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Jinfeng Yun

*Inner Mongolia Agricultural University, China*

Jianhua Hou

*Inner Mongolia Agricultural University, China*

Zhuo Yu

*Inner Mongolia Agricultural University, China*

Zaozhe Li

*Inner Mongolia Agricultural University, China*

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## Developing new germplasm by wide hybridization within Triticeae grasses

Yun Jinfeng , Hou Jianhua , Yu Zhuo , Li Zaozhe

Inner Mongolia Agriculture University , Hohhot , Inner Mongolia 010018 P . R . China .

E-mail xsgrass@vip .163 .com

**Key words** : Triticeae grasses , interspecific and intergeneric hybrids , fertility restoration

**Introduction** Wide cross is an effective method of breeding new varieties of forage . For years , the interspecific and intergeneric hybridization of *Agropyron* , *Elymus* and *Leymus* were conducted , according to the principles of complementarities between advantages and disadvantages and still maintaining great ecotypical difference between parents . Many F<sub>1</sub> hybrids from these crosses were highly sterile . In this study , the sterility reasons and the breeding value of fertility restoration of hybrids were studied . Parents , F<sub>1</sub> hybrid and the progeny of restored fertility parents were compared using morphological , production performance , physiological and biochemical , cytogenetical and molecular genetic parameters . Chromosome stability and seed set on the progeny of fertility restored plants were discussed so as to establish the basis for wide cross breeding .

**Materials and methods** The materials and main combinations are listed in Table 1 . Artificial emasculation , bagging and pollination were conducted . Seedlings of F<sub>1</sub> hybrid were obtained from germinated seeds without the aid of embryo culture . The fertility was restored through selfing of the backcrosses and by induced chromosome doubling using Colchicine ( 0 . 15% - 0 . 20% ) on plantlets and callus of immature inflorescence of F<sub>1</sub> hybrids . Phenology , growth potential , tillering , regrowth and plant weight of the parents and their hybrids were measured . Spikes collection , fixation and staining were used for cytological analysis by the conventional method . The analysis using RAPD , AFLP molecular markers and in situ hybridization of genome were done .

**Table 1** Materials and main combinations of wide-hybridization .

	Hybrid	Genome constitution	Chromosome No .	Origin
Interspecific crosses	<i>Agropyron mongolicum</i> × <i>A . cristatum</i>	PP × P <sub>1</sub> P <sub>1</sub>	14 × 14	China × North American
	<i>Elymus canadensis</i> × <i>E . sibiricus</i>	SSHH × SSHH	28 × 28	North Ame . × China
Intergeneric crosses	<i>Elymus canadensis</i> × <i>Hordeum brevisubulatum</i>	SSHcHc × HHH' H'	28 × 28	North Ame . × China
	<i>Elymus dahuricus</i> × <i>Hordeum brevisubulatum</i>	SdSdHdHdYY × HHH' H	42 × 28	China × China

**Results** The chromosome pairing was irregular in all F<sub>1</sub> hybrids , and bivalents frequency was low , whereas univalents and multivalents frequency were high , such as 7 . 94 I + 10 . 95 II + 1 . 52 III + 0 . 151 V ( *E . dahuricus* × *H . brevisubulatum* ) . The amount of stainable pollen was very low and all F<sub>1</sub> hybrids did not set seed under open pollination conditions . The bivalents frequency , stainable pollen and seed set in the original doubled hybrids of *E . canadensis* × *H . brevisubulatum* , were 20 . 96 , 84 . 97 and 77 . 57% , respectively . Comparing BC<sub>1</sub> F<sub>3</sub> with the BC<sub>1</sub> generation of ( *E . dahuricus* × *H . brevisubulatum* ) × *H . brevisubulatum* , we observed that the chromosome number was stabilized , tending to 28 , and the mean univalents frequency was decreased from 4 . 32 to 0 . 31 , the mean bivalents frequency , were increased from 12 . 59 to 13 . 38 , stainable pollen from 29 . 9 to 59 . 06% and seed sets from 4 . 1 to 21 . 72% . Furthermore , genome in situ hybridization identification illustrated that there were chromosome or chromosome segments of *Elymus dahuricus* in BC<sub>1</sub> F<sub>4</sub> . The genetic similarity coefficients ( GSC ) among 70 C<sub>1</sub> plants of doubled hybrids ( *E . canadensis* × *E . sibiricus* ) marked by RAPD were 1-0 . 286 ; the GSC of 12 C<sub>0</sub> plants of doubled hybrids ( *E . canadensis* × *H . brevisubulatum* ) marked by AFLP were 0 . 43 ~ 0 . 61 . There was significant differences among the progeny lines of backcrosses and doubled hybrids regarding growth potential , tillering , regrowth , plant weight and resistance to drought and salt .

**Conclusions** The interspecific and intergeneric F<sub>1</sub> hybrids were sterile , caused mainly by irregular meiotic behavior . Backcrossing and induced chromosome duplication in hybrids successfully restored the fertility of F<sub>1</sub> hybrids . The chromosome number became more stable and chromosome-pairing behavior at PMC became more regular in advanced generations . There is extensive genetic variation among the progeny lines of backcross and doubled hybrids , therefore providing with considerable breeding value .

### References

- Dewey , D . R . 1984 . Wide hybridization and induced polyploid breeding strategies for perennial grass of the Triticeae tribe . *Iowa Jour . Res .* , 58 : 283-399 .
- Richard , R . C . 1990 . Chromosome doubling by colchicine treatment following inflorescence culture of perennial Triticeae hybrids . *Proceedings of the Second International Symposium on Chromosome Engineering in Plants* . Aug . 13-15 , Columbia , Mo . pp . 218-222 .