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Identification of prevalent races of black or stem rust of Wheat in North Gujarat

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ABSTRACT

Emergence of new highly virulent races of wheat rust due to mutation inside pathogen has rendered many resistant varieties of wheat into susceptible one with passing of time. Earlier report for the breakdown of stripe rust resistance against *Yr9*, virulence of *Sr24, Sr25* and *Sr31* for black or stem rust has posed a serious challenge while combating rust pathogens. The pattern of dynamism of black or stem rust races during the last six years (2011-12 to 2016-17) has revealed that two races i.e. 11 and 40A were predominantly well established in climatic conditions of North Gujarat while another two races i.e. 40-1 and 40-3 were detected only during 2013-14.

Key words: Black or stem rust, Race, Ug99, Virulence

Black or stem rust of wheat incited by *Puccinia graminis* f.sp.*tritici* Eriks. and E. Henn. is most important disease in Central and Peninsular Southern parts of India where the warmer temperature prevails during growing season of wheat. Generally new races in wheat rusts evolved through sexual reproduction in the presence of alternate hosts. However, in absence of functional alternate hosts in India, new virulent forms mostly arise through mutation only. But in some cases, somatic hybridization is also responsible to give rise to new races (Bhardwaj *et al.*, 2006). Due to their air borne nature of spore dispersal mechanism and its ability to rapid multiplication of inoculum, local races can migrate to other areas and quickly become regionally and often globally predominant races with advancement of time (Saleem *et al.*, 2015). Races 79G31 virulent on *Sr5, Sr11* in 1962, 16G2 with virulence on *Sr8b* in 1959, 73G7 with virulence for *Sr28* and *Sr30* in 1954, 7G11 in 1952, 36G2 in 1961 and 7G43 in 1962 were identified. Cultivation of CIMMYT wheat like Chhoti Lerma in Nilgiri hills led to selection of races such as 62G29 (Bhardwaj *et al.*, 1990). Race 62G29-1 with virulence for *Sr24* was detected in 1989, much ahead of release of variety HW 2004 (*Sr24*) in 1995 (Bhardwaj *et al.*, 1990). Recently *Sr25* has also become susceptible to black or stem rust of wheat (Jain *et al.*, 2009). Break down of yellow rust resistance *Yr9* in 1986 in Western Asia and subsequently in other parts of the world was a serious challenge to combat rust pathogen. The widespread cultivation of varieties with 1B/1R translocations led to develop another races designated as 46S119 with virulence for *Yr9* in 1996 and on *Yr9* and *Yr27* in 2001 (Prashar *et al.*, 2007) which have been rendered susceptible in India. Another report of virulence on *Sr31* designated as Ug99 was identified from Uganda (Pretorius *et al.*, 2000). Due to evolution and dispersal of highly virulent races of black rust under Ug99 group has once again become a threat to global wheat production. This gene was known to confer black or stem rust resistance in wheat materials covering more than 40% area world over. Fortunately, so far *Sr31* types of virulence have not been reported in India suggesting that it may not be a threat for the Western Asia (Nagarajan, 2012) but occurrence of independent mutation for *Sr31* locally in the much prone areas of Peninsular and Central zone of India can not be ruled out (Bhardwaj *et al.*, 2014). Many useful resistance genes like *Lr26, Lr9, Lr19* and *Lr28* have been rendered susceptible over the years (Nayar *et al.*, 1991, 2003; Bhardwaj *et al.*, 2005, 2010). Though the new races evolved through the gain in virulence, however, recently loss of virulence has been recorded on *Lr20, Lr2a* and *Lr2c* (Bhardwaj *et al.*, 2010; Bhardwaj, 2013). In recent surveys, 37

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races have been reported to occur in *Puccinia triticina* during 2009-2013 (Bhardwaj *et al.*, 2016). Thus, there is a need for proper investigation for the distributional pattern of races of black or stem rust which will be helpful for mitigating the disease outbreak well in time. Hence, the present study was conducted to identify the predominant races prevalent in North Gujarat conditions and also to detect any emergence of new race of black or stem rust of wheat.

MATERIALS AND METHODS

Pathogen of black rust is dynamic in nature and evinces innumerable oddities. So, the pathogen is known to have many races of various degree of virulence and emergence of new race by mutation generally renders resistant variety to become susceptible. Hence, dynamism of races has tangible repercussions. Every year the rust inoculum comprising four races of black rust i.e. 11, 40-A, 40-1 and 40-3 were procured from Regional Station, Indian Institute of Wheat and Barley Research, Flowerdale, Shimla for the creation of artificial epiphytotic condition in screening programme of different nursery against black or stem rust of wheat under pathological trials at Wheat Research station, SDAU, Vijapur. The inoculum were multiplied in infectors which were sown in all the borders of pathological trials for screening programme. In order to monitor the variability in rust races and their distribution as well as to countercheck the emergence of new race periodic rust samples were randomly collected through mobile surveys depending upon location and transportation facility. The samples were collected from regular crop as well as from off-type plants in regular crops as they also serve as source of inoculum. The samples showing typical rust symptoms of black or stem rust collected from different locations were brought to the laboratory. Samples of those entries showing more than 40 per cent severity of black or stem rust from screening programme of different nurseries against rust of wheat under pathological trials under artificially created epiphytotic conditions were also collected and brought to the laboratory. Then, small bits of each black rust infected sample were dried overnight at room temperature followed by wrapping in paper envelope and information *viz.*, name of person who collected the sample, type of rust, date and place of collection, details of host/variety, *etc.* were mentioned on each sample. Later on samples were sent to Regional Station, Indian Institute of Wheat and Barley Research, Flowerdale, Shimla for race analysis.

RESULTS AND DISCUSSION

Out of ninety six samples analyzed in last six years for black or stem rust, primarily four races were identified, but majority of them were identified as races 11 and 40-A. This suggested that these two races i.e. 11(79G31) and 40-A (62G29) had developed and well established in climatic conditions of North Gujarat. While two races 40-1 (62G29-1) and 40-3 (127G29) were detected only during 2013-14. This clearly indicated that these two races could not be able to establish in climatic conditions of North Gujarat. But fortunately so far, no any new virulent race of black rust had been reported from Gujarat including Ug99 which is a great concern of threat in global wheat production (Table 1). Similar findings were also reported by Prasad *et al.* (2017) where they observed population differentiation of brown rust of wheat in South Asia and suggested that races 12-1, 12-3, 12-6, 12-7, and 12-8 shared more than 80 per cent similarity. Likewise races 77-2, 77-3, 77-6, 77-A and 77-A-1 shared more than 70 per cent similarity, which indicated that they might have evolved from genetically similar ancestors as reported by Bhardwaj (2012) and concluded that high diversity among the races might be due to evolution and mutation in the pathogens along with long term continuous cultivation of same wheat varieties in different wheat growing zones of the country. Moreover, three brown rust races 12-2, 77-5 and 104-2 were identified in more than 86 per cent out of total 622 samples analysed from fourteen states of the country (Bhardwaj *et al.*, 2006).

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Table 1 Status of black or stem rust races distribution in Gujarat during last six years

S.N.	Year	No. of isolate analyzed	Races identified			
			11 (79G31)	40A (62G29)	40-1 (62G29-1)	40-3 (127G29)
1.	2011-12	8	—	8	—	—
2.	2012-13	15	15	—	—	—
3.	2013-14	8	1	5	1	1
4.	2014-15	26	24	2	—	—
5.	2015-16	17	17	—	—	—
6.	2016-17	22	22			
Total	96	78	15	1	1	

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