

Nilgiri Wheat News

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IARI, Regional Station, Wellington

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Indian wheat rust surveillance programme strengthened by increasing temporal and spatial frequency of pathogen monitoring in south Indian hills

Inference on pathotypic diversity of rust pathogens in southern hills of India is likely to remain underestimated due to lesser sampling represented by few samples collected only once or twice in a year. IARI Regional Station, Wellington ideally located in south Indian Nilgiri hills is gifted with natural environment for conducting research on Wheat – rust system for the entire year and hence can be thus effectively employed to identify rust pathotypes in field samples collected with an adequate spatial and temporal frequencies. This research station is also an ideal place to maintain pathotypes of all the three rusts *in vitro* for the whole year even without much investments on electrical operations inside the glasshouses. A battery of glasshouses has been rejuvenated for undertaking an active programme devoted to virulence analysis of wheat rust pathogens in southern, central and peninsular India. Separate glass houses with ample space are now

available for analyzing field samples of stem, leaf and stripe rusts of wheat. Work is already in place for analyzing samples of Wellington as well as few locations in peninsular and central India. Through the intensive surveys the pathogen monitoring has been accomplished in wheat for knowing the pathotype situation in the country and detection of new pathogenic variations as well.

A brief account of results obtained after analyzing samples of Wellington has been presented in Table 1. As many as 506 samples of wheat brown rust and 146 of wheat black rust were analysed. Brown rust race 77-5 was found dominant followed by 77A, 77-8, 17 and 77-7. In black rust, two races 40A and 40-1 prevailed in equal proportions. Interestingly a pathotype different to all the available Indian pathotypes was also found existing in Wellington. This new pathotype of brown rust pathogen available in a few isolates so far, has virulence for *Lr9+ Lr19*. Patterns of its differential reactions tend to resemble an already existing pathotype 77-7(121R127) and 77-8 (253R31) with few exceptions in all sets 0, A and B . Further investigations in terms of

repeatability of differential reactions of this new pathotype on 0, A and B sets is in progress.

Table 1. Pathotypic scenario of black and brown rust pathotypes at wellington

RUST	PATHOTYPE	NO.OF ISOLATES
Black	40A (62G29)	75
	40-1 (62G29-1)	71
Brown	17 (61R24)	18
	77-5 (121R63-1)	204
	77-A (109R31)	221
	77-7 (121R127)	17
	77-8 (253R31)	46

Ug 99 and variants not present in Nilgiris

In pursuance of point 7 of “Delhi declaration on stem rust Ug99, November 8, 2008, New Delhi” an “Ug 99 Trap Nursery” has been structured at IARI regional station, Wellington. This nursery has been planted at all regional stations of IARI having wheat crop as a mandate.

All black rust samples totaling 146 and collected from the premises of IARI regional station, Wellington from volunteer plants and off – season crop were also inoculated on the seedlings of the above said Ug 99 trap nursery (also called as Ug 99 quick differential set). But all of them yielded pathotypes 40 A and 40-1 and none resembled with Ug

99 or its reported variants. Hence it is concluded that Ug 99 has not yet reached in Nilgiri hills where stem rust survives the whole year and which acts as primary source of inoculum for peninsular and central India. Wellington isolates of *P. graminis tritici* exhibit the following reaction types on Ug 99 quick set (Table 2).

Table 2: Reaction of Wellington isolates of stem rust pathogen on Ug 99 quick set

Differential Line	Observed reaction	Ug99 reaction
Morocco	3+	3+
LMPG	;1and2	3+
CS2A/2M-Lr28	;2	-
MACS 2496	;and;2	3+
Bacanora-WH 542	-	3+
PBW 343	;and2	3+
Sr31/LMPG	;2	3+
Sr24(Tr 380-14)	;1and2	3+
Sr 36(Cook)-2	;and2	3+
Sr36(Cook)	;1	3+
Sr36(LMPG)	;1and;2	3+
Rye	;	-

Ug 99 quick set also termed as Ug 99 trap nursery is planted in a staggered manner on three months basis at IARI, regional station, Wellington and is kept on regular watch for appearance of Ug 99 and its variants in Nilgiris. This nursery has also been planted at all the regional stations of IARI located at Shimla, Pusa, Indore and at IARI main campus, New Delhi to keep a watch on Ug 99 occurrence nationally.

Strengthening rust resistance and quality traits in popular Indian wheat cultivars - back-cross and molecular approach

Identifying and cataloguing of new specific rust resistance genes and making it available in better agronomic back-ground made it possible to initiate a meticulously planned back-cross programme in mid-eighties at IARI, RS, Wellington to introgress known genes in some popular Indian bread wheat cultivars. Initially *Aegilops umbellulata*-derived rust resistance gene *Lr9*, *Thinopyrum ponticum*-derived genes *Lr19+Sr25*, *Lr24+Sr24*, *Sr26*, *Ae.speltooides*-derived gene *Lr28*, *Ae.squarrosa*-derived gene *Lr32*, *Ae.venticosa*-derived linked genes *Lr37+Sr38+Yr17* were incorporated in nearly 20 cultivars viz, Kalyansona, Sonalika, HD 2329, HD 2285, PBW 226, C 306 etc. and some of them namely **HW 2004(Lr24+Sr24)**, **HW 2044**, **HW 2045(Lr19+Sr25)**, **HW 2034(MACS 2496, Lr28)**, **HW 1085**, **HD 2833**, **COW(W)1** and **HW 5207(I)** all carrying pyramided genes *Lr24+Sr24*, *Lr26+Sr31+Yr9+Pm8* and *Sr2+* were officially released as cultivars. Many of the stocks carrying afore said genes were registered as genetics stocks and shared among the breeders in India which are well utilized to diversify the rust resistance gene pool. The subsequent breakdown of the genes viz., *Lr9* (77-7), *Lr26* (77-6), *Sr24* (40-1) at Wellington and reporting of new pathotypes virulent on *Lr19* (77-8), *Lr28* (77-9) and the threat posed by Ug99 and its variants virulent on *Sr31*, *Sr24* and *Sr36* prompted us to re-orient our breeding strategy. Now we are

pyramiding both the minor and major genes to exploit additive gene action so as to develop durable rust resistant wheat varieties. Pyramiding of rust resistance genes *Lr24* with *Lr19*, *Lr28*, *Lr32*, *Lr35*, *Lr37*, *Lr39*, *Lr44*, *Lr45* for leaf rust resistance, *Sr24* with *Sr2*, *Sr22*, *Sr25*, *Sr26*, *Sr27*, *Sr29*, *Sr33*, *Sr36*, *Sr39*, *Sr40*, *Sr44* for stem rust resistance in combination of stripe rust genes *Yr10* and *Yr15* are completed and molecularly confirmed using SSR markers in more than 20 currently, widely cultivated well adapted Indian bread wheat cultivars. Many of the constituted lines are expected to confer resistance against the threat posed by Ug99 and also the possible evolving leaf, stem and stripe rust pathotypes. The effective deployment of *Sr2* and *Sr22*(APR) genes in-combination of certain major genes for stem rust resistance, *Lr34* and *Lr46* for leaf rust employing both conventional (Back-cross/modified pedigree) and molecular approach are now under way to develop durable rust resistant wheat varieties. Since many of these genes are alien in nature they are likely to be associated with both useful and unwanted traits. The useful combinations of *Lr19+Sr25* with *Lr28*, *Lr32*, *Lr26* for enhanced yield(based on our observations) *Lr19+Sr25*, *Lr28*, *Lr32*, *Lr37* and *Lr47* with *Sr36+Pm6* for reduced powdery mildew incidence and enhanced yield are currently exploited. The recently identified wheat variety HW 5207(Pusa-Navagiri) carrying *Lr24+Sr24*, *Sr2* and *Sr31* complex showed enhanced end use grain quality by way of increased micro-nutrient content for Cu, Fe, Zn and Mg indicating that the alien genes can be exploited for

not only disease resistance but also for end use quality.

Support to Indian Wheat research programmes – rust inoculum supplied

Individual and mixture pathotypes of Black rust (40A and 40-1) and brown rust races (77A, 77-5, 77-7 and 77-8) were supplied to the following for creation of artificial epiphytotics in DWR nurseries and other research materials of individual wheat scientists named below:

Drs. K.V. Jivani, Ajay Prakash Aggarwal, A.N. Mishra, V.A. Solanki, P.D. Thakkar, I. Kalappanavar, R.S. Shukla, P.C. Mishra, P.N. Rasal, Dr. Kurundkar, P.M. Kotecha, B.K. Honrao, Sr. Scientist-TCB College, Bilaspur, U.D. Singh, Research Scientist - Vijapur etc.

Training to be organized

A BGRI sponsored training programme on wheat rust techniques and breeding for rust resistance is scheduled in March, 2010 for participants of SAARC countries.

Seminar to be held

IARI, Regional station, Wellington is organizing a brainstorming one day seminar on the topic “Checkmating evolution of race group 77 of wheat leaf rust pathogen” during the first week of March, 2010. Please convey your consent for participation by 10th January, 2010 to the Head using email: iariwellington@gmail.com or moola01@yahoo.com. A nominal amount of Rs. 1000/- (One thousand only) will be charged as registration fee on the counter itself.

Distinguished Visitors

- 1) Dr. H.S. Gaur, Joint Director (E) and Dean, IARI, New Delhi – 9-10th December, 2009.
- 2) Dr. K.R. Koundal, Joint Director (Research), IARI, New Delhi – 24-26th December, 2009.
- 3) Dr. S. Nagarajan, Chairperson, PPV&FRA - November, 2009.
- 4) Dr. Harbans Bariana, Univ. of Sydney – October, 2009.

- 5) Summer Nursery users representing ICAR and SAUs numbering 42.

Request for rust samples

All wheat workers of central, peninsular and south India are requested to send rusted samples of wheat for race analysis at this station. Samples may be sent by post to: The Head, IARI, Regional Station, Wellington, Distt. Nilgiris, T.N. 643231.

News:

- Dr. V.K. Vikas, Scientist (Plant Breeding) joined station in Decemeber, 2009.
- Smt. N. Logu (SSG-1), Smt. M. Suguna (SSG – 3), Sh. A. Gopala Krishnan (SSG – 3) superannuated after serving station for more than 30 years.

Externally funded projects sanctioned:

- DBT project “Network project on marker assisted development of biotic stress resistant wheat varieties”(PI – Dr. M. Sivasamy) sanctioned for 2009 - 14.
- ICAR - ACIAR project “Molecular markers for broadening the genetic base of stem rust resistance genes effective against strain Ug 99” (PI - Dr. M. Sivasamy) sanctioned for 2009 – 14.