PHENOTYPIC CHARACTERIZATION FOR STEM RUST RESISTANCE IN INTRODUCED AND SELECTED KENYAN BREAD WHEAT GERMPLASM

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DECLARATION

This thesis is my original research work, and has not been submitted for examination to any university for the award of any degree. The sources of information have been duly referenced and acknowledged.

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ABSTRACT

Stem rust disease caused by *Puccinia graminis* f. sp. *tritici* is the most economically important disease affecting wheat production in Kenya. Since the emergence of virulent race Ug99 and its variants, 95% of the wheat grown in Kenya has been rendered susceptible causing between 70% to 100% yield losses. This study was undertaken to identify sources of resistance to stem rust among exotic genotypes and to determine the genetics of stem rust resistance among old Kenyan Uwheat varieties. Three hundred and sixteen exotic genotypes together with a susceptible check Canadian Cunninghum Kennedy, CACUKE, obtained from the International Maize and Wheat Improvement Center (CIMMYT) were evaluated for adult plant resistance at the Food Crop Research Centre (KALRO)-Njoro, for two seasons namely January to May 2015 and June to November 2015. The study identified six outstanding genotypes namely: ALBW-100, ALBW- 204, EPCBW-261, EPCBW-295, PCHP-309 and PCHPBW-310, with immune response to stem rust. Thirty five genotypes also exhibited the pseudo-black chaff (PBC) trait suggesting the presence of the adult plant resistance gene- *Sr2*. These genotypes had significantly lower disease severities of not more than 25% and depicted moderately susceptible to susceptible responses during both seasons of evaluation. There were significant differences at $p \leq 0.05$ among the genotypes for agronomic traits including plant height, 1000-kernel weight and number of tillers indicating that a suitable level of variation existed among the genotypes. Based on Pearson correlation coefficients tests, negative relationships among stem rust disease parameters and agronomic traits including plant height, spikelet length, and 1000-kernel weight were observed.

Inheritance studies were conducted among ten generally uncharacterized old Kenyan wheat varieties and advanced lines- K. Zabadi, K. Cheetah, K. 6820, K. Hunter, Morris, K. Trophy, Beacon-K, Mentor-K, 1012-B.1 and K. Salmayo, which had shown a high degree of stem rust resistance in a separate study. These parents were crossed to the susceptible line LMPG-6 and

advanced to the F_2 generation. A chi square ratio of 3R: 1S suggested that a single dominant gene conferred resistance to stem rust among six cultivars namely parents- K. Zabadi, Morris, K. Trophy, Beacon-K1012-B.1 and K. Salmayo. However, this test pointed to two resistance genes with epistatic effects among genotypes K. Cheetah, Mentor K, K. 6820 and K. Hunter. Crosses between the parents K. Cheetah and Mentor-K conformed to the 9R:7S genetic ratio in the F_2 consistent with duplicate recessive epistasis or complementary gene action, while resistance in genotypes K. 6820 and K. Hunter conformed to the 13R:3S genetic ratio alluding to a dominant and recessive epistasis. This study revealed the presence of possible sources of resistance which could be introgressed into adapted high yielding but stem rust susceptible Kenya commercial wheat varieties. Further studies involving seedling tests coupled with quantitative trait loci mapping could help identify genomic regions associated with stem rust resistance. Linked markers identified in such downstream studies would be useful in marker assisted selection and in efficient utilization of these parental germplasm in breeding.