

# Screening of the Nepalese Wheat Genotypes against Ug99 in Kenya in 2017

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## ABSTRACT

The stem rust disease of wheat caused by *Puccinia graminis* f. sp. tritici (*Pgt*) is potential for devastating loss in grain yield. The stem rust has become a burning issue in the area of wheat disease after the appearance of *Pgt* race TTKSK, also known as Ug99. The screening of the wheat genotypes at Kenya platform has become a new way to develop the resistant varieties. Different wheat genotypes have been tested in Kenya since 2005/2006 wheat season with the assistance of CIMMYT-SARO. Nepal has been sending segregating materials as well as advanced material of bread wheat. In 2017 also Nepal had send the 100 wheat genotypes for the screening against Ug99 including 50 advanced varieties and 50 segregating materials. The observation of the disease severity and the infection type was recorded. Among the 50 advanced lines, 18 wheat genotypes including the four crosses from National Wheat Research Program (NWRP), Bhairahawa have the coefficient of infection (CI) below 1. Wheat genotypes NL 1260 and NL 1321 have the lowest CI with resistant infection type. Similarly BL 4708, BL 4812, BL 4814 and BL 4820 were the best Nepalese wheat genotypes with low severity (trace) with moderately susceptible type infection. These genotypes will be evaluated in advanced trials and will be used in hybridization program for the development of Ug99 resistant wheat varieties.

Key words: Coefficient of Infection, genotype, stem rust, wheat, Ug99

## INTRODUCTION

Wheat (*Triticum aestivum* L.) is the third major cereal crop after Rice and Maize in production but in consumption second after rice in Nepal. It is grown from Terai (plains) to high hills in the country. It was grown in 703992 ha area and produced 2,005,665 metric tons with productivity of 2849 kg/ha (MOALD, 2020). Wheat stem rust caused by *Puccinia graminis* f. sp. tritici (Erikss. & Henning) has historically been a major yield-limiting factor of wheat in many part of the world. New virulent race Ug99 has threatened future wheat production as most of the commercial wheat varieties are susceptible to this new biotype of stem rust and many other biotypes are emerging. The most effective approach to prevent losses from stem rust is through the deployment of resistant cultivars. More effective sources of resistance need to be identified and incorporated in the existing commercial cultivars (Njau et al., 2010).

National Wheat Research Program (NWRP), Bhairahawa is conducting initial screening for stem rust (Ug99) with the support of CIMMYT, SARO in Kenya since 2005. There are some genotypes which possess good level of resistance to Ug99 in CIMMYT materials received in different years and used in hybridization program. Vijay (BL 3063) was released in 2010 as Ug99 resistant variety. NL 1073 (Francolin#1) is a Ug99 resistant genotype released by the name of Tilottama in 2015 for general cultivation. Similarly, Banganga (BL 3623) was released for Terai region in 2016 (NWRP, 2018).

## MATERIALS AND METHODS

Fifty wheat genotypes including selected lines from the CIMMYT materials (NL series) and fixed lines from the crosses made at Bhairahawa, Nepal (BL series) and Agri-Botany Division (WK series) were sent to KALRO, Njoro, Kenya in 2017 to screen against Ug99. During the grain filling stage, Modified Cobb's scale (1-100%) method was used for the stem rust severity notes and stem rust response was noted as R for resistant, MR for moderately resistant, MS for moderately susceptible and S for susceptible type of pustules. Coefficient of infection was calculated. Data was analyzed using the MS-Excel and R-software.

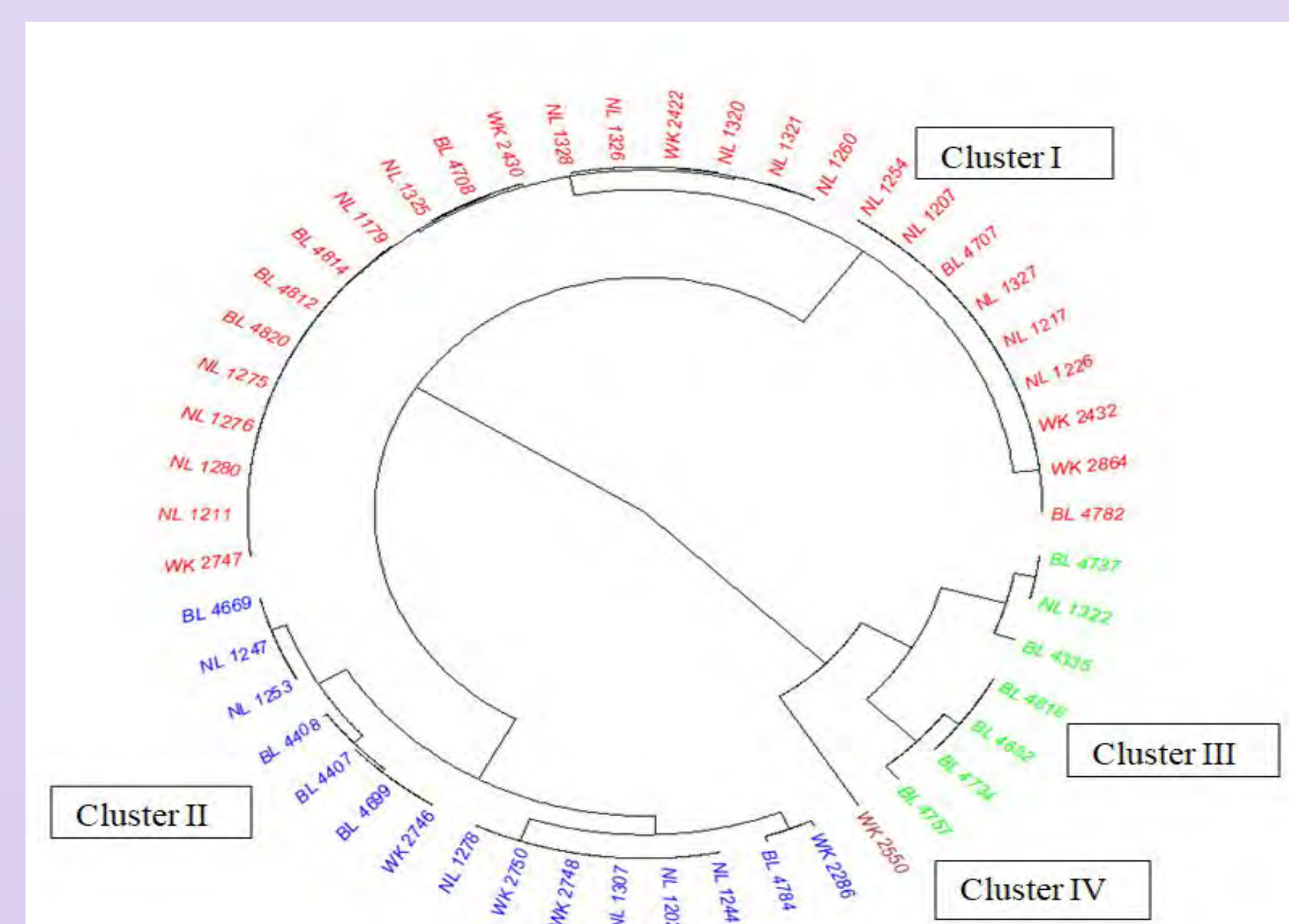
## RESULT AND DISCUSSION

Among the 50 advanced lines tested in the screening nursery to identify the resistant genotypes 18 wheat genotypes including the four crosses from National Wheat Research Program (NWRP) have the coefficient of infection (CI) below 1. Wheat genotypes NL 1260 and NL 1321 have the lowest CI with resistant infection type. Similarly BL 4708, BL 4812, BL 4814 and BL 4820 were the best Nepalese wheat genotypes (Table 1). WK 2550 and BL 4757 were the most susceptible wheat genotypes for the Ug99.

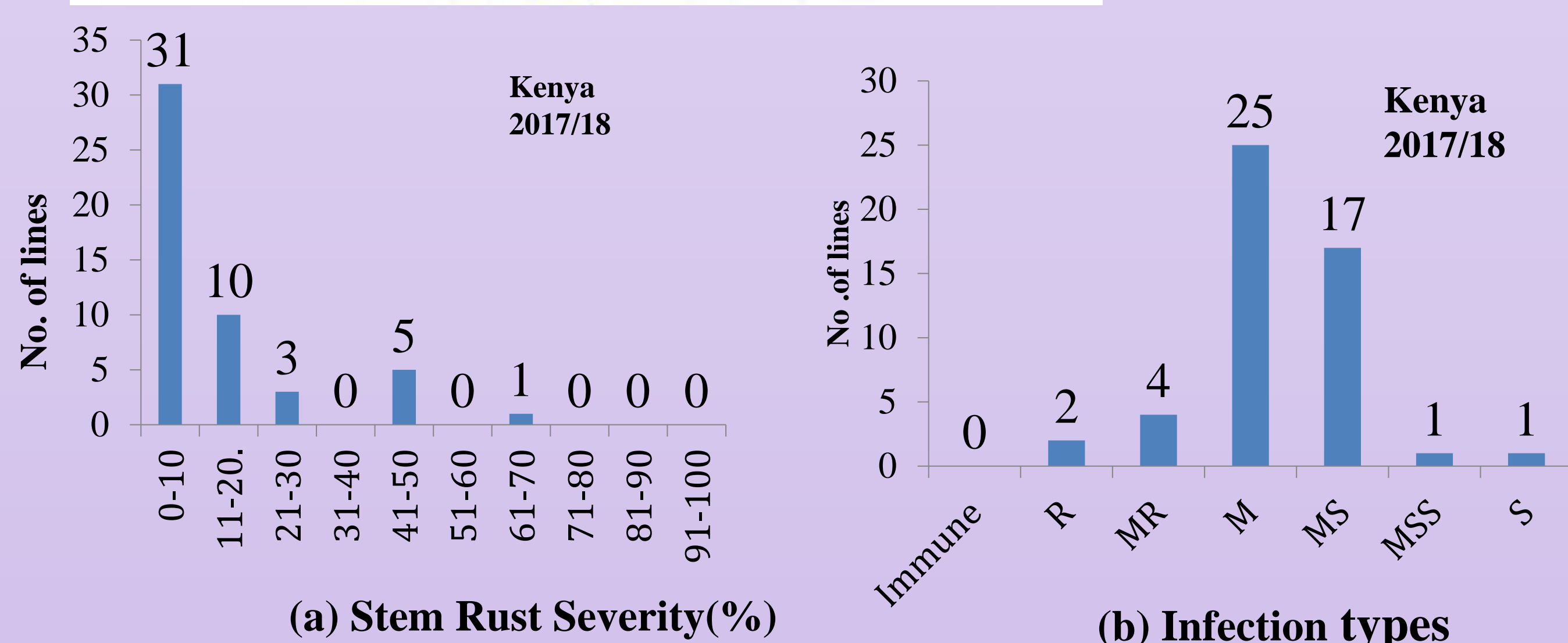
The cluster I consists of 27 genotypes having very low CI ranging from 0.2 to 3. These genotypes have good resistance to race Ug99 (Figure 1). While analyzing the stem rust severity score 31 genotypes have CI very low (1-10%). Only one genotype had the severity above 50 with none of them above 70% (Figure 2a). Similarly analyzing infection type, most of the genotypes showed M (moderately resistant to moderately susceptible) infection type as shown in Figure 2b.

**Table 1: The most resistant wheat genotypes identified in the screening Nursery at Njoro, Kenya(2017/18)**

EN	Genotypes	Cross/Parentage	SR (%)	IR	IR value	CI
1	NL 1260	BAJ#1/3/KIRITATI/HUW234+LR34/PRINIA/4/KIRITATI/HUW234+LR34/PRINIA	1	R	0.2	0.2
2	NL 1321	TRCH/SRTU//KACHU*2/8/REH/HARE//2*BCN/3/CROC-1/AE.SQ.(213)//PGO/4/HUITES/5/T.DICOCCON PI94624/AE.SQ.(409)//BCN/6/REH/HARE//2*BCN/3/CROC-1/AE.SQ.(213)//PGO/4/HUITES/7/MUTUS	1	R	0.2	0.2
3	NL 1326	PICUS/3/KAUZ*2/BOW//KAUZ/4/KKTS/5/T.SPELTA PI348530/6/2*FRANCOLIN#1/7/2*WBLL1/KUKUNA/TACUPETO F2001/3/BAJ#1	1	MR	0.4	0.4
4	NL 1328	PICAFLO#1/4/INQALAB 91*2/TUKURU // T.SPELTA PI348599/3/INQALAB 91*2/KUKUNA/5/KINGBIRD#1//INQALAB91*2/TUKURU	1	MR	0.4	0.4
5	WK 2422	WBLL4/KUKUNA//WBLL1/3/WBLL1*2/BRAMBLING	1	MR	0.4	0.4
6	NL 1320	FRET2/KUKUNA//FRET2/3/WHEAR/4/IWA 8600211//2*PBW343*2/KUKUNA/5/PBW343*2/KUKUNA/TECUE#1	1	MR	0.4	0.4
7	BL 4708	BL 3629/KIRITATI//SERI/RAYON	1	M	0.6	0.6
8	NL 1325	KVZ/PPR47.89C//FRANCOLIN#1/3/2*PAURAQ/4/PBW343*2/KUKUNA*2//FRTL/PIFED	1	M	0.6	0.6
9	WK 2430	SUP152*2/TECUE #1	1	M	0.6	0.6
10	NL 1211	W15.92/4/PASTOR//HXL7573/2*BAU	1	MS	0.8	0.8
11	WK 2747	NELOKI/3/IWA 8600211//2*PBW343*2/KUKUNA	1	MS	0.8	0.8
12	NL 1280	WBLL1*2/BRAMBLING//CHYAK	1	MS	0.8	0.8
13	NL 1276	FRET2/TUKURU//FRET2/3/MUNIA/CHTO//AMSEL/4/FRET2/TUKURU//FRET2	1	MS	0.8	0.8
14	NL 1275	BAV92//IRENA/KAUZ/3/HUITES/4/2*ROLF07	1	MS	0.8	0.8
15	BL 4820	NL971/BL 1082	1	MS	0.8	0.8
16	BL 4812	BL 2930/KIRITATI/WBLL1//BL 4154	1	MS	0.8	0.8
17	BL 4814	BL 2930/KIRITATI/WBLL1//BL 4154	1	MS	0.8	0.8
18	NL 1179	W15.92/4/PASTOR//HXL7573/2*BAU/3/WBLL1	1	MS	0.8	0.8



**Figure 1: Clustering of the Nepalese wheat genotypes based on CI (coefficient of infection) value of Stem rust (Ug99) while screening at KALRO, Njoro, Kenya (2017/18)**



**Figure 2: Stem rust severity (%) (a) and Stem rust infection type ratings (b) in specialized field nurseries created to screen for Ug99 reaction at Njoro, Kenya, in 2017/18.**

## CONCLUSION

These 18 genotypes NL 1260, NL 1321, NL1326, NL1328, WK 2422, NL1320, BL4708, NL 1325, WK2430, NL1211, WK2747, NL1280, NL 1275, NL1276, BL 4820, BL4812, BL4814 and NL 1179 were found to have low stem rust severity with Resistant to Moderately susceptible infection type. These genotypes has been used in the hybridization program and some genotypes BL 4820, BL 4708, BL 4814, NL 1179, WK 2430, NL 1211 and NL 1280 are also under testing in advanced yield trial.

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