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BREEDING FOR DISEASES RESISTANCE

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ABSTRACT

Plant diseases significantly reduce crop yields each year and major driving force to cause a threat to global food and agricultural sustainability. Artificial or natural selection are major breeding techniques that are environmentally safe for managing the disease among crop plants. However, breeding for disease resistance varieties is always a challenge for breeders. Resistance breeding could play an essential role in reducing crop losses caused by disease. The relevance and scope of developing resistant varieties lies in understanding and manipulation of interactive behavioural properties of host and pathogen

INTRODUCTION

The commonly observed responses of the plant to the pathogen are (i) Escape where the host avoids the contact, penetrance, and establishment of the pathogen on account of its inherent capabilities or through the exploitation of available environmental factors. (ii) Tolerance is an inherent property of the host to give a normal performance under the stress of pathogen and even the appearance of disease symptoms. (iii) Resistance is the hereditary capability of the host to reduce the development of the pathogen after its infection so that the severity of the disease is minimized. (iv) Immune is the absolute freedom from disease symptoms. (v) Susceptibility host is said to be susceptible if the disease develops in its most intense form affecting a substantial part of each plant or the crop as a whole. It is the lowest limit of resistance**.** A pathogen is a living organism that induces suffering to another organism i.e., host, in distinct disorders to the plant. Pathogenicity and virulence are the important properties of the pathogen to disease development.

TYPES OF GENETIC RESISTANCE

a. **VERTICAL RESISTANCE:** In this, a crop variety shows a high degree of resistance to a single race or strain of pathogen.

b. **HORIZONTAL RESISTANCE:** In this, the crop varieties show protection against several strains of a pathogen, even though this protection is not complete.

c. **DURABLE RESISTANCE:** Durable resistance provides the ability to compete in favorable conditions for the disease over time. The maintenance of resistance over a long cultivation period in a wider area favoring disease development is the only test of durability.

THE BREEDING PROCEDURES

The resistance to diseases requires a thorough knowledge of the genetic sources for resistance, pathogen's racial composition, and the genetic basis of host-pathogen interaction. The control of environmental conditions is essential in breeding for disease resistance to ensure the right type of pathogen, adequate quantity of inoculum, and congenial environmental conditions to developa disease to identify resistant plants from those harboring genes for susceptibility. A sound screening procedure is required to differentiate between resistance and escape on the one hand and between resistance and susceptibility on the other. The screening techniques must involve the creation of artificial epiphytotic. The first step in resistance breeding is collecting and maintaining resistance genes, which can then be used according to the breeding strategy, i.e., for the development of 'VR' or 'HR' or a combination of both. The sources of resistance may include:

1. Advanced breeding lines or new genetic stocks developed through pre-breeding or genetic engineering.
2. Commercial varieties under cultivation
3. Landraces or primitive cultivars
4. Wild relatives in the form of original progenitors or related species.

Availability of resistance from locally adapted commercial or obsolete varieties is preferred because it has minimum undesirable side effects as compared to resistance from wild species. The choice of a specific breeding procedure depends upon the mode of reproduction of the crop, source of resistance, type of resistance, and the strategy for the management of resistance genes.

Breeding for disease resistance assumes special significance with the appearance of new disease or increased virulence of pathogen of already prevalent disease. Both the situations put the survival of varieties under cultivation which become the natural targets to incorporate resistance genes to recover and stabilize their inherent potential through stabilizing breeding. The evolution of new virulent races in the

procrastinated co-existence of host and pathogen under intensive agriculture is becoming the main breeding basis for resistance.

The backcross is the most commonly used breeding method to incorporate resistance into existing adapted varieties. Indeed, this method owes its existence in plant breeding for the transfer of selected major genes to varieties without disturbing their overall genetic constitution. Backcross method is equally applicable for quantitative characters, but more plants have to be sampled for backcrossing where selfing generation has to be grown for selection after first and third backcrosses. Relatively more number of backcross families and several plants in each family need to be grown. The use of molecular markers can increase the recovery rate of genes of the recurrent parent and concentrate all the polygenes conferring resistance.

The backcross is the ideal method for developing multigene varieties, i.e., diverse resistance alleles are concentrated for a particular disease. The resistance genes to match different virulent races of a pathogen are deployed in one variety through the backcross method. But it requires rigid screening techniques using cultures of specific races to identify plants in each backcross generation so that all the genes are ensured to be deployed. Moreover, isogenic component lines of multiline varieties are developed through the backcross method. The backcross is the only breeding method by which the resistance genes available in wild relatives of crop plants can be transferred to cultivated varieties.

ADVANTAGES OF MULTILINE VARIETIES

1. Multilines Varieties provide greater protection against disease by exploiting strong vertical resistance convenient and workable.
2. Linkage and allelism: Multiple alleles for disease resistance at a particular locus can easily be incorporated in a single variety.
3. Prolonged life of res genes.
4. Longer life of varieties: Multilines can stay in the field for a longer period due to reduced selection pressure on the pathogen that remains in a stable state for many years.
5. Stability and adaptability of varieties

PROBLEMS IN BREEDING FOR DISEASE RESISTANCE

The development of disease-resistant varieties is the most viable biological alternative to the use of other means of disease control but it has unique requirements and problems

1. Lack of Resistance Gene

2. Breakdown of Resistance

3. Development of New Races of Pathogen

4. Combination of Resistance with High Yield and Adaptability

CONCLUSION

The development of disease-resistant varieties may play an important strategy in reducing crop losses and maintaining agricultural sustainability. Around the world, many disease resistance varieties has been developed. In present times, the advancement and adoption of resistance breeding can enhance the production of food crops and also food security.

REFERENCES

Geiger, H. H., and M. Heun. 1989. Genetics of quantitative resistance to fungal diseases. *Annual Review of Phytopathology* **27**: 317— 341.

Jensen, N.F. 1952. Intra-varietal diversification in oat breeding. *Agronomy Journal***44**:30-34.

Johnson, R. 1981. Durable resistance: definition of genetic control and attainment in plant breeding. *Phytopathology* **22**: 309— 330.

McDonald, B. A., and Linde C. 2002. The population genetics of plant pathogens and breeding strategies for durable resistance. *Euphytica* **124**: 163— 180.

Nelson, T. O. 1984. A comparison of current measures of the accuracy of feeling-of-knowing predictions. *Psychological Bulletin* **95**(1):109–133.

Parlevliet, J. E. 1981. Disease resistance in plants and its consequences for plant breeding. In: K. J. Frey (ed.), *Plant Breeding II*, 309— 364. The Iowa State Univ. Press, Ames, Iowa, USA.

Parlevliet, J.E. and Kuiper,H. J. 1977. Partial resistance to leaf rust, puccinia hordei.IV .Effect of cultivar and development stage on infection frequency. *Euphytica***26:**249-255.

Vander plank, J. E. 1984. Disease Resistance in Plants, 2nd edn. Academic Press, London.

Welz, H. G., A. Dölz, and Geiger, H. H.1992. Assessment of the durability of partial resistance in the rye/powdery mildew pathosystem. In: Th. Jacobs, and J. E. Parlevliet (eds), *Durability of Disease Resistance*, 343— 344. Kluwer Academic Publishers, Dordrecht, The Netherlands.