IDENTIFICATION OF WHEAT LEAF RUST RESISTANT GENES IN SOME NEWLY-DEVELOPED EGYPTIAN WHEAT CULTIVARS

By

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B.Sc. Agric. Sci. (Plant Pathology), Fac. Agric., Minufiya Univ., 2003
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APPROVAL SHEET

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ABSTRACT

The objective of this research was to study the geographic distribution of *Puccinia triticina* in five wheat growing Governorates during three seasons 2009-2012 and determination of resistance genes in some Egyptain wheat cultivars by gene postulation, genetic analysis and molecular markers. Leaf rust resistance genes, *i.e.* *Lr19*, *Lr*25, *Lr9*, *Lr28*, *Lr45*, *Lr29*, *Lr43*, *Lr47*, *Lr22a*, *Lr18*, *Lr34*, *Lr36*, *Lr46*, *Lr27*, *Lr21* and *Lr24* were found to be resistant at adult stage. On the other hand, the wheat cultivars, *i.e.* Giza-168, Misr-1, Misr-2, Sakha-94, Sakha-95, Sids-12 and Sids-13 showed low values of final rust severity at adult stage. The genes *Lr9*, *Lr19*, *Lr*21, *Lr*24, *Lr25*, *Lr28*, *Lr29*, *Lr34*, *Lr46* and *Lr47* were identified in the tested wheat cultivars by genetic analysis. These results were confirmed by molecular markers used for identification of these resistance genes expect *Lr9* which was detected by molecular markers in two cultivars Sids-12 and Sids-13 although it was detected in three cultivars Sakha-95, Sids-12 and Sids-13 by genetic analysis. In addition the leaf rust resistance genes *Lr51* and *Lr67* were identified in ten wheat cultivars, *i.e.* Sakha-94, Sakha-95, Gemmeiza-9, Gemmeiza-10, Gemmeiza-11, Sids-12, Sids-13, Giza-168, Misr-1 and Misr-2 by molecular markers. Partial leaf rust resistance in the tested wheat cultivars was a quantitative trait loci with dominance effects being more pronounced in its genetic expression. This type of resistance was controlled by one, two or three genes pairs in most cases at adult stage. The heritability in its broad-sense was generally high which indicated that the selection for partial resistance materials in the early generations was possible, while delaying is more effective.

Key words: Wheat, *Puccinia triticina*, Lr's genes, breeding resistance, Molecular markers, partial resistance.

DEDICATION

I dedicate this work to whom my heartfelt thanks; to ***my parents, my wife*** *and my children* ***Mohammed*** *and* ***Ahela*** *for their patience and help, as well as to my brothers* ***Ibrahim*** *and* ***Awad*** *for all the support they lovely offered along the period of my post graduation.*

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INTRODUCTION

Wheat (*Triticum aestivum* L.) is cultivated worldwide as stable food with a global production. Egypt produced 8.5 million tons of wheat grains from 3.214 million feddans in 2013 growing season (Anonymous, 2013). The gap in production and consumption is escalating due to over increasing population. Wheat production is also decreasing due to the attack of certain diseases like rusts, smuts, powdery mildew…etc.

Rust diseases of wheat are among the oldest plant diseases known to human. Wheat leaf rust caused by *Puccinia triticina* is one of the most important diseases of wheat resulting in high yield losses and reduced grain quality (Cloutier *et al*., 2007). Accordingly, the use of resistant cultivars offers the most effective and ecologically sustainable method of control the disease, and subsequently incorporating genetic resistance to this pathogen into adapted germplasm is a major goal in most wheat breeding programs.

Plant disease resistance can be classified into two categories: qualitative resistance, conferred by a single resistance gene (also termed as major, seedling resistance or race specific resistance) and quantitative resistance, mediated by multiple genes or quantitative trait loci (QTLs) (also termed as adult plant resistance, race non-specific or slow rusting resistance) with each providing a partial increase in resistance