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A new pathotype 93R57 (104-4) of *Puccinia triticina* on wheat from India

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Abstract

A new pathotype 93R57 of *Puccinia triticina* was identified in 2010 from district Solan of Himachal Pradesh, India. The new pathotype is close to the 104 group, however, is avirulent to *Lr3*.The new pathotype appears to be a case of reverse mutation for *plr3* in the existing pathotype 21R63. Its avirulence/virulence structure and rust resistance sources are listed. This year it was identified in a sample from Uttarakhand.

Key words: Leaf rust, brown rust, wheat, pathotypes, variation, *Puccinia triticina*, resistance

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Introduction

Rusts of whVVVeat are historic diseases. Brown (leaf) rust (*Puccinia triticina* Eriks.) is the most damaging of all the three rusts of wheat. Breeding for resistance and cultivation of resistant varieties is economic, ecologically safe and most effective way to manage wheat rusts. However, resistant varieties are frequently rendered susceptible on an average in 3-5 years. Therefore, identification of new pathotypes in initial stages, distribution of pathotypes, knowledge of resistance genes, multi-location screening, identification of resistant varieties and their deployment is the most popular strategy for the management of wheat rusts (McIntosh and Brown, 1997). Epidemics of wheat rusts have been avoided through monitoring variation, evaluation of advance lines and their deployment based on the pathotype distribution (Nayar *et al*., 2002). Identification of pathotypes from wheat growing areas in initial stages is a prime effort that helps in developing strategies for rust management.

Materials and Methods

Samples of wheat leaves infected with brown rust were collected from different parts of India during 2009-10. The rusted samples were inoculated with the help of a lancet needle on week old susceptible wheat variety Agra Local grown in loam soil in plastic pots (12.5 cm dia) each containing about 12 plants, in spore proof chambers. Inoculated plants were sprayed with a fine mist of water. These plants were kept in saturated humidity chambers for 48 h to maintain a thin film of water on the leaves. Uredospores were produced in sufficient quantity in about 15 days on these inoculated plants. These fresh uredospores were used to inoculate the 0, A and B sets of differentials (Nagarajan *et al.* 1983; Nayar *et al.* 1997). The differentials, 5 plants each were grown in aluminum trays or bread pans (29 cm long, 12 cm wide and 7 cm deep) using loam soil containing 5 g NPK (12:32:16) mixture.

Inoculation was done using a lancet needle. Inoculated plants were sprayed with a fine mist of water and placed overnight in dew chambers at 20±2C temp, 100% relative humidity and 12 h daylight. To prevent powdery mildew, fine sulphur was dusted on the plants immediately after taking out of the dew chambers.

The plants were then transferred to greenhouse bench and kept at 22±2C in relative humidity of 40-60%, and illuminated at about 15,000 lux for 12 h. Infection types (resistant or susceptible) on the test lines were recorded 14 d after inoculation following modified method of Stakman *et al.* (1962). Infection types were characterized as 0;= no visible infection, ;= small hypersensitive flecks,1= uredia minute, surrounded by necrotic areas, 2 = small to medium uredia surrounded by chlorotic area, 3 = uredia small medium in size and chlorotic areas may be present, 3^+= uredia large with or without chlorosis, sporulating profusely and forming rings. Infection type 33+ is classified when both 3 and 3+ pustules occur together. The experiment was performed twice.

Wherever a sample showed different infection types than the pathotypes already reported, single spore or pustule isolations were taken (Stakman *et a.l* 1962; Nayar *et al.* 1997) on Agra Local. To ascertain the characteristic difference, the new pathotype is then inoculated simultaneously with closely resembling pathotypes under the same set of conditions (Nayar *et al*., 1997). The sample with different infection pattern was designated as new pathotype on the basis of the binomial nomenclature as given Nagarajan *et al.* (1983) for brown rust of wheat. Subsequently the new pathotype is added to the national repository. International designations of new pathotypes are also given (Mc Vey *et al*., 2004).

Results and Discussion

In 2009-10 crop season, few samples collected at harvesting of wheat from district Solan of Himachal Pradesh yielded a pathotype of *P. triticina* that differed from the pathotypes reported earlier from India. The differentiating infection types of the newPathotype 93R57 in comparison to the closely relating pathotype is presented in Table 1. It is evident from the table that all the relating pathotype are virulent to *Lr*2a and *Lr*3 whereas new pathotype is avirulent. The New pathotype (93R57) differs from pathotypes 29R23 and 21R55 on Lr20 to which it is virulent whereas both the pathotypes are avirulent.

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Table 1 Differentiating infection types of pathotype 93R57 (104-4)

Pathotype name		Year	Infection types* produced differentials				
New	Old		Webster (Lr2a)	Democrat (Lr3)	Lr10	Thew (Lr20)	Lr26
29R23	104B	1980	3+	3+	X	;1	0;
21R55	104-2	1991	3+	3+	X	;1	3+
21R63	104-3	1993	3+	3+	X	3+	3+
93R57[1]	104-4	2010	;1	;1	3+	3+	3+

*=All the isolates are virulent to Lr23 and avirulent to Lr15, 1=New pathotype

Table 2 List of identified varieties showing resistance to pathotype 93R57

Identified varieties resistant to pathotype 93R57 (total # 72 varieties)
AKDW3722, AKAW4627, AKDW2997-16, CBW38, COW(W)1, DBW39,DBW59/PBW621, DDK1001, DDK1009, DDK1029, DL784-3, DL788-2, DL975-1, DWR185, GW273, GW322, GW366, HD2781, HD2833, HD2864, HD2888, HD2967, HD2987, HI1500, HI1531, HI1544, HI1563, HP1633,HPW251,HS375, HS507 , HW2004, HW2044, HW2045, HW5001, HW5207, K8962, KRL19, KRL210, KRL213,MACS2971, MACS6145, MACS6222, MP3288, MP4010, MPO1215, NIAW917, NIAW1415, NIDW295, NP200, NP846, NW2036, PBW396, PBW524, PBW550, PBW590, PBW596, PDW291, PDW314, PDW315, RAJ4083,RAJ4120, RAJ4041, TL2942, UAS304, UP2565, VL829,VL907,WH283, WH1031, WH1080,WHD943

The new pathotype produces susceptible infect ion type on *Lr*10 to which 104 groups gives mesothetic response. Pathotype 29R23 is avirulent to Lr26 to which pathotype 93R57 is virulent. This is the first pathotype which has virulence to *Lr*23 and *Lr*26 and *Lr*3. The avirulence/ virulence structure of this pathotype is *Lr*2a, , *Lr*3, *Lr*9, *Lr*15, *Lr*19 (Thew), *Lr*24, *Lr*25, *Lr*28, *Lr*32, *Lr*39, *Lr*45,*Lr*47/ *Lr*1,*Lr*2b, *Lr*2c, *Lr* 10, *Lr*11, *Lr*12, *Lr*13, *Lr*14a, *Lr*14b, *Lr*14ab, *Lr*16, *Lr*17a, *Lr*17b, *Lr*18, *Lr*20 ,*Lr21, Lr22a, Lr*22b, *Lr*23,*Lr*26, *Lr*27+31, *Lr*29, *Lr*30, *Lr*33, *Lr*34, *Lr*35, *Lr*36, *Lr*37, *Lr*38, *Lr*40, *Lr*44,*Lr*46, *Lr*48, *Lr49,Lr*51and *Lr*57. As per the North American system, the pathotype is designated as NHKSP and the live culture is being maintained in the National repository of pathotypes at this station. More than 700 lines of wheat from India and exotic material were evaluated against new pathotype in comparison to pathotype 21R63. More than 500 lines were resistant to this pathotype. Among the identified varieties of wheat, 72 varieties were resistant to this pathotype (Table 2).Pathotype 104 was reported in 1973. Its variants with virulence to *Lr*23, *Lr*26 (21R55, 21R63) were identified in 1993 and 1996,respectively (Nayar *et al*., 1996, 1998). This pathotype appears to be a case of reverse mutation on Lr3 in the parent pathotype 21R63 Though the new pathotypes evolve through the gain in virulence (Bhardwaj *et al*., 2005), however, recently loss of virulence has been seen to *Lr*20,*Lr*2a and *Lr*2c. The phenomenon is reported in literature from elsewhere (Statler,1985,1987).This year the new pathotype was identified in one sample only from Uttarakhand though this pathotype does not appear to be of much epidemiological concerned ,however, listed rust resistant sources can be used against this pathotype.

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References

1. Bhardwaj S C, Prashar M, Kumar S, Jain S K and Datta D (2005). *Lr*19 resistance in wheat becomes susceptible to *Puccinia triticina* in India. *Plant Disease* **89**: 1360.
2. McIntosh R A and Brown G N (1997). Anticipatory breeding for resistance to rust diseases in wheat. *Ann Rev Phytopathol* **35**: 311–326.
3. McVey D V, Nazim M, Leonard K J, Long D L (2004). Patterns of virulence diversity in *Puccinia triticina* on wheat in Egypt and the United States in 1998–2000. *Plant Disease* **88**: 271–272.
4. Nagarajan, S., Nayar, S.K., Bahadur, P. (1983). The proposed brown rust of wheat (*Puccinia recondita* f. sp *tritici*) virulence monitoring system. *Current Sci* **52**:413–416.
5. Nayar S K, Prashar M, Kumar J, Bhardwaj S C, Verma L R and Basandarai A K (1994). Two new pathotypes of *Puccinia recondita tritici* with combined virulence for *Lr23* and *Lr26 Pl Dis Res* **9(2)**: 122-126.
6. Nayar S K, Prashar M, Bhardwaj S C, Kumar J and Verma L R (1998). Pathotype 104-3(21R63) of *Puccinia recondita tritici* with combined virulence for *Lr23* and *Lr26. Indian Phytopathology* **51(3)**: 290-91.
7. Nayar S K, Prashar M, Bhardwaj SC (1997). Manual of current techniques in wheat rusts. Research Bulletin No. 2, Regional Station, Directorate of Wheat Research, Flowerdale, Shimla Himachal Pradesh 171002, 32 pp.
8. Nayar S K, Bhardwaj S C and Jain S K (2002). Fungal diseases of wheat and barley-Rusts. Diseases of field crops (Gupta, V.K. and Y.S. Paul eds.) Indus Publishing Company, FS-5, Tagore Garden, New Delhi 110027:1-39.
9. Stakman E C, Stewart D M, Loegering W Q (1962). Identification of physiological races of *Puccinia graminis tritici. US Agr Res Serv ARSE* **617**:53.
10. Statler G D (1985). Mutations affecting virulence in *Puccinia recondita. Phytopathology* **75**: 565-567.
11. Statler G D (1987). Mutation studies with race 1 *Puccinia recondita. Can J Pl Pathol* **9**:200-204.