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**PATHOLOGICAL STUDIES ON WHEAT LEAF
RUST AND ITS CONTROL IN EGYPT**

By

ALAA SHAHAT ABD EL-AZIZ ALI

B.Sc. Agric. Sci. (Plant Pathology), Fac. Agric., Cairo Univ., 2007

THESIS

**Submitted in Partial Fulfillment of the
Requirements for the Degree of**

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In

**Agricultural Sciences
(Plant Pathology)**

**Department of Plant Pathology
Faculty of Agriculture
Cairo University
EGYPT**

2013

APPROVAL SHEET

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ABSTRACT

Leaf rust caused by *Puccinia triticina* was subjected to several studies concerning the distribution of its physiologic races over some Egyptian governorates as well as induction of resistance through applying different chemical inducers.

Ninety four physiologic races of *P. triticina* were identified in addition to pathotypes TKT and STT were the most frequent during 2010/11, respectively. Geographical distribution of the identified pathotypes indicated that Kafr el-sheikh, Alexandria and Gharbia governorates have the great number of pathotypes. The pathotypes TTT was the most virulent while pathotype BBB was avirulent to all resistance Lr's genes. Gene efficacy, at seedling stage in greenhouse indicated that *Lr 17*, *Lr 1*, *Lr 16*, *Lr 30* and *Lr 3ka* had high efficacy. Wheat cultivars Gemmiza 10, Gemmiza 7, Sakha 93, Giza 168 had high efficacy. Rust severity was first recorded at the fast –rusting cvs. (Giza 139 and Sakha 93) and later on slow rusting resistance cvs. (Sakha 94, Giza 168 and Sids 12) and the monogenic lines *Lr 30* had mean rust severity (0%) , *Lr 9*, and *Lr 26* showed low values of rust severity (less than 30%).

Fungicide (Tilt) gave the best results in decreasing uredospores germination followed by benzothiadiazole (200 ppm). Fungicide (Tilt) gave the best results in controlling leaf rust in seedling stage followed by benzothiadiazole (80 ppm, 200 ppm) under greenhouse and field conditions. Benzothiadiazole (80 ppm, 200 ppm), gave the best results in increasing grain yield followed by sodium salicylate (200 ppm, 250ppm). Tilt (fungicide) and oxalic acid gave the best results in reducing electrolytes leakage in both wheat cultivars . Benzothiadiazole gave the best results in reducing level of superoxide ($O_2^{\cdot -}$) followed by ascorbic acid in both wheat cultivars. Benzothiadiazole gave the best results in reducing level of hydrogen peroxide (H_2O_2) followed by ascorbic acid in both wheat cultivars. Benzothiadiazole and salicylic acid gave the best results in increasing catalase (CAT) activity in Giza 168, while treatment by sodium salicylate and oxalic acid in Giza 139. Salicylic acid and ascorbic acid gave the best result in increasing dehydroascorbate reductase (DHAR) activity on Giza 168, while treatment by benzothiadiazole and ascorbic acid gave the best result in increasing dehydroascorbate reductase (DHAR) activity on Giza 139.

Key words: Wheat, leaf rust, induction of resistance, superoxide, hydrogen peroxide, catalase, dehydroascorbate reductase.

DEDICATION

*I dedicate this work to whom my heartfelt thanks; to my father **Shahat**, my mother, my wife **Kholood**, my son **Marwan** and my daughter **Rawan** for their patience and help, as well as to my brothers for all the support they lovely offered along the period of my post graduation.*

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INTRODUCTION

Wheat (*Triticum aestivum* L.), is considered one of the most important nutritive cereal crops in Egypt and all over the world.

Production of wheat grains is not sufficient to cover the Egyptian local consumption. This is due to the shortage in the cultivated area, disease infection and pest attacks.

To meet the shortage in wheat production, the policy of the Egyptian governorate aimed to increase the cultivated area from 1.955 million feddans in 1990 to 3 million feddans in 2012 which increased the production from 4.268 to 9.4 million tons. Also the production was increased by developing high yielding new cultivars and partially resistant genotypes.

Rusts are the most important diseases of wheat in Egypt because of their ability to form new physiological races that can attack resistant varieties and their potential to develop and rapidly spread under optimum environmental conditions (El-Daoudi *et al.*, 1994). Leaf rust caused by *Puccinia triticina* Eriks., (syn. *Puccinia recondita*) is the most common wheat rust disease regularly occurring in Egypt and world wide .The fungus is heteroecious, and therefore requires a telial/uredinial host (usually wheat) and an alternative pycnial / aecial host (*Thalictrum speciosissimum* or *Isopyrum fumaroides*) to complete the full life cycle. It had been widespread on most cultivars of wheat

grown in Egypt causing yield losses up to 50% (Abdel- Hak *et al.*, 1980) while were up to 23 % in cv. Cham 1 (Kassem *et al.*, (2011).

Although, leaf rust disease is able to form new races within a short time that are capable to overcome the resistance of newly produced commercial cultivars. Chemical compounds or their degradation products are toxic to plant invaders, causative agents or vectors of plant diseases. So, the searches for new, harmless means of disease control is strongly needed.

Since late 1950s, increasing evidence on the natural phenomenon of induced resistance was accumulated (Kuć, 2001). Induced resistance is the phenomenon by which the plant can utilize own defense mechanism to increase the level of resistance without changing plant genome (Van Loon, 1997).

Many investigations have been made to understanding the physiological and biochemical basis of the systemic acquired resistance (SAR) and the induced systemic resistance (ISR). Much of this knowledge is due to the identification of a number of chemical and biological elicitors, some of them are commercially available for use in conventional agriculture.

Several natural and synthetic chemical agents have been described as activators of defense related processes when applied to plants. Some of these activators may have potential application in Agriculture (Kessmann *et al.*, 1994).