J Indian bot Soc Vol 72 (1993) 149-150

TRANSFER OF *SECALE CEREALE* DERIVED LINKED RUST RESISTANCE GENE COMPLEX SR 31 + LR 26 + YR 9 INTO INDIAN WHEAT CULTIVARS

V.R.K. REDDY*, R.N. BRAHMA AND R. ASIR

Directorate of Wheat Resarch, Regional Station, Wellington, The Nilgiris- 643 231

** Cytogenetics Laboratory, Deptt. of Botany, Bharathiar University, Coimbatore - 641 046.*

(Accepted January 1993).

Secale cereale derived linked gene complex Sr 31+Lr 26 + Yr 9 was successfully transferred from donor CIMMYT wheat variety Veery `S' into Indian wheat cultivars Kalyan Sona and Unnath Kalyan Sona. Hybrid derivates showed complete resistance to all the three rusts in field condition at Wellington. It was concluded that the stem rust resistant gene Sr 24 is ineffective while both leaf rust resistant genes Lr 24 and Lr 26 are equally effective in the studied materials.

Key Words: Wheat, Rust resistance.

Genes for resistance to one pathogen do not provide resistance to the other pathogen. Therefore, to develop resistance to more than one rust, it is necessary to incorporate resistance to each separately. However, exceptions are there, where two genes responsible for providing resistance to two pathogens inherited together because of their close linkage. Transfer of such linked genes not only provides simultaneous protection to more than one rust pathogen but can also help in the analysis as marker when transfer of completely effective genes to a specific pathogen is to be confirmed. The present communication reports the results of transfer of *secale cereale* derived linked gene complex Sr 31 + Lr 26 + Yr 9 from CIMMYT hexaploid wheat cultivar Veery's' into two Indian wheat cultivars Kalyan Sona and Unnath Kalyan Sona.

MATERIALS AND METHODS

The crossing and screening for disease resistance were made at Directorate of Wheat Research, Regional Station, Wellington, The Nilgiris in South India. The place is a `hot spot' for wheat diseases, where all the three wheat rusts perputuates through out the year under natural conditions. Two Indian Cultivars Kalyan sona and Unnath Kalyan Sona were used as recurrent parents. Kalyan Sona is highly susceptable to all the three rusts. Unnath Kalyan Sona, an improved variety of Kalyan Sona were developed by Kochumadhavan *et al.* (1988) by incorporating a linked gene complex Sr 24 + Lr 24 from an Australian wheat cultivar TR 380-14 7/3 Ag 14. Stem rust resistance was broken down in this cultivar (UKS) during early 1990's. this cultivar also suceptable to yellow rust. CIMMYT wheat variety Veery `s' carrying *Secale cereale* derived Sr 31 + Lr 26 + Yr 9 linked gene complex was taken as donor parent. Leaf rust resistance in Veery's' was partially broken down by leaf rust race 77-1.

Crosses between Kalyan Sona X Veery's' and Unnath Kalyan Sona X Veery's' were highly successful. Hybrids (F_1, BC once) were inoculated with mixtures of Nilgiri's black, brown and yellow rust races for better infection and for selection. Resistant plants were backcrossed successively and resistant lines were constituted after BC_5 generation. Rust reactions were recorded according to modified Cob's method.

Table 1: Rust reactions in two Indian wheat cultivars and their hybrids with wheat variety Veery's.

Parents/Cross	Rust reactions		
	Black rust	Brown rust	Yellow rust
Veery's'	TR	5-10Mr	F
Kalyan Sona (KS)	60-805	605	405
Unnath Kalyan Sona (UKS)	405	F	405
KS/Veery's'	F	F	F
UKS/Veery's'	F	F	F

RESULTS AND DISCUSSION

Frequent failure of rust resistance in wheat cultivars is due to the spread of previously unknown races or new races with matching pathogensity. The variety Kalyan Sona released in India during 1967 (Rao, 1978) was highly resistant to all the three rusts. The variety possesses leaf rust resistance genes Lr 13. Lr

Received October 1992

14a, Lr 18 (Reddy, 1974). This variety also seems to have some unknown Sr gene possibly Sr 2 (hoelfs *et al.*, 1992). However, the variety become susceptible to all the three rusts during early in 1970's due to break down or ineffectiveness of resistant genes for new races. Similarly the improved variety of Kalyan Sona, the Unnath Kalyan Sona, resistant to stem rust and leaf rust developed by Kochumadhavan *et al.* (1988) also become susceptable to stem rust during early 1990's due to the same reasons as that of Kalyan Sona. Unnath Kalyan Sona possesses Sr 24 + Lr 24 in which stem rust resistance gene Sr 24 is broken while Lr 24 gene for leaf rust resistance is still effective.

Breakdown of rust recestance in most of the cases is mainly due to development of new virulence consequently ineffectiveness of existing of resistance gene (s). However, the ineffectivenes of stem rust resistance gene (Sr 24) in Unnath Kalyan Sona either due to break down by a new rust race or by crossing over between Sr 24 and Lr 24 is ruled out since, the only stem rust race (40-1) which break down this gene did not showed any symptoms on the original Australian wheat cultivar TR 380-14 7/3 Ag 14 from which the linked gene complex was derived, further, break down of Sr 24 in Sr 24 + Lr 24 linked complex due to crossing over is remote as they are tightly linked together (McIntosh, 1988). Thus, ineffeciveness of a gene in expressing resistance in a introduced recurrent parent when compared to donor parent from which the gene was derived was explained due to `dilution' effect (Roelfs, 1988) and further it was suggested that resistance in such cases can be restored by changing the position of introduced gene from one place (on the chromosome) to another or by incorporating additional rust resistant gene (s) so that a cumulative effect can bring a durable resistance (MchIntosh, 1988; Roelfs *et al.*, 1992). Singh and McIntosh (1986) has shown that in wheat cultivar Kenya Plume the stem rust resistance is due to cumulative effect of eight Sr genes. Similarly, the list of the wheat varieties given by Roelfs (1988), McIntosh (1988) and Roelfs *et al.* (1992) contain two or more resistant genes for controlling rust resistance.

In the present study both the recipient parents developed complete resistance to all the three rusts after crossing with wheat variety Veery's' (Table 1). Ineffectiveness of stem rust resistant gene Sr 24 is evident from the fact that gene Sr 31 provided complete resistance in Kalyan Sona (without Sr 24) and Unnath Kalyan Sona (with Sr 24). Similarly, the leaf rust resistant genes Lr 24 and Lr 26 both are equally effective as evident from the rust reactions of Unnath Kalyan Sona (having Lr 24) and hybrid derivates of the cross Kalyan Sona X Veery's' (having only Lr 26), in both the cases malterials were free from brown rust. The donor parent Veery's' showed slightly susceptability to leaf rust and it was well established that leaf rust races 77-1 and 12-1 causes virulence on Lr 26. Since hybrid derivatives are completely free from leaf rust, it is evident that, the genes Lr 11 and Lr 13 which are already present in both the recipient parents are providing adult plant resistance in combination with Lr 26. The effectiveness of yellow rust resistance gene Yr 9 is clearly evident that it gave complete resistance in the hybrid derivates with Kalyan Sona and Unnath Kalyan Sona.

REFERENCES

Kochumadhavan K, S M S Tomar & P N N Nambisan 1988 Transfer of rust resistance genes into commercial cultivars of wheat. *Annual Wheat News Lett* **34** 54-55.

McIntosh R A 1988 The role of specific genes in breeding for durable stem rust resistance in wheat and triticale *In* Breeding Strategies for Resistance to the rusts of Wheat (Eds N W Simmonds & S Rajaram) CIMMYT Report pp 1-9.

Rao M V 1978 Varietal improvement *In* Wheat Research in India (1966-76) ICAR, New Delhi pp 20-60.

Reddy M S S 1974 Genetics of seedling resistance in wheat to leaf rust races of India Ph. D Thesis IARI New Delhi 147 pp.

Roelfs A P 1988 Resistance to leaf and stem rusts in wheat *In* Breeding Strategies for Resistance to the rust of Wheat (Eds N W Simmonds and S Rajaram) CIMMYT Report pp 10-22.

Roelfs A P, R P Singh & E E Saari 1992 Rust diseases of wheat: Concepts and methods of disease management CIMMYT report, Mexico 81 pp.

Singh R P & R A McInthosh 1986 Genetics of resistance to *Puccinia graminis tritici* and *Puccinia recondita tritici* in Kenya Plume wheat. *Euphytica* **35** 245-256.