Effective Resistance Genes as Sources of Resistance against Hungarian Wheat Rusts

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Abstract: According to our data of seedling and field tests conducted in the past five years we found a lot of effective resistance genes against Hungarian wheat rusts. Experiences proved that Hungarian varieties carry only some of the investigated resistance genes, and most of them (e.g. *Lr26*, *Yr9*) are not effective nowadays. It has been realised that the opportunity of protection of wheat against rusts by resistance genes is uncultivated. The effectiveness and safety of protection can be increased by using combinations of several types of resistance genes. Therefore, it is important to find new genotypes with effective resistance genes for new varieties in Hungary.

Keywords: wheat; stem rust; leaf rust; yellow rust; effective resistance genes

Wheat rusts (stem rust, leaf rust and yellow rust) caused by *Puccinia graminis, P. triticina* and *P. striiformis* are important diseases of wheat in many parts of the world. The frequency of epidemics and damage caused by rusts is different in each country. Lot of methods are available to control wheat rusts. One of them, the economical and environmentally safe protection of wheat against rusts is possible by growing resistant wheat varieties.

MATERIALS AND METHODS

Field studies and the collection of wheat rusts samples have been carried out all over the Hungarian wheat growing areas from year to year.

The determination of virulence genes in rust populations and the detection of the effective resistance genes against leaf, stem and yellow rust were made by testing 23 stem rust (*Sr*), 41 leaf rust (*Lr*) and 16 yellow rust (*Yr*) isogenic backcross lines.

The seedling resistance of grown Hungarian wheat varieties was tested in the greenhouse by applying races and pathotypes, which originated from the Hungarian wheat rust populations. Infection types on the seedlings were scored 14 days after inoculation on a 0–4 scale.

The adult resistance of wheat varieties to rusts was examined by artificial inoculation tests in the rust nursery and in spontaneously infected field nurseries. The infection of varieties was characterised by an average infection coefficient, ACI.

RESULTS AND CONCLUSIONS

The role of resistance genes in protection of wheat against rusts depends on virulence changes of pathogens.

According to our data of seedling and field tests (Table 1) conducted in the past five years (1996–2000) the resistance genes *Sr24, Sr25, Sr26, Sr31, Sr32, Sr33, Sr36* were effective against Hungarian stem rust races. Among 41 leaf rust resistance genes *Lr9, Lr19, Lr23, Lr24, Lr25, Lr28, Lr29, Lr35, Lr37* were effective, *Lr12, Lr13, Lr17, Lr20, Lr22, Lr32, Lr38, Lr44* and *LrW* were moderately effective against leaf rust in Hungary. No virulent isolates were found for isogenic lines with *Yr1, Yr4, Yr10, Yr15, YrSU*, *Yr*SPA yellow rust resistance genes.

These effective resistance genes can be recommended as resistance sources for incorporation in breeding programmes in Hungary.

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Table 1. Effective resistance genes against wheat rusts in Hungary

Wheat rust	Total number of investigated rust resistance genes	Effective resistance genes against Hungarian wheat rust
Stem rust	23	*Sr24, Sr25, Sr26, Sr31, Sr32, Sr33, Sr36*
Leaf rust	41	*Lr9, Lr19, Lr23, Lr24, Lr25, Lr28, Lr29, Lr35, Lr37, Lr12, Lr13, Lr17, Lr20, Lr22, Lr32, Lr38, Lr44, LrW*
Yellow rust	16	*Yr1,Yr4, Yr10, Yr15, YrSPA, YrSU*

Experiences proved that Hungarian varieties carry only some of the investigated resistance genes (Table 2), and most of them (e.g., *Lr26, Yr9*) are not effective nowadays. This means that the opportunity of protection of wheat against rusts by resistance genes is uncultivated in Hungary.

Table 2. Rust resistance genes in Hungarian wheat varieties

Stem rust (*Sr*)	Leaf rust (*Lr*)	Yellow rust (*Yr*)
Sr5	*Lr3*	*Yr2*
Sr31	*Lr34*	*Yr3*

The secured strategy of protection of wheat against rusts could be increased by utilisation of many different kinds of resistance genes in breeding programmes. Therefore the breeders have to find new resistance sources which carry the effective resistance genes against rust populations in Hungary.

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