TABLE I

Meiosis in some hexaploid triticale strians

Strain	Metaphase I		Anaphase I		Telophase II	
	% irregular cells	univalents/ pmc	% irregular cells	laggards/ pmc	% irregular cells	micronuclei/ pmc
JNK 6T002	46·0	1·1 (0–6)*	57·3	1·1 (0–7)	52·0	0·8 (0–4)
JNK 6T007	42·7	1·3 (0–8)	43·3	1·2 (0–8)	84·0	3·2 (0–8)
JNK 6T012	45·8	1·1 (0–6)	56·7	1·7 (0–6)	61·1	1·5 (0–6)
JNK 6T039	42·2	1·1 (0–6)	76·7	1·4 (0–6)	55·6	1·8 (0–5)
JNK 6T059	24·0	0·5 (0–6)	25·5	0·4 (0–3)	47·8	0·9 (0–4)
JNK 6T090	29·3	0·8 (0–6)	23·3	0·3 (0–4)	61·3	1·4 (0–5)
BRONC090	46·0	1·2 (0–8)	78·9	1·8 (0–9)	47·3	0·9 (0–4)

* Values in parenthesis indicate range of irregularity.

Hexaploid triticale strains ($2n = 6x = 42$) namely, JNK 6T002, JNK 6T007, JNK 6T012, JNK 6T059, JNK 6T090 and Bronce 90 were examined for meiotic stability. The floral buds were fixed in Cornoy's fluid (6 parts absolute alcohol : 3 parts chloroform : 1 part acetic acid) at appropriate stage and were subsequently squashed in 2% acetocarmine. Thirty cells were analysed from each plant and five plants were screned from each strain. Meiotic abnormalities such as univalents at metaphase I, lagging chromosomes at anaphase I and micronuclei at telophase II were recorded and are presented in Table I.

Meiosis in all the strains studied is irregular. In some cases the frequency of lagging chromosomes at anaphase I is higher than that of univalents at metaphase I. Sometimes univalents at anaphase I are also seen dividing into chromatids. This may result in the increased frequency of micronuclei as is observed in some cases.

The irregular cell division is supposed to be due to lack of compatibility in parental genomes of triticale[4,5] due to different cell cycles[6–8] or due to heterochromatin associated with rye chromosomes[9–10] and is polygenically controlled[3]. The per cent irregular cells can be taken as a measure of instability. As its value shows variation, different triticale strains have achieved varying degrees of stability.

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1. Hulse, J. H. and Spurgeon, D., *Scientific American*, 1974, **231**, 72.
2. Tsuchiya, T. and Larther, E. N., *Euphytica*, 1971, **20**, 591.
3. Merker, A., *Hereditas*, 1973, **73**, 285.
4. Yashvir and Gupta, P. K., *Biology and Plants*, 1972, p. 259.
5. Kempanna, C. and Seetharam, A., *Cytologia*, 1972, **37**, 327.
6. Bennett, M. D., Chapman, V. and Riley, R., *Proc. Roy. Soc. Lond.*, 1971, p. 259.
7. — and Kaltsikes, P. K., *Can. J. Genet. Cytol.*, 1973, **15**, 671.
8. Shkutina, F. M. and Khvostova, V. V., *Theoret. Appl. Genet.*, 1971, **41**, 109.
9. Merker, A., *Hereditas*, 1976, **63**, 215.
10. Roupkias, D. G. and Kalsikes, P. J., *Can. J. Genet. Cytol.*, 1977, **19**, 543.

TRANSFORMATION OF STREPTOMYCIN RESISTANCE IN *RHIZOBIUM* AND *AZOTOBACTER*

THOUGH there have been many reports on the intraspecific and interspecific genetic transformation in *Rhizobium*[1–3], reports on the intergeneric transformation between *Rhizobium* and *Azotobacter* are scarce[4] and require furthor confirmation[5]. The present communication deals with the transfer of streptomycin resistance in *Rhizobium cowpea*, transformation between *Rhizobium cowpea* and *Rhizobium japonicum* and between *Rhizobium cowpea* and *Azotobacter chroococcum*.

Preparation of complex and competence media for growth and development of competence for *Rhizobium* and intraspecific and interspecific transformation in *Rhizobium* were done as per the method given by Raina and Modi[1]. For growing streptomycin resistant mutant and screening transformants, streptomycin was added at the concentration of 1000 μg^{-ml} to the complex media. DNA was extracted[6] from *R. cowpea* Str. + grown on complex medium with streptomycin for 24 h. The isolated DNA dissolved in sterile saline citrate (0·15 M NaCl and 0·015 M sodium citrate pH 7·0) and preserved over a layer of chloroform at 0° to 4° C, was used for transformation experiments. The concentration of DNA was estimated by the diphenylamine reaction[7]. For intergeneric transformation, *A. chroococcum* grown on Waksman 77 broth for 45 h was used as the recipient culture. Cells were washed with sterile distilled water and resuspended in fresh medium at a concentration of 10^6 $cells^{-ml}$. The transformant mixture contained 0·5 ml of this cell suspension and 0·5 ml of donor DNA (50 μg^{-ml}). Receipient cells and DNA were incubated for 30 min at 30° C in a rotary shaker, after which period, DNase (100 μg in 10^{-3} M $MgCl_2$) was added and further incubated for another 30 min. After suitable dilution, plating was done on Waksman 77 agar medium and incubated for 48h and the colonies were counted. Appropriate platings were done for total count, transformants and contols.

TABLE

Transformation frequency of streptomycin sensitive recipients

Recipient culture	Frequency of Transformation
Rhizobium cowpea Str⁻	0·04–0·08%
Rhizobium japonicum Str⁻	0·002–0·006%
Azotobacter chroococcum Str⁻	0·00001–0·0001%

Donor DNA from *Rhizobium cowpea* Str^+.

The frequency of intraspecific transformation appears to be the same as that of the one, reported by Raina and Modi for the same marker in *R. japonicum*[8]. The frequency is low in interspecific transfer and it is still lower in the intergeneric transfer (Table). Despite repeated attempts, we could not obtain the high value of frequency reported by Sen *et al.*[4] for intergeneric transfer of streptomycin resistance between *Rhizobium* and *Azotobacter*. Perhaps the short life of competence and the progressive inactivation of the transformable DNA may be the causes for lower frequency in intergeneric transformation observed in the present study[9].

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1. Raina, J. L. and Modi, V. V., *J. Gen. Microbiol.*, 1969, 57, 125.
2. Balassa, R., *Nature*, 1960, 188, 246.
3. Gadre, S. V., Mazumdar, L., Modi, V V. and Parekh, V., *Archiv fur Mikrobiologie*, 1967, 57, 338.
4. Sen, M., Pal, T. K. and Sen, S. P., *J. Microbiol, Serol.*, 1969, 35, 533.
5. Brill, W. J., "Genetics of N_2-fixing organisms," In *The Biology of Nitrogen Fixation* (edited by A. Quispel), North Holland Publishing Company, Amsterdam, 1974, p. 639.
6. Marmur, J., *J. Molec. Biol.*, 1961, 3, 208.
7. Giles, K. W. and Meyers, A., *Nature*, 1965, 206, 93.
8. Raina, J. L. and Modi, V. V., *J. Bacteriol.*, 1972, 111, 336.
9. Doctor, F. and Modi, V. V., "Genetic transformation in *Rhizobium japanicum*," In *Symbiotic Nitrogen Fixation in Plants* (edited by P. S. Nutman), Cambridge University Press, 1975, p. 69.

INDUCTION OF TENDRIL MUTATIONS IN LENTIL (*LENS CULINARIS* MEDIC.)

DRY seeds of the lentil variety L-235 were treated with 6 and 10 kR doses of Co^{60} gamma rays and 0·005 and 0·01%. N-nitroso-N-methyl urea (NMU). M_2 progenies were raised from M_1 seeds for screening various mutations. A progeny in 6 kR and 3 progenies in 0·01% NMU treatment segregated for tendril mutations in M_2 generation, which had similar phenotypic expression. The mutation was named as Tendril-1. Another mutation, which was slightly similar to the first one, was isolated when normal M_2 progenies of 0·01% NMU treatment were grown in M_3 generation. This mutation was designated as Tendril-2. The characteristics and the inheritance of the two types of mutations are presented.

Tendril-1 : The stem and branches were smooth, wiry and prostrate. The lanceolate leaflets showed modifications for shape, size, number and tendrils. The modified characteristics are not conspicuous at