *Corchrus* and their F_1 hybrid. Bangladesh J. Bot., 21: 113-117.