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Breeding of Disease resistance and pathogen population genetics in plants

Shivani Chaudhary
Ph. D. Scholar, Department of Plant Pathology, S.V.P.U.A.T., Meerut, U.P

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Introduction

The subdivision of genetics that deals with genetic differences between and within the populations, and is a fragment of evolutionary biology. Studies in this branch of biology have different phenomena such as adaptation, speciation, and population structure. The objective of the population genetics designates the genetic variation of the population, quantify and use this variation to conclude the evolutionary process that marks the population (Hartl and Clark, 1997). Mutations, migration, genetic drift, selection and recombination change gene frequencies in populations are evolutionary forces. It focuses on evolutionary processes and genetic variations beneath the species level (microevolution), but the difference between population genetics and systematics (macroevolution) is not clear. It is the evolutionary force applied to control pathogens, which improves disease management (Burdon, 1993).

Pathogen Populations having Virulence Variation (Races)

Plant breeders and pathologists have way back understood the importance of variation in pathogens to the efficiency and sturdiness of host resistance. The breakdown of resistance occuers in a very short period of time, between the various pathogens and their interaction with a specific host genotype (Brown, 1995). Its detection has been conventionally depending on upon the identification of virulence variation in the population of pathogens by inoculating a pathogen isolate on a series of hosts with defined resistance genes and then detecting the compatible or incompatible disease phenotypes. This monitoring approach has been extremely valuable in the development and arrangement of host resistance (Andrivon and De Vallavieille-Pope, 1993, Roelfs, 1985). Still in today's time pathotype monitoring is done extensively in different pathosystems and provides timely information of the pathogen populations that is important in breeding programs and disease resistance reduction.

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Pathogen Population: Resistance Breeding and Genetics

An immediate impact on the resistance breeding can be obtained by various areas of genetic studies on pathogen population. A better understanding of pathogenic variation can be done by keeping focus on pathogen populations, because of close association between plant breeding and plant pathology. Mostly work has been done on fungi so this review will focus on fungal pathogens. However, the concepts described here are also applicable to pathogenic bacteria, nematodes and viruses. Some major issues on the pathogen to solve effective resistance breeding programs. A similar approach will be pursued with other pathosystems, and a stricter incorporation of pathology and breeding will outcome in more competent and sturdy disease control in the future.

Genetic Variability of the Pathogenic Population Dispersed Intergalactic

An important consideration for screening for the resistance of the breeding program is the pathogenic geographical distribution of the genotype. Geographically path-genopathy is under structured, which is found only in in-depth sampling and the application of suitable genetic markers. A thorough knowledge of pathogen population structure can be predicted through effects and durability of resistance.

Are Early-Generation Resistant Plants Bare to All Budding Variation in the Pathogen?

Screening of resistant germplasm often occurs in only one location (i.e., a screening nursery) or a limited number of pathogen genotypes are being inoculated in plants. It is crucial to know if the pathogen population at the screening site is illustrative of variation in the population of pathogen once the resistant plants are positioned. For measured inoculation, it is significant to depiction resistant plants to all possible variation in the pathogen population. This involves inoculating a large number of pathogen genotypes than the presently used, in breeding programs.

How is Genetic Variation being Circulated in Time?

Through time the composition of pathogen populations can change and this can also be an important contemplation for breeding programs. In late blight (*Phytophthora infestans)* on potato and tomato the complete replacement of one dominant genotype by another has occurred recently and these types of deviations must be taken into contemplation in designing

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resistance screening programs. Monitoring of pathogen populations on a regular basis is done to govern if novel genotypes have been familiarized into a region and whether frequencies of some genotypes alter over time.

Sign for Pathogen Genotype by Host Genotype Interactions

The profound effect on the rate at which pathogens progress increased virulence on host plants and the robustness of resistance by the existence of pathogen genotype by host genotype interactions. Race-specific resistance is the resistance that is specific for a particular pathogen genotype. Non-race specific resistance or partial resistance is the resistance which is effective against a large number of pathogen genotype. It is said that partial resistance may be more durable than race-specific resistance because pathogens are less likely to progress, the ability to overcome partial resistance.

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