WIDE HYBRIDIZATION IN THE GENUS BRASSICA. I. B.TOURNEFORTIIxB.CAMPESTRIS AND B.NIGRAxB.ALBOGLABRA

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Abstract

Interspecyfic F_1 hybrids between B.tournefortii /TT; 2n=20/ and B.campestris /AA; 2n=20/,and between B.nigra /BB; 2n=16/ and B.alboglabra /CC; 2n=18/ were developed. The AT hybrid was intermediate in morphology whereas BC resembled the natural amphiploid B.carinata /BBCC/.Meiotic studies revealed a maximum of three bivalents, with a mean bivalent frequency of 0.62 in AT hybrid and five bivalents with a mean bivalent frequency of 1.27 in BC hybrid. Anaphase distribution was irregular ending in aberrant meiotic products. No seed setting could be obtained in BC hybrid even after repeated backcrossing, selfing and crossing with natural B.carinata /BBCC/ plants. Colchicine treatment leading to amphiploid sectors and seeds fertility, was successful only on AT hybrid. Meiotic studies of the amphiploid sector revealed 1IV + 16II at metaphase I which indicates the presence of one allopair in AT hybrid and thus partial homology between one A and T chromosome pair.

Introduction

Since the genomic characterization of Brassica species /U, 1935/, a large number of artificial hybrids involving various monogenomic species have been produced. While a majority of studies aimed at cytological analysis, synthetic amphiploids were produced in few cases. Some synthetic B.napus and B.juncea amphiploids have, in fact, been utilized in crop improvement work in India /Prakash,1980/. The present study was initiated to produce new amphiploids between B.tournefortii /TT; 2n=20/ and B.campestris /AA;

2n=20/ and between B.nigra /BB; 2n=16/ and B.alboglabra /CC; 2n=18/.

Material and methods

Interspecific hybrids were developed through prickle pollination of tournefortii and nigra with pollen of campestris and alboglabra respectively. GA_3 /50 ppm/ was applied twice on the pollinated buds to enhance the seed setting. The F_1 seedlings were raised in pots and later transferred to the field. Potential hybrid plants were examined cytologically. Colchicine was applied on the meristematic regions of the hybrid plants to induce amphiploidy.

Results

B.tournefortii x B.campestris: Twenty three seeds resulted from 1175 prickle pollinated buds. Out of sixteen plants which grew to the adult stage, nine were hybrids and the rest were matromorphs. The somatic chromosome number in all hybrid plants was 20. The plants were intermediate in morphology, flower colour /pale yellow/ and size but shape was more like that of B.tournefortii flowers. Anthers were smaller in size and had less pollen than that in the parents. Pollen fertility ranged from 23-45 per cent, the mean being 30 per cent. Seed setting on open pollination and crossing with either of the parents was low /0.25 per cent/. The chromosome pairing at metaphase and diakenensis /Table 2/ revealed 14 to 20 univalents and a maximum of three bivalents /Plate 1a-c/ with a mean bivalent frequency of 0.62. The overall frequencies of PMC's having zero, one, two and three bivalents were 62, 18, 7, 14.4 and 4.8 per cent, respectively.
The anaphase distribution was irregular with frequent occurrence of laggards.

B.nigra x B.alboglabra: Only one hybrid plant resulted from 1661 prickle pollinated buds of B.nigra with B.alboglabra pollen /Table 1/. The hybrid /BC/ plant was white flowered like paternal parent but resembled natural B.ca-

rinata /BBCC/. Both male as well as female fertility was extremely low. Despite repeated pollinations with parents or with B.carinata and application of GA_3, no seed set could be induced. The number of bivalents per PMC ranged from 0 to five /Plate 1d-f/. About 44 per cent of PMC's examined had exclusive occurrence of univalents /Table 2/. The mean bivalent frequency was 1.27.
The chromosome distribution at anaphase was irregular.

Discussion

The occurrence of bivalents at meiosis in F_1 hybrids of different genomes can result from allo- or auto- pairing. Mizushima /1968/ reported a maximum of four bivalents in his hybrid B.tournefortii x B.campestris as against three observed in the present study. The cytological analysis of the amphiploid sector /colchicinated/ of the hybrid in this study revealed 1IV + 16II at M_1, indicating the occurrence of at least one allopair. This is in conformity with the report of Fukushima and Iwasa /1966/.

A maximum of four autopairs are possible in the second cross as two autopairs each have been reported in haploids of B.nigra and B.oleracea /Thompson, 1956; Prakash, 1973/. B.alboglabra is a sub species of B.oleracea. Thus at least the fifth bivalent observed in the present study is an allopair, their number in fact may be more as Muzushima /1968/ has reported allosyndetic pairing in the four bivalents observed in his hybrid between B.nigra and B.oleracea. This indicated that there are few homeologous regions in few chromosomes belonging to B and C genomes where chiasma formation is possible.

The new amphiploid between B.tournefortii and B.campestris is important in Brassica breeding programme as B. tournefortii is known for its tolerance to aphids and water stress.

Acknowledgements

The authors are grateful to Dr C.Gomez-Campo, Universidad Politecnia, Madrid, Spain for supplying the seeds of B.tournefortii and B.alboglabra.

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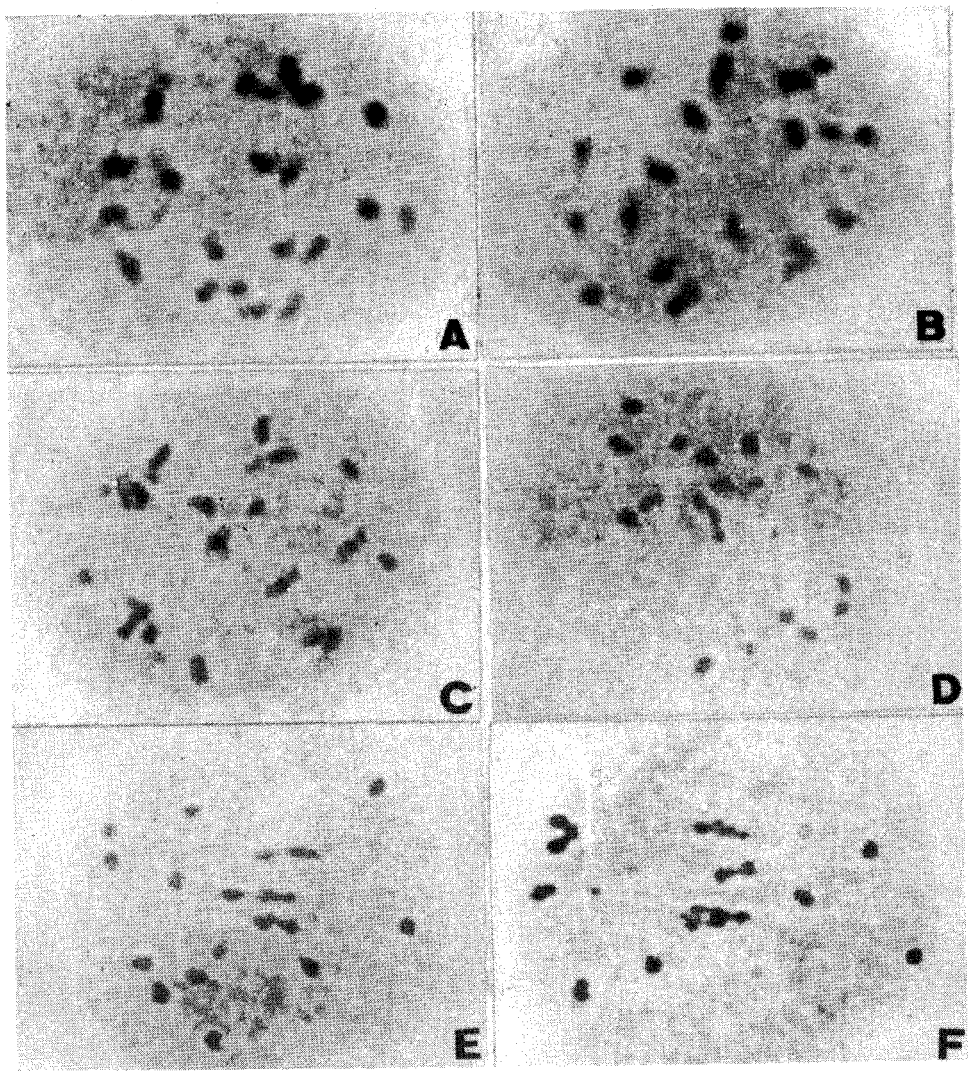

Plate-1. Pollen mother cells at meta-anaphase-1 in interspecific hybrids: B.tournefortii x B.campestris; A.20 I, B.18 I + 1 II, C.14 I + 3 II; B.nigra x B. alboglabra; D.15 I + I II, E. 11 I + 3 II, F.7 I + 5 II

Table 1. Results of interspecific cross pollination in Brassica

Cross	No. of flowers pollinated	Total seed set	No.of seeds germinated	No.of surviving plants	Number of true hybrids
B.tournefortii x B.campestris	1175	23	16	11	9
B.nigra x B. alboglabra	1661	9	3	2	1

Table 2. Bivalent frequencies and pollen fertility of the two interspecific F_1 hybrids

Cross	Number of bivalents per cell							Mean pollen fertility/%/
	5	4	3	2	1	0	Mean	
B.tournefortii x B.campestris	0	0	8 /4.8/	24 /14.4/	31 /18.7/	103 /62.0/	0.62	38
B.nigra x B. alboglabra	6 /2.1/	18 /6.3/	38 /13.3/	47 /16.5/	51 /17.9/	125 /43.9/	1.27	3

Figures in parentheses indicate per cent frequencies